Tasmania
Explore the possibilities

Strategic Water Information and Monitoring Plan, Tasmania

Prepared by the Department of Primary Industries, Parks, Water and Environment

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Water Information
DATA › INFORMATION › INSIGHT

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The Department of Primary Industries, Parks, Water and Environment

The Department of Primary Industries, Parks, Water and Environment provides leadership in the sustainable management and development of Tasmania's resources. The mission of the Department is to advance Tasmania's prosperity through the sustainable development of our natural resources and the conservation of our natural and cultural heritage for the future.

The Water Resources Division provides a focus for water management and water development in Tasmania through a diverse range of functions, including the design of policy and regulatory frameworks to ensure sustainable use of the surface water and groundwater resources; monitoring, assessment and reporting on the condition of the State's freshwater resources; facilitation of infrastructure development projects to ensure the efficient and sustainable supply of water; and implementation of the *Water Management Act 1999*, related legislation and the State Water Development Plan.

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Onstream

Foreword

The issue

In recent years water has become a pressing public policy issue for Australian society. As water demand increases and supply dwindles, the strain on existing water supplies has reached new heights. Protracted drought and mounting evidence of climate change have added momentum behind a growing community and political will to see improvements in both our understanding of water resources and the way we manage them.

The challenge

Better management of water poses a national challenge, requiring a coordinated response. Our ability as a community to reach agreement on the tough issues relies on access to accurate, reliable water information that is freely available and of the highest standards. Key to making these decisions and arriving at sound policy is a definitive water data source that stands above reproach.

Australian Government response

Aligned with this need, the Australian Government assigned the Bureau of Meteorology (the Bureau) responsibilities under the *Water Act 2007* to compile and deliver comprehensive water information for the country. As part of the Australian Government's long term framework for water security, Water for the Future, $450 million was allocated to the Bureau over 10 years to deliver the Improving Water Information Program. This program includes development and maintenance of an integrated, national water information system which will be freely accessible to the public. Details of the full suite of Bureau objectives and deliverables can be found at www.bom.gov.au/water

A partnership model...

Vital to the success of the Bureau's mission is the partnership and cooperation of all state and territory governments and all water data collecting organisations in each jurisdiction. One of the vehicles for effective collaboration is the Jurisdictional Reference Group for Water Information (JRGWI), established to provide regular input to the Bureau's activities, and bringing to the table the experience and wisdom of respected senior officials from across the water sector.

…and putting it into practice

The Modernisation and Extension of Hydrologic Monitoring Systems Program (the M&E Program) is an $80 million fund administered by the Bureau and available to organisations named under the *Water Regulations 2008*. The M&E Program is aimed at improving technologies employed by those who collect water information, and enabling better approaches to data transfer and standardisation. Coordination activities are also supported through the M&E Program via funding for Strategic Water Information Coordinators (SWICs) in each state and territory. SWICs have been tasked with bringing together key stakeholders in their jurisdiction to distill state/territory priorities in water data collection, and to set these out in a series of Strategic Water Information and Monitoring Plans (SWIMPs).

Strategic plans…

The SWIMPs provide a framework for describing where we are going and how we will get there. Each SWIMP has been produced with a whole of jurisdiction focus to encapsulate the current state of play in water information and monitoring, describe the gaps, issues and opportunities that exist, and articulate a series of priorities, strategies and actions that will bring us closer to the end vision of better water information for all.

…and how they contribute to the solution

Through the M&E Program the Bureau is able to assist the states and territories to get closer to our agreed view of what constitutes a fit-for-purpose hydrologic observing system in each jurisdiction. The Bureau looks to the SWIMPs to provide guidance on how best to invest M&E Program funds to achieve this goal. In this regard, the SWIMPs are a vital product.

The future

In closing, the Bureau appreciates the energy and expertise that has been applied in the preparation of this SWIMP, and thanks all of the officers who have participated in its development and review. Our special thanks go to the lead author of the SWIMP, the Tasmanian Department of Primary Industries, Parks, Water and Environment.

Dr Rob Vertessy

Deputy Director (Climate and Water)

Bureau of Meteorology

20 May 2011

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Executive Summary

The *Water Act 2007* places an obligation on the Bureau of Meteorology (BoM) to collect collate and publish information on the state of Australia's water resources. To achieve this goal BoM requires an understanding of the current status of jurisdictional water monitoring systems, identification of the issues that monitoring systems may have, and what improvement strategies are possible to improve current water monitoring systems.

Under the Modernisation and Extension of Hydrologic Monitoring Systems Program (otherwise known as the Modernisation Fund or M&E), BoM has funded the development of a Strategic Water Information Monitoring Plan (SWIMP) for Tasmania. This document provides an inventory of Tasmania's current water information and monitoring systems, identifies gaps in those systems and ultimately offers a strategy for improvement through BoM's Modernisation Funding Program.

In Tasmania, the Department of Primary Industries, Parks, Water and Environment (DPIPWE), Hydro Tasmania (HT), and BoM collect the majority of river level, stream flow, rainfall, continuous water quality, groundwater, and water usage data. In previous drafts of the SWIMP, due to the limited response from many Tasmanian named organisations, views have been predominantly expressed through a series of SWIMP working group meetings involving HT, DPIPWE and BoM. This document now includes responses from many of the remaining Tasmanian named parties.

Upon review of gap closure though M&E investment in 2011 (see Section C2 of this document) the investment towards Gap #2 (improvements to site infrastructure, instrumentation and OH&S) has been significant and has resulted in Gap #1 (establishment of key sites) becoming a higher priority to that identified in the previous SWIMP version. Geospatial information and metadata (Gap #8) has also received significant funding under M&E and is now considered as priority 7 for the jurisdiction. Based upon the gaps identified in this version of the Tasmanian SWIMP, the current priorities for the State in order are:

1. Database infrastructure (Gap #5)
2. Data management and transfer (Gap #6)
3. Establishment of key sites for water management and planning, water accounting, and water infrastructure development projects (Gap #1)
4. Water accounting (Gap #7)
5. Improvements to site infrastructure, instrumentation and OH&S (Gap # 2)
6. Groundwater (Gap #4)
7. Geospatial information and metadata (Gap #8)
8. Knowledge enhancement (Gap #3)

Tasmania like many other states has experienced expansions and contractions in water information monitoring networks with Hydro Tasmania, the Department of Primary Industries, Parks, Water and Environment (and its historical predecessors) and the Tasmanian Regional Office of the Bureau of Meteorology collecting the vast majority of water information related to quantity. Given there is no underlying Tasmanian strategy for the collection of water quantity information, close but informal dialogue between these three major parties has provided the strategic spatial basis for developing monitoring networks across the state within the constraints of each organisations strategic business needs. The SWIMP has documented these arrangements and articulated these to set the foundation for strategic planning into the future across the entire state in a more formal manner.

The Tasmanian Surface Water Quality Monitoring Strategy identifies the role that the Tasmanian Government can play in coordinating water quality monitoring and reporting programs, developing and maintaining a centralised database, and in forming strategic partnerships to ensure that we achieve our goals of sustainability and provide suitable indicator sets to guide on-ground management action. The strategy underpins water quality monitoring arrangements in Tasmania and the development of a co-ordinated and integrated jurisdictional water quality monitoring network.

Tasmania's overall strategy in the last three years since the introduction of the *Water Act 2007* has been to build on the existing water information monitoring networks particularly relating to stream flow and groundwater, to consolidate and develop metadata for existing sites and to evaluate and upgrade data management systems. This sets a solid foundation for significant changes in the water and sewerage sector and the significant irrigation development agenda in Tasmania that are currently underway.

Collectively, these changes will result in increased water information collection across the state by regional water corporations and irrigation entities and likely to result in new or significantly augmented monitoring networks that will generate significant water information relevant to the Bureau's activities and product suite. In addition, commercial irrigation development will require metering of water use which will result in a significant increase in the amount of water usage information (an identified data category under the *Water Regulations 2008*).

In many ways, this will have a profound impact on the traditional arrangements for the collection of water information in Tasmania, and Tasmanian agencies recognise that strategic planning and integration of new networks is essential for informed decision making on water resource management and development. This extends to ensure that data is collected to the appropriate standards and stored on 'state of the art' data management systems.

Given the magnitude of these changes in the Tasmanian water sector and that the implications on water information collection in Tasmania (which is likely to extend beyond the current five-year tenure of the modernisation program) it is difficult to fully factor these into the current timeline for the development of the SWIMP and have any specificity regarding jurisdictional priorities in these areas.

However organisations such as the regional water corporations, the Rivers and Water Supply Commission and associated subsidiaries have been pro-active in providing as much input into the SWIMP as possible and submitting proposals to the Modernisation Fund.

Significant changes such as these will alter the strategic focus and priorities articulated in the SWIMP as jurisdictional focus shifts to the expansion of water and sewerage and irrigation development sectors and away from existing core monitoring networks that have already been upgraded significantly in the current tenure of modernisation funding. It is expected that the SWIMP will continue to be updated significantly to reflect these future changes in strategic priorities for Tasmanian water information collection.

1 Introduction

The Strategic Water Information Monitoring Plan (SWIMP) is a considered document that provides Tasmania with a jurisdictional plan for water information and monitoring. It aims to present a coordinated plan from the suite of water information collectors in Tasmania (including government agencies and business enterprises, regional water authorities, local government and natural resource management regions) in a united approach to efficient investment and development of jurisdictional water monitoring, now and into the future. While it is jurisdictionally based, the SWIMP is written with the objectives of BoM's water information mission at front of mind. The functional objectives of BoM include:

- Water resources assessments
- National water accounts
- Water availability prediction
- Flood warning services.

This May 2011 document version is the seventh draft that has been provided to BoM since the last submission in February 2011. Most sections have therefore been edited to reflect changes within water monitoring agencies or where information was previously lacking. Major additions in this version include a new section (Section C2) that reports on gaps addressed though M and E investment and updated information describing the current status of irrigation development in Tasmania. Appendix 5 now provides a list of funding agreements for Rounds 1 to 4 within Tasmania outlining all the projects that have been implemented since the beginning of the funding program in 2007. Section D has also been updated to identity a new order of priorities relating to water monitoring and data management requirements in Tasmania.

The *Water Regulations 2008* specify 10 categories of water information that 'named organisations' are required to deliver to assist BoM in achieving their functional objectives. Eighteen Tasmanian water monitoring organisations are currently named by BoM as required to deliver this water information providing certain criteria are met: a) if it is in electronic format, and, b) if it is in the organisation's possession, custody or control. The Tasmanian SWIMP has attempted to document all monitoring sites and management systems that are currently operational for the following 10 categories of water information under the *Water Regulations 2008*:

Category 1 – Surface water information

Category 2 – Groundwater resource information

Category 3 – Information on major and minor storages

Category 4 – Meteorological information

Category 5 – Water use information

Category 6 – Information about rights, allocations and trades in relation to water

Category 7 – Information about urban water management

Category 8 – Information about water restrictions

Category 9 – Water quality information

Category 10 – Descriptive and reference information about water information in other categories.

The Tasmanian SWIMP will assist BoM to identify key opportunities for investment through the Modernisation Fund in the national water monitoring and data collection network.

The SWIMP comprises four significant sections as follows:

1. Section A: Water information – a summary of jurisdictional water information questions/drivers: the fundamental reasons for requiring water information in Tasmania.
2. Section B: Current jurisdictional investment in water monitoring networks – a description of water monitoring networks, technologies, and data management and information systems in place within Tasmania.
3. Section C: Gap analysis (issues and opportunities) – an assessment of, and statement of gaps in existing Tasmanian water information and monitoring investment and systems. Section C2 follows on from this section reporting on gaps addressed through M&E investment.
4. Section D: Strategy for improvement – a description of priorities, strategies and recommended actions within Tasmania, indicating the salience of these to the Bureau of Meteorology's water information mission.

The Tasmanian SWIMP should be considered as a living document and should support the water information and monitoring strategy of Tasmania into the future, as well as assisting BoM to identify key investment opportunities.

The SWIMP is structured in a way that will allow for future revisions, extensions and ongoing development. This is particularly relevant for Tasmania given the current water and sewerage reform agenda, the anticipated increase in irrigation water infrastructure and the development of monitoring programs and networks that would result from both initiatives. It is also expected that all jurisdictional SWIMPs will form key inputs in the development of future strategic planning around the 'national water monitoring and data collection network'.

It is recognised that across the range of practitioners there will be variations in the understanding of terms used to describe water information and monitoring. For the purpose of the SWIMP, and accepting some flexibility in interpretation, the following descriptions are offered:

Monitoring – The observation and measurement assets, equipment and capital works on ground at a measurement site. This would incorporate supporting site infrastructure, telemetry hardware, repeater stations etc. It is acknowledged that some may consider this only part of the full description of the term 'monitoring'.

Water Information – Water information may be derived from an array of sources; it is needed to gain insight in the face of water challenges and to answer water related questions. In many cases a variety of components are needed, contained in the progression from observation and measurement, obtainment of data, data capture, delivery and administration and associated ICT infrastructure. Components of evaluation, reporting on and understanding data are also embedded in the term 'water information'.

Note that 'Water Information' for the Bureau of Meteorology's purposes is defined in section 125 of the *Water Act 2007* to mean 'any raw data and metadata, or any value added information product, that relates to: (a) the availability, distribution, quantity, quality, use, trading or cost of water; or (b) water access rights, water delivery rights or irrigation rights; and includes contextual information relating to water (such as land use information, geological information and ecological information)'.

During the preparation of the SWIMP the various organisations named in the Water Regulations under the *Water Act 2007* were contacted to identify their requirements and key information gaps. A listing of the entities contacted and their respective correspondence is included in the attachments in Appendix 3.

It should be emphasised that this document version is a jurisdictional SWIMP that focuses upon currently understood jurisdictional needs. It is likely that many of the jurisdictional water information questions could be posed within the context of the eight questions developed by BoM:

1. How much water is there right now and where is it?
2. How does it compare with history?
3. How much water will we have tomorrow, next month, next year?
4. Who has the rights to use water?
5. How much are they using?
6. How much water is being traded and to where?
7. How much water is the environment getting?
8. What quality is the water, and how is water quality changing?

2 History of water infrastructure in Tasmania

The following section, 'History of Water Infrastructure and Monitoring in Tasmania' is a series of extracts taken directly from various websites and articles on the history of water infrastructure and monitoring in Tasmania. These sources have been referenced throughout this section.

2.1 Potable Water Supply

Settlement and survival in Tasmania depended on the availability of water – for drinking, growing crops and attracting potential food sources, as well as for washing, drainage and turning mills. In the selection of settlement sites for both Hobart and Launceston, in 1803 and 1804 respectively, securing a reliable supply of clear water for drinking was a prime motivator – and was part of the reason for the abandonment of the Risdon Cove site in 1804 for the more abundant and permanent supply flowing from Table Mountain (Mount Wellington). In 1831 an aqueduct was constructed to bring water from the rivulet at the base of Mount Wellington to Hobart. An exceedingly dry summer in 1834-35 led to the passing of the *Water Act (1835)*, which aimed to ensure a supply of pure water for Hobart Town. (CTHS, 2006)

By 1843 the polluted state of the rivulet and the resultant spate of disease epidemics led Major Hugh Cotton to make an impassioned plea for the incorporation of the City of Hobart. Three years later a Board of Commissioners was elected to manage the affairs of the city. The first major waterworks, comprising a storage reservoir, iron pipes and sandstone fluming, were constructed in 1861 to conduct water from Mount Wellington to the Waterworks on the Sandy Bay Rivulet and onto the city and suburbs via the Hill Street reservoir. An upper storage reservoir was completed in 1888, and by 1900 a Water Act regulated construction, extension and maintenance work on the supply pipeline, with a Waterworks Department levying rates to fund the works. A Metropolitan Drainage Act followed, to ensure the discontinuation of those practices which had led to the pollution of the town rivulet. As Hobart grew, shortages of water led, always after considerable debate, to the construction of the Ridgeway Reservoir (1919), the Lake Fenton water scheme (1939), then, after enormous growth in the 1950s, the Hayes–Bryn Estyn water scheme (1963), which took water from the River Derwent at Hayes and served the whole metropolitan area. (CTHS, 2006)

In the north, the citizens of Launceston obtained their fresh water from the Cataract Gorge by boat until the first pump was erected in 1825 on planks placed over the North Esk River. Many schemes for obtaining water came and went before the *Launceston Water Act (1856)* empowered the Council to raise the finances to build a scheme which would supply the inhabitants of the city. The Launceston Waterworks, opened the following year, diverted water from St Patrick's River via a tunnel into Distillery Creek, from where it was conducted to the city in mains, with reservoirs on high grounds outside the city adding to the supply. To commemorate the inauguration of the city's water supply, in 1858 a

large ornamental fountain was erected in Princes Square, where the water was initially brought into town prior to reticulation. (CTHS, 2006)

Settlers in the Midlands towns of Campbell Town and Ross were well supplied with water from the Macquarie and Elizabeth Rivers, and in 1901 investigated bringing water from the Western Tiers to increase production on their farms. Meanwhile, inhabitants of Bothwell and Hamilton on the Clyde River had to fight long and hard to achieve a reliable supply of clean drinking water, due to the conflicting demands of townsfolk and farmers. While settlers on the East Coast of Tasmania often had only enough water for their basic needs, those on the West Coast had water in abundance due to the much heavier rainfall on that side of the island. (CTHS, 2006)

Plans for the establishment of a regional water authority were discussed between the State Government and the north-west municipal councils as early as the mid-1960s (DPIWE, 2005). The first feasibility study was undertaken in 1965 and a second in 1972. In May 1975 a report entitled 'North-West Tasmania Regional Water Supply Scheme' was prepared by Judith A. Rees, B.Sc.(Econ.), M. Phil., London School of Economics and Political Science. U.K. for the Federal Department of Urban and Regional Development which drew substantially from earlier reports. This report, together with the Federal Government agreeing to finance 60% of the total cost (provided that a regional scheme included all municipalities in the north-west region) revived discussions between the State Government and the municipal councils. (DPIWE, 2005)

The Burnie municipality conducted an investigation into the findings of the Rees report and subsequently decided not to join the proposed scheme. The remaining municipalities agreed to proceed with the establishment of the Authority, but without the Federal Government contribution. (DPIWE, 2005)

Prior to the establishment of the North West Regional Water Authority (NWRWA) in 1977, the eight municipalities of the north-west region depended on 14 separate water schemes supplying untreated water. This water was generally of poor quality with frequent restrictions imposed in dry seasons. (DPIWE, 2005)

Esk Water Authority (trading as Esk Water) was formed on 1 July 1997 by the amalgamation of the bulk works of the previously discrete water schemes servicing the Launceston / Tamar Valley region. Three schemes were brought together to form Esk Water including:

- Distillery Creek Scheme
- West Tamar Water Supply Scheme
- North Esk Regional Water Supply Scheme.

Distillery Creek Scheme

In 1852 the Municipal Government prepared plans to divert water from St Patricks River at Nunamara to supply the City of Launceston. A weir was constructed across the river about 20 kilometres from the city. Water was transported via concrete channels and a tunnel into the head of Distillery Creek and stored in a

dam a short distance downstream from the existing treatment plant. The scheme was completed in 1857 and the supply remained unchanged for over 60 years. (DPIWE, 2005)

After World War One agreement was reached to provide treatment in order to service a proposed wool factory (Patons and Baldwins). The plant was built in three stages. All three stages of the plant were constructed to the design of the Candy Filter Company, an English firm responsible for a number of significant advances in water treatment. The capacity is now of the order of 40 ML/day. (DPIWE, 2005)

West Tamar Water Supply Scheme

The original *Beaconsfield Water Act 1938* provided a water supply scheme to service Beaconsfield and Beauty Point. This Act was extensively amended and renamed the *West Tamar Act 1949*. The amended Act provided for a water supply scheme servicing the area from Riverside to Beauty Point. The then Beaconsfield Council commenced work on the scheme in 1951. However, the Council encountered financial difficulties and approached the State Government for assistance in 1959. As a consequence, the *West Tamar Water Act 1962* was passed, repealing the 1938 Act and vesting the scheme in the Rivers and Waters Supply Commission (RWSC). Construction of the scheme was then completed by the RWSC. The original treatment plant, officially opened in 1962, had a capacity of about 10 ML/day and was supplied with water via a pump station constructed in the left abutment of the Hydro Electric Commission's Trevallyn Dam. By 1964, the trunk main had been completed to Beauty Point. The treatment plant was duplicated in 1971, bringing the capacity to 20.5 ML/day. (DPIWE, 2005)

North Esk Regional Water Supply Scheme

The North Esk Regional Water Supply Scheme first arose out of a marriage of necessity between a scheme originally envisaged by the St Leonards Council for its own purposes and the Government's task of providing adequate supply of water to the aluminium works sited at Bell Bay, now Comalco. (DPIWE, 2005)

In 1949 the *North Esk Regional Water Act* was passed and active preparation for the scheme commenced. The original scheme consisted of a pump station at White Hills and pipeline and associated works as far north as George Town. In 1958 control of the scheme transferred from the Water Sewerage and Drainage Board to the Rivers and Water Supply Commission. (DPIWE, 2005)

In 1976 a temporary 2.5 ML/day treatment plant was constructed at Hadspen along with pump stations and pipelines to service Hadspen and Prospect Vale. In 1991 a temporary 6.9 ML/day treatment plant and pump station was constructed at Prospect. In 1996 the 20 ML/day Mt Leslie treatment plant and pump station was completed, replacing the temporary plants at Hadspen and Prospect. Ben Lomond Water Corporation began trading on the 1st July, 2009. (DPIWE, 2005)

On July 1 Tasmania entered a new era in water services designed to meet the future water needs. Three new corporations in Tasmania's three regions, Cradle

Mountain Water, Ben Lomond Water and Southern Water were formed to provide regional management of the State's potable water and sewerage services. Tasmania's regional water corporations are owned by local councils and offer a new approach to water and sewerage management.

2.2 Hydro Electricity

Tasmania's first European settlers used water to power most of their myriad flourmills for almost a century. Not surprisingly, when they embraced the new technology of electricity in the 1880s (ahead of most of the industrially developing western world) to light their towns, mines and factories, they frequently installed small hydro-electric schemes. (CTHS, 2006)

The promise the island's 900-million tonne annual rainfall-fed waterways offered was only recognised after rapid advances in electrical transmission technology prompted the University of Tasmania's Professor of Mathematics and Physics, Alexander McAulay, to design in 1905 a major hydro-electric scheme based on the Central Plateau's Great Lake. Six years later, a Melbourne-based metallurgist-entrepreneur, James Hyndes Gillies, began to build McAulay's Great Lake scheme in order to commercialise a new electrolytic zinc- making process he had invented. (CTHS, 2006)

When Gillies' Hydro-Metallurgical Company Pty Ltd went bankrupt in 1914, the Tasmanian Government took over the scheme, and it's newly created Hydro-Electric Department (HED) completed it in 1916. The capital cost was largely met by a thirty-year bulk power supply contract negotiated with the Broken Hill-based Amalgamated Zinc for the manufacture of zinc at Risdon. The HED also aggressively marketed electricity to Hobart households and shops, Hobart Council and Hobart Tramways. During the 1920s there was a steady growth in demand from industrial and retail consumers, and the HED's distribution system was gradually expanded to include population centres around the state. (CTHS, 2006)

In 1929 the HED was reconstituted as the Hydro-Electric Commission (HEC) and given far-reaching powers to exploit the state's waterways, take over municipal schemes, regulate electrical tradesmen, installations and appliances, and raise government-backed loans to fund future capital development. By the late 1930s most households on the mainland of Tasmania were connected to electricity. When several big companies moved into the state to process its rich native timber resources, the HEC was compelled to begin building a second major hydro-electric scheme, based on the waters of the River Derwent system. (CTHS, 2006)

The HEC's growth into the only statewide electricity utility (and the most powerful government business in the country) was characterised by a uniform system of retail pricing, the construction of some of the largest civil works projects ever attempted in Australia, the employment of a workforce of thousands, and a policy of hydro-industrialisation which saw a series of bulk electricity metal and timber processors settle in the state. It was also marked by public criticisms of its exploitation of waterways traditionally relied on by farmers for irrigation, the unreliability of parts of its regional retail network, and the low pricing regimens

of its bulk industrial supply contracts. However, the Hydro consistently employed world-class engineering in all its generation, transmission and distribution works. It became a world pioneer in rock fill dam building and many of its civil works, like the eggshell-shaped concrete Gordon Dam on the Gordon Power Development, were unique. (CTHS, 2006)

By 1940 the HEC's belated efforts to remedy a threatened shortfall in its generating capacity by building the Derwent scheme had highlighted problems in its senior administration, which became the subject of a Government Board of Enquiry. This resulted in a government subsidy aimed at reducing electricity prices in rural areas and re-uniting the design and construction arms of electrical and civil engineering branches. The Commissioner (whom the Board had mainly blamed for the HEC's ills) survived to sack several of his senior executives. In 1967 another shortfall in capacity caused by a prolonged drought forced the HEC to build its only thermal power station, an oil-fired development at Bell Bay, 1969 (which has since been converted to use natural gas). (CTHS, 2006)

At about the same time, a decision to significantly enlarge the hydro-electric system by building a scheme based on the South-West's Gordon River drew widespread protests over the contingent flooding of Lake Pedder and its unique floral and faunal ecosystem. Though the protests proved futile, they engendered a national re-evaluation of the relative merits of exploiting or preserving significant wilderness areas, and led to the formation of the world's first conservationist political party, the United Tasmania Group. In 1980, when the HEC planned to build another big hydro-electric scheme in the South-West on the Gordon River, local conservationists mounted a campaign to save 'Tasmania's last wild river' which aroused the emotions of middle-class urban dwellers across Australia and abroad. The campaign won a World Heritage listing for the Franklin and a promise that the incoming Australian Labor government would halt the power scheme. The HEC abandoned the scheme when the High Court found that the External Relations powers enjoyed by the Commonwealth under the Australian Constitution gave it the right to honour its international treaty obligations by preventing the flooding of the Franklin, notwithstanding Tasmania's constitutional land use rights. (CTHS, 2006)

In 1994, with the commissioning of the Anthony Power Scheme on the West Coast, Tasmania had seven major power developments and 27 power stations. No further economically or politically feasible major hydro-electric schemes were currently under consideration. However, since 1978, the HEC had been experimenting with another form of renewable energy which suited Tasmania's climate and geography, wind power. In 1998 the HEC commissioned the first stage of its first wind farm – three 250-kilowatt generators sited on Huxley Hill, King Island. In 2004, the first half of a 130-megawatt wind farm at Woolnorth, on the state's far North-West, was commissioned. Tasmania was now producing 60 percent of Australia's renewable energy and had plans to build a 160-megawatt wind farm at Heemskirk on the West Coast, a 140-megawatt wind farm at Musselroe in the North-East, a 66-megawatt wind farm at Cathedral Rocks on South Australia's Eyre Peninsula, plus several mini hydro-electric schemes in Tasmania and South Australia. (CTHS, 2006)

Meanwhile, in 1998, a decade of Commonwealth-State negotiations aimed at increasing the competitiveness of Australia's energy industry culminated in the creation of a National Electricity Market, and the HEC disaggregated into three separate businesses so it could participate. Hydro Tasmania (the owner and operator of Tasmania's dams and power stations) remained a Government Business Enterprise, and Transend Networks Pty Ltd (the owner and operator of its high voltage transmission network) and Aurora Energy Pty Ltd (the owner of its low voltage distribution network) became state-owned corporations. (CTHS, 2006)

In 2000 Hydro Tasmania commissioned the British transmission company, National Grid, to build a High Voltage Direct Current interconnector across Bass Strait (Basslink) at an estimated cost of $482 million so that it could trade electricity interstate from 2005, selling its attractively priced renewable water and wind power to the mainland during times of peak load and buying back the mainland's fossil-fuelled thermal power as base load, off-peak. (CTHS, 2006)

2.3 Irrigation

The practice of irrigation is thought to have begun in Tasmania in 1826 when 'Strathmore' at Nile, near Evandale, was completed and began utilising its five kilometres of water-race.

In the early days of the colony, irrigation schemes were being established on several properties in the Clyde River Valley in the Central Highlands. 'Sherwood', with its unique water tunnel, and 'Ratho' near Bothwell, were irrigating in the 1830s. (Mason-Cox, 1994)

There was an upsurge in the interest in the practice of irrigation during the 1840s due to the pressures brought about by a prolonged drought. During this decade, eminent advocates of irrigation – the Cotton brothers, Arthur and Hugh, and Sir Paul Edmund de Strezlecki – arrived in the colony. (Mason-Cox, 1994)

Some enterprising property owners made use of the good advice proffered by these experts in order to increase the productivity of their farms. 'Glenleith', and 'Lawrenny', in the Derwent Valley; 'Hunterston' on the Shannon River; 'Kingston' near Ben Lomond and 'Mona Vale' near Ross, all began irrigating around this time. (Mason-Cox, 1994)

The interest in irrigation shown by the colony's Lieutenant-Governor Sir John Franklin resulted in Government advice and assistance being offered for the implementation of such schemes as the damming of Tooms Lake. This, in turn, led to smaller schemes including the combined Wetmore-Somercotes scheme and the Beaufront-Ross Reserves scheme on the Macquarie River. (Mason-Cox, 1994)

Plans to build Long Marsh Dam began in 1842. After the dry summer of 1842, Tooms Lake could not supply all the domestic and irrigation requirements of the residents of the district. A proposal to create a dam on the Macquarie River at Long Marsh was presented to a meeting in May 1842, and in June the Government under Sir John Franklin agreed to supply a probation party for the construction of the dam. Preliminary works began in September. However,

Eardley-Wilmot's government was forced to withdraw support (namely, convict labour) under instructions from London. The promoters of the dam did not give up, seeing themselves as the plaintiffs in a breach of contract. In 1847, the new Governor, Sir William Denison, insisted there was never any evidence of a contract between the government and the gentlemen proposing the scheme. Without Government assistance, the scheme was doomed to failure. (Mason-Cox, 1994)

The damming of the Elizabeth River at Kearney's Bog to form what is now known as Lake Leake was proposed as early as 1841. It was hoped the reservoir would provide a reliable water source for Campbell Town as well as for the irrigation of land. Faced with much opposition and financial hardship, work did not begin until 1881, and the first filling occurred in 1883. (Mason-Cox, 1994)

The growth of the State's valuable hop industry is said to date from 1822, when William Shoobridge planted out a hop garden at Providence Valley, near Hobart Town. The development of the colony's hop industry ties in with the history of irrigation since artificial watering was used extensively in the successful production of hops, particularly by members of the Shoobridge family. Well-known Tasmanian architect and engineer William Archer designed and built the effective irrigation schemes at his properties 'Cheshunt' near Deloraine and 'Saundridge' near Cressy. (Mason-Cox, 1994)

Major Hugh Cotton's plans to implement a State-run irrigation scheme during the 19th century proved too ambitious. Parliamentary Select Committees examined the plans in 1844-5 until 1886. By then, the dream of a national irrigation scheme had faded and individual farmers were left to carry out their own irrigation schemes. It was not until the establishment of the Rivers and Water Supply Commission in 1957 that some of the grand ideas of earlier times came to fruition. This body oversaw the construction of three large-scale irrigation schemes: the Cressy-Longford Scheme (1974), the South-East Irrigation Scheme (1986) and the Winnaleah Scheme (1987). The *Water Management Act 1999* retained the Commission as a Government agency, giving it ownership, management and control over the operation of public irrigation schemes. In 2007 the Meander Dam was completed and the Meander Irrigation Scheme was established. (Mason-Cox, 1994)

2.4 Surface Water Monitoring

Monitoring of water quality and stream flow in Tasmania first occurred in the early 1900s. The first water samples taken that are recorded on the DPIPWE database were in 1903 from Idaho Creek. These samples were associated with mining exploration on the West Coast.

The first measurement of stream flow occurred around 1901 investigating water resources of the lakes of the Central Plateau Region. Water courses that were measured included the Shannon, Ouse, Dee, Nive and Derwent Rivers. This region showed potential for power generation but apart from further investigations in this region no other areas were investigated until the State Rivers and Water Supply Commission of Victoria prepared a report on 'Irrigation Development in

Tasmania'. It was recommended in this 1901 report that a regular stream gauging program be undertaken. (Park, 1971)

With the formation of the Hydro-Electric Department (HED) in 1916 a program of regular gauging commenced in 1920. This consisted of the establishment of 71 stations throughout Tasmania, 62 of which were daily read staff gauges and nine automatic recorders. In 1922 after 18 months of operation a report on the information collected was published, but as might be expected after such a short period of operation, it was incomplete, due mainly to a lack of discharge data. (Park, 1971)

The work suffered from lack of people in subsequent years, with the result that most of the stations established were neglected, not having been properly rated or supervised. Other than those equipped with automatic water level recorders, most proved of little value. (Park, 1971)

Due to financial stringency, in the 1930s some 60 of these stations were abandoned, and whilst the rest continued these were in name only, as no discharge measurements were undertaken and no supervision of the recording of gauge heights was made. (Park, 1971)

Figure 1 – Franklin Rivulet gauging station (photo taken July 1974, RWSC)

In 1941 a decision was made to re-introduce a regular system of stream gauging on streams which had possibilities of water power development, as provided by the HEC Act. It was decided that the work was to be based on the best techniques and was to be as accurate as possible. By 1956 the HEC had built a system of accurate stream flow monitoring including 70 automatic recorder stations together with the necessary measuring equipment. (Park, 1971)

In 1957 a statutory body, the Rivers and Water Supply Commission (RWSC) was established to take control of Tasmania's water resource (outside of the HEC districts) under the *Water Act 1957*. In 1960 the RWSC commenced a program of stream gauging with the first installation on the Coal River. By 1970 RWSC operated 52 stations all of which were equipped with automatic water level recorders (RWSC, 1971). Figure 1 shows a typical gauging station setup on the Franklin Rivulet that includes a stilling well and chart recorder (on right) and cable car infrastructure for river discharge measurements during flood events.

By 1977, all water levels were recorded on paper charts, rain gauges were based on float operated collector tanks or punched tape Sumner recorders. Daily flows and rainfall totals were extracted from charts manually and entered into files for reference and rating curves were drawn by hand. Calculation of stream discharge was performed using a counter and stopwatch. This had been an advancement from listening to a buzzer and manually counting the contacts that was required to determine velocities at each vertical measurement section. (Johnston, 2010)

The RWSC concentrated mainly on monitoring the coastal streams along the South Coast, the East and the North, with a few stations on the West and inland, where there was potential for agricultural, municipal and general industrial use. This new monitoring program complemented the already existing HEC stream flow monitoring program that mainly monitored streams in the Central Highlands and West Coast primarily to assess the power potential of the major rivers in the higher inland areas.

By 1983 the RWSC was monitoring 117 stations all of which were equipped with automatic water level recorders. In the early 1990s the RWSC was amalgamated in a new department called the Department of Resources and Energy. Around this time it was decided that due to financial restraints the number of RWSC stream gauging sites would be reduced to approximately 60 sites and the monitoring program would be contracted to HEC. The HEC monitored all the stream flow sites in the state until around 1997 when the former RWSC sites were transferred back to the newly formed Department of Primary Industries and Fisheries (DPIF). By the late 1990s due to further limited resources the number of stream gauging sites being permanently monitored by DPIF was reduced down to approximately 30 sites. Over this period the HEC stream gauging network continued to steadily grow to around 100 permanently operated stream flow sites.

Most states (and territories) have adopted the Australian Water Resources Council (AWRC) system in numbering conventions for their sites. Tasmania however has not applied this to its monitoring network. The system was introduced by the AWRC in the 1960s and allocates a six or seven digit number to each station.

For stations within drainage divisions I to IX, the first digit describes the drainage division and the second and third digits identify the river basin within the division. Whilst sites in Tasmania do not incorporate the ARWC system they are however identified according to a local system which can be unique for each organisation.

On 1 January 2000 the new *Tasmanian Water Management Act 1999* was adopted with a single State Water Manager, the Department of Primary Industries, Water and Environment (DPIWE). The Water Management Act retained the RWSC as a Government agency, giving it ownership, management and control over the operation of public irrigation schemes.

In 2000 the Australian Government's National Land and Water Resources Audit 2000, highlighted the need for the strategic design and implementation of water quality monitoring programs to assist in the management of riverine, estuarine and coastal regions, particularly the need to collect water quality trend and loads information. Of particular significance to Tasmania was the lack of sufficient water quality data (minimum three years) to enable such an assessment. At the time water quality monitoring in the state was disjointed and the ambient monitoring of baseline water quality by the State (DPIPWE) was limited to short term State of Rivers projects and sporadic monitoring of continuous water quality (11 sites – electrical conductivity, temperature and turbidity) across the state. (DPIW, RBWQMP, 2009)

In 2001 the Draft Tasmanian Surface Water Quality Monitoring Strategy (TSWQMS) was released in recognition of the importance of surface water quality in national strategies, local government strategic plans and the public's environmental concerns. The strategy highlighted the need for a coordinated approach to the monitoring and reporting of water quality information and identified current gaps of information in Tasmania. In its implementation the Strategy clearly identified the leading role that the Tasmanian Government's lead agency for natural resources management (DPIPWE) should take in the establishment of a baseline water quality monitoring system and coordination of water monitoring and data sharing activities in Tasmania. This culminated in the establishment of the Baseline Water Quality Monitoring Program (BWQMP). (DPIW, RBWQMP, 2009)

In 2003 as a direct outcome of recommendations made by the TSWQMS and in recognition of national and regional (i.e. NRM) strategies, the Water Assessment Branch of the Water Resources Division of DPIPWE proposed a comprehensive Baseline Water Quality Monitoring and Stream Flow Monitoring System Project. Assisted with funding from the National Action Plan, Salinity and Water Quality (NAPSWQ) and State Water Infrastructure Fund (WIF) a core set of 52 baseline water quality and stream flow monitoring stations were established. In 2005 outcomes from associated projects funded through NAPSWQ and WIF established the current Baseline Water Quality Monitoring Program (BWQMP) which is recognised in Divisional and Branch Management Business Plans as part of core business operations. (DPIW, RBWQMP, 2009)

In 2006 the SMART (Sustainable Management of Agricultural Resources in Tasmania) farming budget initiative by the Tasmanian Government was

implemented to significantly enhance productivity and the long-term viability of the Tasmanian agricultural sector though clear, secure access to additional farm water supplies. One component of the initiative was to enhance the availability and accessibility of DPIW surface water stream flow information to underpin water development and sustainable water use. Funding over four years was provided for a 45% increase in the number of stream flow monitoring stations to the current number of 82 sites. (DPIW, 2009)

Presently Hydro Tasmania (the owner and operator of Tasmania's dams and power stations) operate approximately 208 water monitoring sites in Tasmania.

As part of the management of activities the *Environmental Management and Pollution Control Act (EMPCA)* was enacted in1994 (which replaced *EPA 1973*) and the State Policy on Water Quality Management (SPWQM) 1997 was released. Both documents reinforced the management of discharges and establishment of monitoring of surface water as part of the sustainable operation of these activities with the principle aim to prevent environmental harm in the receiving environments. Over the years many preoperational, operational and decommissioning ambient monitoring programs for the activities have been conducted. A data management system has been developed to manage this data and subsequent iterations are ongoing for refinement of the system.

2.5 Ground Water Monitoring

The installation of ground water infrastructure In Tasmania commenced during the 1800s. Documented borehole drilling commenced in the 1860s. Up until the 1930s the rate of development was low with less than 10 boreholes being drilled annually. The rate of borehole drilling steadily increased until reaching a peak in the early 1980s of over 400 boreholes per annum. (Bacon and Latinovic, 2003)

Mineral Resources Tasmania (MRT) (then the Department of Mines) was originally responsible for the collection and management of groundwater data. By 2003 the MRT ground water database contained records for over 8,000 boreholes installed in various Tasmanian groundwater aquifers. (Bacon and Latinovic, 2003)

Despite the degree of development no assessment of the impact of groundwater extraction from aquifers had been undertaken.

Monitoring of water level and groundwater use in Tasmania began in the Devonport area in 1985 by the then Department of Mines. The Devonport network was established as a part of the groundwater assessment project to monitor the impact of groundwater extraction for irrigation purposes from the local/regional basalt aquifer. This network consisted of two groups of boreholes. The first group was drilled close to existing irrigation boreholes and for some years the irrigation boreholes were monitored to record extraction volumes. The second group of 12 boreholes was drilled away from existing private boreholes to monitor natural aquifer conditions and the potential over extraction/induced drawdown on a regional scale.

In the period from 1990 to 1991 monitoring was expanded across Tasmania. The Statewide Groundwater Monitoring Network (SGMN) was developed by the

Department of Mines (now Mineral Resources Tasmania) in the early 1990s using existing boreholes and by drilling additional boreholes. Monitoring sites were selected to monitor natural temporal changes in water levels and water quality of the particular aquifers in areas of the state with higher potential for development of groundwater resources. Manual and continuous water level data with temperature data were collected from these bores and standard groundwater analysis were conducted on water samples from these bores twice per year (in October before the start of the pumping season and in April-May at the end of the pumping season). The purpose of collecting manual water level readings was to calibrate data logger information and identify any times of aquifer stress during annual recharge and discharge groundwater cycle.

With changes to agency responsibilities in 2006, the Department of Primary Industries and Water (DPIW) assumed responsibility for all groundwater related activities in the state, including the SGMN. The current monitored network consists of 51 bores made up of the remaining operational statewide and Devonport network boreholes (33 and 12 holes respectively) and six recently drilled bores in Nine Mile Beach aquifer near Swansea. (DPIW Hydstra database contains additional data for five monitoring sites that were either decommissioned or transferred to other organisations.)

During 2007-2008, for the purposes of developing groundwater hydrological models under a collaborative project between the Tasmanian Government and the National Water Commission (now administered by DEWHA), 24 monitoring bores were established in the northern part of the state. Twice yearly recording of the groundwater levels manually is planned to be carried out on these monitoring sites until financial and physical resources allow the upgrade of sites to provide continuous data for electrical conductivity, temperature and water levels.

In 2008 licensing of drillers in Tasmania was implemented under the *Water Management Act 1999*. The objective of the Tasmanian Well Driller's Licence System is to protect groundwater resources by ensuring that all water well drillers are properly skilled and their work meets minimum standards. As the licensing system is based on a national system there are certain requirements and standards that need to be met in order to gain a licence. Under the national system, licences are classified according to the type of aquifers licencees are permitted to work on and licences are endorsed with the relevant drilling method qualifications. This ensures the skills, knowledge and experience of a driller will match the groundwater protection requirements. During 2009, what is required in terms of skills, qualifications and experience to initially obtain or upgrade a driller's licence was detailed in the Water Well Drillers Licensing Handbook. Three classes of licences are available through the Tasmanian Well Driller's Licensing system:

Class 1: Restricted to drilling operations in single non-flowing aquifer systems;

Class 2: In addition to operating in Class 1 conditions, permits drilling operations in multiple on-flowing aquifer systems (i.e. confined aquifers); and

Class 3: In addition to operating in Class 1 and 2 conditions, permits drilling operations in flowing aquifer systems (i.e. artesian aquifers).

3 Section A: Water Information Questions and Drivers

Water consumption in Tasmania can be categorised into seven main sectors (see Figure 2). These include agriculture, household, water supply, manufacturing, mining, other industries, and forestry and fishing. Water supply refers to water used by the water supply, sewerage and drainage industry. The agricultural sector is clearly the largest user of water in the state. (TWSSOTIR 2009)

The sustainable management of the irrigation sector is a major driver for various monitoring programs that currently exist. Many of these programs are supported by various State policies and strategies (the majority of which are not statutory). Whilst hydro electricity generation is not shown in the chart (as water used for power generation is identified in Tasmania as a non-consumptive use) it is considered as an important factor relating to the state's economy. As water is released from storages under hydro electricity management this will also impact on water availability for other purposes. (TWSSOTIR 2009)

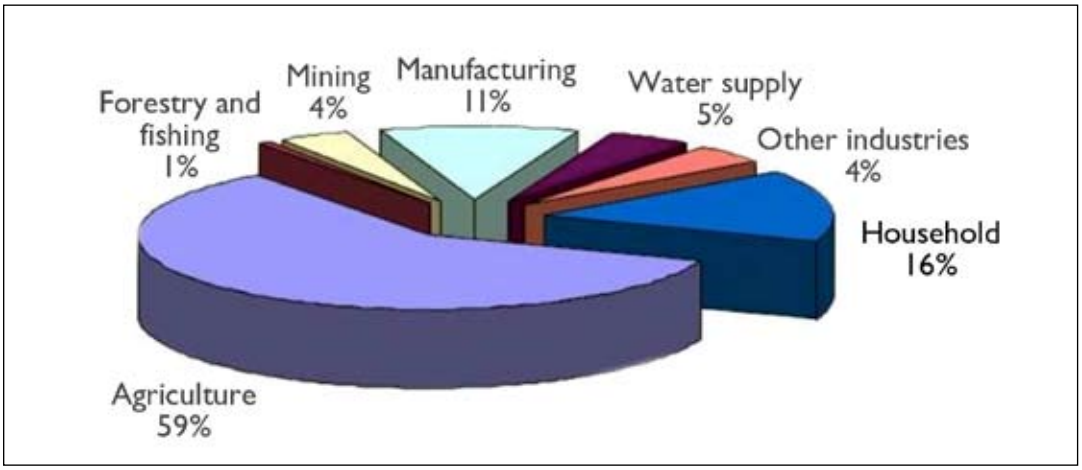


Figure 2 – Water consumption in Tasmania (2004-05) Australian Bureau of Statistics water account data (source: Tasmanian Water and Sewerage State of the Industry Report 2007-08)

Tasmania has 12% of the fresh water resources of Australia in an area of less than 1% of the total Australian land area and some 3% of the population. The average annual surface runoff is around 45,000 Gigalitres. There is often a misconception that Tasmania's freshwater resources are plentiful, however the majority of rainfall occurs in the State's West and conditions in more populated and farming areas are much drier. Average annual rainfall for the Midlands is approximately one – sixth of that available on the West Coast. (DPIPWE website, 2011)

As shown in Figure 3, recent rainfall trends between 2006 and 2009 indicate below average rainfall across the state compared to the long term average. This figure also takes into account above average rainfall experienced during the winter/ spring period in 2009 (also reflected in Section 5.7 of this report).

Recent studies such as the Tasmanian Sustainable Yields Project (TSYP) suggest that future water yields will decline as a result of climate change although these are not expected to be significant. The outcomes of the TSYP indicate an average 3% reduction in rainfall and a corresponding 5% reduction in runoff under a mid future climate scenario in 2030. (CSIRO 2009)

Figure 4 lends support to the outcomes of this project revealing a decline in inflows to all Hydro Tasmania managed storages since 1924.

The Tasmanian Government's response to climate change under its irrigation development agenda involves various irrigation development projects that will attempt to provide an additional 250,000 Megalitres (ML) of irrigation water per year. This represents an increase of around 50% in existing irrigation supplies. As irrigation development projects are progressed, this section of the report and subsequent versions of the SWIMP will be updated significantly to incorporate additional drivers for monitoring that will inevitably be required for these irrigation schemes. Other water consumption sectors will also be considered in identifying any monitoring gaps that exist where water information questions cannot be answered.

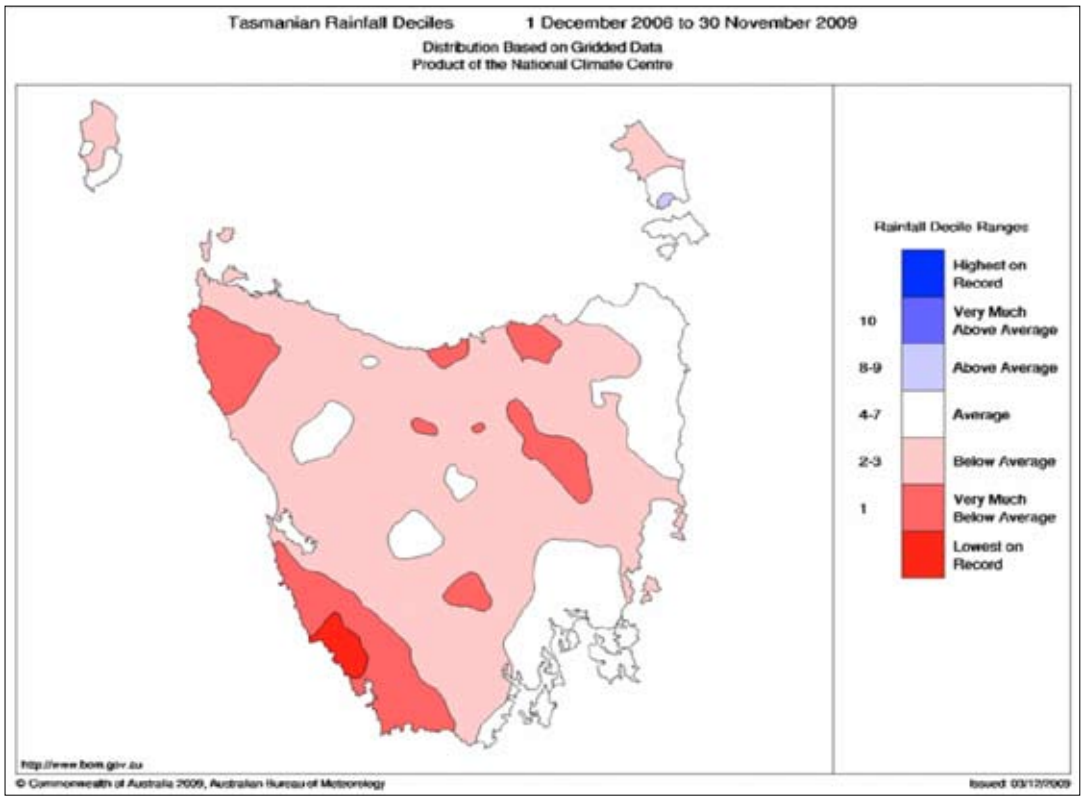


Figure 3 – Tasmanian rainfall map showing decile ranges for three year period (Source: www.bom.gov.au, Dec 2009)

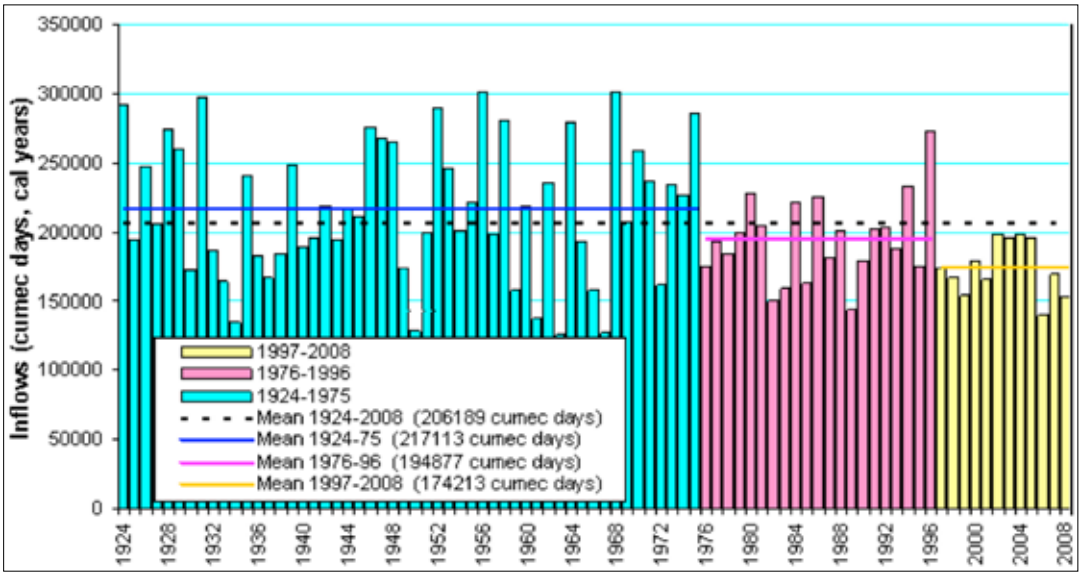


Figure 4 – Total volume of inflows to all Hydro storages for the period 1924-2008. The data is a combination of actual storage and station measurements and estimated data for the years prior to a particular storage existing. The estimated data is derived from rainfall and stream flow data (source: Hydro Tasmania 2009)

DPIPWE, Hydro Tasmania, and BoM collect the majority of river level, streamflow, rainfall, continuous water quality, groundwater, lake level and water usage data in Tasmania.

For the purposes of this SWIMP version these three major water information collectors' views have predominantly been expressed through a series of SWIMP working group meetings. Input for this document has also been sought from all remaining named parties within the state.

It should be noted that major water quality spot sampling programs also exist, however, non continuous data involving WQ spot sampling programs have not been thoroughly documented. This has been due to the extent of the networks across various organisations and limitations in time associated with accurately documenting these networks.

3.1 Water Information Questions

The following series of questions attempt to describe the fundamental and underlying reasons for requiring and collecting water information across Tasmania. It includes an extensive list of questions that represents the type of information needed by the majority of water information users in Tasmania. This SWIMP does not attempt to answer the questions but rather it explores whether the current monitoring networks, database infrastructure and processes are sufficient.

Where current data and processes cannot assist in answering a question it may reflect upon a need to improve a current monitoring network, program, method, database systems or management regime. It would also be expected that where gaps exist and questions cannot be answered, these gaps would then be identified within the gap analysis section of this document (Section C).

3.1.1 How much water is there right now and where is it?

1. Is there enough water available for my purpose concerning:
   a. Power generation?
   b. Environmental flow (including releases)?
   c. Irrigation?
   d. Urban?
   e. Recreational?
2. Where in a catchment is the best place for development concerning:
   a. Irrigation?
   b. Power schemes?
   c. Urban?
3. Do I know enough about the water resource to meet requirements of the *Water Management Act 1999*?
4. Can we quantify/describe the surface and groundwater resource?
5. For what purpose is the water required in a particular catchment? And how should these be prioritized based on the current situation?
6. Is the resource over allocated or under allocated?
7. Can we accurately estimate water use?

3.1.2 How does it compare with history?

1. Were we able to collect and report adequate data to meet our legislative obligations?
2. Were we able to meet community expectations with regard to water and water information?
3. Were the data sets missing significant amounts of record?
4. Has the resource changed over time? Quantity and spatially?
5. What is the impact of a changing water resource on resource availability and utilisation?
6. Do we have enough information for optimal operation of our systems e.g. power generation?
7. How much water did we store and spill?
8. How do evaporation rates vary spatially/temporally around the state?
9. Has our ability to describe the resource improved?
10. Is there still missing information for certain catchments?
11. Are some catchments better resourced than others?
12. How has the utilisation of the resource changed with history?

13. Has this utilisation had a major impact on the resource?
14. Is it wetter or drier and are there also differences between regions?
15. Has the incidence of flooding and drought changed?
16. Was the water allocated equitably?
17. Was there adequate catchment information to allocate sustainably?
18. Was the water used correctly?
19. Was the water used optimally?
20. Are allocations still available?

3.1.3 How much water will we have tomorrow, next month, next year?

1. Can we accurately estimate our future requirements?
2. Do we have adequate information to make predictions?
3. Do we have adequate climate information for input to models?
4. Do we have adequate models and knowledge?
5. How should we operate our system in the future to maximise our revenue and meet our energy supply obligations?
6. Will some catchments be in better shape in the future compared to others, and will some regions be better than others?
7. Are predictive climatic and hydrological models, able to provide information that is reliable for decision making?
8. Is the monitoring network able to provide the basic information to assess the resource now and into the future?
9. Is the requirement and necessity for water metering understood by water users and the broader community?
10. How is the groundwater resource influencing the resource available?
11. Will there be areas more susceptible to drought?
12. What water is required for riparian releases? (i.e. what is the downstream demand)?
13. Can we adequately predict flooding to protect our dams and infrastructure and downstream community?
14. Can we adequately quantify losses in the systems?
15. What is the impact of future changes to the resource (both spatially and temporally)?
    a. To the environment?
    b. To power generation?
    c. To water supply?
    d. To irrigation?
16. What are the data requirements to assist with future modelling practices?
17. Are current policies adequate for the allocation of water resources?
18. Has the understanding of groundwater increased to allow sustainable allocation?
19. Is the allocation policy adequate to deal with a diminishing resource?

3.1.4 How much water is the environment getting?

1. What are the base flows and how do these compare to requirements under water management plans?
2. What methods are employed to estimate environmental flows and are the results periodically review?
3. Are environmental flows suitable for water management planning purposes and to meet legislative requirements?
4. How are environmental flows monitored? Is this adequate?
5. Where will future statutory water management plans be developed or updated? What data is needed for these?

3.1.5 What quality is the water, and how is water quality changing?

1. Can we characterise the quality of water over time?
2. Can we detect trends within a decade?
3. Is the monitoring of water quality adequate for purpose?
4. Are we measuring the relevant parameters?
5. Is the frequency of monitoring adequate to detect short and long term changes/trends in water quality?
6. Is the spatial distribution of sites adequate for purpose?
7. Is monitoring generating scientifically defensible data?
8. Is the resolution (accuracy) of the monitoring equipment sufficient for intended use of the data?
9. Are water quality sampling, protocols and procedures consistent with state and National guidelines?
10. How is the data managed and stored?
11. How is the data reported
12. Are we meeting requirements of the *Water Management Act 1999* and the State Policy on Water Quality Management 1997?
13. Does current monitoring address gaps identified in the Tasmanian Surface Water Quality Monitoring Strategy?
14. Is the monitoring of water quality able to answer the questions raised?
15. How are land use practices affecting water quality?
16. Are we complying with our water licence?
17. How is power generation affecting downstream water quality?
18. Are we meeting community expectations?
19. Are we achieving integration of data sets?
20. How easy is it to analyse data from different sources?
21. Who has what data?
22. What metadata is available for sites?
23. What impact are point and diffuse sources of poor water quality having on groundwater downstream?

24. Is the water fit for purpose, e.g. irrigation, drinking water, recreation?
25. Is there a seasonal change occurring?
26. What impacts are the following having on water quality?
    a. Current land use?
    b. Future land use?
    c. Power generation?
    d. Water use?

3.1.6 Is the data fit for purpose?

1. Is the data adequate (fit for the purpose I want to use it for)?
    a. Is the resolution (accuracy) of the monitoring equipment sufficient for my intended use of the data?
    b. Are we recording the right parameters?
    c. Do we know enough information about our monitoring sites to make decisions based on the data (i.e. metadata)?
    d. Are ratings available and are they fit for purpose?
    e. Are there gaps in the data and can I fill them?
2. What are the processes for verifying and checking the accuracy of the data?
    a. Standards used?
    b. Frequency?
    c. Method of noting or correcting errors?
3. Can I access the data in a timely manner and in an appropriate format?
4. What do we know about inter-catchment diversions? Is this adequate?
5. Which are the key catchments – for environmental, economic or community values?
6. Do we have metadata such as sites, locations, parameters, date range from other data owners, and accessibility status to data?
7. What automation do we have to obtain data?

3.2 Water Information Drivers and Supportive Programs

Where water information questions have been put forward in the previous pages, the following section outlines ongoing programs and fixed term projects that utilise water data that is collected in Tasmania. These various programs and projects (including legislation) will contribute towards answering many of the questions that have been posed.

Table 1 – Water Information Data Uses, Drivers, Legislation and Supporting Programs.

TYPES OF WATER DATA	DATA USES, DRIVERS, LEGISLATION AND SUPPORTIVE PROGRAMS
SURFACE WATER **(LEVEL/ DISCHARGE)**	> *National Water Act 2007* and *Water Regulations 2008* > *Commonwealth Meteorology Act 1955* > National Water Initiative Implementation Plan for Tasmania > Irrigation Development > Power Generation • Planning daily hydro generation operations • Modelling for hydro generation operations planning purposes • Dam safety management during flood events • Investigations for modifications to existing schemes • Estimating catchment yields for planning purposes • Managing releases for environmental, riparian and irrigation purposes > SMART Farming Water Initiative (Tasmanian Government) > Tasmania's Major Irrigation Schemes > Australian Government Water Fund Project – Hydrological Models Project* > Water Availability and Forest Land-use Planning Tool > State of Rivers Reports > Derwent Estuary Program > Tamar Estuary Esk River Program (TEER) > Tasmania Together Benchmarks* > Water Development Plan Tasmania > Tasmania Flood Warning Network* > Climate Futures for Tasmania > CSIRO Tasmanian Sustainable Yields Project > Pesticide and Herbicide Monitoring Project > Tasmanian Water Metering Initiative > Tasmanian Water Use Metering Project > *Tasmanian Water Management Act 1999** • General Water Management – Regulation / Compliance • Water Management Planning • Water Information Systems of Tasmania (WIST) • Annual Waterway Monitoring Reports • Water Accounting Reports • Natural Resource Management (NRM) Regions
WATER QUALITY	> *Tasmanian Water Management Act 1999* • General Water Management – Regulation / Compliance • Water Management Planning • Water Information Systems of Tasmania (WIST) • Water Accounting Reports • Natural Resource Management (NRM) Regions • Monitoring River Health Initiative > Tasmanian Surface Water Quality Monitoring Strategy 2003 > *The Public Health Act 1997* Public Drinking Water Guidelines* > Derwent Estuary Program > Tamar Estuary Esk River Program (TEER) > Planning releases from hydro generation and irrigation storages > National Water Quality Management Strategy • ANZECC 2000 – Compliance and trend monitoring > State Policy on Water Quality Management 1997 > *Environmental Management Pollution and Control Act 1994* > Tasmania *Together* Benchmarks > National Water Initiative > National Action Plan for Salinity and Water Quality

TYPES OF WATER DATA	DATA USES, DRIVERS, LEGISLATION AND SUPPORTIVE PROGRAMS
	> Commonwealth Environmental Facilities Scheme – Landscape Logic research hub > Tasmanian State of Rivers Report > State of Environment Reporting > Australian Natural Resources Atlas > *National Water Act 2007* and *Water Regulations 2008* > *Water and Sewerage Industry Act 2008* > *Natural Resource Management Act 2002*
RAINFALL	> *Tasmanian Water Management Act 1999* • Water Management Planning • Water Information Systems of Tasmania (WIST) • Water Accounting Reports • Natural Resource Management (NRM) Regions > Power Generation • Planning daily hydro generation operations • Dam safety management during flood events > *National Water Act 2007* and *Water Regulations 2008* > *Commonwealth Meteorology Act 1955* > CSIRO Tasmanian Sustainable Yields Project > Climate Futures for Tasmania
GROUNDWATER	> *Tasmanian Water Management Act 1999* • Water Management Planning • Water Information Systems of Tasmania (WIST) • Water Accounting Reports > *Environmental Management and Pollution Control Act 1994* > *National Water Act 2007* and *Water Regulations 2008* > *Commonwealth Meteorology Act 1955* > *State Policy on Water Quality Management 1997*

(Note: Whilst an attempt has been made to include all data uses, drivers, legislation and supportive programs for all BoM named water agencies in Tasmania, this table only comprises information from the major organisations and smaller contributing agencies.)

4 Section B: Current Water Monitoring Networks and Management Regimes

This following section describes the current investment in water information assets that exist within Tasmania. The section is a snapshot of existing water monitoring systems, and describes relevant water measurement and observation networks, metadata and ICT infrastructure. Maps showing the locations and spatial distribution have also been included for water level, water quality, rainfall and groundwater sites. The metadata that was used for this section was requested from each organisation named in the Water Regulations in the form of a database inventory. This information has been included in Appendix 6.

Table 2 provides the approximate number of monitoring stations operated by named parties in the Water Regulations. This table is a work in progress and only represents the information that was provided within the inventory.

Table 2 – Summary of Current Monitoring Sites in Tasmania

	Stream or storage level	Stream flow	Water Quality continuous	Water Quality samples >2 yrs	Rainfall	Ground water
Hydro Tas	193	98	69	23	72	
DPIPWE	82	79	37	51	36	54
BoM	*46				47	
Hobart Water (Southern Water)	9		4	4		?
Forestry Tasmania	3		3	42	2	
IFS	2					
NRM North				92		
Launceston City Council	6	2			7	
Ben Lomond Water	?	1	1			
Cradle Coast Water (Cradle Mountain Water)	4		12	13		
Clarence City Council		3	3			
Totals	**345**	**183**	**129**	**226**	**164**	**54**

*Note: Numbers of sites are only represented for organisations that have provided suitable information within the inventory from Appendix 6. Some sites from Hydro Tasmania may include third party sites which would incur an overlap of total amounts. Some figures have not been verified. (*Represents Bureau flood warning sites only.)*

Due to the quantity of data sets that exist for water quality spot sampling programs, this version of the report will only include those sites with greater than two years of data and which are sampled under a current monitoring program. Stream and storage level sites have been separated from stream flow sites to distinguish between the amount of sites that only collect water level, and where a flow rating has not been developed or does not apply. Table 4 offers the number of actual storages monitored in Tasmania and is included in section 4.4 of this report.

4.1 Telemetry

Tasmania has good telemetry coverage for its continuous water monitoring network amounting to around 86% of all sites having some sort of telemetry system (see Table 3). However, a few key sites important to water management and business operations remain untelemetered. This is where landline or sufficient Next G coverage is not available and where some previous satellite telemetry trials have failed. At DPIPWE such trials to date have involved Global Star low earth orbit (LEO) and Iridium LEO based satellite services incorporating dial up telemetry systems.

Table 3 – Proportion of Telemetered Sites for Tasmanian Continuous Water Monitoring Network

Organisation	Total number of sites for continuous water monitoring	Number of sites on telemetry	% of total sites telemetered
Hydro Tas	208	185	89%
DPIPWE surface water network	84	79	94%
DPIPWE groundwater	54	37*	69%
Bureau of Meteorology	63	47	75%
Southern Water	?	?	?
Forestry Tasmania	3	3	100%
Ben Lomond Water	**2?	2	100%?
Cradle Mountain water	9	9	100%
Totals	**423**	**362**	**86%**

*Note: Organisations and number of sites only reflect information that was provided for the inventory in the appendix. *DPIPWE groundwater sites to have telemetry systems installed by June 2010. **Cannot determine from inventory whether WQ sites are continuous or spot samples.*

At the 2008 Australian Hydrographers Association (AHA) Conference held in Canberra, a presentation of trial results recommended Globalstar LEOs as the preferred satellite service to reliably send and receive data where monitoring sites were amongst hills and valleys. Such varying topography is typical for Tasmanian stream monitoring sites. However, this service is disadvantaged where connection

drop outs occur if dialup interrogation is used. It is now understood that the more reliable and cost effective data transmission system for LEO satellites is push telemetry or packet data. This is also dependent upon a compatible data logger which can be programmed to send the data accordingly.

4.2 Category 1 Data – Surface Water

From the information presented in Table 2 it has been identified that across Tasmania there are approximately 345 operational water level sites that provide continuous electronic time series data. DPIPWE and Hydro Tasmania operate complementary surface water monitoring networks across the state, as shown in Figure 5.

Most of the river sites managed by these two major organisations involve permanent (many historical) stream gauging stations that collect data relating to stream flow. The Tasmanian BoM is also a major collector of continuous water level data used for flood warning purposes. However, differences arise between these agencies where accuracies in water level information are not as critical for flood warning purposes as they are for low flows required under water management (e.g. water restrictions). For example, level data required for accurate low to medium flow rating development needs to be in the order of +/- 5mm. Such tolerances are not usually required in flood forecasting.

4.2.1 Irrigation Development

Tasmanian Irrigation Pty Ltd (TI P/L) is a newly formed State-owned corporation, created from the amalgamation of the Rivers and Water Supply Commission (RWSC), Tasmanian Irrigation Development Board (TIDB) and Tasmanian Irrigation Schemes (TIS). TI P/L will have responsibility for the development, management and ongoing operations for existing State-owned irrigations schemes as well as new schemes developed under the National Water Initiative.

Regarding the development of new irrigation schemes TI P/L is currently examining thirteen irrigation scheme projects across rural Tasmania. These projects are in various states of progression from the early stages of pre-feasibility to currently being constructed.

The development of water monitoring plans for each of the proposed irrigation schemes is largely determined from the approvals and regulatory processes associated with each scheme. In general, water monitoring on water courses is likely to be required above and below all on-stream irrigation water storages and upstream of pipe outlets that deliver water into natural watercourses. Monitoring may in some situations be required to determine transmission losses down watercourses as well as to monitor any environmental effects on water ways.

All irrigation extractions from pipelines and water courses will be monitored using flow meters, and where practical to do so be connected to telemetry to deliver near real time usage data.

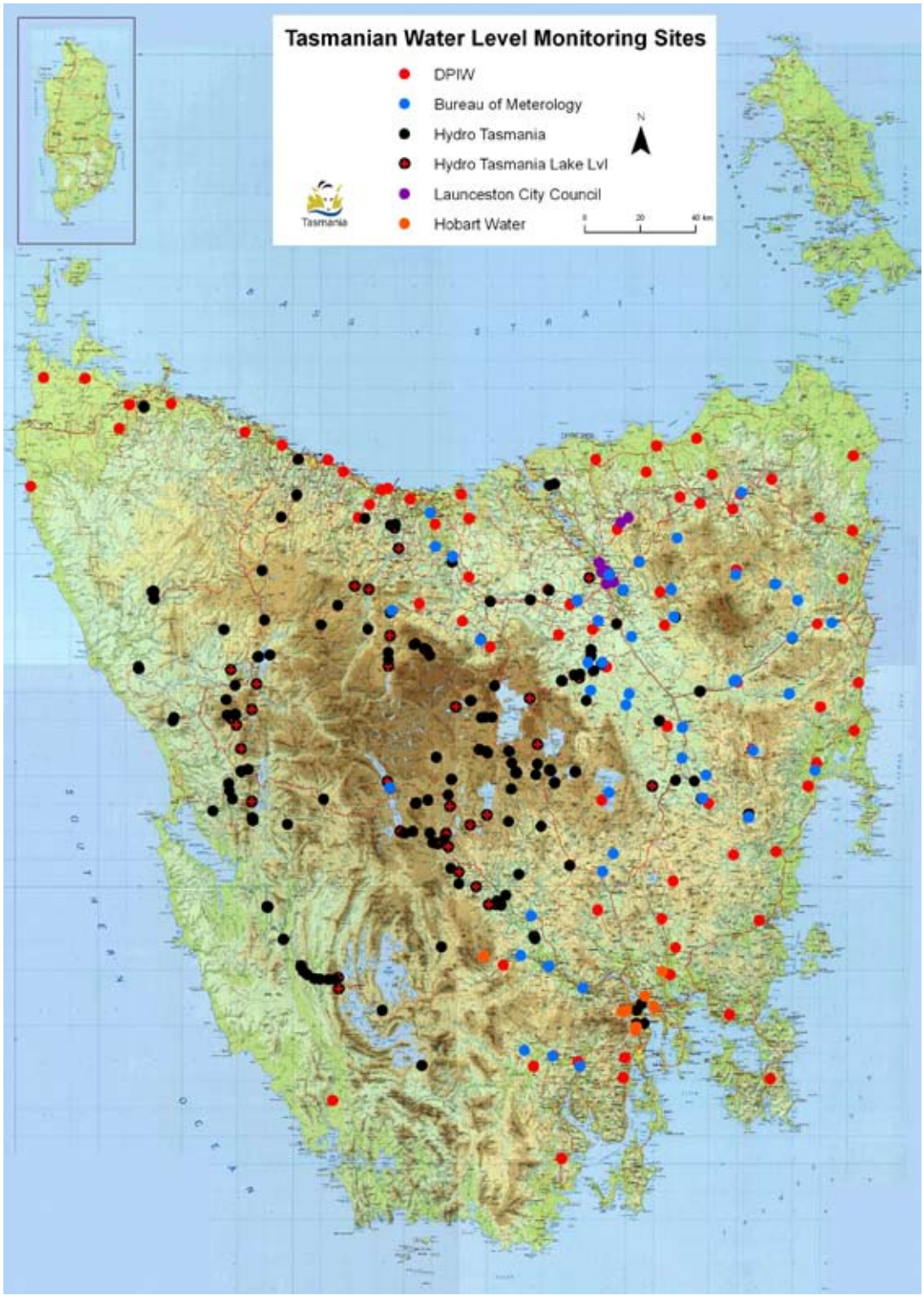


Figure 5 – Tasmanian surface water level monitoring network map (Data obtained from inventory included in Appendix 6)

The following is a brief description of each of the projects being examined and the likely water monitoring that will be required if the projects are constructed:

- **Whitemore Irrigation Scheme:** $11.3m. Designed to deliver 5,500 ML of water over the summer period to about 12,000 ha of farmland stretching from near the foot of the Western Tiers to just north of the Bass Highway near Carrick. Water, sourced from the Poatina power station tailrace, is extracted from the Cressy Longford Irrigation Scheme at the Stoneycroft pump station. It is distributed via 38 km of pipeline (with some channel and river sections). The scheme incorporates a pump house adjacent to the Liffey River to take water to a small (98 ML) holding dam prior to pipeline distribution.
- **Headquarters Rd Dam:** $5m. The 1,980 ML earthen dam is located on an unnamed tributary in the headwaters of the Great Forester River near South Springfield, south-west of Scottsdale. It incorporates a significant concrete spillway and stilling basing to mitigate against turbidity when the dam spills. The scheme is designed for the dam to be fully drawn down to deliver 1,980 ML to an irrigable area of 1800 ha along the Great Forester River nearly as far as the coast east of Bridport. Delivery is via the Great Forester River and extraction from the river is through metered riparian off-takes.
- **Sassafras Wesley Vale Irrigation Scheme:** $12.28m. The project is designed to deliver nearly 5,500 ML to 10,650 ha of farmland extending from Devonport to almost Port Sorell and down to Latrobe. Water is sourced from the Mersey River and transported to the region using 10.8 km pre-existing trunk main which formerly serviced the TasPaper mill at Wesley Vale. This trunk main and the associated Great Bend pump station are now incorporated into the irrigation scheme. Water is delivered via 74 km of branch pipelines and three booster pump stations.
- **Winnaleah Irrigation Scheme Augmentation:** $10.7m. This augmentation of an existing scheme will provide an additional 3,700 ML of water to take the Winnaleah scheme's total licenced capacity to 6,950 ML and extend its irrigable area to a total of approximately 4,500 ha. The scheme involves rehabilitating the existing Frome dam and construction of 15 km of pipeline (including a boost pump station on Banca Link Rd) to connect it to the existing scheme.
- **Midland Water Scheme – Arthurs Pipeline:** $88.15m. This scheme is designed to deliver 38,500 ML to an irrigable area of 55,684 ha extending from around Campbell Town to just south of Kempton. It uses water from Arthurs Lake which otherwise would have been used by Hydro Tasmania to generate power. Water is delivered from Arthurs Lake via a 34 km high pressure pipeline to a 5.5 Megawatt mini-hydro plant on Floods Creek, from where it is distributed using approximately 100 km of pipelines and sections of the Blackman/Macquarie, Isis and Jordon rivers, and a section of Kittys Rivulet. The distribution branch pipelines incorporate four pump stations.

- **Lower South Esk Irrigation Scheme:** $12.2m. The Lower South Esk Irrigation Scheme is designed to deliver up to 5,200 ML to an irrigable area of 9,000 ha extending north from approximately Conara to as far north as Longford. It is based on extracting winter flows from the South Esk which are stored in a 6,000 ML capacity off-river dam on the Milford property for release back into the river during spring/summer. The project incorporates a powerful pump station and short trunk pipe to take the water to the dam. Extraction by land-owners is via riparian off-takes.
- **South-East Irrigation Scheme:** $40m. This project is designed to supply 5,000 ML to an irrigable area of about 25,000 ha extending from the lower Jordan Valley, through the Coal River valley, to Orielton, Sorell and as far as the Forcett area. It is designed to enable future upgrading to a total of 10,000 ML. The project will utilise spare winter capacity in Southern Water's greater Hobart supply system to take untreated Derwent River water in winter. New pipeline infrastructure totalling 115 km will be built to take the water to the existing Craigbourne Dam and distribute it to properties. The supply infrastructure includes a new trans-Derwent crossing at Granton and pump stations at Tea Tree and below the Craigbourne Dam.
- **Upper Ringarooma Irrigation Scheme (North-East):** $30.8m. This project is the based on a dam of 10,000 ML capacity on Dunns Creek in the headwaters of the Ringarooma River. The scheme is designed to deliver 9,000 ML annually to an irrigable area of 10,177 ha via pipelines and a section of the Ringarooma River. The dam is filled mainly from the catchment with supplementary takes from the Ringarooma River. Infrastructure includes a total of 42 km of pipeline comprising a 3.4 km Ringarooma-Dunns Creek Dam section and three distribution pipelines. Two of the distribution pipelines are connected to the Ringarooma-Dunns Creek pipeline section and the third is based on extraction from the Ringarooma River at Ringarooma. There are two pump stations. Two other North-East schemes are under development in the Little Forester catchment and in the Great Forester/Brid catchments. Preferred options have not yet been developed for these.
- **Kindred North Motton Irrigation Scheme (Forth):** $10m. The Kindred North Motton Irrigation Scheme is designed to deliver 2,500 ML annually to an irrigable area of 1,000 ha. It is based on water sourced from the Forth River below Paloona Dam. The scheme comprises 46 km of supply and distribution pipeline and incorporates two pump stations.Two other Forth schemes are under development in the Forthside-Don and Sheffield-Melrose areas. Preferred options have not yet been developed for these.
- **Shannon Clyde Irrigation Scheme:** the project is deferred pending resolution of external factors and will be reviewed once these factors are resolved.
- Schemes for **Dial Blythe, Swan Valley** and St Pauls catchment **(Meadstone)** have not yet progressed to preferred option stage.

4.3 Category 2 Data – Groundwater

With changes to agency responsibilities in 2006, DPIPWE assumed responsibility for all groundwater management and related monitoring and assessment activities in the state, including the Statewide Groundwater Monitoring Network (SGMN). As shown in Figure 6, the current network consists of 51 bores. These are comprised of the remaining operational statewide and Devonport network boreholes (33 and 12 holes respectively) and six recently drilled bores in Nine Mile Beach aquifer near Swansea. The DPIPWE Hydstra database contains additional data for five monitoring sites that were either decommissioned or previously transferred to other organisations.

During 2007-2008, 24 additional monitoring bores were established in the northern part of the state for the purposes of developing groundwater hydrological models. Twice yearly recording of manual water levels will be carried out initially on these monitoring sites until funding and staff can be secured to upgrade sites to provide continuous data series for electrical conductivity, temperature and water levels.

Subject to future available funding standard groundwater sampling should become an integral part of the bi annual monitoring program.

A project funded through Round 3 of BoM's Modernisation Fund, will see 70 groundwater monitoring bores upgraded in 2010. The main objective of the upgraded SGMN is to monitor changes in the quantity and quality of groundwater with respect to changes in land use, climate and increased or decreased resource utilisation. The collection of this primary data will facilitate other secondary objectives, including;

1. Determination of aquifer specific variability in groundwater quality;
2. Provision of baseline data for use by DPIPWE, local government, private companies and individuals, researchers and other government organisations;
3. Ability to perform network analysis on groundwater and surface water data in order to optimise management of water networks; and
4. Ability to maintain and improve recently developed groundwater models in the key areas of the state.

Both EMPCA and SPWQM assist in the protection of groundwater from activities with the aim of prevention of environmental harm. With these activities many preoperational, operational and decommissioning ambient monitoring programs for the activities have been conducted. While much of the detail is in hardcopy reports or non-interconnected data files the water data management system developed in the EPA Division (with subsequent iteration) is geared for electronic transfer of data and storage of groundwater data.

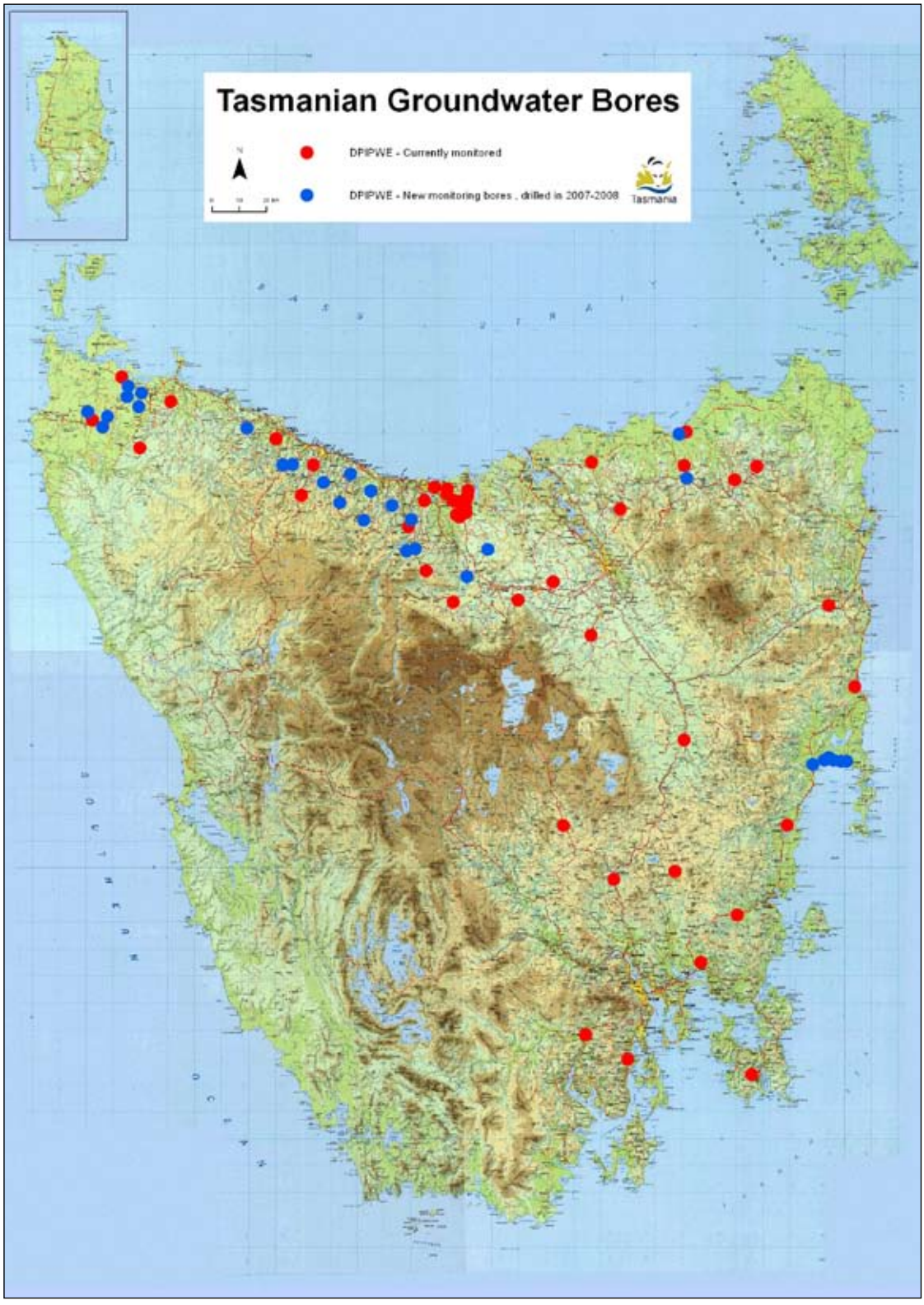


Figure 6 – Tasmanian groundwater bore network map
(Map supplied by DPIPWE Groundwater Section)

4.4 Category 3 Data – Storage Monitoring

In 2010 BoM released its first version of the Australian Water Resource Information System (AWRIS). Access to information in relation to continuous monitoring of major water storages for Tasmania is now available on a single website. BoM's Water Storage website allows users to compare water storage levels and volumes for more than 250 publicly-owned lakes, reservoirs and weirs in different states and territories and to see how much water is available over the entire country. There are currently 46 Tasmanian storages listed in AWRIS.

In Tasmania, Hydro Tasmania (HT) are the main data collectors for continuous water storage monitoring. Many of these sites are monitored to assist with the management and release of storages relating to hydro electricity. The approximate number of storage monitoring sites that involves continuous recorded data is 69 (Table 4).

Table 4 – Number of Storage Monitoring Sites for Tasmanian Organisations

Organisation	Total number of sites involving continuous storage monitoring
Hydro Tasmania (HT)	49
IFS (sites managed by DPIPWE)	2
Bureau of Meteorology	1
Southern Water	9
Forestry Tasmania	0
Ben Lomond Water	2
Cradle Mountain Water)	4
Tasmanian Irrigation Schemes (TIS)	2
Total	**69**

In 2010 DPIPWE installed two continuous water monitoring sites to record storage levels at Lake Crescent and Lake Sorell. Previously 'daily read' data for these sites was collected by Inland Fisheries (IFS) which was forwarded to DPIPWE and entered onto their Time Studio database on a monthly basis. DPIPWE also monitor outflows from four Tasmanian irrigation storages (Tooms Lake, Lake Leake, Lake Crescent and Craigbourne Dam).

Tasmanian Irrigation Schemes (TIS) also collect continuous data for two storage sites, Meander Dam and more recently Craigbourne Dam. It is expected

that as irrigation development projects are completed, associated storage level monitoring systems will need to be installed and would be expected to become the responsibility of Tasmanian Irrigation Schemes under the RWSC.

The newly appointed water corporations now manage three regional areas and are responsible for much of the water data collected from councils under their jurisdiction. It is expected that as these corporations better understand their assets and become familiar with historically collected data and subsequent incorporation into regional data management systems, they will provide information to BoM as per their obligations under the Water Regulations.

Prior to the reform of the urban water and sewerage sectors, Tasmanian water authorities and councils recorded storage levels at various reservoirs and lakes. However information that had been provided for the inventory in this report has been lacking for some of these councils. It is therefore assumed that the total number of storage monitoring sites responsible under the new water corporations is likely to be greater than indicated in Table 4. At this point in time it is unknown whether any data exists relating to continuous level monitoring for large privately owned storages or those managed within the mining industry.

4.5 Category 4 Data – Meteorological

In Tasmania major water monitoring agencies monitor and record rainfall around the state providing for what would appear to be a good distribution for an appropriate rainfall monitoring network (as shown in Figure 7). Many of these stations are managed by Hydro Tasmania and DPIPWE whom perform quality control checks on a regular basis (twice yearly).

BoM Tasmanian Hydrology Unit also manage a rainfall network that consists of around 29 telemetered rain gauges. Meteorological sites used for weather reporting in Tasmania also exist for BoM outside of their Hydrology Unit. These sites have not been included or discussed within this document.

Hydro Tasmania (HT) has a network of 72 rainfall stations that are situated throughout Tasmania. All the stations operated by HT are visited at least twice a year for calibration checks. These checks are done using BoM standard 203 mm calibrator flask. The data is also plotted up against sites in nearby catchments on a weekly basis for preliminary quality coding and checking. These weekly data management reviews keep field staff informed of any potential non conformances with the data which can then be checked on the next field trip to the area.

DPIPWE has recently acquired sufficient equipment to accurately calibrate and maintain their distribution of 36 rainfall sites. These include 23 new rainfall site installations that were funded by BoM under the Modernisation Fund in 2008/09. Rain gauge calibrations are also conducted bi-annually for these sites.

The majority of rainfall stations managed by major water agencies have been issued with the preferred BoM standard RIMCO 203 mm rain gauge.

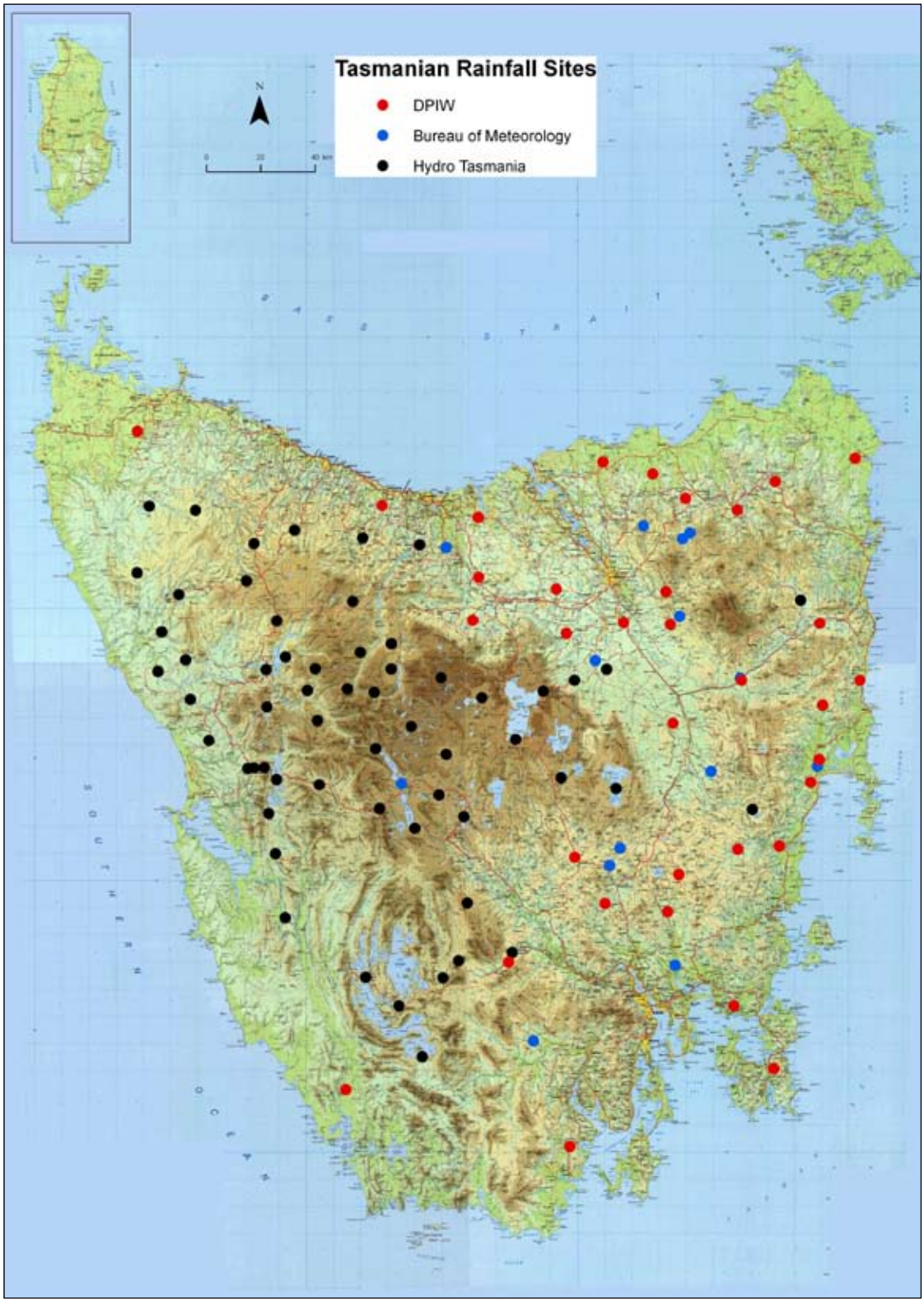


Figure 7 – Tasmanian rainfall network map. Data obtained from inventory included in Appendix 6 (Note: BoM Hydrology Section flood warning sites only)

Under the *Water Regulations 2008* and in addition to rainfall, BoM require the reporting of various meteorological parameters if collected and stored in electronic format. Table 5 lists the various named organisations that collect specific meteorological data within the state. Note that this table does not include Tasmanian BoM sites managed by other BoM areas outside of the hydrology group, for example the Automatic Weather Stations (AWS) used for weather reporting.

Table 5 – Organisations that Collect Specific Meteorological Data within Tasmania

	Rainfall	Wind speed	Total daily evaporation	Solar exposure	Solar irradiance	Dry bulb temper-ature	Wet bulb temper-ature	Relative humidity	Vapour pressure deficit
DPIPWE	36								
LCC	7								
Forestry Tas	2	2			2	2		2	
Hydro Tas	72	1	1		1	28		1	
BoM*	47	4	2	2		3	3	2	
Total	**164**	**7**	**3**	**2**	**3**	**33**	**4**	**5**	**0**

*Note: Information has been sourced from the inventory provided in the appendix of this report. *This refers only to the Bureau of Meteorology telemetered sites owned by the Hydrology group and operated as part of the Tasmanian flood warning network.*

4.6 Category 5 Data – Water Use and Metering

The following information regarding water use and metering has been sourced from the Department's website at www.dpipwe.tas.gov.au/water. The Department is currently finalising a State Metering Strategy to increase the number of water meters to accurately measure water use that is taken and used for consumptive purposes under a water licence. These developments reflect the growing need to obtain data through water metering in order to make informed decisions regarding water allocation and sustainable water management of water resources at the property, regional and state-wide levels.

4.6.1 Requirement for Water Meters

The Tasmanian Water Management Act 1999, under which water licences are issued, provides that the Minister may require the installation of a meter by any person taking water from a State resource, but until 2003 it had only been required in specific cases. Since 2003, DPIPWE has extended metering more broadly in recognition of its importance for water management and planning.

The move to ensure that all significant licensed water users are metered follows a commitment made when Tasmania became a signatory to the National Water Initiative (NWI) in 2005. The NWI is a comprehensive strategy driven by the Australian Government to improve water management nationwide, and sets out objectives, outcomes and actions and time lines for ongoing water reform. Improving water metering and measuring are among its goals.

4.6.2 Tasmanian Water Metering Initiative (TWMI)

The intent of the TWMI is that water licence holders whose volume of water allocated under their licence represents a significant proportion of the total water allocated in the relevant catchment will be metered within the next few years. In the case of the issue of new water licences and the transfer of existing allocations, licence holders may be required to act by installing meters as part of the relevant allocation and transfer procedures. In addition some licensees may be required to install meters in order to address specific management or compliance needs. By adopting this process it is planned that all significant water taken under a DPIPWE licence for commercial use will be metered within the next few years.

4.6.3 Tasmanian Water Use Management Project (TWUMP)

This project will collect and develop a data management system to hold water use data for all irrigation licensees through the installation of up to 3000 telemetry units on farm water meters which are being rolled out across Tasmania. The water use data from the on-farm meters will be stored on a central web-based database and licensees will be able to access their own daily water use, total use and use against their allocation on line. A training program will be offered for irrigators, and will link with existing state-wide research and extension programs on water use efficiency.

The project will provide water users and water resource managers with reliable water use data for water management and planning purposes across Tasmania. Licensees will have real time access to accurate water use data which will result in more water efficient production. The project will advance the National Water Initiative objectives of improving water metering and measuring, and increase efficiency of water use in agriculture. A diagram of the project is shown in Figure 8. The project is currently under review pending the resolution of resourcing issues.

4.7 Category 6 Data – Water Rights, Allocations and Trades

Information on water entitlements in Tasmania is stored on DPIPWE's Water Information Management System (WIMS) database. Information within this database includes annual allocations and periods for each licence. For example, a licence may be for 200 ML from October to February. Each licence in a given catchment is of a given surety (surety hierarchies 1 to 8 detailed below).

As there are many irrigation extractions unmetered in the state, reliable records of actual extraction amounts do not exist. In the absence of any information on the actual extraction amount it is often assumed that all extraction licences are fully utilised. (Hydro Tasmania, 2010)

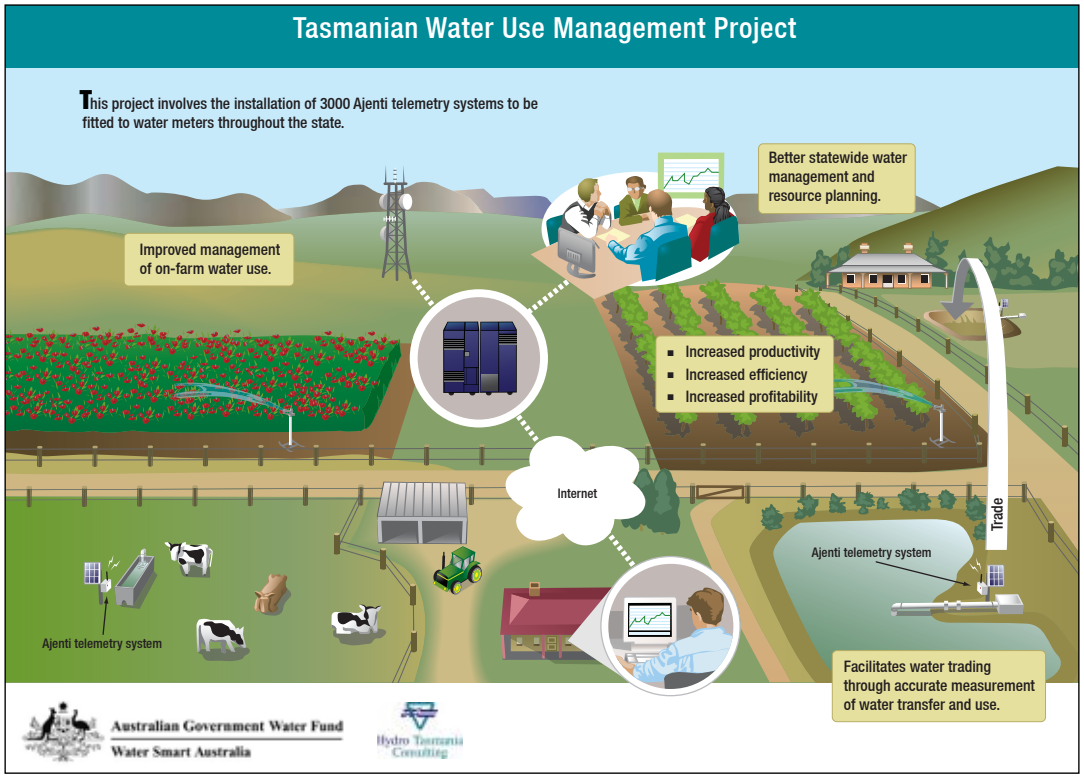


Figure 8 – Diagram of the Tasmanian Water Use Management Project

The WIMS database indicates that (as at May 2011) there are 10,283 extraction licences with a combined extraction amount of 1,743.6 GL. Table 6 provides a breakdown for the number of licences that have been issued against extraction/ licence types. Prescriptive rights are also identified as an extraction type in WIMS but represent historical rights which are not issued anymore. These rights have now been converted to a high surety licence.

Table 6 – Number of Water Licences and Extraction Amounts Recorded in WIMS Database (May 2011)

Extraction/Licence Type	Number of Licences	Extraction Amount (GL) incorporates consumptive and non consumptive use
Riparian rights	1,685	26.9
Statutory rights	52	36.2
Water licences	8,530	1,676.2
Temporary rights	16	4.3
Total	**10,283**	**1,743.6**

The following information provides information on water rights, allocation and trades and has been sourced from the Department's website at www.dpipwe.tas.gov.au/water

Under the *Water Management Act 1999*, DPIPWE has been delegated the power to grant or refuse water licence applications. Users must have a water licence and water allocation to take water from a river or stream, or store water in a farm dam, for farming or other commercial purposes with the exception of users listed under Part 5 of the Act.

Rights to water under Part 5 of the Act are predominantly for riparian landholders wishing to take water for stock, domestic house and garden purposes. Part 5 rights also cover the following uses of water:

- Riparian landholders for domestic purposes and livestock consumption
- Fire fighting
- Casual users for the above purposes
- Surface water (water flowing over land and not in a watercourse) for any purpose
- Groundwater for any purpose unless the area has been declared as a specified Groundwater Area
- Small-scale generation of hydro-electricity.

A water licence will be issued for a period of 40 years with provision made for reassessment of licence conditions every five years.

Surety Levels

Surety levels indicate the surety with which a water allocation can be expected to be available for taking. Level 1 water is available at the highest surety level. Where water restrictions are imposed the restriction protocol will generally restrict water allocations at a lower level of surety before restricting the taking of water of allocations at higher surety. The hierarchy of levels from highest to lowest is as follows:

Surety 1 Water (expected to be available at greater than 95% reliability)

i. Rights for the taking of water for domestic purposes, consumption by livestock or fire fighting under Part 5 of the WMA 'Rights in Respect of Water' (i.e. no licence required);

ii. Rights of councils to take water for town water supplies (allocation at this surety level is two thirds of their actual daily usage in the five years prior to 2000 multiplied by 1.05 with the remaining one third allocated as surety 5).

Surety 2 Water

The water provision allocated to supply the needs of ecosystems dependent on the water resource.

Surety 3 Water

Rights of licensees granted a licence by way of replacement of 'old' prescriptive rights granted under previous Acts. Under Clause 10 of Schedule 4 of the WMA, these licences are issued for a period of not less than 99 years. The taking of water is generally for commercial purposes.

Surety 4 Water

Rights of special licensees such as Hydro Tasmania. Special licences are granted to a body corporate for the generation of electricity, or for purposes reasonably incidental to that purpose, or for a specified purpose on application in writing to an Advisory Committee if the application is consistent with the objectives of the WMA.

Surety 5 Water (expected to be available at about 80% reliability – eight years in ten)

Rights issued for the taking of water otherwise than for the purposes described above under Surety levels 1–4. This includes rights issued for the taking of water under Part 6 of the WMA 'Licensing and Allocation of Water' for direct extraction, and for winter storage in dams, for use for irrigation or other commercial purposes.

Surety 6 Water (water allocations available at between 50% and 80% reliability)

Rights at this surety level issued for the taking of water under Part 6 of the WMA 'Licensing and Allocation of Water' for direct extraction for use for irrigation and other commercial purposes and for winter storage in dams.

Surety 7 and 8 Water

Water allocations available with a lower level of reliability than a Surety 6 allocation (less than 50%). These allocations include water provided under catchment or site specific limitations and conditions, such as water taken in flood peaks in Hydro Water Districts to fill dam storages.

4.8 Category 7 Data – Urban Water Management

The Minister for Primary Industries and Water is responsible for administering the *Water and Sewerage Industry Act 2008*. The Minister is further responsible under this Act for developing and coordinating policies related to the regulation of the water and sewerage industry. The Urban Water Policy Unit has been created within DPIPWE to assist the Minister in carrying out these functions under the legislation. (www.dpipwe.tas.gov.au/water)

Figure 9 – Regional map of new water corporations (source www.mywatertas.com.au)

Tasmanian Water and Sewerage Reform

The State Government, with the support of local government, has recently introduced wide ranging structural and regulatory reforms that will improve the delivery of water and sewerage services in Tasmania. Principally, the responsibility for the provision of drinking water and sewerage services has been removed from local councils and invested in three new regional corporations. These regional corporations include Cradle Mountain Water, Ben Lomond Water and Southern Water (see Figure 9). A fourth common services entity was also created to service these regional corporations. The corporations began operation on 1 July 2009 and will be independently run, but owned by local councils.

The *Water Regulations 2008* currently name six Tasmanian councils that are required to deliver specified water information to BoM. The three new regional corporations will take on the responsibility for delivering much of this data to BoM. However, under the Water Regulations the regional corporations will also be responsible for delivering much of the newly collected water information from an additional 22 councils (some flood warning information will remain the responsibility of local councils). It is yet to be determined what types of water information are being monitored and collected for these additional councils.

4.9 Category 8 Data – Water Restrictions

DPIPWE provides licence and allocation information to BoM directly via WIST on a weekly basis. During the summer period, a weekly report on water restrictions is also sent to BoM, and on an ad hoc basis during winter.

4.10 Category 9 Data – Water Quality

In Tasmania the water agencies that collect the majority of continuous water quality data are Hydro Tasmania and DPIPWE. As shown in Figure 10 and derived from Table 2, Hydro Tasmania operates 69 continuous water quality monitoring stations. Several of these sites are short term and project related. In addition, DPIPWE's current Baseline Water Quality Monitoring Program (BWQMP) consists of 52 monitoring sites predominantly located at the bottom of catchments and across rural areas of Tasmania where flow monitoring stations exist.

Currently, the measurement of basic water quality parameters by DPIPWE is completed on a quarterly basis at all gauging stations (or whenever stations are visited) and includes basic physicochemical parameters (temperature, electrical conductivity, dissolved oxygen, turbidity and pH). Prior to August 2009 total and dissolved nutrients samples (total nitrogen, total phosphorus, ammonia, nitrite, nitrate and dissolved reactive phosphorus) were collected on a monthly basis but this nutrient sampling program has now ceased.

As part of the EPA Division's requirements, proposed and existing activities conduct specific ambient monitoring programs. The extent and complexity of these programs are activity specific. The Division is also involved in baseline ambient monitoring programs.

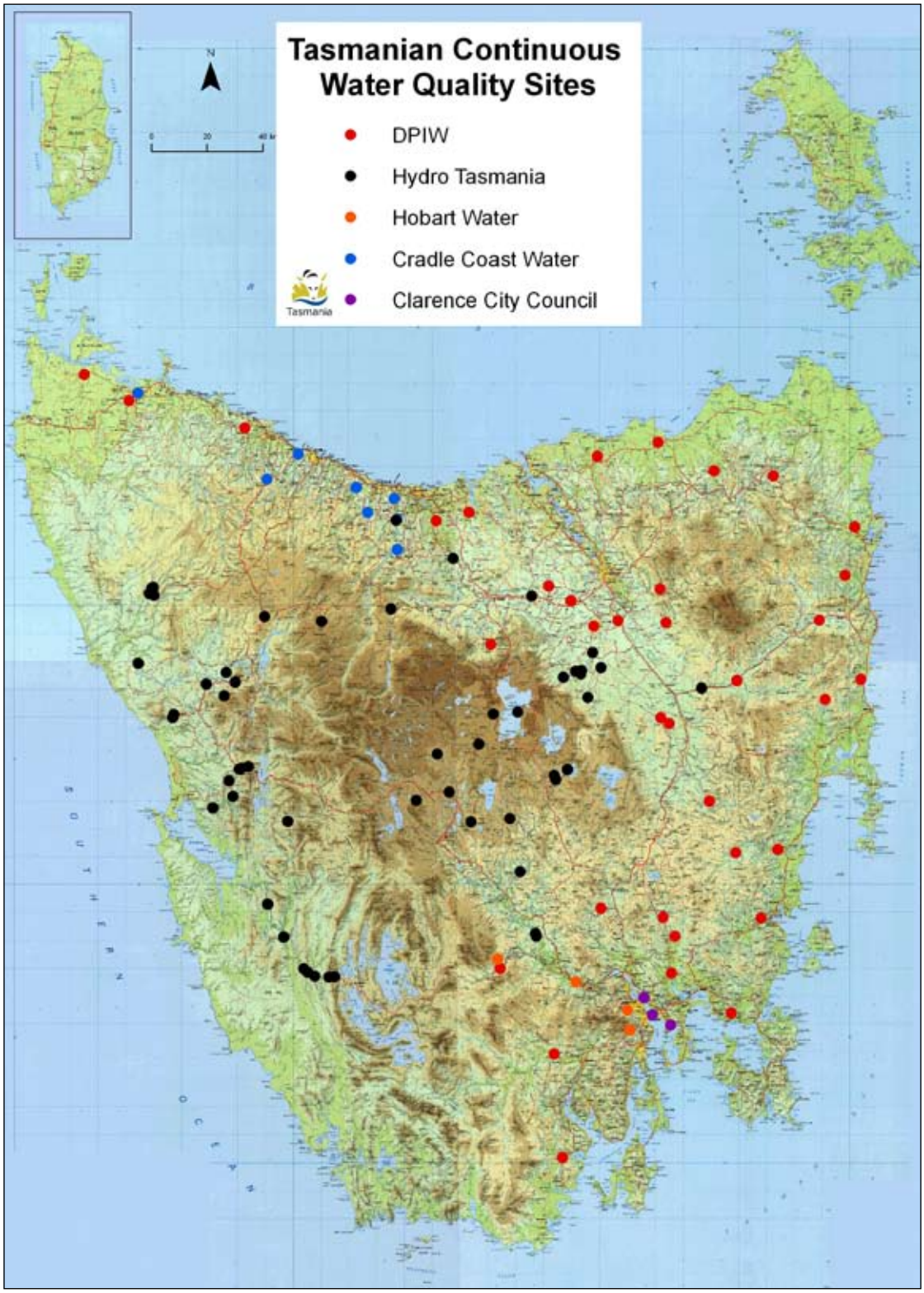


Figure 10 – Tasmanian surface water continuous water quality network (Data obtained from inventory included in Appendix 6)

At a subset of 37 DPIPWE sites, continuous recording instruments have been deployed which log electrical conductivity, temperature and turbidity at 20-minute intervals. At two of the 37 sites dissolved oxygen is also continuously monitored however these probes are currently being phased out due to ongoing data quality issues. It is not anticipated that these will be replaced in the near future until superior products become available with the required accuracy. Data from the 37 sites is generally quality checked and coded within a two to three month timeframe for availability to the public on WIST.

The inventory component of this report has also identified Southern Water, Cradle Mountain Water, Ben Lomond Water, Clarence City Council, and Forestry Tasmania as water agencies that manage sites involving in situ water quality instrumentation (refer to Table 2 for number of sites). Figure 10 that follows only identifies sites that have provided suitable mapping coordinates within the inventory.

DPIPWE's water quality monitoring stations are prioritised in terms of the frequency of maintenance and data quality checking and coding. Priority status for each DPIPWE site is provided in the following Table 7.

Table 7 – DPIPWE – Water Quality Site Maintenance Prioritisation

Site No		Name	Priority	Site No		Name	Priority
18312		Macquarie River downstream Elizabeth River	High	635		Huon River at Judbury	Low
18312		Meander River at Strathbridge	High	17200		Rubicon River at tidal limit	Low
181		South Esk River above Macquarie River at Perth	High	18221		Jackeys Creek downstream Jackeys Marsh	Low
18217		Macquarie River at Trefusis	High	14207		Leven River at Bannons Bridge	Low
18313		Macquarie River 1.25 kms upstream Elizabeth River Junction	High	164		Liffey River at Carrick	Low
191		Break O' Day River at Killymoon	High	14200		Montagu River at Stuarts Rd	Low
18311		St Pauls River upstream South Esk	High	2219		Swan River upstream Hardings Falls	Low
25		Nile River at Deddington	High	2218		Douglas River upstream Tasman Hwy	Low
19201		Great Forester River 2 km upstream Forester Rd Bridge	High	2206		Scamander River upstream Scamander tWater Supply	Low|
447		Mersey River at Latrobe	High	2202		Prosser River upstream Lower Dam	Low
30.2		Ringarooma River at Moorina	High	499		Tyenna at Newbury	Low
2235		Little Swanport River 3 km upstream Tasman Hwy	High	3209		White Kangaroo Rvt	Low
2212		Little Swanport 800 m downstream Eastern Marshes Rvt	High	2209		Carlton River at tidal limit	Low
3208		Coal River at Richmond	High	3206		Coal River downstream Craigbourne Dam	Low
14214		Duck River upstream Scotchtown Rd	High	14215		Flowerdale River at Moorleah	Low
2205		George River at St Helens Water Supply	High	4201		Jordan River at Mauriceton	Low
19204		Pipers River downstream Yarrow Creek	Low	7200		Esperance River at Dover Water Supply	Low
76		North Esk at Ballroom	Low	18219		Back Creek upstream Wilmores Lane	Low
19200		Brid River 2.6 km upstream Tidal Limit	Low				

In addition to continuous water quality monitoring, spot samples are also routinely collected and tested by many Tasmanian water agencies. Many of these samples that are recorded onto databases involve short term projects with less than one year of data. For the purpose of this report sites identified in Figure 11 only include those with greater than five years of record. Alternatively, Table 2 in Section 4.2 includes the total number of spot sample sites with greater than two years of data.

Sites have only been included in Figure 11 for those organisations that have provided suitable mapping coordinates within the inventory.

Water Quality and Water Pollution

The Environment Division of DPIPWE ensures that water quality measures are consistent with the objectives of the State Policy on Water Quality Management 1997 (SPWQM). The main objective of the Policy is to maintain or enhance water quality. The Division also aims to address the problems associated with water pollution through a process of detection, control and remediation. It is responsible for the environmental assessment of high-risk activities that have significant potential to pollute waterways and may use the enforcement provisions of the *Environmental Management and Pollution Control Act 1994* to require the clean-up and remediation of water bodies affected by industrial pollution.

4.11 Database Infrastructure

Information on database infrastructure has been gathered for many of the water information collection agencies in Tasmania and presented below. Progressive versions of this document will endeavour to include database descriptions for all ‘named agencies’ and document any intentions of future upgrades. In the past Hydstra TSM has been adopted in Tasmania as the preferred data management system for major water agencies. The owners of Hydstra TSM (Kisters) have recommended that this system be replaced in the near future as the product has been declared ‘end of life’. Major Tasmanian water agencies are now faced with the task of choosing an appropriate replacement.

4.11.1 Hydro Tasmania

Hydro Tasmania currently use the Hydstra TSM data management system from Kisters AG Germany. As Time Studio has been declared ‘end of life’ the Kisters recommended replacement is their next generation time-series data management system WISKI 7 (WISKI). WISKI is an environmental data management system designed for but not limited to management of data in the areas of surface water monitoring, groundwater monitoring, dam safety, hydro power generation, wind power generation, meteorology, flood forecast and alarming and urban hydrology.

WISKI is a scalable three tier data management system; the data tier where the time series data is stored is a relational database such as Oracle or SQL server. Time series business logic is provided by the middle tier and the presentation tier performed by time series client applications (TCAs). TCAs include the WISKI

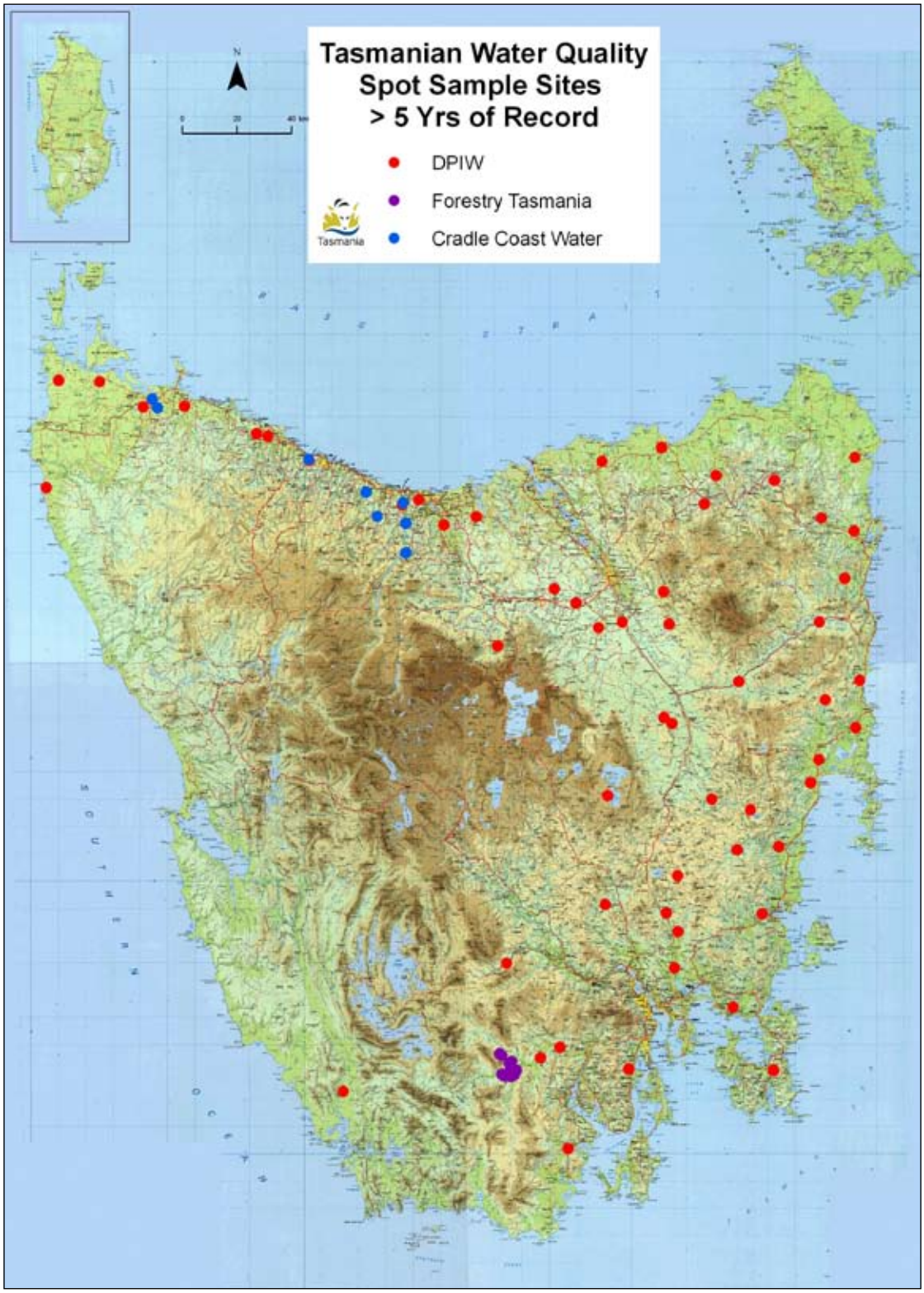


Figure 11 – Tasmanian surface water, water quality spot samples network. (Data obtained from inventory included in Appendix 6)

interactive client for quality assurance, analysis and data publication, WISKI modelling used primarily for time-series forecasting such as water storage inflows, WISKI web for visualisation of time series data via internet technology, and WISKI Service Provider for automation of work processes such as creation of standard reports and flood warnings. A diagram showing the architecture and system components of WISKI is represented in Figure 12.

At Hydro Tasmania the time-series data management system provides near real time decision support for energy production, energy trading, and dam safety. The typical work flow is:

- Telemetered data acquisition;
- Automated data quality assurance (max/min value exceedance, value rate of change exceedance, temporal gap detection);
- Scheduled production of, decision support plots, tabular reports, and exception alarms based on both acquired and modelled time-series; and
- Manual data quality assurance and analysis.

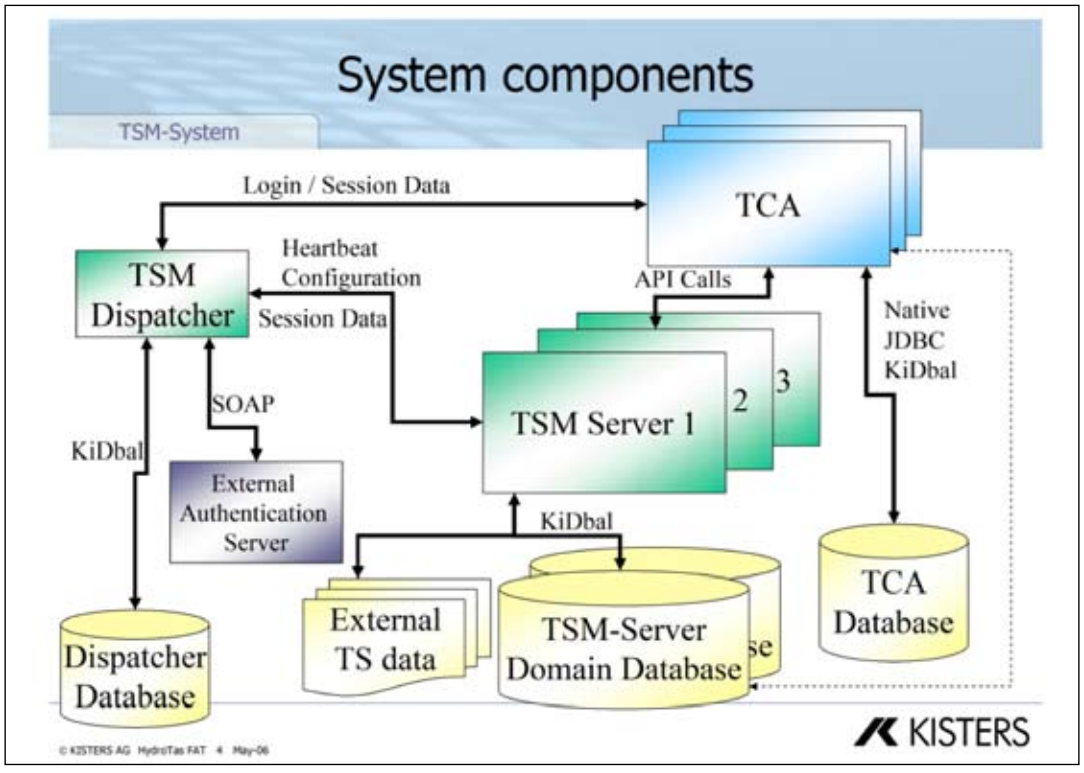


Figure 12 – Simplified WISKI architecture diagram

4.11.2 Department of Primary Industries, Parks, Water and Environment (DPIPWE)

DPIPWE also stores its water resource information within Hydstra TSM and is currently in the process of determining an appropriate fully supported replacement for the near future. The current Hydstra TSM system also includes data series data for water levels and groundwater chemistry for monitored groundwater sites and will include some water use (metering) information (telemetered and non-telemetered) in the near future. Allocation data is stored in the WIMS (Water Information Management System) database and managed through the WIMS Oracle application.

Groundwater management is a new responsibility for DPIPWE under the *Water Management Act 1999* with the Groundwater Information Management System (GWIMS) currently under development. Monitoring bores construction details and hydro geological parameters are currently stored in the Tasmanian Information on Geoscience and Exploration Resources (TIGER) Oracle spatial database together with information for remaining 9200 boreholes. These bores form a basis for assessmtent and management of Tasmanian groundwater resources. During the GWIMS database development all groundwater data will be migrated from the TIGER database system into GWIMS. Allocation data will also be stored in WIMS and any successor licence and allocation management system. Individual servers are used within the DPIPWE Corporate IT infrastructure for data storage and as application servers for Time Studio and WIMS. Data supply to the Bureau is maintained via a separate high availability server system and DPIPWE is participating in the Bureau's database merger project using this platform.

4.11.3 Bureau of Meteorology (BoM) – Rainfall and Water Level Data

The Tasmanian BoM polls data through the Hydstra TSM data base system, which is then stored on a TSM database in Melbourne. As with the other major water information collection agencies, BoM will also be determining an appropriate replacement of this database system in the near future. Event-based radio data is received and decoded through the Bureau owned Enviromon-Real Time Environmental (Flood) Data Monitoring System. Data is stored on local servers; automatic weather stations (AWS) data via PSTN dedicated lines and radio links; daily reporting is via a ROT (remote observer terminal) or manual reporting via the world wide web. Manual and daily records are sent in at the end of the month for data entry. All data is stored in AIFS – Australian Integrated Forecasting System.

4.11.4 Southern Water

Up until recently Hobart Water (now Southern Water) has used Time Studio to store and manage their water resource information. They are currently in the process of replacing this system with a new product called Aquarius. Onstream is involved with rolling out the Aquarius database and reporting tools to the remaining regional bodies, Cradle Mountain Water and Ben Lomond Water, in the near future.

4.11.5 Rivers and Water Supply Commission (RWSC)

RWSC currently stores all water records on Excel spreadsheets. RWSC has expressed the need to purchase a new database to improve its current system and ensure automated delivery of data to BoM.

4.11.6 EPA Division (DPIPWE)

Under the EPA Division's reporting requirements, activities may be required to routinely report environmental monitoring data as part of their permit conditions. The EPA Division has developed a data management system inhouse that consists of several components. A software program (+Temp) automates the importing of monitoring data from laboratories (csv, .txt, .xls or .xlsx files) and instruments such as Hydrolabs. Another developed software Sink is designed to take many different data formats produced by different laboratories, instruments (e.g. hydrolab) and templates, such as +Temp and converts the data into a consistent data format that can be imported via Drain or Spigot into the monitoring database.

The water sample software and interface (Drain) links to an SQL database. It is designed to import a standardised data format produced by Sink into the monitoring database after it quality checks the data for errors and duplication. A Java standalone application (Spigot) uses a MySQL local database to house both discrete (sample-based) and flow data from multiple sources. Spigot allows the user to perform hundreds of types of calculations including mass loads and hardness correction. Spigot uses the MySQL database to easily share data between other Spigot users using the built in sql file export. Using an XML exporter, samples of required data can be transferred to the Bureau of Meteorology (BoM) at specified frequencies. Spigot also has an XML engine built in that can be extended to provide direct reporting to the BoM database.

Another software program that is used within the EPA called Splash-Back runs a variety of different query functions that interrogate an identified monitoring database and produces outputs of tabular data, statistics and graphs as MS Excel spreadsheets and tables. A version control package called Schooner is also used to combine the data entry template +Temp with the data conversion tool Sink, the integration and calculation program Spigot, and finally the reporting capability of Splash-Back. It uses the Java Web Start technology so as to deliver the package from the web which will allow users to always have the latest version. By packaging these four tools together, and providing simple deployment to data users and providers, Schooner will allow the management of water quality data from laboratory analytical certificates (results) through to reporting. A high level of QA/QC is maintained for data importing, interrogation, integration of different data sources and tabular and graphical outputs.

Groundwater data monitoring conducted by new and existing activities including contaminated sites regulated by the EPA Division is mostly stored on hard copy and isolated spreadsheets. However, with the iterations of the EPA Division's data

management system data importing and storage will be achieved. Integration of databases with data owners will also be developed as part of the modernisation of data management in the EPA Division.

4.12 Coordination of the Flow of Information and Data Transfer Process

BoM has stated:

"Ultimately, organisations listed in the Regulations are accountable for the provision of data to the Bureau and any arrangements for third party data provisions need to be mindful of this fact. Where an agency (e.g. A lead water agency) seeks to act as an intermediary for data delivery between another agency and the Bureau and another organisation named in the Regulations, that agency must demonstrate that the arrangement will streamline data provision, with no impediment or risk to the delivery requirements specified in the regulations. While the Bureau is prepared to consider such arrangement on a case by case basis, the onus is on the organisations delivering the data, not the Bureau, to make the case." (Papers for JRGWI Meeting 12-13th March 2009)

The requirement to comply with the *Water Regulations 2008* by providing data to BoM has precipitated the clarification of hydrographic site management protocols in Tasmania. Each site now has a primary owner and operator responsible for the provision of water information to BoM. This has resolved previous issues where the multiple site users recorded similar data but used individual instrumentation, logging and telemetry systems. Near real time sharing of water monitoring data (via ftp) is now possible between Hydro Tasmania, the Department of Primary Industries, Parks, Water and Environment; and the Tasmanian BoM. (Web server data transfers may be possible where the telemetry is provided by Ajenti units). The remaining section describes data transfer processes for various organisations and data types.

4.12.1 Hydro Tasmania

Hydro Tasmania operates a number of hydrographic sites on contract for various parties named in the Regulations. Where requested by the named party, Hydro Tasmania is able to provide the water information directly to BoM at the same time that it provides its own data.

4.12.2 Urban Water

The consolidation of three new water corporations should simplify the provision of urban water information in the future.

The Water Smart Australia program (now administered by the Department of Environment, Water, Heritage and the Arts (DEWHA) has funded a project to telemeter many of the agricultural water meters (e.g. irrigation pumps). The water information collected in this project is all placed into a centralised database. Presently the project is being constrained by the number of compatible meters that have been installed.

4.12.3 DPIPWE

DPIPWE is supplying two data streams to the Bureau, an initial historical set with twice daily updates including ratings (this meets DPIPWE's statutory obligations) and groundwater information. The recent upgrade of the current groundwater monitoring network, including the installation of new loggers and telemetry will allow the direct download and transfer of data collected from temperature and water level probes into the department's database.

The EPA Division of DPIPWE has recently developed an XML exporter. Samples of required data can therefore be transferred to BoM at specified frequencies consistent with the WDTF. The developed software Spigot also has a XML engine built in that can be extended to provide direct reporting to BoM database. The version control package Schooner combines the data entry template +Temp with the data conversion tool Sink, the integration and calculation program Spigot, and finally the reporting capability of Splash-Back. It uses the Java Web Start technology so as to deliver the package from the web which will allow users to always have the latest version.

The EPA Division has also developed a data management system that applies QAQC in the importing, storing, integration and exporting of data. Samples of required data can be transferred to BoM in the required water data transfer format at specified frequencies extracted from the primary data source that has been imported and stored using QAQC principles. With the integration capacity of developed software the application of standards and best practice is possible through the developing integrated network.

DPIPWE provides licence and allocation information to BoM directly via the Water Information System of Tasmania (WIST) on a weekly basis. During the summer period, a weekly report on water restrictions is also sent to BoM, and on an ad hoc basis during winter.

4.12.4 Flood Warning Data

Flood warning information is also provided for nominated stations. Flood warning river level information is provided as soon as it becomes available in the telemetry system. Both information streams are supplied by FTP but in different formats. These formats include flood warning data being supplied as HCS formatted files for BoM's operational systems and statutory sets which are supplied in BoM WDTF.

4.12.5 SWIC Role

Subject to funding availability the Strategic Water Information Coordinator (SWIC) is able to assist the various named parties in their interactions with BoM as they clarify their data supply obligations.

5 Section C: Gap Analysis – Issues and Opportunities

The effective ongoing management and sustainable development of Tasmania's water resources relies on accurate and readily available water level, stream flow and water quality information to both water managers and water users. Stream flow and water level information not only supports water management decision making on a daily basis but also supports hydrological modelling, environmental flow determination and flood warning.

Investment in irrigation and other water infrastructure has increased significantly over the past 25 years. This has lead to an increased demand by water management agencies for reliable and timely water level and flow information that they can use for making management decisions. Unfortunately much of the existing monitoring infrastructure and associated systems do not currently have the capacity to meet these increased demands.

The previous sections of this SWIMP described the various reasons for establishing water monitoring networks in Tasmania. This following section will identify what gaps exist within current networks and associated data management systems. It will also provide a summarised list of major gaps at the end of Section C for each category of data.

Each of the named parties was requested to provide an assessment of what they viewed as the gaps in their existing networks (template included in Appendix 3). They were asked to focus on the following points:

- In the spatial distribution of field stations for the collection of water level, flow and water quality data;
- Processes and protocols for the storage, management, and transfer of water information;
- Potential improvements to existing infrastructure and monitoring equipment;
- Instrumentation and equipment upgrades including acoustic doppler technology to improve current stream flow gauging data; and
- Flood warning systems.

The detailed unedited responses from the various named parties are provided in Appendix 3.

5.1 Surface Water Monitoring – Streams and Lakes

During the 1970s and 1980s the State Government's stream flow monitoring network (excluding Hydro Tasmania sites) exceeded 140 sites. Due to financial restraints in the early 1990s the network was reduced to around 30 sites. It is now considered that 140 sites best represents the required number of sites to manage the water resource sustainably (outside of the Hydro Tasmania Districts).

It should be mentioned that 140 sites would be viewed as providing an adequate spatial representation but not necessarily provide an ideal representation on an operational basis. As the number of DPIPWE stream flow monitoring sites is currently at 82 it is considered that to manage Tasmania's water resource at finer spatial scales an expansion of the network with approximately an additional 60 sites will be required in the foreseeable future.

In many instances only the terminus of catchments are being monitored, which is not providing sufficient information to adequately manage the upper sub-catchments. Many catchments in Tasmania still either have no stream flow monitoring or the stream flow monitoring that is carried out is still not sufficient to manage the water resource locally, particularly in terms of water management restrictions. Table 8 identifies additional sites that would assist in improved management of such catchments.

Decisions on irrigation restrictions, licence applications and future management strategies in these un-monitored circumstances have to be based upon anecdotal evidence and may appear to be arbitrary as there is little or no data available to ensure carefully calculated decisions occur.

There is a lack of certainty regarding ongoing funding for many of the monitoring sites. For example, over the past five years Hydro Tasmania's budget for operating and maintaining its hydrographic network has been reduced by approximately 25%. Similarly, DPIPWE's funding, sought through the State Government's 'SMART Farming' program in 2006, resulted in 26 new and re-established gauging stations and hiring of temporary staff. This funding ceased in 2010 although base level funding is ongoing to maintain the baseline network. The recent expansion of DPIPWE's stream flow monitoring network from 56 to 82 sites has shown considerable benefits in the ability to manage water both on a daily basis, to identify future water availability and to provide information for daily irrigation management by farmers.

Constrained resources means it is important that a core water monitoring network is identified and maintained. A core network would include existing sites that are used by multiple water entities. A network of 50-75 sites should become priority sites for ongoing funding and upgrades in Tasmania. These sites will meet the needs for a range of users and provide quality data possibly in 'real time'.

The sites will hopefully be a priority for repair and maintenance for the organisation managing them. The criteria for identifying these sites have not been determined. It must be emphasised that this core network would not include all the sites necessary to monitor, manage and report on Tasmania's water resources. Additional sites would need to be established for that purpose.

The various named parties have identified a number of additional sites that would be required to improve the sustainable management of Tasmania's water resources. Table 8 lists these sites.

Table 8 – Establishment of Additional Stream Flow and Water Level Sites Identified as Water Management and Flood Warning Priorities for Various Organisations

Agnes Rivulet (DPIPWE)	*Lake Crescent (DPIPWE)
Arthur River downstream of Rapid River (DPIPWE)	*Lake Sorrell (DPIPWE)
Ben Lomond Rivulet (DPIPWE)	Leven River in upper catchment (DPIPWE)
Blythe River at Iron Mine Road (DPIPWE)	Little Brid River (DPIPWE)
Boobyalla River (DPIPWE)	Montagu River at Togari (mid catchment) (DPIPWE)
Browns River (DPIPWE)	New Haven Creek upstream of Black River (DPIPWE)
Camp Creek at Wynyard Water Supply Intake (DPIPWE)	Nicholls Rivulet (DPIPWE)
Clayton Rivulet at Sprent (DPIPWE)	Nile River in bottom of catchment (DPIPWE)
Clayton Rivulet at Thompsons Road (DPIPWE)	North George River (DPIPWE)
Clyde River upstream of Meadowbank (DPIPWE)	North West Bay River (upper catchment) (DPIPWE)
Coiler at Coilers Crossing (DPIPWE)	Orielton Rivulet upstream of tidal limit (DPIPWE)
*Craigbourne Dam – lake level site (RWSC)	Peak Rivulet 3.5 km upstream of Esperance River (DPIPWE)
Dasher River (DPIPWE)	Pet River upstream of Burnie Water Supply (DPIPWE)
Derwent River – above water supply (Hobart Water)	Plenty River (DPIPWE)
Duck River in upper of catchment (DPIPWE)	Quamby Brook d/s of Eden Rivulet (DPIPWE and RWSC)
Edith Creek (DPIPWE)	Riley's Creek upstream of Dam (DPIPWE)
Emu River in bottom of catchment (DPIPWE)	Roger River (DPIPWE)
Ettrick River upstream of South Rd (King Island) (DPIPWE)	Rocky Creek near Lilydale (LCC)
Flowerdale River in bottom of catchment (DPIPWE)	Ringarooma River above tidal limit (DPIPWE)
Franklin Rivulet 1.5 km upstream of tidal limit (DPIPWE)	Russell River (DPIPWE)
George River in upper catchment (DPIPWE)	Samphire River (Flinders Island) (DPIPWE)
Gordon below Huntley (Hydro Tas)	Sisters Creek (DPIPWE)
Great Musselroe River 6.5 km upstream of Mouth (DPIPWE)	South Esk above Trevallyn Dam (DPIPWE)
Greens Creek (DPIPWE)	South Pats River at Whitemark water supply intake (DPIPWE)
Inglis River upstream of Flowerdale River junction (DPIPWE)	Styx River (DPIPWE)
Iron Creek (DPIPWE)	Supply River 0.5 km upstream of Tamar River (DPIPWE)
Isis River (DPIPWE)	Tomahawk River upstream of tidal limit (DPIPWE)
Jordan River at Bridgewater (DPIPWE)	*Tooms Lake (BoM)
Kermandie River (DPIPWE)	Tyenna River – lower catchment (Hobart Water)
Lachlan River (DPIPWE)	Welcome River at Redpa (DPIPWE)
Leith Creek at Meander – flow monitoring (RWSC)	Watery Plains intake on North Esk River (BLW)
Lake Leake (BoM)	Wilmot River upstream of Forth River (DPIPWE)
Waratah Water Supply (CMW)	Western Creek downstream of Dale Brook (RWSC)
Gawler River-Pump station upstream (CMW)	Zeehan Water upstream of Weir (CMW)
Gawler River-Pump station downstream (CMW)	Queenstown River-New Sewer TP (CMW)
Manuka Creek-Strahan (CMW)	Railton Creek-Sewer (CMW)
Mt Creek-Rosebery (CMW)	Ridgley River-Sewer Outfall (CMW)
Stitt River-Rosebery (CMW)	Dowlings Creek-Yolla (CMW)
Conglomerate Dam-Queenstown (CMW)	Zeehan Water downstream of Weir (CMW)
Conglomerate River-Queenstown (CMW)	Dasher Creek-Sheffield (CMW)
Southern Marine Shiplift Warf (LCC)	

(Note: information obtained from gap analysis in Appendix 3)
**Indicates new sites recently installed or upgraded*

5.1.1 Rivers and Water Supply Commission

As listed in Table 8, the Rivers and Water Supply Commission (RWSC) has identified deficiencies in water monitoring at Craigbourne Dam, Quamby Brook and Western Creek. Currently water levels at Craigbourne Dam are recorded by hand. Automation and telemetry of the dam level is required which would allow for better stream management (BoM funding in round 3 has now been provided to install monitoring equipment at Craigbourne Dam). Reinstating the automation and telemetry of the decommissioned DPIPWE stream flow sites (Quamby Brook downstream of Eden Rivulet (Station No. 18226) and Western Creek downstream of Dale Brook (Station No. 18213)) would allow for accurate environmental stream flow management within the Meander Irrigation Scheme.

RWSC has also identified a critical information gap regarding current flow estimates for the amount of water being diverted from Meander River into Leith Creek. The Tasmanian Irrigation Schemes (TIS) regulates water into this creek for irrigators to extract from. Remaining flows are then released into Western Creek. Flow monitoring equipment and associated infrastructure would allow accurate measurement of this water so water balances can be determined within this system.

As future schemes come online more monitoring sites may be required to monitor for sufficient environmental flows downstream of the irrigation schemes.

5.1.2 Launceston City Council

With previous endorsement through the Tasmanian BoM's hydrology section, LCC have identified the need for an additional Tamar River level gauge at Southern Marine Shiplift Wharf. This new site would assist in the calibration of river models used in flood warning predictions and aid towards refining the relationship between Low Head surges and flood levels at Launceston. In addition it would also be used to issue direct SMS alarms relating to the imminent flooding of critical infrastructure points such as roads and floodgate closures.

5.1.3 NRM South

NRM South has indicated that the Swan-Apsley catchment is lacking in the amount of permanent monitoring sites that are established to record stream level and flow. They have advised that this catchment has significant conservation values, and includes two Ramsar wetlands, three wetlands listed on the Directory of Important Wetlands (DIWA) and a number of rivers that have a high conservation value. The catchment also contains many rare and threatened species and communities. It has been identified by NRM South as a priority catchment in Tasmania's southern region. In the face of climate change pressure on water resources within these river systems is also expected to increase in the future with regard to agricultural irrigation and drinking water requirements. (Kathleen Broderick, CEO NRM South, personal communication. 5 June, 2009)

5.1.4 Cradle Mountain Water

After a recent change in responsibility from local councils to water authorities, Cradle Mountain Water (CMW) is now responsible for the North-West and western area of Tasmania in relation to water supply. Currently there exists major gaps in accurately determining what the actual water supply is for communities across these areas. In an effort to resolve this critical information gap, CMW has engaged a consultant to prepare a report recommending the type of infrastructure and instrumentation that would be required to assist with determining accurate water availability and supply.

Currently CMW has identified 16 sites that would require the installation of sufficient water monitoring systems that would also provide real time data. These sites have been prioritised to a list of eight critical stations that are necessary to provide CMW with information to manage these water supplies efficiently. These sites have been identified in Table 8 (a prioritised list of these sites are included in Appendix 3).

If installed, information collected from these sites would be useful for other organisations or persons including the Bureau of Meteorology (BoM), in that stations would provide information from areas not traditionally assessed by the local hydrographic agencies who are more concerned with hydro electricity generation and irrigation. This data would not only assist CMW, but many other water information users when looking at water efficiencies and accounting throughout Tasmania. CMW is prepared to maintain these stations into the future from an ongoing operation and maintenance perspective to ensure the data is available to CMW and other interested parties if required.

5.1.5 Review of Stream Flow Monitoring Networks

There have been few formal whole-of-state reviews relating to stream flow monitoring in Tasmania which have been referenced in this document. Individual water management agencies periodically review their own networks. These reviews are typically driven by funding availability and do not necessarily consider the broader issues or value of the agencies network on a state-wide or strategic basis. For example, in 2006 DPIPWE received SMART Farming funding to open some previously decommissioned gauging stations and a limited number of new sites. Also, Hydro Tasmania periodically reviews its sites in accordance to their business needs and funding availability. This involved identifying sites in order of importance. Higher category sites would therefore receive a higher level of maintenance. Alternatively, maintenance was reduced at sites perceived to be of reduced value to the business.

Documented reviews for stream flow monitoring networks are limited to the following:

- The Design of a Monitoring System for Tasmania's Water Resources – DPIWE, January 2000
- DPIW Water Monitoring Station Annual Audit – Tas Water Consulting 2009.

5.1.6 Review of Water Quality Monitoring Network and Systems

Across Tasmania there is a number of largely independent water quality monitoring networks in existence. The networks may consist of either continuous monitoring sites with a limited number of parameters being monitored or regular spot sampling where the number of parameters tested for is more comprehensive.

Among the entities operating these networks are:

- Water and sewerage supply authorities – to determine water treatment requirements and sewerage outfall compliance;
- State agencies (DPIPWE) – as part of the state baseline Water Quality Program or other programs;
- Mining companies – to monitor impacts on the environment and demonstrate compliance;
- Hydro Tasmania – to monitor impacts on the environment and licence compliance; and
- Natural Resource Management Regions.

A number of reviews of water quality monitoring in Tasmania have been undertaken. Some of these include:

- Review of DPIPWE's Baseline Water Quality Monitoring Program 2008 (BWQMP);
- Review of the State Policy on Water Quality Management 1997;
- An assessment of Surface Water Quality Monitoring in the Southern Tasmania NRM Region 2008;
- North-East Rivers Environmental Review 2001; and
- North-West Rivers Environmental Review 2001.

The collection of water quality data and its use in Tasmania still needs to be reviewed from a jurisdictional perspective. There are a number of potential gaps in data collection, and possible duplication that need to be determined. A jurisdictional review would:

- Assess the current network of sites and data collected; and
- Review and analysis of WQ data by sub catchment to determine current trends and establish accepted triggers.

Reference sites to further inform the development of aspirational water quality targets are required. The trigger values would be used for management purposes across the catchment. Current BWQMP sites are located at the bottom of catchments in rural areas and are therefore predominantly modified to some extent. Achieving a consistency in what water quality triggers and targets are on a catchment/regional/sub catchment basis will need discussion with other named parties.

In recent communications, NRM South has indicated that BoM should consider as their role under the *Water Act 2007*, the development of nationally consistent guidelines and processes for the development and application of triggers, reference sites and targets. (Kathleen Broderick, CEO NRM South, personal communication. 5 June, 2009)

Within DPIPWE the EPA has identified the need for an integrated data collection, processing and storage system for water quality information.

5.1.7 Water Quality Sampling

Additionally, DPIPWE and Hydro Tasmania baseline water quality monitoring networks are overlaid with a higher density network of NRM monthly water quality monitoring sites. These additional networks exist predominantly in the North-West, North-East and northern Midlands of Tasmania and provide a good level of coverage for the monitoring of ambient water quality. However there are significant gaps in the southern Midlands and southern regions of the state (the southern NRM region). Therefore there are some catchments in Tasmania which either have no water quality monitoring or insufficient water quality monitoring required.

Additional water data may be available from monitoring programs conducted as part of the requirements specified by the EPA Division for new and existing activities and baseline monitoring programs conducted either by the EPA Division or in partnership with other programs and organisations including the Derwent Estuary Program, NRM groups (Tamar Estuary and Esk River Program) and other industries.

As part of the requirements to maintain or enhance water quality in the State under the SPWQM 1997, proposed and existing activities regulated by the EPA Division are required where relevant to conduct ambient monitoring of surface and groundwater quality. This will continue into the future so site specific monitoring will generate robust data to assist in the generation of water quality targets and objectives. These monitoring programs are funded by the proponents of the new activities and existing operators of activities.

Summary of Gap Analysis for Surface Water Monitoring Network

1. *Additional monitoring sites required at strategic locations for improved water management and water accounting.*
2. *Determine 50 – 75 priority sites for Tasmania that will meet the needs for multiple users. May incorporate existing sites as well as establishment of some new sites.*
3. *Formal review for whole of state stream monitoring network.*
4. *Jurisdictional whole of state review required for WQ monitoring to assess current network.*
5. *Consideration of nationally consistent guidelines for development and application of WQ triggers, reference sites and targets.*
6. *Integrated data collection, processing and storage system for water quality information within the EPA.*

5.2 Irrigation Schemes and Development

The Tasmanian Irrigation Development Board (TIDB) has also been established by the State Government to identify and construct a number of irrigation projects across Tasmania. If these projects are constructed a considerable number of water monitoring sites will be required to assure that these irrigation schemes are operated sustainably. Currently the RWSC is not sufficiently equipped to engage in a regular stream monitoring, calibration and maintenance program. As new monitoring sites are established it will need to be determined who and how these sites will be managed so as to meet regulatory requirements.

Information on the location and type of monitoring sites that will be required will be included in future versions of the SWIMP as the information becomes available.

Summary of Gap Analysis for Irrigation Development

7. *Determine who and how new monitoring sites will be managed under irrigation development projects.*
8. *Determine what types of monitoring sites will be required under irrigation development projects.*

5.3 Instrumentation

The potential exists, where practicable to standardise the equipment used to monitor flows and transmit the data to the various water entities databases. Ideally this should be completed as equipment is replaced at the end of its useful life. Standardising equipment should lead to reduced costs. Some examples of possible changes follow.

5.3.1 Level Sensors

The Hydro Tasmania network of water level stations currently uses a range of instrumentation from encoders to depth probes to pressure transducers. It would be beneficial to standardise on shaft encoders and the gas pressure system using pressure transducers. An upgrade of 14 old hydrostatic DRUCK depth probes to a gas pressure system would be required. Within Tasmanian water agencies, gas pressures systems have been recognised as providing more accurate data and a preferred system than ‘wet sensor’ type instruments.

5.3.2 Side Looking ADV Instruments

DPIPWE has identified a few key sites that require the installation of Acoustic Doppler Velocimeters (sidelookers) to assist with backwater issues where conventional monitoring cannot record accurate flow. This technology has already been proven as a reliable means for recording flow during backwater events within many water monitoring agencies.

5.3.3 Rain Gauges

The Hydro Tasmania network includes approximately 20 rainfall stations that are due for upgrade from old 200 mm gauges (various brands) to BoM preferred standard of RIMCO 203 mm units in the next few years.

The Tasmania BoM also requires additions to its rainfall network. Apart from service delivery aspects associated with flooding there is the service aspect related to supporting the engineering and design community with information on large rainfall events. Although BoM has a reasonable network of rain gauges the density of the pluviographic network is quite limited. In addition, the pluviographs are limited to measurement of defined volumes on an interval basis or an event basis. There is not the ability to estimate variable rainfall rates over very short intervals. Expanding BoM's pluviographic network to have clusters of standard gauges supporting high-end droplet measuring gauges is seen as a cross-cutting activity to not only improve the service delivery function but quasi-research activity, and the development of water information standards.

5.3.4 Telemetry

As mentioned in section B and shown in Table 3, Tasmania has reasonable telemetry coverage for its continuous water monitoring network. However, some key sites important to water management, business operations such as hydro electricity and flood management still require telemetry systems where there is no available landline, Next G coverage, or satellite system installed.

As mentioned in Section 4.1, packet data is recognised as a more efficient, reliable, and secure method for data transfer with satellite systems. This is also applicable to 3G networks. DPIPWE will therefore be adopting packet data technology for all remote telemetered sites in the near future. It is also expected that other Tasmanian water agencies will follow this path.

Launceston City Council has identified the need for telemetry upgrades at selected flood warning sites. These sites have been prioritised with advice from the Tasmanian BoM hydrology section. Telemetry upgrades would include the installation of SERCK SCADA remote telemetry units. These upgrades would enable real time level monitoring at sites critical to flood warning in urban catchments. Data can then be distributed to local servers for storage, alarming, website display and provision to BoM. Sites prioritised for these upgrades are included in Table 9.

Table 9 – LCC Flood Warning Sites Requiring Telemetry Upgrades

Site name	Telemetry upgrade type	Current system
Kings Meadows Rvt at Hobart Rd	SERCK SCADA	3G
Newnham Rvt at Georgetown Rd	SERCK SCADA	3G
Low Head automatic tide gauge	SCADA	NIL

DPIPWE has also identified a number of sites in Table 10 that require the installation of telemetry or conversion from existing landlines to a more efficient and cost effective packet data system.

Table 10 – Remaining DPIPWE Sites that Require Telemetry Installation or Conversion

Site name	Telemetry upgrade type	Current system
Meander River at Strathbridge	3G	Landline
Pipers River below Yarrow Creek	3G	Landline
Tyenna River at Newbury	3G	Landline
Coal River at Craigbourne	3G or Sat/packet data	Landline
Jordon River at Mauriceton	3G or Sat/packet data	Landline
Ransom River at Sweet Hills Rd	Radio/3G	Nil
Snug River at Snug Tiers	Radio/3G	Nil
Lake Sorell	Radio/3G	Nil
Lake Crescent	Radio/3G	Nil
Clyde River downstream Lake Crescent	Sat/packet data	Landline
Coal River at Baden	Sat/packet data	Nil
Davey River Pluvio	Sat/packet data	Nil
Little Swanport River at Eastern Marshes	Sat/packet data	Landline
South Esk River at Upper Esk	Sat/packet data	Sat/dialup
St Patricks diversion flume and river sites	Sat/packet data	Landline
Davey River below Crossing River	Sat/packet data	Sat/dialup
Huon River up-stream Frying Pan Creek	Sat/packet data	Sat/dialup
North Esk River at Ballroom	Sat/packet data	Sat/dialup
Swan River at Hardings Falls	Sat/packet data	Sat/dialup
Leven River at Bannons Road	Sat/packet data	Sat/dialup

5.3.5 Water Quality Instrumentation

A major concern with current water quality networks for many water agencies in Tasmania are issues related to frequent instrument malfunction, resulting in significant levels of lost and or poor data. Resources (people and funding) are required to replace ageing and/or malfunctioning equipment. Replacement of this instrumentation would assist in gathering higher quality and reliable data.

The Hydro Tasmania network of water quality stations has a range of sensors that are not all referenced to supply the same quality data. To standardise the entire network would require the purchase of a number of new Hydrolab water quality

instruments. These instruments would compliment an existing Hydrolab network making the calibration and replacement much more efficient and ultimately leading to better quality data.

5.3.6 Additional Parameters

Collectively, Tasmanian water information agencies have a fairly comprehensive network of monitoring sites within many of the state's catchments. The majority of these sites are on telemetry systems and many have the infrastructure required to record additional parameters. An opportunity exists to add value to data with the addition of, for example, air temperature at every station.

The efficiencies gained from standardising on the one instrument, be it RIMCO rain gauges or Hydrolabs, also helps to offset the ongoing reduction in operation and data management budgets.

Summary of Gap Analysis for Instrumentation

9. *Replacement of old and superseded in-situ level sensors, water quality sensors and data logging equipment.*
10. *ADV (side looking Dopplers) for measuring backwater effects.*
11. *Installation/upgrade and standardisation of rain gauge instrumentation.*
12. *Installation/upgrade and standardisation of WQ instrumentation.*
13. *Installation of telemetry at key sites incorporating satellite and next G packet data systems.*
14. *Telemetry upgrades involving SERK SCADA at priority flood warning sites enabling real-time monitoring.*

5.4 Upgrading Sites

5.4.1 Power Supplies

There are a number of sites near the electricity distribution network. These sites could be provided with reticulated electricity reducing the need for solar panels, which are prone to vandalism or theft, and improve the reliability of the site. A number of these sites are used by a number of users including for irrigation restriction management and flood warning.

5.4.2 Vandalised/Damaged Sites

Water level and stream flow sites are destroyed from time to time, often as a result of storm damage, falling trees or vandalism. However, these unfortunate occurrences represent an opportunity, when the site is reinstated, to upgrade the existing equipment and take advantage of improved technology.

Depending on the degree of damage or loss the reinstating of a site can often be delayed. Reinstating can be dependent on whether there are

instrumentation spares available and/or the time it will take to repair or replace weather proof enclosures.

For some organisations it has been recognised that there are specific sites in isolated areas prone to vandalism. A considerable effort has already been made at a number of key sites to install more secure and vandal resistant shelters (see Figure 13) but many sites still require these upgrades.

Replacement of instrumentation on an ongoing basis is extremely costly and risks the decommissioning of a site where damage or theft has occurred on numerous occasions. The initial outlay in investment for upgrading these shelters has been recognised as being a priority.

Figure 13 – Heavy duty shelters installed at key sites prone to vandalism

Summary of Gap Analysis for Upgrading Sites

15. *Improvements to existing power supplies to reduce chances of data loss as a result of vandalism to existing solar power systems. Would involve connection where possible to reticulated 240v power supply.*
16. *Identify key sites that are susceptible to vandalism and subsequent data loss and install or replace existing shelters with vandal-resistant shelters.*

5.5 Occupational Health and Safety Issues

More stringent occupational health and safety (OH&S) requirements are leading to increased costs associated with field work. For example, it is no longer appropriate for a single person to complete site inspections and maintenance in and around rivers, or for flow gaugings to be completed from a manned cableway (cable car) during floods. Occupational health and safety is the major driver of the change to shore based flow gauging, meaning permanent platforms and cross lines have to be installed on river banks.

Considerable expenditure has already been made on improving site access, e.g. construction of walkways and installation of ladders and platforms to Australian Standards (see Figure 14). It is expected that continued works in this area will be necessary to maintain the supply of high quality data. At least one site has been shut down in Tasmania in the past 12 months due to the high cost of meeting OH&S requirements.

Summary of Gap Analysis for OH&S Related Issues

17. *Requirements to continue the upgrade or installation of platforms, stairs, and general access to selected sites to improve safety according to occupational health and safety guidelines and in accordance to Australian Standards.*

Figure 14 – New ladder and platform installed at George River gauging station (site 2205) according to OH&S and Australian Standards

5.6 Up-Skilling and Knowledge Enhancement (Training)

Hydrographic training is widely recognised as being of significant value in improving the reliability and accuracy of field data collected for the development and confirmation of rating tables. For example, recent technological advances have provided the opportunity to shift from conventional gauging techniques using mechanical meters, to doppler based equipment. Basic training courses in this technology have been undertaken by Tasmanian-based hydrographers and has shown to be extremely beneficial in instrument use as well as processing and interpretation of data. More advanced and follow up training courses are still required for this and other emerging technologies.

It has also been identified that formal training in correct field procedures relating to water monitoring as well as data quality coding and editing is lacking for some water agencies.

Summary of Gap Analysis for Training

18. *Ongoing requirement for Doppler training and related technologies.*
19. *Formal training required for staff involved with field monitoring and data editing.*

5.7 Flood Warning and Gauging Networks

5.7.1 Lack of Networks

The increasing level of tourism in the state from a few specific seasonal visitors 10 to 15 years ago to large numbers of visitors constantly throughout the year, and of independent means, is putting pressure on BoM to deliver services into areas often thought of as being remote and having a low concern during flood episodes. These areas include the far North East, East Coast and West Coast of Tasmania. There is a paucity of rainfall and river height/flow data in these areas for delivering an effective flood warning service.

5.7.2 Flash Flooding

Like the areas devoid of a flood network, the same areas are also subject to strong flash flooding so there is a strong need to have real-time networks operating in these areas.

5.7.3 Improved Rating Tables

Many of the water level/flow monitoring sites operated by BoM as part of their flood warning system do not have current rating tables/curves. Developing rating curves for these sites would improve their utility for water management and water accounting purposes. Instrumentation at these sites would also need to be reviewed in regards to rating development as accurate rating tables require water level data to within +/- 5mm.

Hydro Tasmania (HT) has allocated substantial funding over the last five years to ensure its network of stations provide reliable, quality data and is available in a timely manner with the installation of a telemetry system covering at the moment 95% of the existing network. This effort will ensure that the raw water level data being delivered to BoM is of an acceptable quality. A review is still required by HT to ensure existing streamflow ratings accurately reflect the flow that is relative to recorded water level.

5.7.4 Gauging Equipment

Many regional towns on Tasmania's East Coast and the Midlands area are experiencing inadequate rainfall to meet the demands of current water supply systems. This is particularly during summer/tourism periods. Over recent years such water shortages have become more common. (TWASSOTIR, 2009)

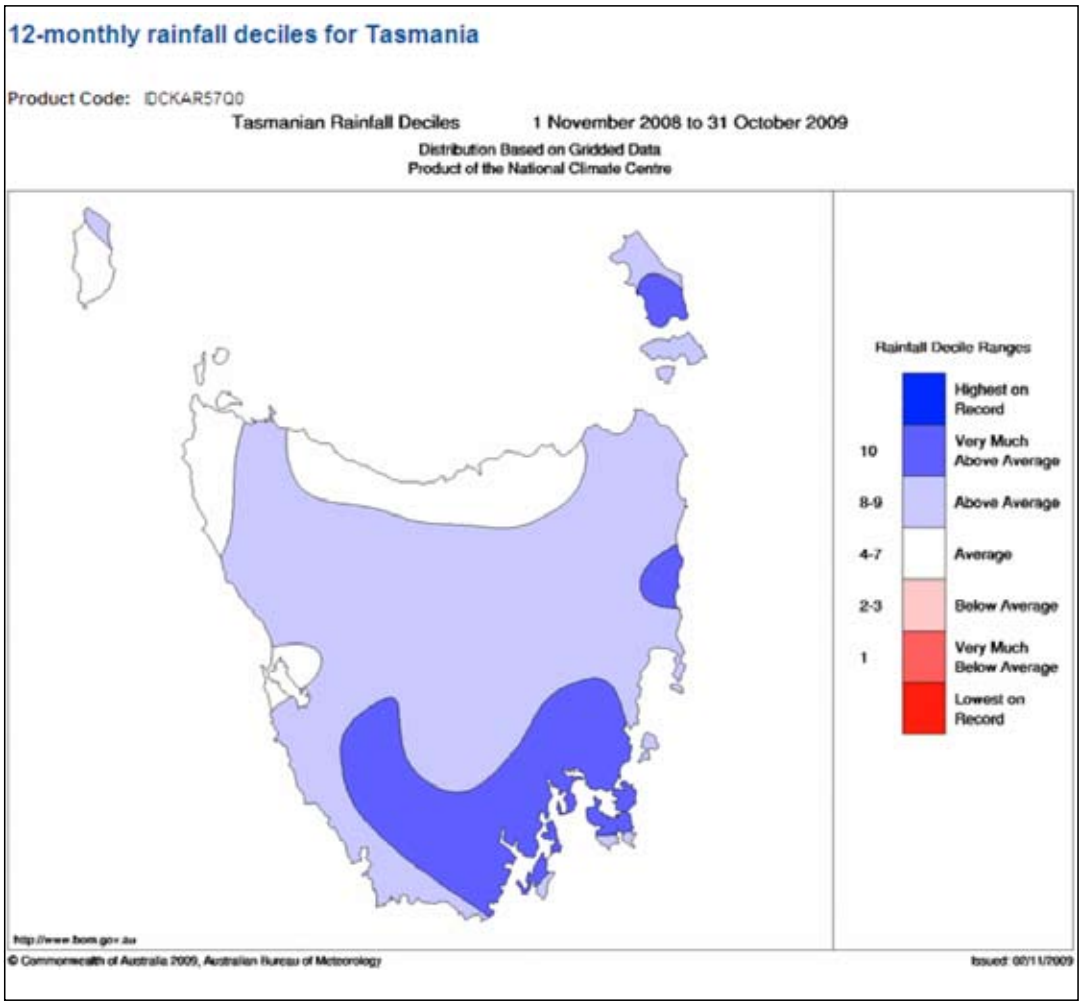


Figure 14 – 12-monthly rainfall deciles for Tasmania (Source: http://www.bom.gov.au/cgibin/silo/rain_maps)

Contrary to rainfall shortage, in 2009 most catchments in Tasmania experienced well above average rainfall events and associated flooding between June and October (see Figure 15). Above average rainfall was particularly significant for the Scamander-Douglas and Swan-Apsley catchments on the East Coast. These catchments were previously affected by drought. A majority of southern catchments also experienced considerable flooding. These infrequent events provided opportunity to gauge many rivers at maximum and key levels to improve existing rating tables and hence river flow information.

During these flood events DPIPWE and HT (the two main water agencies responsible for collecting river flow data in Tasmania) focused efforts to gauge rivers where previous discharge information was lacking or required. Only two mobile Doppler gauging instruments currently exist that are capable of measuring high level flood events in the state.

During the wet winter of 2009 HT relied upon DPIPWE for a loan of their ADCP instrument in an effort to avoid missing important flood gauging data. Whilst is has been a common occurrence to share this instrumentation where possible, problems arise during flood events where flood gauging equipment is needed by all field parties.

As implied in the previous paragraphs, major water agencies in Tasmania involved in measuring stream flow have moved away from using traditional mechanical fan type gauging meters and have purchased acoustic doppler based devices. This technologically advanced equipment has provided more accuracy, efficiency and increase in gaugings that are being collected. DPIPWE no longer use or train staff in the use of mechanical based equipment and now rely solely on doppler technology for measuring stream flow.

DPIPWE has also upgraded other gauging equipment so they no longer require manned cableways (cable cars) to complete flow gaugings during floods therefore reducing OH&S issues (see Figure 16). These upgrades include conversion of cable cars to shore-based travellerways. Whilst this has been a significant improvement to many travellerways there still exist some remaining sites that require installation or conversion.

DPIPWE's three field parties now each have SONTEK doppler equipment, to assist in low to medium flood measurements, that are capable of measuring around 90% of most river situations in Tasmania. These instruments can measure depths of up to six metres. However a limitation of this equipment is that it is only capable of measuring flow in depths under six metres. Equipment is still required to measure water depths in excess of six metres which would assist towards a 100% capture in measuring Tasmania's floodwaters.

HT is following a similar approach to DPIPWE by utilising the latest technology in flow measurements, which is leading to improvements in safety, the quality of the data and savings in processing time. HT has three field parties responsible for almost 100 gauging stations and has purchased three SONTEK Flowtracker units for low level wading measurements. HT only has one ADCP capable of measuring flood water.

Figure 16 – Travellerway and doppler equipment used for measuring floodwater

Summary of Gap Analysis for Flood Warning and Gauging

20. *Lack of flood warning networks in particular areas and requirement for these networks to be monitored in real time.*
21. *Development of rating tables for flood warning networks as well as reviews/ improvements to rating tables for stream monitoring/management agencies.*
22. *Additional gauging equipment required to improve data capture for significant stream flows during flood events. There currently is a deficiency in the amount of Doppler stream flow measuring devices available to measure flood events in Tasmania.*
23. *Installation or conversion of Travellerways (cable-ways) for shore based gaugings.*

5.8 Stormwater Monitoring

NRM South has identified storm water monitoring (at least for the southern region of Tasmania) as a significant gap in the management of urban waterways. It has indicated that storm water monitoring is currently not a priority for the major surface water data collection agencies. It hoped that future monitoring will incorporate storm water discharge and identify it as a valuable resource that can be incorporated into whole of water cycle planning and use. This will assist with integrated management of freshwater catchments and estuaries combined. (Kathleen Broderick, CEO NRM South, personal communications. 5 June, 2009)

Summary of Gap Analysis for Storm Water Monitoring

24. *Requirement for storm water monitoring to assist with integrated catchment management.*

5.9 Database Systems and Data Management Processes (including Standards and Procedures)

5.9.1 Replacement of Time Studio

Time Studio software is now at the end of its life and vendor support for it will cease in the near future. Consequently, Hydro Tasmania, BoM and DPIPWE have to replace Time Studio with a fully supported application. The costs associated with this are likely to be substantial and represent a significant risk to DPIPWE's ability to carry out a replacement, including updating any modelling that may be required. DPIPWE has recently received BoM funding to assist with evaluating a suitable replacement data management system. It will also be seeking financial assistance to purchase a new database once the evaluation is complete. Hydro Tasmania is in the process of replacing Time Studio with WISKI.

Hobart Water (Southern Water) is currently replacing its Hydstra TSM database with Aquarius. Onstream will be involved with the rollout of the Aquarius data management system to the two remaining regional urban water authorities (Ben Lomond Water and Cradle Mountain Water).

The Rivers and Water Supply Commission (RWSC) manage a limited amount of monitoring stations and at present data is stored using Microsoft Excel spreadsheets. However, as more irrigation schemes and thus monitoring stations are established (as a result of irrigation development) RWSC will need to review their current data management system. It is assumed and probably beneficial that RWSC should purchase a database in line with the major water agencies for easement in transfer and integration of data.

It has not yet been determined what other organisations are planning regarding database upgrades or replacements. Progressive versions of this document will attempt to document any propositions or changes.

5.9.2 Groundwater Data Management

There are a number of issues relating to the development and operation of the groundwater database. Groundwater database infrastructure needs to be developed that will enable primary, secondary and tertiary groundwater data to be stored, managed and accessed in an efficient manner, and be able to incorporate third party network data. All future monitored groundwater level, pump test and water quality data should be stored in a central groundwater database together with other relevant groundwater feature information.

It is important to ensure that all time series groundwater data stored in Hydstra retains the unique identity inherited by GWIMS database from the Tiger database.

This is critical to preserve the link with original source information required for the accurate interpretation of monitoring data.

5.9.3 WIMS – Water Accounting

In the future DPIPWE may consider storing water use information in the previously noted Hydstra TSM legacy system and its successor. DPIPWE currently stores allocation data in the WIMS DBMS.

WIMS is an Oracle-based legacy application which has significant deficiencies at an operational and data integrity level. It is not spatially enabled and is also bound to other unrelated licensing systems. Whilst it does meet NWI requirements with regard to a compatible water register, it does not and will not be able to meet expectations for production of reliable accounting and trading information under the National Water Account in its present condition. To address this risk DPIPWE is following a strategy of re-scoping the existing application by:

- Simplifying the existing schema as far as possible;
- Data auditing and cleansing to resolve any integrity issues; and
- Decoupling from other unrelated databases.

This strategy has the intention of having a reliable data set to migrate to a new system.

Whilst it is noted that a current process is in train to develop a national water market system, the implementation of this strategy in the meantime is seen as a key measure and will require significant resources.

It is recognised that whilst much of the information and modelling required for water accounting is available from the named parties, there is no system in place to readily produce the inputs required for water accounts for Tasmania as a whole, or on a regional or catchment basis. The input data is also of varying quality and formats, and will require significant manipulation and cleansing prior to any use within accounting.

5.9.4 Improving Quality Assurance Procedures and Checking Systems (QA/QC)

Over the past several years some of the major water agencies have seen significant improvements in the reliability of the instrumentation that has been installed in the field and that has had a flow on improvement in the quality of the data coming in from the field. The next round of ‘efficiency’ improvements should come from improving the processes associated with checking the data and associated data management processes. This task is time consuming and organisations will need to consider how technology can be utilised (e.g. software) to speed up the short term verification process.

Hydro Tasmania developed its Quality System in 1996. Since then there have been significant changes in technology, data collection methods, data

management and streamflow measurements. As with the development of the ratings, budget constraints and the availability of staff to review and update the current procedures has resulted in staff not being fully aware of existing procedures and some procedures being outdated. To ensure hydrographic staff are aware of the procedures involved in data collection and management, financial support in the review and roll out of the quality system would assist in the quality of data being handed over to BoM.

The ability to provide data of reasonable quality to BoM in a timely manner is impacted by the time taken in QA/QC processes. A system that provides a first pass QAQC could be used to allow data managers to quickly identify data that needs further checking, and thus reduce the time required for QA/QC.

Agencies across Australia employ different strategies in regards to quality control processes applied to telemetered data or data retrieved from data loggers. The telemetry devices and loggers themselves offer little in the way of quality assurance of data measured, and at least annual site visits are required for calibration purposes.

The projected amount of telemetered data in Australia alone is set to increase rapidly in order to provide the Bureau with a more accurate understanding of water use. As the number of sites increase the number of Data Managers to manually inspect will need to increase, and the ability to maintain even annual site inspections will be less likely.

The manual inspection of data will eventually be impossible unless automated techniques for problem detection and more of a report by exception approach is taken.

Improving the accuracy of measurement networks is enhanced by the identification and correction of invalid and missing data. Furthering the algorithms to different data types enhances the system's ability to provide good valid data for downstream processes such as modelling.

5.9.5 Reviewing Tasmanian Practices and Implementing Water Information Standards

Appropriate standards for water information are essential to ensuring that data collected and published is fit for its intended purpose. Users of the data also need to have confidence in, and knowledge of, the level of accuracy of reported data. Information gathered across the country indicates that existing standards do not sufficiently cover all the required aspects of water information collection and reporting.

BoM has initiated a series of projects under the Modernisation Funding Program to review current practices. In the 2008/09 funding round these projects included:

- Training in new technology: Doppler current meter training (Qld Department of Natural Resources and Water (DNRW);
- Training to facilitate consistent approaches to rating table development and extrapolation (Qld DNRW);

- Engagement of an Australian co-coordinator to standardise technical innovation, education and monitoring procedures for hydrologic data collection and management (Qld DNRW); and
- Engagement of consultants to establish work practices to form the basis for standardisation and modernisation of water monitoring activities across jurisdictions (Qld DNRW).

Hydro Tasmania and DPIPWE have identified some deficiencies in their existing documents relating to standards and procedures that are currently in use. The processes and protocols used in Tasmania need to be assessed against the outcomes of the above projects and those similar to assess what changes may be required to implement these updated standards. In the past, DPIPWE has used and adopted standards and procedure documents developed by Hydro Tasmania. Some procedures unique to each agency may also exist and will need to be included as part of each agency's individual requirements.

5.9.6 Urban Water Supply and Sewerage Authorities

Since the amalgamations occurred on 1 July 2009, the new water corporations have been more concerned with the re-organisation of operations, emergency repairs, asset management and strategic planning than concentrating on data provisions required under the *Water Act 2007*.

There is a real requirement to facilitate and coordinate the continued provision of data currently supplied by existing water supply organisations, and also to assist in the identification of data which is be to be provided under the Water Act 2007, but was previously managed by councils not listed in the regulations. This, combined with the lack of urban bulk and customer water metering in numerous parts of the state, the need to integrate the various SCADA systems and the inability of existing councils to quantify consumption creates a challenge requiring external independent coordination and facilitation.

5.9.7 Web Services and Data Transfers

The data from a number of the sites in Tasmania is utilised by each of Hydro Tasmania, DPIPWE and BoM's office in Hobart. Previously each agency independently polled the site as they required the data in near-real time (i.e. at least twice per day). However, this lead to situations where a fault at the site could develop due to a problem with the polling protocols of one of the agencies, or repeated polling draining the battery supply. These faults normally meant that no-one could obtain data from the site. Recently it has been agreed that each site will be polled by the primary data user and then distributed via ftp to the other agencies. The FTP process has proved problematic to implement, and implementation of a web server to transfer data between agencies is being considered.

Additionally there are a large number of stand-alone water quality data sets. The development of a web server tool would improve the analysis, presentation and

distribution of water data to interested parties. This would enable data usage but not necessarily centralised storage.

Web service tools could also be developed to transfer SCADA data from the water and sewerage authorities to BoM. These web services could be a pilot for a broader system for transferring data to BoM.

The Tasmanian BoM's operational systems require data in near real-time to the time forecasting is undertaken. A few recent events have highlighted a concern that the forwarding of non-BoM data at present time scales is inadequate for its forecasting needs. The Tasmanian BoM has suggested that water agencies need to increase their interrogation/delivery rates, or consideration should be given in upgrading the critical non-Bureau sites to perform in real-time.

Launceston City Council has also identified some data transfer deficiencies where a number of key flood warning river level stations incorporate SCADA remote telemetry units. LCC require this data to be sent to a hosted web server for collation and distribution. To improve the current system LCC propose that SERCK SCADA build an adapter to transfer the site SCADA data to a hosted Hydro Tasmania web server. Hydro Tasmania could then build processes and adapters to distribute the data from the Web Server to critical locations that would include:

- Storage into the HT time series management system;
- LCC flood warning information website; and
- Automated data transfer to BoM.

5.9.8 Data Duplication

BoM is aware that named agencies are duplicating efforts in the provision of data to comply with the Water Regulations and to support the flood forecasting and warning services. Much of this data is not made public but is incorporated into BoM's products and outputs. Security of this supply is paramount, particularly with a significant proportion of the data streams now being ftp'd. There is an imperative to examine the disaster recovery processes of these external agencies, and to strengthen these processes or infrastructures where found wanting. Certainly there exists scope to consider other transfer mechanisms like web services.

5.9.9 Data Gaps and Lack of Historical Paper Records in a Digital Form

Vast quantities of hydrological time series and other data are yet to be digitised. Some of this data has only been entered into the Timestudio database as 9:00 am daily readings. In many cases data has not been entered at all.

For many sites there is a significant daily variability of time series information within a day. As a result, for all time series that have been previously digitised on a daily time step, the accuracy can be greatly improved by entering all the data within the day.

The identification and recovery of historical bore and groundwater information would provide invaluable data for the inclusion in the groundwater database. This would involve sourcing information from bore drilling logs and historical water level information from a number of agencies and companies that have installed bores, for a number of purposes in Tasmania.

There is the potential for large amounts of data, previously held outside of the department, on groundwater resources to be identified and integrated into the Department's database.

There is also an issue with the digitisation of historical groundwater information. The data entry from large volumes of hard copy drill logs and information into the Department's newly renovated database is required.

DPIPWE has identified information gaps relating to missing records or data gaps for periods of historic data. Preliminary estimations suggest that there are approximately 75 years of missing records across 460 water level recording sites.

5.9.10 Management of Metadata

Within DPIPWE the EPA has also identified the need for the development of a metadata database for monitoring sites including data owners, sites, parameters, locations and date range. This is regarded by the EPA as integral to reviewing and conducting monitoring programs, and planning cooperative programs for optimising efficiencies and application of standards and best practice. Spatial presentation is integral to knowledge sharing.

Summary of Gap Analysis for Data Management

25. *Replacement of Hydstra TSM to new DMS for affected organisations. TSM offers no support in the future as it has been declared end of life.*
26. *Development of an appropriate groundwater database to support primary, secondary and tertiary data sets.*
27. *Improved data management systems involving automated data transfer to BoM for some Tasmanian water agencies.*
28. *Re-scoping of WIMS.*
29. *Improvements and automation of QA/QC systems and procedures.*
30. *Reviewing Tasmanian practices and implementing water information standards.*
31. *Web services and data transfer.*
32. *Data duplication.*
33. *Historical paper records to be digitised for surface water.*
34. *Identification and recovery of historical bore and groundwater information involving information form bore drilling logs and digitisation of historical records.*
35. *Filling of data gaps for periods of missing records.*
36. *Development of a metadata database of monitoring sites.*

5.10 Groundwater

5.10.1 Additional Monitoring Sites and Instrumentation Requirements

The current density of monitoring bores in Tasmania provides inadequate data to be able to manage the state's groundwater (and consequently, connected surface waters) resources in a sustainable manner. The monitoring bores are generally geologically and hydro geologically isolated and consequently can only be relied upon to provide data on localised aquifer characteristics. The Devonport network is currently the only example of a localised network of monitoring bores providing information for the sustainable management of the tertiary basalt aquifers in this region.

In the future, identified areas of priority for the installation of additional network bores are the Smithton synclinal, North-West basalt aquifers and Mathinna and tertiary aquifers in North-East. However, data currently available from this network was successfully used in the past for various groundwater assessments and recently provided valuable input in development and calibration of numerical groundwater models.

The fundamental lack of not only reliable data, but the ability to collect data necessitates a major upgrade of the State Groundwater Monitoring Network (SGMN). A series of measures are outlined in Appendix 3 of this document that, if fully implemented, may ensure that the appropriate data required for management purposes is collected, maintained and made accessible to all stakeholders.

The current groundwater network will eventually require each bore from the current core monitoring network to be telemetered. This will allow the transfer of data collected from temperature, pressure and conductivity probes thus reducing labour required to adequately service the monitoring network.

An upgrade of the current SGMN will monitor changes in the quantity and quality of groundwater with respect to changes in land use, climate and the increased or decreased use of the resource. Through utilisation of the collected data, other secondary objectives may be achieved.

5.10.2 Groundwater/Surface Water Interactions

The continuing integration of the SGMN with surface water monitoring programs within DPIPWE is essential to ensure compatibility of hardware and software, and of data collection, storage and reporting systems.

Future co-location of surface water gauging sites with groundwater monitoring should be considered, in order to acquire data for the assessment and management of surface water and groundwater connectivity. The majority of the potential surface water sites identified in Table 8 in section 5.1 would be suitable for the establishment of new groundwater monitoring bores, and would complement the current monitoring network.

Newly proposed or expanding irrigation developments will require additional monitoring. The establishment of new surface and groundwater monitoring sites

in these areas is required to facilitate the sustainable management of water resources and ensure schemes do not have a negative impact on local water balance and environmental processes.

The development of standard water analysis (including all major cat ions and anions) should be adopted for both surface water and groundwater testing. This is required in order to compare and identify water types of different origin/sources.

Extension of the monitoring network may be required to include the assessment and management of springs.

The assessment of Groundwater Dependent Ecosystems (GDEs) will need to be done in collaboration with CFEV administrators, in order to formalise management of all GDE data collected across the agency.

Summary of Gap Analysis for Groundwater Monitoring

37. *Extension of groundwater monitoring network to identified priority areas.*
38. *Upgrade existing monitoring bores to meet current and future requirements (the first stage of this has been achieved through the 2009-2010 Modernisation Fund).*
39. *Technical support to undertake routine chemical analysis of groundwater.*
40. *Integration between surface water and groundwater interactions.*

5.11 Hydrological Modelling and Other Tools

5.11.1 Catalogue of Hydrological Models

DPIPWE, Hydro Tasmania (HT) and BoM all operate hydrological models to assist them with their day to day operations, future planning, flood warning and management, and the sustainable management of water resources. It is unknown what hydrological models are used or may be required by other water entities. It would be useful to catalogue and describe the hydrological models used by each named party in the Regulations. It must be acknowledged that while some of these models are commercial-in-confidence, the methods used in the models may be useful in developing a water account for Tasmania. Anticipated information in the catalogue could include:

- The Rainfall Runoff Models available for this area (if any), and who owns them; and
- Flood Models available for this area, and who owns them.

5.11.2 Update of DPIPWE Hydrological Models

In 2006 DPIPWE commissioned the development of surface water models for use in water resource assessments. These models should be upgraded to be consistent with the models developed later for DPIPWE hydrological models projects that incorporated seasonal calibrations and achieved improved volume

balances. These models are utilised by DPIPWE for surface water assessments of catchments within Tasmania, including the assessment of proposed irrigation changes within the catchments. The National Hydrologic Modelling Strategy currently being progressed through COAG may have a bearing on how these gaps are addressed.

5.11.3 3D Ratings for all Power Stations for the Conversion of MW to Flow

Currently much of the hydrological modelling that is done at Hydro Tasmania utilises average MW to flow conversion factors for the inclusion of power station flows in models. This is less than desirable as often the average factor is not accurate, particularly where the power station operation has a greater degree of sensitivity to the available head in the storage. Developing 3-D ratings for Hydro Tasmania power stations will improve the accuracy of the conversion from energy to water volumes for transfers between reservoirs.

5.11.4 Revised Calibration for the HT Inflow Forecasts Models

Hydrologists have identified that on occasions the flows from HT storage inflow and flood forecast models are poorly calibrated for current applications. Some of the calibrations are in the order of 5-10 years old, in some cases regional calibrations are adopted and in all cases current calibration methodology is considered better, with a greater emphasis on performance criteria and statistical methods. In order to improve forecast accuracy, calibration of all HT inflow forecast models should be reinvestigated, and different calibration parameters should be investigated for flood vs normal flows. This would assist HT in ensuring that storages are operated with the most efficiency, and that dam and public safety is assured in a flood situation.

The ability to calibrate the models is also impacted in a number of catchments by a lack of digitised records of storage levels, which are currently paper based for large periods of the record.

5.11.5 Error Correction Methodologies

Current error correction methodologies applied within HT forecast model have proven to be problematic, often introducing larger errors. As a result often error correction is disabled and this can cause issues relating to discontinuity in the flow between observed and modelled data.

5.11.6 Performance Monitoring Report of Telemetry Timeliness for Models

Often forecast models have their modelling performance impacted by poor timeliness of critical telemetered rainfall and/or flow information. A tool to identify the time since the last value (of acceptable quality for modelling purposes) would be useful. The tool could be produced at run time of the forecast models and could be archived for review purposes. In addition the most recent report could be displayed on a relevant intranet (dam safety) and operator Favourite's screens.

Summary of Gap Analysis for Hydrological Modelling

41. *Catalogue of hydrological models.*
42. *Update of DPIPWE hydrological models.*
43. *3D Ratings for all power stations for the conversion of MW to flow.*
44. *Revised calibration for the HT Inflow Forecasts Models.*
45. *Error correction methodologies.*
46. *Performance monitoring report of Telemetry timeliness for models.*

5.12 Water Accounting

Hydro Tasmania has recently prepared a draft water account for the Mersey and Forth catchments situated in Northern Tasmania. The report identifies significant gaps in available data as well as discrepancies between Tasmanian water management practices compared to management within mainland states. (Mersey Forth Water Account DRAFT, 2010)

A summary of gaps taken from the Mersey Forth Water Account Draft is as follows:

Detailed data on water inputs due to rainfall, and losses due to evaporation, seepage are typically not available for some catchments. There are a number of inconsistencies between the way water is managed in Tasmania and how it is managed in the Murray Darling Basin. These inconsistencies are a reflection of the historical approaches and how these have been codified in legislation and irrigation scheme operating rules. It appears the PAWAS was designed with developing a water account for the Murray-Darling Basin.

The PAWAS describes a minimum number of line items that should be reported. These include:

Statement of Water Assets and Water Liabilities (PAWAS 49)

- Surface water assets;
- Groundwater assets;
- Other water assets;
- Allocation carryover;
- Other water liabilities; and
- Net water assets.
- Statement of Changes in Water Assets and Water Liabilities (PAWAS 82)
- Surface water increases;
- Groundwater increases;
- Other water asset increases;
- Surface water decreases;
- Groundwater decreases;

- Other water decreases; and
- Change in net water assets.

Given the statutory framework for water management in Tasmania some of these items are irrelevant in the Tasmanian context (e.g. allocation carry over and other water liabilities) and for this reason were not included in the face statements.

In the Murray Darling Basin water is typically made available from storages managed within an irrigation scheme. Allocations are a proportion of the water available from the storages. In good years irrigators may be able to draw in excess of 100% of their allocation, while in dry years the allocation may be reduced to as low as 0% of their annual allocation. Any unused water may be able to be carried over between years. These features are not available in Tasmania.

Irrigation water allocations in Tasmania (excluding the irrigation schemes) are managed on a daily basis based upon the water availability at the time, rather than on a seasonal basis as is the case in the Murray-Darling Basin. This is because most users are either drawing directly from the river to irrigate during summer, or are filling private on-farm storages during winter.

Restrictions on water use are made by DPIPWE on an irregular basis, in accordance with the rules in the water management plan. The reliability of a water allocation is indicated by tagging it with one of eight surety levels (Surety 1. is the highest surety level). Where water restrictions are imposed, the restriction protocol will usually restrict water allocations at lower levels of surety before restricting the taking of water for allocations at higher surety levels. The objective of restrictions is to equitably ration the available water between all the competing water users.

The imposition of restrictions does not affect the total water volume that a water user may take over the water year, only the rate at which it can be taken. Restrictions in the Murray-Darling Basin tend to be on the total volume and may also affect the daily rate.

The Tasmanian approach means that the annual water allocation is not a liability as defined in the PAWAS as there is no confidence that it may be delivered, as is the case in the Murray- Darling Basin.

Cradle Mountain Water operated three significant water supply schemes in the Forth area. These are the:

- Forth River system – supplies townships between Port Sorell and Turners Beach including Devonport;
- Lake Paloona System – supplies water to Devonport and Spreyton; and
- Lake Barrington system – supplies water to Railton and Sheffield.

If a water account was going to be prepared on an ongoing basis specific models for each catchment to calculate natural inflows would be required. This cost was not justified for such a trial.

Whilst the Mersey Forth account has indicated that some significant information gaps existed during its preparation, it is worth mentioning that this catchment is one of the better catchments for collecting data where reasonable quantities of data have been collected from existing gauging stations (refer to Figure 5 for spatial locations of water monitoring sites).

Water accounts from catchments where fewer gauging stations exist would have produced a much poorer result. However, within Tasmania the filling in of information gaps need to be considered in terms of cost/benefit, with the broad conclusion that the costs are likely to be significant with the benefits likely to be questionable.

A strategic investment would be more beneficial to enable more efficient production of ‘basic ‘ accounts, rather than investing in more water monitoring. At the very least a basic account could address inflows, outflows and the main transactions in between. For catchments that are broadly managed by Hydro Tasmania, information is currently available for storage level and diversions to other catchments. Improvements in water use information will be obtained over time as water meters are installed.

Currently, as inflows and outflows are derived from models, an investment in the area of automating model outputs for inflows and outflows would be beneficial. (David Nicholls, Manager Water Policy and Planning, DPIPWE, personal communications. March 12, 2010)

Summary of Gap Analysis for Water Accounting

47. Automated model outputs required for inflows and outflows for selected catchments.

5.13 Geospatial Information and Metadata

Geoscience Australia (GA) completed a National Data Audit in September 2009 on the Australian Hydrological Geospatial Fabric. (Tickle and Crossman, 2009)

This report included recommendations for Tasmania and identified the verification of Tasmanian farm dams and man-made water storages as omissions to existing data. DPIPWE has also recognised that this information is lacking and supports the recommendations from GA. The report suggests that the revision of man-made water bodies will produce a consistent and integrated state-wide coverage at a 1:25,000 scale.

Metadata that includes accurate site coordinates to GDA ’94 datum has also been found to be lacking for many water information collection agencies in Tasmania. This critical information is required by BoM (and other users) to determine accurate location and spatial distribution of monitoring sites. Some water agencies have not recorded any site coordinates and simply rely on individual knowledge to locate their monitoring stations. In other instances crude coordinates have been

obtained from large scale topographic maps. These coordinates have been found to be out by up to 1 km from the actual monitoring location.

Round 2 of the Modernisation Funding Program involved a project to collect and verify metadata for DPIPWE and Hydro Tasmania. This included the collection or verification of stream gauge locations and groundwater bores to GDA 94 datum and AHD. However, information for major storages, rain gauges and verification of farm dam locations is still required. This information could also be value added by including all climate, water quality, and irrigation offtake sites relative to the Bureau's needs.

Accurate coordinate reference data is also required for many water monitoring sites that are 'closed'. Existing metadata for these sites is either of poor quality requiring verification, or currently is not available. Currently DPIPWE has 187 'station closed' sites on its database.

Summary of Gap Analysis for Geospatial Information and Metadata

48. *Revision of farm dams and man-made water bodies.*
49. *Improved metadata required for gauging stations.*
50. *Improved metadata required for groundwater bores.*
51. *Improved metadata required for major storages.*
52. *Improved metadata required for rain-gauges sites.*
53. *Metadata verification for stations 'closed'.*
54. *Metadata acquisition and assisting with the AHGF.*

5.14 Water Information Coordination

In 2008 Tasmania through DPIW as the Lead Agency put forward a proposal which identified key tasks for the Strategic Water Information Co-ordinator. Since 2008 some jurisdictional specific tasks have been added to the current SWIC role. Ongoing coordination requirements for Tasmania include:

- Liaison with persons named in the Water Regulations to assist them in achieving compliance;
- Assisting in the resolution of technical and procedural issues with data ingestion between the 'named persons' and the Bureau, and clarification of data delivery arrangements as required;
- Assisting named persons in development of deferred data delivery plans as required, and promoting the adoption of WDTF;
- Supporting and coordinating Modernisation and Extension funding applications within Tasmania;

- Assisting the Bureau with data capture tasks to support Water Resource Assessment, noting that the Bureau may need data additional to that specified in the Water Regulations;
- Liaison between the Bureau and named persons surrounding the restructuring of the urban water sector in Tasmania, and increased activity by the Irrigation Development Board;
- Assisting the Bureau to achieve streamlined data delivery and non duplication of water quality data from 'named persons', and liaison with the Bureau regarding the planned data management system transition by Hydro Tasmania and DPIPWE; and
- Enhancement and expansion of the Tasmanian Strategic Water Information Monitoring Plan.

Summary of Gap Analysis for Water Information Coordination

55. *Ongoing Water Information Coordination between bureau and Tasmanian water agencies.*

5.15 Gap Analysis Summary Table

The following summary table lists the main water information gaps which have been identified by Tasmanian water agencies that are named in the Water Regulations. The table includes a list of all the information gaps that were identified in the previous section but have been grouped into eight major water information deficiency categories for Tasmania.

Section D of this report offers a list of these eight information gaps in order of priority and importance to the state.

Table 11 – Summary of Information Gaps for Tasmanian Water Information Agencies

1. Establishment of key sites	*a. Additional monitoring sites required at strategic locations for improved water management and water accounting. Includes new sites as required under irrigation development projects.* *b. Determine 50-75 priority sites for Tasmania that will meet the needs for multiple users. May incorporate existing sites as well as establishment of some new sites.* *c. Requirement for storm water monitoring to assist with integrated catchment management.* *d. Lack of flood warning networks in key areas and requirement for these networks to be monitored in real time.*
2. Improvements to site infrastructure, instrumentation and OH&S.	*a. Identify key sites that are susceptible to vandalism and subsequent data loss and install or replace existing shelters with vandal resistant shelters.* *b. Requirements for the upgrade or installation of platforms, stairs, and general access to selected sites to improve safety according to occupational health and safety guidelines and in accordance to Australian Standards. Also incorporates improvements and upgrades to existing weirs.* *c. Improvements to existing power supplies to reduce chances of data loss as a result of vandalism to existing solar power systems. Would involve connection where possible to reticulated 240v power supply.* *d. Replacement of old and superseded in-situ level sensors, water quality sensors and data logging equipment.* *e. ADV (side looking Dopplers) for measuring backwater effects.* *f. Installation/upgrade and standardisation of in-situ WQ instrumentation.* *g. Installation/upgrade and standardisation of rain gauge instrumentation.* *h. Installation of telemetry at key sites incorporating satellite and next G packet data systems.* *i. Telemetry upgrades involving SERK SCADA at priority flood warning sites enabling real-time monitoring.* *j. Additional gauging equipment required to improve data capture for significant stream flows during flood events. There currently is a deficiency in the amount of Doppler stream flow measuring devices available to measure flood events in Tasmania.* *k. Installation or conversion of Travellerways (cable-ways) for shore-based gaugings.*
3. Knowledge enhancement	*a. Ongoing requirement for Doppler training and related technologies.* *b. Formal training required for staff involved with field monitoring and data editing.*
4. Groundwater	*a. Extension of groundwater monitoring network to identified priority areas.* *b. Upgrade existing monitoring bores to meet current and future requirements (the first stage of this has been achieved through the 2009-2010 Modernisation Fund).* *c. Securing a sustainable funding base to enable long-term, ongoing maintenance and operation of the SGMN by DPIPWE.* *d. Technical support to undertake routine chemical analysis of groundwater.* *e. Requirement for the development of a sufficient groundwater DMS.* *f. Improving accuracy, reliability and integrity of bore information.*

5. Database infrastructure	*a. Replacement of Hydstra TSM to new DMS for affected organisations. TSM offers no support in the future as it has been declared end of life.* *b. Improved data management systems involving automated data transfer to BoM for some Tasmanian water agencies.* *c. Re-scoping of WIMS.*
6. Data management and transfer	*a. Improvements and automation of QA/QC systems and procedures.* *b. Web services and data transfer.* *c. Data duplication.* *d. Lack of historical paper records in digital form.* *e. Filling of data gaps for periods of missing record.* *f. Identification and recovery of historical bore and groundwater information involving information form bore drilling logs and digitisation of historical records.* *g. Reviews of current and historic rating tables.* *h. Formal review for whole of state stream monitoring network.* *i. Jurisdictional whole-of-state review required for WQ Monitoring to assess current network.* *j. Consideration of nationally consistent guidelines for development and application of WQ triggers, reference sites and targets.* *k. Integrated data collection, processing and storage system for water quality information within the EPA.* *l. Development of a metadata database of monitoring sites.* *m. Reviewing Tasmanian practices and implementing water information standards.* *n. Development of rating tables for flood warning networks.* *o. Ongoing water information coordination between Bureau and Tasmania water agencies.* *p. Upgrade of telemetry management systems.*
7. Water accounting	*a. Catalogue of hydrological models.* *b. Update of DPIPWE hydrological models.* *c. 3D ratings for all power stations for the conversion of MW to flow.* *d. Revised calibration for the HT inflow forecasts models.* *e. Error correction methodologies.* *f. Performance monitoring report of Telemetry timeliness for models.* *g. Automated model outputs required for inflows and outflows for selected catchments.*
8. Geospatial information and metadata	*a. Revision of farm dams and man-made water bodies.* *b. Improved metadata required for gauging stations.* *c. Improved metadata required groundwater bores.* *d. Improved metadata required major storages.* *e. Improved metadata required rain-gauges sites.* *f. Metadata verification for stations 'closed'.* *g. Metadata acquisition and assisting with the AHGF.* *h. Metadata required within EPA.*

6 Section C2: Reporting of Gaps Addressed through M&E Investment

Rounds 1-3 of investment under the Modernisation and Extension (M&E) Fund have had a significant impact on the state of Tasmanian hydrographic networks, water data management and water information programs in general. This section reports on the benefits of M&E investment by detailing how specific gaps have been addressed and 'closed' (or expected to be closed)' through the completion of M&E projects, and the extent to which this has occurred in each case. The section will also identify outstanding gaps and issues. Priorities, strategies and actions to address remaining gaps are incorporated into Section D.

The following section will:

- Allow a stock-take of data, network and system gaps and review the extent to which they have been addressed through M&E investment;
- Provide a structured, quantifiable way of highlighting areas where further investment is required to address identified gaps; and
- Provide the Bureau of Meteorology with another means of demonstrating the value of the M&E program, consistent across jurisdictions. The Bureau will have the opportunity to aggregate state/territory reports into a single national report, providing a powerful visualisation of the achievements of M&E and the scale of investment still outstanding.

Objective and benefits:

- Identify the relevance/applicability of each gap to each of the named organisations;
- Link M&E funded projects undertaken in Rounds 1, 2 and 3, and also those projects currently being undertaken in Round 4, with gaps in the 2010 SWIMP;
- Report on the extent to which gaps have been addressed for individual organisations through completion (or anticipated completions) of specific M&E projects; and
- Depict, for each gap, the level to which it has been addressed from a whole of State/Territory perspective.

6.1 Assessment of Major Gaps

Section C of the SWIMP identifies 55 individual gaps that various organisations have nominated as deficiencies within their current water monitoring networks or data management systems. Within section C, Table 11 organises these 55 water information gaps into eight major gap types for Tasmania. It should be mentioned that the numbering associated with these gaps is not related to a priority order; Section D addresses the prioritisation of these gaps.

Over the past four years (2007 to 2010) 'named' water agencies in Tasmania have received funding for 40 projects under the Bureau's Modernisation and Extension program with the intention of addressing specific gaps relating to water information. Some of these projects have addressed multiple gaps and this should be considered when interpreting histograms in the following section of this report.

Summary information from these projects has been compiled into a spreadsheet and is included in Appendix 7. The following section and graphical representations draw upon the information obtained from the spreadsheet.

During the last four funding rounds and from the 18 BoM Tasmanian named organisations listed in the *Water Regulations 2008*, eight organisations have applied for funding to address their individual water information gaps. Seven of these have been successful in receiving partial or full funding.

Tasmania has received around $6.8M over the four funding rounds which has been directed towards improving water information and monitoring systems within the state. Figure 17 shows the amount of funding invested in Tasmania with regards to each major gap with Gap 2 (improvements to infrastructure, instrumentation and OH&S), Gap 6 (data management and transfer), and Gap 5 (database infrastructure) having received the bulk of this investment.

The following histogram (Figure 18) shows the number of projects funded that address specific gap types for Tasmania.

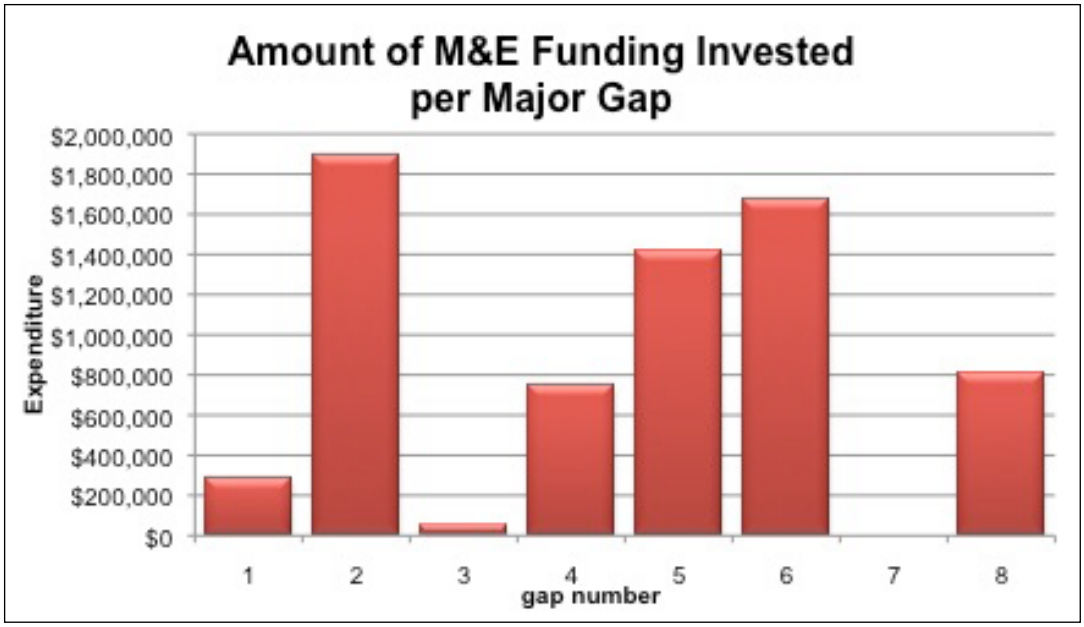


Figure 17 – M&E expenditure on each major gap type for Rounds 1 to 4 with Gaps 2, 6 and 5 having received the most funding to date (information derived from Appendix 7)

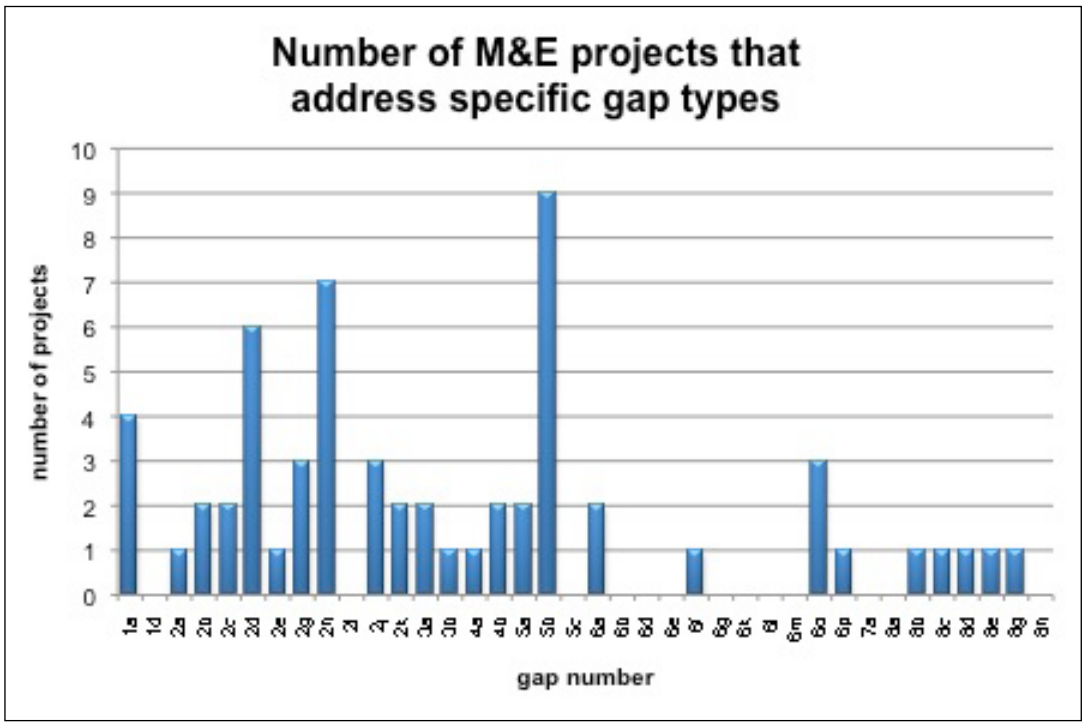


Figure 18 – Number of projects funded to address individual gaps identified by BoM 'named organisations' in Tasmania. Gap 5b (Improving data management systems) has been the most common project to be funded and is also the highest priority for Tasmania (priority ranking in Section D).
Note: some projects have addressed more than one gap.

From the eight major gaps identified in Table 11, gaps 2, 5 and 6 have been the most common gap types where M&E funding has been sought. Gap 2 projects have been funded to improve existing site infrastructure, instrumentation, OH&S, and purchasing of Doppler equipment for improved stream flow data. Gap 5 projects relate to the purchase or improvements to data management systems and automation of data transfer to BoM, and gap 6 projects focus on improving the quality of data within existing systems. Where Gap 7 (water accounting) involves deficiencies relating to hydrological modelling, Figure 17 shows that there have been no projects funded in Tasmania through M&E to address water accounting issues.

6.2 Revision of Individual Gaps and Percentage Gap Closure for Jurisdiction

The following assessment has been made on information obtained within Appendix 7. In most instances gap closure for each agency has been based upon the percentage of funding that was received for a project against the amount requested. However, in some cases further closure of gaps may have been achieved where agencies have contributed to the project outside of M&E funding. Whilst gap closure at an organisational level is discussed within this section the prime objective is to determine gap closure for the jurisdiction.

'Percentage gap closure' has been provided within four broad groupings, i.e. 100%, 75%, 50% or <50% closed. Gap closure for the jurisdiction has been estimated by averaging the percentage closure across all projects for an individual gap. It is also acknowledged that some percentage values coming from smaller water information agencies may skew overall results. Where this has been observed the jurisdictional value has been adjusted to more accurately represent a jurisdictional view. The following histograms (Figure 19 and Figure 20) provide an estimate on gap closure for 24 of the 55 gaps identified in Table 11. Information could not be provided for gaps where the gap closure has not yet been determined.

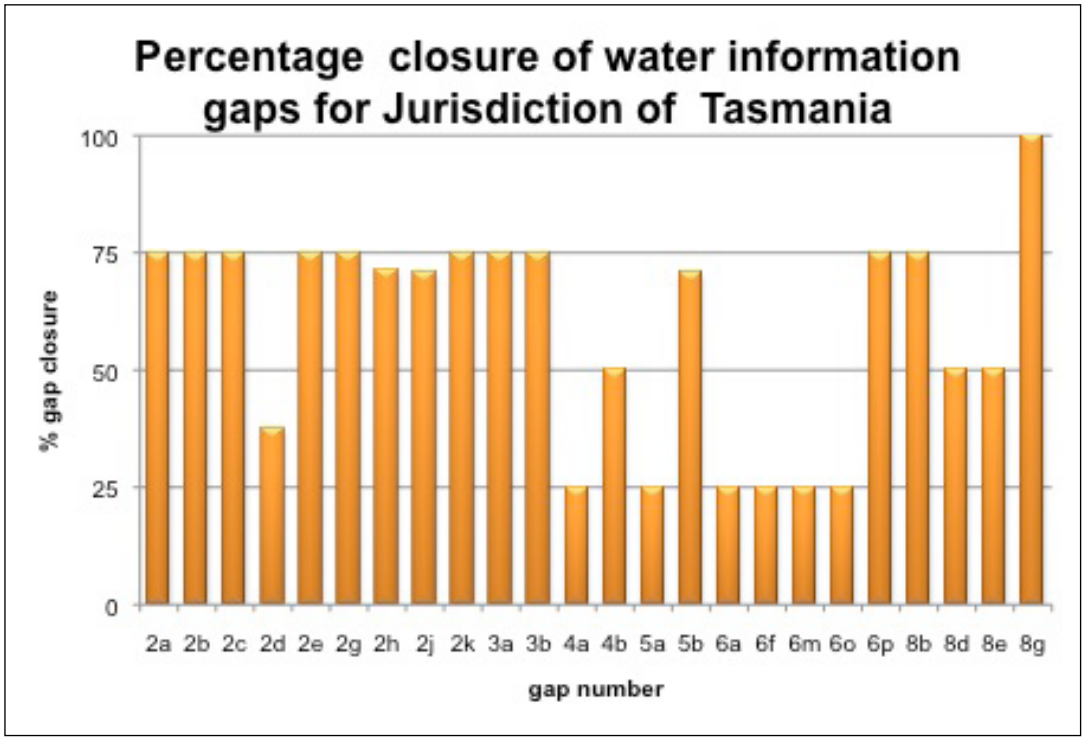


Figure 19 – Percentage gap closure for jurisdiction according to individual gap types. Description of gap types in Table 11.

Whilst the assessment of jurisdictional gaps are broadly estimated it is clear to see from Figure 20 that the majority of gaps that have received M&E funding are approximately 75% closed. Of the seven gaps identified as being <50% closed most of these represent Gap 6 (data management and transfer) and involve QA/AC automation, groundwater information recovery, improved standards, and ongoing coordination relating to BoM's water information agenda. These remain as large information gaps for the jurisdiction and closure for these gaps is viewed as being a timely process. This is where some projects involving QA/QC automation, development of standards, and historical information recovery have been scaled to fit within funding timeframes, and due to restrictions associated with such timeframes such projects often cannot achieve broader and more desirable outcomes.

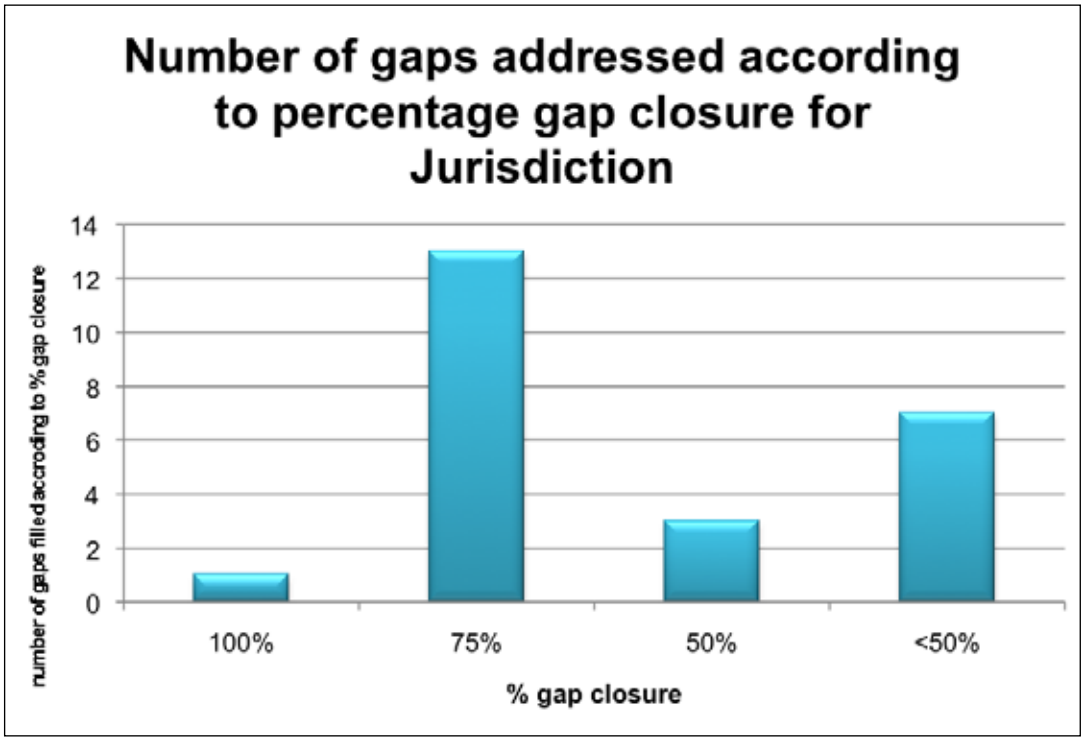


Figure 20 – Assessment of number of gaps that have been addressed and to what percentage they are considered closed. Out of the 55 gaps identified in Section C, 24 gaps have been assessed at a jurisdictional level. Jurisdictional gap closure for remaining gaps have not been determined.

6.2.1 Gap 1 – Establishment of Key Sites (priority 4)

Section C (Table 11) of the SWIMP lists four subsidiary gaps under Gap 1 relating to the establishment of new sites as required by individual organisations. Out of seven project submissions under the M&E program, four of these projects have been either full or partially funded and involve the installation of new sites to improve water management and accounting. Section C lists over 80 sites (see Table 8) where organisations have identified requirements for new stream flow and storage monitoring sites that are priorities for water management and flood warning. However it is likely that many organisations have not applied for funding under the M&E program to install many of the sites identified in this table as the associated ongoing operational costs are not sustainable.

6.2.2 Gap 2 – Improvements to Site Infrastructure, Instrumentation and OH&S (priority 3)

Section C (Table 11) of the SWIMP lists 11 subsidiary gaps relating to Gap 2. Out of the 37 projects submitted (which may include a number of proponents within a project) under the M&E funding program, 27 of these projects have been full or partly funded. Individual assessment of subsidiary gaps under Gap 2 are as follows:

Gap 2a: *Identify key sites that are susceptible to vandalism and subsequent data loss and install or replace existing shelters with vandal resistant shelters.*

This gap was recognised within the Lead Water Agency (DPIPWE) where a number of sites were experiencing failure due to vandalism. Through M&E funding selected DPIPWE sites have now been upgraded and incorporate vandal resistant shelters. This gap is now considered to be closed within DPIPWE. It is expected that a small gap remains under this category for some remaining Tasmanian water information agencies and the jurisdictional gap closure is estimated at around 75%.

Gap 2b: *Requirements for the upgrade or installation of platforms, stairs, and general access to selected sites to improve safety according to occupational health and safety guidelines and in accordance to Australian Standards. Also incorporates improvements and upgrades to existing weirs.*

OH&S issues were predominantly recognised within the Lead Water Agency (DPIPWE) stream gauging network. Many sites within this deteriorating network involved ladders, platforms or handrails that did not met current OH&S requirements. Several weirs were also identified as requiring repairs where flow ratings were compromised. Sites that required such upgrades are now complete and this gap is considered to be near closed for DPIPWE. A small gap is expected to remain in this category and is estimated to be 75% closed for the jurisdiction.

Gap 2c: *Improvements to existing power supplies to reduce chances of data loss as a result of vandalism to existing solar power systems. Would involve connection where possible to reticulated 240v power supply.*

Two organisations have received partial funding to address Gap 2c. It is expected that whilst this gap is not closed and probably remains for other water monitoring agencies it is not a significant issue for Tasmania. Jurisdictional gap closure is estimated at 75%.

Gap 2d: *Replacement of old and superseded in-situ level sensors, water quality sensors and data logging equipment.*

There have been six projects funded amongst four organisations to address issues relating to Gap 2d. Under M&E funding the replacement of level sensors and data logging equipment has been a major focus for the lead water agency and other major water information agencies within the jurisdiction. Whilst the replacement of water quality sensors has not been a priority for BoM, this still remains a significant information gap for most Tasmanian water agencies. Gap 2d is estimated to be >50% closed for the jurisdiction.

Gap 2e: *ADV (side looking Dopplers) for measuring backwater effects.*

Only a few of the major water agencies have expressed the need for ADV equipment to measure flows at monitoring sites that experience backwater effects. DPIPWE has been successful in receiving funding to purchase ADV instrumentation and the jurisdictional gap is estimated at 75% closed.

Gap 2f: *Installation/ upgrade and standardisation of in-situ WQ instrumentation.*

There have been no projects funded to address Gap 2f and this gap still remains for the jurisdiction.

Gap 2g: *Installation/ upgrade and standardisation of rain gauge instrumentation.*

Three projects have been funded across three organisations to improve information relating to rainfall. This gap is now viewed as being 75% closed for the jurisdiction.

Gap 2h: *Installation of telemetry at key sites incorporating satellite and Next G packet data systems.*

Seven projects have been funded across four organisations to improve telemetry related information gaps. This information gap is now viewed as being <75% closed for the jurisdiction.

Gap 2i: *Telemetry upgrades involving SERK SCADA at priority flood warning sites enabling real-time monitoring.*

There have been no projects funded to address Gap 2i and it is expected this gap still remains for the jurisdiction.

Gap 2j: *Additional gauging equipment required to improve data capture for significant stream flows during flood events. There currently is a deficiency in the amount of Doppler stream flow measuring devices available to measure flood events in Tasmania.*

Three projects across two organisations have been funded to purchase Doppler stream gauging equipment. With two of the major water information agencies having purchased stream gauging Doppler equipment under M&E funding, this information gap is viewed as being <75% closed for the jurisdiction.

Gap 2k: *Installation or conversion of travellerways (cable-ways) for shore-based gaugings.*

The lead water agency (DPIPWE) has received significant funding under M&E to install travellerways amongst their network of monitoring stations. It is however expected that this gap would still exist for at least one other major water information agency. The jurisdictional gap is viewed as being approximately 75% closed.

6.2.3 Gap 3 – Knowledge Enhancement (priority 8)

There have been three projects funded in Tasmania relating to knowledge enhancement and training. Doppler training has been a focus for funding in past funding rounds for the lead water agency and whilst this gap is expected to be ongoing, the knowledge that has been obtained through formal training has provided much benefit for improving ADCP gauging techniques. Formal hydrographic training has also been funded for selected staff among four Tasmanian water agencies. The overall information gap for Gap 3 across the jurisdiction is now viewed as being 75% closed.

6.2.4 Gap 4 – Groundwater (priority 7)

Under Gap 4, there have been three projects funded to address Gaps 4a and 4b and relate to the extension and upgrade of the DPIPWE groundwater monitoring network. The Round 4 project that was submitted to address Gap 4a 'extension of the groundwater monitoring network' will achieve most (if not all) of the project objectives, however some gaps remain for Tasmania where existing network coverage that is required for remote telemetry of sites is not sufficient. Also, the coverage of the SGMN is still inadequate to provide sufficient data to support water management plans in all areas/catchments. As particular catchments or water management units come under increasing pressure for water resources, this may present a gap that will require attention. Gap 4a and Gap 4b are estimated as 25% and 50% closed respectively for the jurisdiction

6.2.5 Gap 5 – Database Infrastructure (priority 1)

This current version of the SWIMP has prioritised the purchase or upgrade of 'database infrastructure' (Gap 5) as priority one for Tasmanian water agencies. In many instances this is where organisations have acknowledged the requirement to deliver specified water information to BoM as required in the Water Regulations. As shown in Figure 18, and under Gap 5, 11 projects have been funded amongst five organisations to improve database infrastructure and transfer of data to BoM.

A recent report provided to BoM regarding the capacity for the LWA to deliver data according to the Regulations identified the following key issues within DPIPWE:

- Hydstra TSM at 'end of life' with no future technical support offered; and
- Anticipated data collection responsibilities as LWA expects jurisdictional pressure to become the central data hub for smaller water information agencies, particularly irrigation entities as the technical expertise within government lies within the LWA. A sufficient, robust and reliable DMS is therefore required to replace TSM and support a range of additional data sources.

Gap 5a and 5b relate to current deficiencies as identified in the LWA 'data delivery capacity report'. The replacement of Hydstra TSM (Gap 5a) is considered to be <50% closed for the jurisdiction. Automation of data to BoM (Gap 5b) is estimated at <75% closed.

6.2.6 Gap 6 – Data Management and Transfer (priority 2)

There have been seven projects funded over the past four years relating to Gap 6, which have addressed Gaps 6a, 6f, 6o and 6p.

Gap 6a: *Improvements and automation of QA/QC systems and procedures*

Hydro Tasmania (HT) has received consecutive funding over two years to develop QA/QC automation systems. Whilst this project has met the objectives within the project scope according to funding constraints and timeframes the gap is viewed as 75% closed for the project. However, this project still requires further

funding to automatically validate the algorithms ability to find a standard set of known error types. QA/QC automation is also viewed as a major jurisdictional gap where 'named' organisations currently delivery raw unverified data to BoM. The jurisdictional gap is therefore viewed as <50% closed.

Gap 6b: *Web services and data transfer*

There have been no projects funded under M&E to address this gap. Jurisdictional Gap is uncertain but considering projects submitted under M&E that were not funded it expected that there remains a need for web services within the jurisdiction.

Gap 6c: *Data duplication*

This gap relates to multiple organisations transmitting the same data sets to BoM. There have been no projects funded under M&E to address this gap. However, some duplicate data sets have been identified through the SWIC. In these instances BoM proformas have been completed identifying which single organisation will provide the data. The jurisdictional gap is unknown.

Gap 6d: *Lack of historical paper records in digital form*

DPIPWE has identified information gaps relating to hydrological time series and other data that is yet to be digitised. There have been no projects funded to address this specific information gap and it is understood that this gap remains for DPIPWE and other water information agencies in the jurisdiction. DPIPWE gap remains at <50% closed. Jurisdictional gap unknown.

Gap 6e: *Filling of data gaps for periods of missing records*

There have been no projects funded under M&E to address this gap. This gap was originally identified in DPIPWE where it identified information gaps relating to missing records or data gaps for periods of historic data. Preliminary estimations suggest that there are approximately 75 years of missing record across 460 water level recording sites. Gap remains for organisation at <50% closed. Jurisdictional gap unknown.

Gap 6f: *Identification and recovery of historical bore and groundwater information involving information from bore drilling logs and digitisation of historical records*

DPIPWE has received M&E funding under Round 4 to recover and incorporate historical groundwater information into its groundwater database. Within the scope of this DPIPWE project the gap is considered to be 75% closed. However, there are still many bores within the state that will not be included as part of this project and the gap for the jurisdiction is estimated at <50% closed. In some instances there is difficulty obtaining information for a number of bores such as historical sites that have been designed to monitor groundwater adjacent to petroleum service stations.

Gap 6g: *Reviews of current and historic rating tables*

There have been no projects funded under M&E to address this gap. Rating table reviews are considered to be a standard business function to the major water information agencies involved with stream flow monitoring. However there are instances where budgetary constraints and limited staff resources within these agencies have impacted on the ability to develop and update many streamflow ratings where priority has not been given. In contrast, DPIPWE has more recently had the opportunity to review and update its rating tables outside of M&E funding. The gap closure for the jurisdiction is unknown.

Gap 6h: *Formal reviews for whole-of-state stream monitoring network*

There have been no projects funded under M&E to address this gap. Network reviews completed for other organisations within the jurisdiction is unknown.

Gap 6i: *Jurisdictional whole of state review required for WQ monitoring to assess current networks.*

There have been no projects funded under M&E to address this gap. Network reviews completed for other organisations within the jurisdiction is unknown.

Gap 6j: *Consideration of nationally consistent guidelines for development and application of WQ triggers, reference sites and targets*

There have been no projects funded under M&E to address this gap. Gap for jurisdiction is unknown.

Gap 6k: *Integrated data collection, processing and storage system for water quality information within the EPA*

There have been no projects funded under M&E to address this gap. Gap for organisation and jurisdiction remains at <50% closed.

Gap 6l: *Development of a metadata database of monitoring sites*

There have been no projects funded under M&E to address this gap. This organisational gap identified by EPA describes the need for the development of a metadata database for monitoring sites including data owners, sites, parameters, locations and date range. Gap for organisation remains at <50% closed.

Gap 6m: *Reviewing Tasmanian practices and implementing water information standards*

Some of the major Tasmanian water information agencies have identified deficiencies in their existing documents relating to standards and procedures that are currently in use. There have been no projects funded under M&E to address this gap in Tasmania and it is understood that updated water information standards and guidelines are still a priority for this jurisdiction. Through standards related projects funded under M&E in other jurisdictions it is envisaged that some of these outputs can be adopted in Tasmania but at present the jurisdictional gap remains at <50% closed.

Gap 6n: *Development of rating tables for flood warning networks*

Calibration of rating tables for both BoM and councils involved with flood warning is required. There have been no projects funded under M&E to address this gap. Jurisdictional gap is unknown.

Gap 6o: *Ongoing strategic water information coordination between bureau and Tasmanian water agencies*

The Strategic Water Information Coordinator has been funded since 2008. Ongoing coordination between BoM and named organisations is still required to assist with improving data transfer and communication of BoM's agenda.

Gap 6p: *Upgrade of telemetry management systems*

DPIPWE had identified deficiencies in their existing 'dial up' telemetry system. An evaluation of available telemetry systems resulted in DPIPWE's purchase of Clear SCADA and incorporation of packet data modems that now allows data to be retrieved in near 'real time'. The organisational gap for DPIPWE is now viewed as 100% closed. With Hydro Tasmania using the Ajenti DMS, the jurisdictional gap for sites involving telemetry is estimated at around 75% closed for the jurisdiction.

6.2.7 Gap 7 – Water Accounting (priority 6)

Hydro Tasmania and DPIPWE have identified a significant gap in producing water accounts for Tasmania. In Section C Hydro Tasmania advise that it would be more beneficial to enable a more efficient production of 'basic' accounts, rather than investing in additional water monitoring sites. DPIPWE conclude that an investment in the area of automating model outputs for inflows and outflows would also be favourable. There have been no projects funded under M&E to address this jurisdictional water accounting gap.

6.2.8 Gap 8 – Geospatial Information and Metadata (priority 5)

Under Gap 8 there have been two projects funded that address subsidiary Gaps 8b, 8c, 8d, 8e and 8g.

Gap 8a: *Revision of farm dams and man-made water bodies*

Information and Land Services (ILS) within DPIPWE has received M&E funding to provide an integrated and complete coverage of available watercourse and water body mapping held by government. This has been achieved by completing the capture and revision of farm dams at 1:25,000 scale and completion of a single consistent 1:25,000 scale database for Tasmania including natural watercourses and natural and man-made water bodies. The jurisdictional gap is now considered as 100% closed.

Gap 8b: *Improved metadata required for gauging stations*

DPIPWE has received M&E funding to improve geospatial information and metadata for the DPIPWE/Hydro Tasmania stream gauging network. It is understood that both these organisations are responsible for the majority of stream gauging stations in Tasmania. The jurisdictional gap is therefore considered to be approximately 75% closed.

Gap 8c: *Improved metadata required for groundwater bores*

The DPIPWE groundwater section identified the need for improved geospatial information and metadata for its groundwater monitoring network. Through M&E funding this organisational gap has been partially addressed for priority sites. The gap closure has not yet been determined for the jurisdiction but is expected to be <50% closed.

Gap 8d: *Improved metadata required for major storages*

The Tasmanian Metadata Collection project funded in Round 4 will address this gap proportional to the amount of funding that was received. Once the project is completed it is estimated that the gap will be approximately 50% closed for the jurisdiction.

Gap 8e: *Improved metadata required for rain-gauge sites*

The Tasmanian Metadata Collection project funded in Round 4 will address this gap proportional to the amount of funding that was received. Once the project is completed it is estimated that the gap will be approximately 50% closed for the jurisdiction.

Gap 8f: *Metadata verification for stations 'closed'*

There have been no projects funded under M&E to address this gap. Gap for jurisdiction is unknown.

Gap 8g: *Metadata acquisition and assisting with the AHGF*

DPIPWE has received funding in Round 4 to provide an integrated and complete coverage of available watercourse and water body mapping held by government that will directly support the ongoing improvement of catchment, state and national scale water accounting and water resource assessment. On completion of this state-wide Hydrological Geospatial Fabric Project the jurisdictional gap should be 100% closed.

Gap 8h: *Metadata required within the EPA*

Within DPIPWE the EPA has identified the need for the development of a metadata database for monitoring sites including data owners, sites, parameters, locations and date range. This is regarded by the EPA as integral to reviewing and conducting monitoring programs, and planning cooperative programs for optimising efficiencies and application of standards and best practice. There have been no projects funded under M&E to address this organisational gap. Gap for jurisdiction is unknown.

6.3 Revision of Funding Invested per Theme Category

The following section provides an assessment of M&E funding in relation to Bureau of Meteorology funding themes. Within the M&E funding guidelines BoM provided particular project themes that are eligible for funding for a given funding round. Whilst there have been some slight variations to these themes between funding rounds the basic themes over the past four funding rounds have remained, and include the following:

Theme 1 – Improving the accuracy of existing water measurement networks;

Theme 2 – Installation of telemetry;

Theme 3 – Extending the coverage of monitoring networks;

Theme 4 – Installation of software and upgrade or purchase of data management systems (DMS);

Theme 5 – Recovery or rescue of water information;

Theme 6 – Improving the Australian Hydrologic Geospatial Fabrics (AHGF) national surface water foundation data set;

Theme 7 – Improving the Australian Hydrologic Geospatial Fabric (AHGF) national foundation groundwater data set;

Theme 8 – Participating in the cooperative planning and production of the National Water Account (NWA);

Theme 9 – Engagement of Strategic Water Information Coordinators; and

Theme 10 – Development of best practice guidelines or standards.

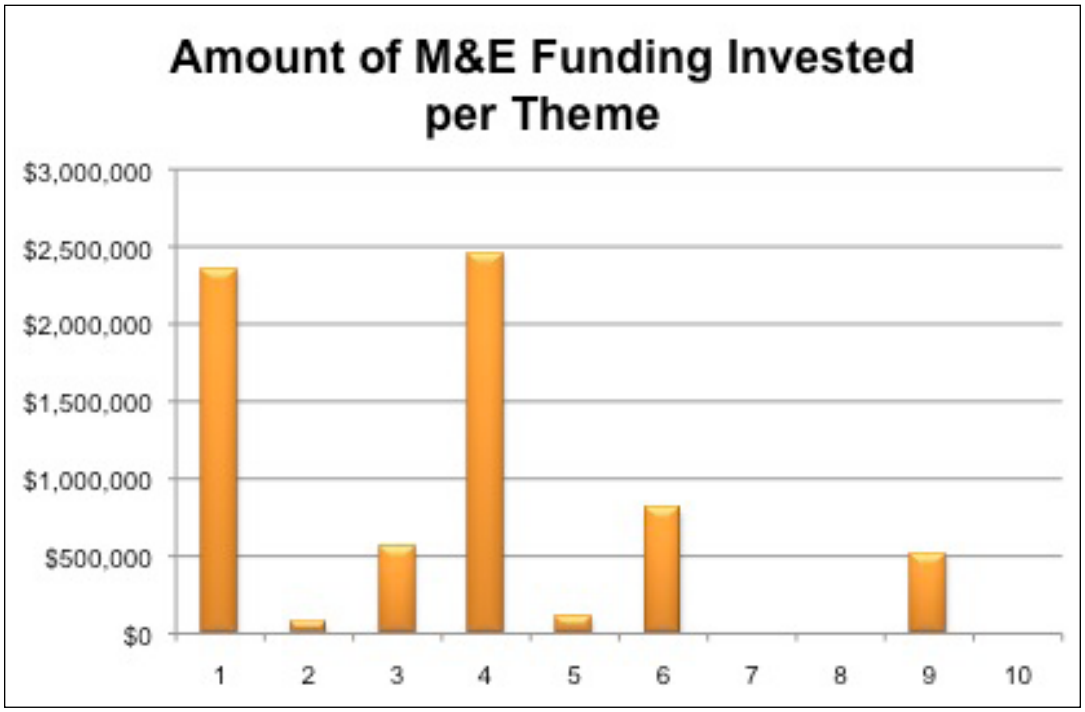


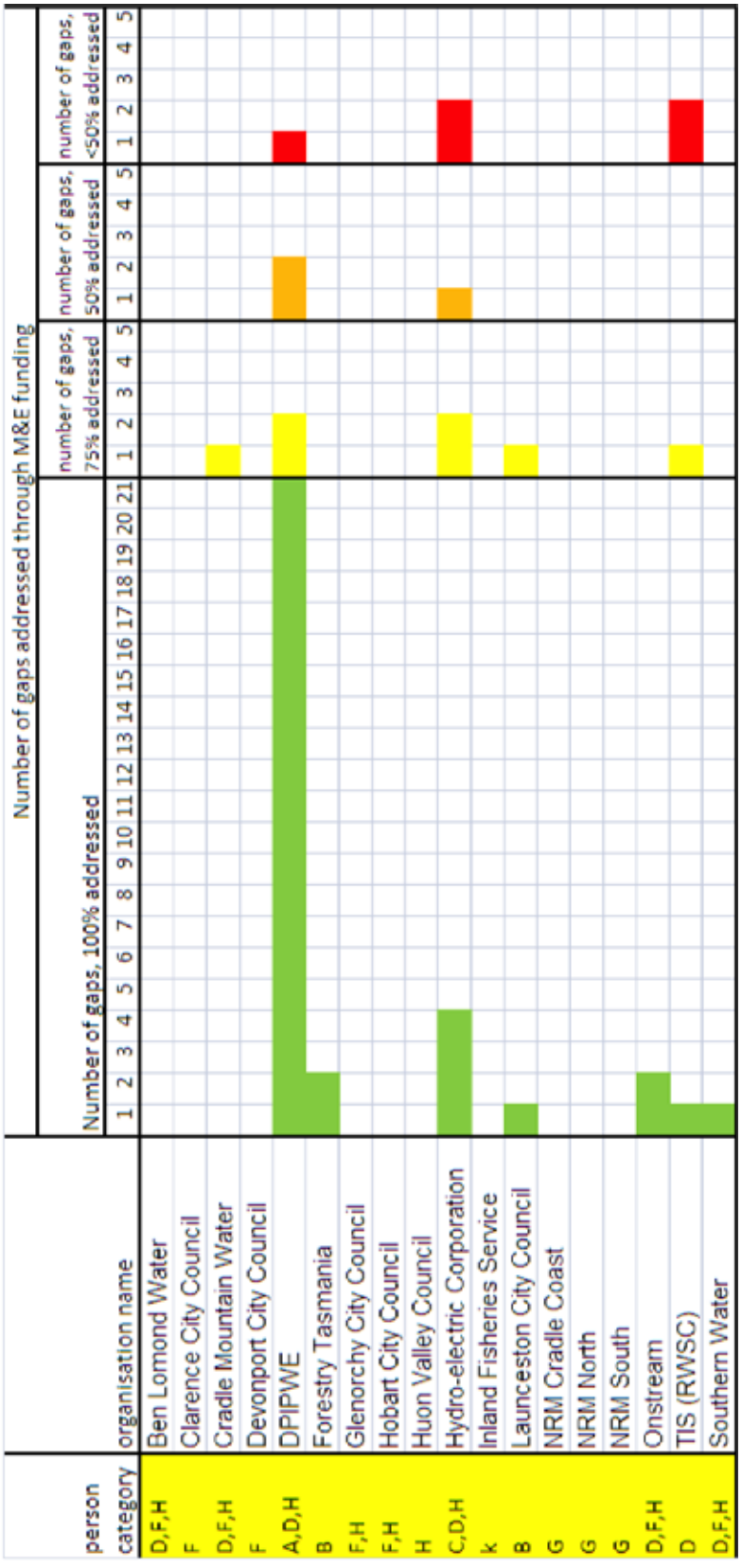
Figure 21 – Amount of funding spent in Tasmania on M&E program themes. Theme 1 (improving accuracy of data) and Theme 4 (purchase/upgrade of DMS) have received the most funding, whilst in contrast Themes 7, 8 and 10 have had no projects funded to address information gaps.

As shown in Figure 21 over the past four funding rounds the majority of M&E funding received in Tasmania has been directed towards addressing Theme 1 (improving accuracy of data) and Theme 4 (purchase/upgrading data management systems). Themes where no funding has been allocated in Tasmania include: improving groundwater spatial data sets (Theme 7); participating in the National Water Account (Theme 8); and improving guidelines and standards (Theme 10).

The information contained within the following tables depicts the number of gaps that have been addressed through M&E funding and to what extent. These tables include:

- **Table 12:** for each organisation, this table shows how many gaps have been addressed though M&E funding and to what extent (number of gaps addressed according to percentage closed).
- **Table 13 through to Table 22:** according to theme and for each gap these tables show how many M&E projects were funded and to what extent the gap has been closed (number of projects which either fully or partly address gap for the funded organisation i.e. 100%, 75%, 50% or <50% closed).

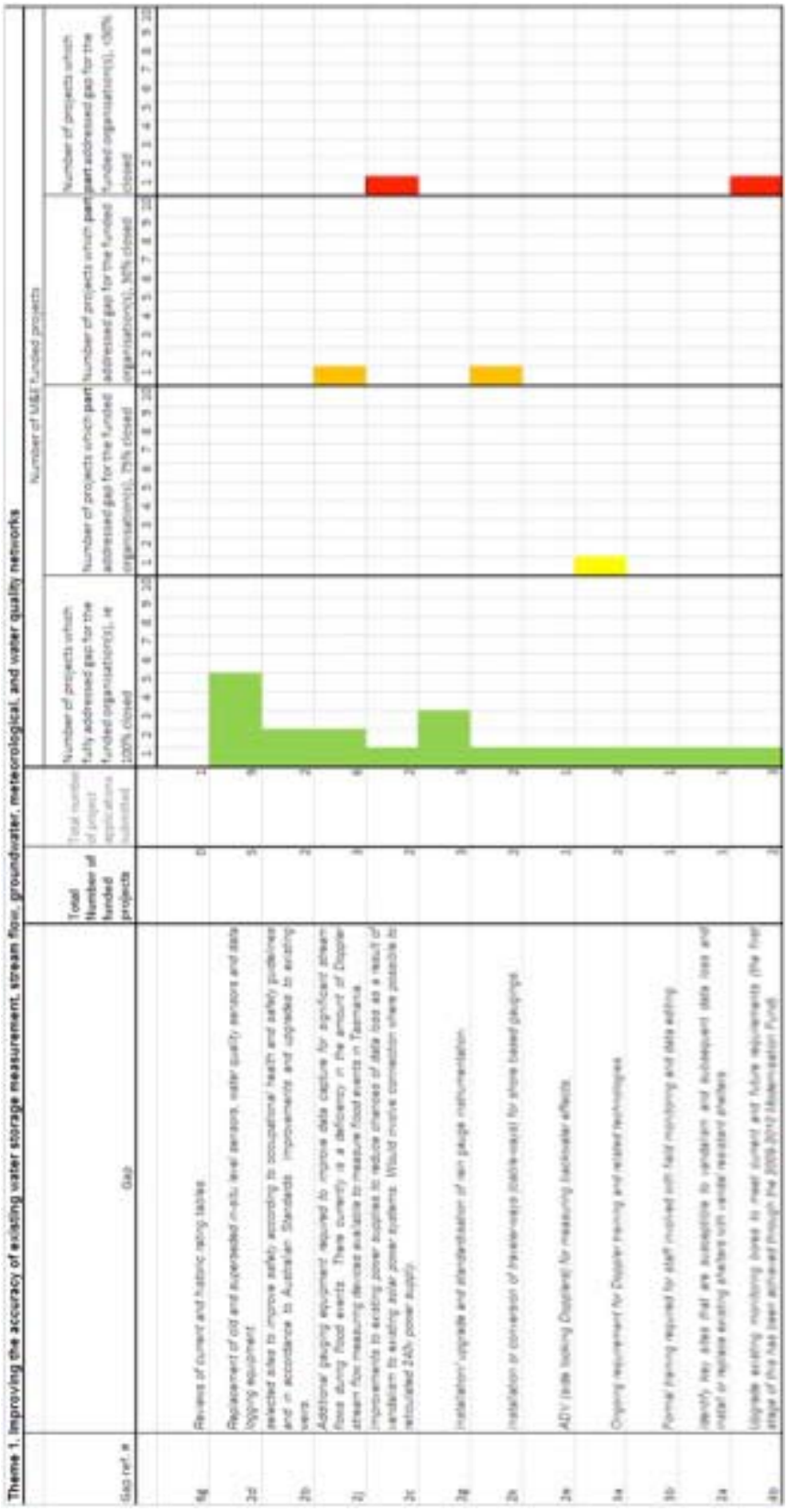
Table 12 – Number of Gaps Addressed and Percentage Gap Closure For All Tasmanian-Named Organisations



person category	organisation name	Number of gaps addressed through M&E funding: Number of gaps, 100% addressed																				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
D,F,H	Ben Lomond Water																					
F	Clarence City Council																					
D,F,H	Cradle Mountain Water		1																			
F	Devonport City Council																					
A,D,H	DPIPWE		1																			
B	Forestry Tasmania		1																			
F,H	Glenorchy City Council																					
F,H	Hobart City Council																					
H	Huon Valley Council																					
C,D,H	Hydro-electric Corporation				1																	
k	Inland Fisheries Service																					
B	Launceston City Council		1																			
G	NRM Cradle Coast																					
G	NRM North																					
G	NRM South																					
D,F,H	Onstream		1																			
D	TIS (RWSC)																					
D,F,H	Southern Water																					

person category	organisation name	Number of gaps addressed through M&E funding: number of gaps, 75% addressed					number of gaps, 50% addressed					number of gaps, <50% addressed				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
D,F,H	Ben Lomond Water															
F	Clarence City Council															
D,F,H	Cradle Mountain Water	1														
F	Devonport City Council							1								
A,D,H	DPIPWE		1						1				1			
B	Forestry Tasmania															
F,H	Glenorchy City Council															
F,H	Hobart City Council															
H	Huon Valley Council															
C,D,H	Hydro-electric Corporation		1				1						1			
k	Inland Fisheries Service															
B	Launceston City Council	1														
G	NRM Cradle Coast															
G	NRM North															
G	NRM South															
D,F,H	Onstream		1													
D	TIS (RWSC)	1											1			
D,F,H	Southern Water															

Table 13 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 1



Theme 1. Improving the accuracy of existing water storage measurement, stream flow, groundwater, meteorological, and water quality networks					Number of M&E funded projects		
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
1M	Review of current and historic rating tables	0	11				
2d	Replacement of old and superseded in-situ level sensors, water quality sensors and data logging equipment	5	8				
2b	selected sites to improve safety according to occupational health and safety guidelines and in accordance to Australian Standards improvements and upgrades to existing weirs	2	3				
2i	Additional gauging equipment required to improve data capture for significant stream flows during flood events. There currently is a deficiency in the amount of Doppler stream flow measuring devices available to measure flood events in Tasmania	1	6				
2c	improvements to existing power supplies to reduce chances of data loss as a result of vandalism to existing solar power systems. Would involve connection where possible to reticulated 240v power supply	2	2				
2g	Installation/ upgrade and standardisation of rain gauge instrumentation	1	6				
2h	Installation or conversion of traverse-wire (cable-way) for shore based gaugings	2	2				
2e	ADV (Side looking Doppler) for measuring backwater effects	1	1				
3d	Ongoing requirement for Disaster training and related technologies	2	2				
3b	Formal training required for staff involved with field monitoring and data editing	1	1				
2a	Identify key sites that are susceptible to vandalism and subsequent data loss and install or replace existing shelters with vandal resistant shelters	1	1				
4b	Upgrade existing monitoring bores to meet current and future requirements (the first stage of this has been achieved through the 2009-2010 Rejuvenation Fund)	2	2				

Table 14 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 2

Theme 2. Installation of telemetry							
				Number of M&E funded projects			
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
2h	Installation of telemetry at key sites incorporating satellite and next G packet data systems	7	10				
2i	Telemetry upgrades involving SERK SCADA at priority flood warning sites enabling real-time monitoring	0	1				

Table 15 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 3

Theme 3. Extending the coverage of the monitring network to address critical							
				Number of M&E funded projects			
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
1a	Additional monitoring sites required at strategic locations for improved water management and water accounting. Includes new sites as required under irrigation development projects	4	8				
4a	Extension of groundwater monitoring network to identified priority areas	1	1				
1d	Lack of flood warning networks in key areas and requirement for these networks to be monitored in real time	0	1				

Table 16 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 4

Theme 4. Installation of software, upgrading of existing data management systems or purchase and installation of new data management systems to improve water data (and metadata) management procedures within organisations.

Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects: Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
5a	Replacement of Hydstra TSM to new DMS for affected organisations. TSM offers no support in the future as it has been declared end of life	2	3				
5b	Improved data management systems involving automated data transfer to BoM for some Tasmanian water agencies	9	10				
5c	Re-scoping of WMS	0	1				
6b	Upgrade of telemetry management systems	1	2				
6a	Improvements and automation of QA/QC systems and procedures	2	3				
6b	Web services and data transfer	0	1				
6k	Integrated data collection, processing and storage system for water quality information within the EPA	0	2				
6l	Development of a metadata database of monitoring sites	0	2				

Table 17 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 5

Theme 5. Recovery or rescue of water information, including metadata, of demonstrated strategic value to the Bureau's purposes that is at risk of imminent loss due to its condition, storage status and/or the future lack of staff to interpret it or undertake its recovery.

Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects: Number of projects which Fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
6d	Lack of historical paper records in digital form	1	2				
6f	Identification and recovery of historical bore and groundwater information involving information form bore drilling logs and digitisation of historical records	1	1				
6e	Filling of data gaps for periods of missing record	0	1				

Table 18 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 6

Theme 6. Improving the Australian Hydrologic Geospatial Fabric's (AHGF) national surface water foundation data set by the population of compatible geo-databases.

Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of M&E funded projects: Number of projects which Fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
6b	Improved metadata required for gauging stations	1	1				
6g	Metadata acquisition and assisting with the AHGF	1	1				
6d	Improved metadata required major storages	1	1				
6e	Improved metadata required non-gauged sites	1	1				
6a	Revision of farm dams and man-made water bodies	0	1				
6h	Metadata required within EPA	0	1				

Table 19 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 7

Theme 7. Improving the Australian Hydrologic Geospatial Fabric's (AHGF) national foundation groundwater data set.								
				Number of M&E funded projects				
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
8c	Improved metadata required groundwater bores	0	0				

Table 20 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 8

Theme 8. Participating in the cooperative planning and production of the National Water Account (NWA).								
				Number of M&E funded projects				
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
7a	Catalogue of Hydrological Models	0	0				

Table 21 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 9

Theme 9. Engagement of Strategic Water Information Coordinators.							
				Number of M&E funded projects			
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
6o	Ongoing Strategic Water Information Coordination between Bureau and Tasmania water agencies	1	1				

Table 22 – Number of Gaps Addressed and Percentage Gap Closure Under Theme 10

Theme 10. Development and application of best practice guides or standards for the collection, monitoring, measurement and storage of water information and or metadata.							
				Number of M&E funded projects			
Gap ref. #	Gap	Total Number of funded projects	Total number of project applications submitted	Number of projects which fully addressed gap for the funded organisation(s), ie 100% closed	Number of projects which part addressed gap for the funded organisation(s), 75% closed	Number of projects which part addressed gap for the funded organisation(s), 50% closed	Number of projects which part addressed gap for the funded organisation(s), <50% closed
				1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
6m	Reviewing Tasmanian practices and implementing water information standards	1	1				

7 Section D: Strategies for Improvement

A strategy is required to assist BoM in directing the application of the Modernisation and Extension of Hydrologic Monitoring Systems Program, to improve water information collected from water monitoring networks in Tasmania. The strategy should identify opportunities, where possible, for co-investment by jurisdictional agencies and the federal government to maximise available funding. It will provide a key input to jurisdictional based applications in current and future rounds of BoM's Modernisation and Extension of Hydrologic Monitoring Systems Program.

The priorities listed below have been determined during discussion amongst named organisations and stakeholders through a series of SWIMP working group meetings. This has involved identifying what significant gaps exist within section C of this document and then through group discussion agreeing to what order these gaps should be prioritised. The order of prioritisation should then reflect a common need amongst Tasmanian water information agencies. As water information gaps have been filled through M&E investment it is also expected that the order of these gaps will change and be reflected in successive SWIMP versions.

7.1 Order of Priorities for Jurisdiction

In March 2011, the SWIMP working group agreed on an updated order of priorities to reveal water monitoring and data management requirements for Tasmania. This order of priorities has also taken into account the outcomes of Section C2 (Reporting of Gaps Addressed Through M&E). The priorities for Tasmania currently are (in order):

Priority 1: Database Infrastructure (Gap #5) – This includes purchases and upgrades of databases and associated systems and applications.

Whilst this gap has already received significant funding within the jurisdiction, the lead water agency and irrigation entities (and other unaccounted emerging water information collectors) manage a significant proportion of water information within the state. There is still a requirement amongst these agencies to upgrade or purchase sufficient database management systems to support growing demands and data responsibilities into the future. For example, Section C2 of the SWIMP considers the replacement of Hydstra TSM to be <50% closed for the jurisdiction.

Priority 2: Data Management and Transfer (Gap #6) – Includes reviews of current data collection and management standards; improvements to QA/QC processes; web services to improve data transfer to BoM and between agencies; digitisation of paper records; rating table development and review.

This gap remains a priority for Tasmania. There is still a jurisdictional requirement for a working automated model that would improve QA/QC processes. A considerable gap relating to the recovery of historical groundwater information also remains. Furthermore, little or no funding has been issued in the jurisdiction to address gaps relating to standards.

Priority 3: Establishment of Key Sites (Gap #1) (for water management, flood warning, planning, accounting and water infrastructure development projects) – Includes sites used by multiple agencies; multiple purposes; has significant importance to the state.

As M&E funding has assisted towards closure of other gap categories, Gap #1 in this funding round has shifted from priority 4 to priority 3 given expanding and significant monitoring responsibilities for the Tasmanian Irrigation Development Board and the three regional water corporations. Establishment of new sites will improve information gaps in state-wide stream-flow monitoring and reporting on water balance and accounting.

Priority 4: Water Accounting (Gap #7) – Includes review of hydrological models with reference to Tasmanian water account; development of tools to determine relevant inflows on a state-wide, regional, and catchment area basis; development of discharge and 3-D ratings at key sites that do not currently exist.

This gap largely remains for Tasmania. Section 5.12 of the SWIMP suggests that to assist water accounting a strategic investment would be more beneficial to enable more efficient production of basic accounts rather than investing in more water monitoring. Investing in the area of automating model outputs for inflows and outflows is recommended by the jurisdiction.

Priority 5: Improvements to Site Infrastructure, Instrumentation and OH&S (Gap #2) – Includes refurbishment of weirs; upgrade or replacement of sensors, power supplies, logging and telemetry equipment; stream gauging instrumentation; instrument shelters; installation or conversion of existing cableways to traveller-ways; site access for improved OH&S (e.g. ladders, stairs, platforms, handrails).

Through significant investment in the jurisdiction the priority of this gap has shifted from priority 3 to priority 5 for this funding round. However, there are still some outstanding issues under Gap #2 that require addressing.

Priority 6: Groundwater (Gap #4) (instrumentation and refurbishment) – Includes groundwater sites that require upgrades to improve accuracy and currency of data.

Listed as priority 7 in previous funding rounds, closure of gaps in other gap categories has resulted in groundwater becoming a higher priority for this funding round.

Priority 7: Geospatial Information and Metadata (Gap #8) – Includes revision of Tasmanian farm dams and verification of monitoring locations to GDA 94 and AHD.

Through successful M&E funding bids significant investment has already been made in Tasmania to address many information gaps to improve geospatial information and metadata. Listed as priority 5 in previous funding rounds Gap #8 is now priority 7 under this funding round. Some outstanding gaps in this gap category still remain, particularly relating to operational storages and rainfall sites.

Priority 8: Knowledge Enhancement (Gap #3) – Includes training in technologies to assist with improved understanding and use of new equipment; hydrographic training for field work and data editing.

Gap #3 remains the lowest priority for the jurisdiction. Some training projects funded under M&E have assisted towards improving gauging techniques for field staff and ultimately assisted toward improving the accuracy of data that is collected. Training and knowledge enhancement is still however a requirement within many organisations and remains a priority for the jurisdiction.

7.2 Round 5 M&E Funding Themes and Projects

The following section incorporates six funding themes specific to Round 5 M&E. A series of projects that have been submitted under Round 5 have been identified to fit within each of the six themes. Each of the following projects within the themes listed below has been allocated a priority based on the above list i.e. 1-8. These are a 'best fit' priority ranking for each project and may not necessarily reflect a jurisdictional priority for an individual project.

These projects will assist with addressing major gaps identified in Section C. Where practicable the final scope of these projects will allow more than one named party to be involved (and may involve named parties in other jurisdictions).

7.2.1 THEME 1 – Improving the currency (via telemetry), accuracy and coverage of surface or groundwater monitoring.

The proposed projects under Round 5 M&E funding that fit within Theme 1 of BoM's funding guidelines include:

- Improving accuracy of hydrologic data through instrumentation, infrastructure upgrades and site auditing **(Priority 5)**.
- Refurbishment and reconfiguration of GMU specific groundwater monitoring bores, Tasmania **(Priority 6)**.
- Training in Hydrography **(Priority 8)**.
- Purchase of RTK module for remote gaugings and an MST-2 dilution instrument **(Priority 5)**.
- QA/QC anomaly detection and correction criteria **(Priority 2)**.
- Improvement of Hobart flood monitoring network **(Priority 4)**.
- Sub-catchment scale water monitoring in key irrigation development catchments in Tasmania **(Priority 3)**.
- Installation of a monitoring station above the tidal limit on the Derwent River by Southern Water **(Priority 3)**.
- Installation of monitoring stations to enhance the quantity and quality of data retrieval for water catchments in the Cradle Mountain Water District **(Priority 3)**.

7.2.2 THEME 2 – Coordination activities

The proposed projects under Round 5 M&E funding that fit within Theme 2 of BoM's funding guidelines include:

- Priority coordination activities identified in Tasmania to assist the Bureau's water information program **(Priority 2)**.

7.2.3 THEME 3 – Participating in cooperative planning and production of the National Water Account

The proposed projects under Round 5 M&E funding that fit within Theme 3 of BoM's funding guidelines include:

- National Water Account support from Tasmania region – assistance in NWA notes and descriptive information **(Priority 4)**.

7.2.4 THEME 4 – Improving the Australian Hydrological Geospatial Fabric (AHGF) national surface water foundation data set

The proposed projects under Round 5 M&E funding that fit within Theme 4 of BoM's funding guidelines include:

- Metadata survey to accurately locate storages, rainfall stations and off-takes operated by the major water resource stakeholders in Tasmania **(Priority 7)**.

7.2.5 THEME 5 – Developing the National Groundwater Information System (NGIS)

The proposed projects under Round 5 M&E funding that fit within Theme 5 of BoM's funding guidelines include:

- Enhancements to the DPIPWE Groundwater Information Management System (GWIMS) to enable the supply of Tasmanian groundwater data to the National Groundwater Information System (NGIS) **(Priority 1)**.
- Assistance for development of hydro-geological units – Tasmania **(Priority 6)**.

7.2.6 THEME 6 – Data provision and water data transfer

The proposed projects under Round 5 M&E funding that fit within Theme 6 of BoM's funding guidelines include:

- Purchase and rollout of a state-wide hydrological database management system, and improving the reliability of the Category 6 data supply process **(Priority 1)**.
- System enabling specialist training **(Priority 8)**.

Abbreviations and Acronyms

ADCP	Acoustic Doppler Current Profiler
ADV	Acoustic Doppler Velocimeter
AHA	Australian Hydrographers Association
AHD	Australian Height Datum
AHGF	Australian Hydrologic Geospatial Fabric
ANZECC	Australian and New Zealand Environment and Conservation Council
AWS	Automatic Weather Station
AWRC	Australian Water Resources Council
BoM	Bureau of Meteorology
BWQMP	Baseline Water Quality Monitoring Program
CMW	Cradle Mountain Water
COAG	Council of Australian Governments
DBMS	Database management system
DEWHA	Department of Environment, Water, Heritage and the Arts
DPIW	Department of Primary Industries and Water
DPIPWE	Department of Primary Industries, Parks, Water and Environment
EMPCA	Environmental Management and Pollution Control Act
EPA	Environmental Protection Authority
GDA	Geocentric Datum of Australia
GDE	Groundwater Dependent Ecosystems
GWIMS	Groundwater Information Management System
HEC	Hydro Electric Corporation
HED	Hydro Electric Department
HT	Hydro Tasmania
JRGWI	Jurisdictional Reference Group Water Information
LEO	Low Earth Orbit
M&E	The Modernisation and Extension of Hydrologic Monitoring Systems Program
ML	Mega litres
MRT	Mineral Resources Tasmania
NAPSWQ	National Action Plan, Salinity and Water Quality
NRM	Natural Resource Management

NWA	National Water Account
NWI	National Water Initiative
PSTN	Public Switched Telephone Network
QA/QC	Quality Assurance / Quality Control
ROT	Remote Observer Terminal
RWSC	Rivers and Water Supply Commission
SCADA	Supervisory Control and Data Acquisition
SGMN	State-wide Groundwater Monitoring Network
SMART	Sustainable Management of Agricultural Resources in Tasmania
SQL	Structured Query Language
SWIC	Strategic Water Information Coordinator
SWIMP	Strategic Water Information and Monitoring Plan
TCA's	Time-series Client Applications
TEER	Tamar Estuary Esk River (Program)
TIDB	Tasmanian Irrigation Development Board
TIGER	Tasmanian Information on Geoscience and Exploration Resources
TIS	Tasmanian Irrigation Schemes
TS	Time Studio
TSM	Time Studio Management
TSWQMS	Tasmanian Surface Water Quality Monitoring Strategy
TWMI	Tasmanian Water Metering Initiative
TWUMP	Tasmanian Water Use Management Project
WIF	(State) Water Infrastructure Fund
WIMS	Water Information Management System
WIST	Water Information Systems of Tasmania
WMA	(Tasmanian) Water Management Act
WQ	Water Quality

References

Alexander, A., (editor) (2005) *The Companion to Tasmanian History* Centre for Tasmanian Historical Studies, University of Tasmania, Hobart. ISBN 186295223X

Bacon, C.A., and Latinovic, M., (2003). A review of groundwater in Tasmania. *Record Tasmanian Geological Survey* 2003/01.

Broderickl, K.B. June 5, 2009. *'NRM South – personal communications'*.

Coffey Geosciences. (2002). Hydrogeological studies for the examination of soil salinity, Tunbridge, Waterhouse, Coal River – Tasmania. Coffey Geosciences Pty Ltd.

Cromer, W. C. (1993). Geology and groundwater resources of the Devonport-Port Sorell-Sassafras Tertiary Basin. Bulletin Geological Survey Tasmania 67.

CSIRO (2009) Water availability for Tasmania. Report two of seven to the Australian Government from the CSIRO Tasmania Sustainable Yields Project, CSIRO Water for a Healthy Country Flagship, Australia.

CTHS (2006), Centre for Tasmanian Historical Studies, website viewed in April 2010 www.utas.edu.au/library/companion_to_tasmanian_history

Dell, M. (2002). Hydrogeological setting of areas subject to soil salinity in Tasmania. Record Tasmanian Geological Survey 2000/05.

DPIPWE (2009). Guidelines for assessing applications for well drillers licence. Water and Marine Resources, Policy #2009/1. Department of Primary Industries, Parks, Water and Environment, Hobart.

DPIPWE (2009a). *Well Drillers Handbook*. Department of Primary Industries, Parks, Water and Environment, Hobart.

DPIPWE website, 2011. *Overview of Surface Water in Tasmania,* www.dpiw.tas.gov.au/internnsf/WebPages/RPIO-4Y4VHT?open

DPIW website, 2009, http://www.dpiw.tas.gov.au

DPIWE (2003) *The Tasmanian Surface Water Quality Monitoring Strategy,* Department of Primary Industries, Water and Environment.

DPIWE (2008). Water Assessment Branch, A Review of the Baseline Water Quality Monitoring Program (BWQMP) undertaken by the Water Assessment Branch, Department of Primary Industries and Water.

DPIWE website, 2005, http://www.dpiwe.tas.gov.au

Ezzy, A. R. (2002). The effects of waste disposal on groundwater quality in Tasmania: An overview of NHT funded project NLP13188. R*ecord Geological Survey Tasmania* 2002/17 [23 December 2002].

Ezzy, A., (2004). An overview of the Mineral Resources Tasmania state wide ground water monitoring network. *Record Tasmanian Geological Survey* 2004/04. http://www.tidb.com.au/

Hydro Tasmania (2010). Mersey-Forth Water Account 2007/ 08 Financial year. Draft report prepared by Hydro Tasmania, Cambridge.

Johnston, M. (2010) AHA Conference paper: History of Hydrographic Development in Tasmania.

Koehnken, L. (2008). Review of Baseline Water Quality Monitoring Program, prepared for Water Assessment Branch, Department of Primary Industries and Water.

Latinovic, M.; Matthews, W. L.; Bastick, C.; Lynch, S.; Dyson, P.; and Humphries, E. (2003). Tasmanian Groundwater Flow Systems for dryland salinity planning. *Record Tasmanian Geological Survey* 2003/02.

Mason-Cox, M. (1994). Lifeblood of a colony: A History of irrigation in Tasmania. Rivers and Water Supply Commission, Hobart, Tasmania NHT funded project NLP13188. *Record Tasmanian Geological Survey* 2002/17.

Mersey – Forth Water Account Draft, 2010 (2007/08 Financial Year). Prepared by Hydro Tasmania.

Park, T. (1971). Methods of Collection, Recording, Analysis and Dissemination of Hydrological Data. Un-published report. Hydro Electric Commission, Tasmania.

Rockcliff, D. (2008). DRAFT Tasmanian Groundwater Strategy.

RWSC, Stream Gauging Records to 1970, 1971. Rivers and Water Supply Commission, Hobart, Tasmania.

Sinclair Knight Merz (2000). National Land and Water Audit. Groundwater Data for Tasmania. Sinclair Knight Merz Pty Ltd: Armadale, Victoria.

State of Environment Tasmania website viewed in February 2009.

Tasmanian Geological Survey Record 2004/04 19.

Tasmanian Irrigation Development Board website viewed in April 2010.

Taylor, K. (2000). Groundwater resources of the Northern Midlands and Fingal Valley regions. *Record Tasmanian Geological Survey* 2000/04.

Tickle, P., and Crossman, S. (2008). Australian Hydrological Geospatial Fabric (Geofabric) 'National Data Audit' Draft, Sep 2009. National Mapping and Information Group, Geoscience Australia.

TWSSOTIR (2009). Tasmanian Water and Sewerage State of the Industry Report 2007-08. Office of the Tasmanian Economic Regulator.

Documents Considered for Drivers Table 1 and Descriptions in Appendix 2

ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council, Canberra.

ANZECC (2000) *Australian Guidelines for Water Quality Monitoring and Reporting*. Australian and New Zealand Environment and Conservation Council, Canberra.

Australian Natural Resource Atlas website viewed in March 2009 http://www.anra.gov.au/about/index.html

Commonwealth Environmental Facilities Scheme – Landscape Logic Research website viewed in March 2009, http://www.landscapelogic.org.au/

DEPHA (Oct 2008) Review of the State Policy on Water Quality Management 1997, Discussion Paper, Department of Environment, Parks, Heritage and the Arts, Environment Division, Policy Section.

DPIWE (2006) Water Assessment Branch – Water Quality Sampling Protocols, Standards and Procedures.

DPIWE (2007) Developing Turbidity Guidelines for Tasmania – Discussion Paper for the Tasmania *Together* Progress Board (Benchmark 12.2.1), Department of Primary Industries and Water, Water Resources Division, Hobart.

DPIWE (2003) *The Tasmanian Surface Water Quality Monitoring Strategy,* Department of Primary Industries, Water and Environment.

DPIPWE (2009) website viewed in February 2009 http://www.DPIPWE.tas.gov.au/inter.nsf/ThemeNodes/DREN-4VH8C4?open

DPIPWE (2009) websites viewed in November 2009 http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/JMUY-6X473H?open http://www.dpipwe.tas.gov.au/inter.nsf/WebPages/JMUY6X473H?open#Water QualityandWater

Hydro Tasmania website viewed in March 2009 http://www.hydro.com.au/home/

National Action Plan for Salinity and Water Quality website viewed in March 2009 http://www.napswq.gov.au/

Natural Resource Management in Tasmania website viewed in March 2009 http://www.nrmtas.org/home.shtml

Pesticide and Herbicide Monitoring Project website viewed in April 2010 http://www.dpiw.tas.gov.au/inter.nsf/WebPages/CART-69STWK

RWSC (2008) Fiftieth Annual Report, for the Year 2007-2008, viewed 16 February 2009, http://www.stors.tas.gov.au/au-7-0054-00309

Tasmanian Irrigation Development Board website viewed in April 2010
http://www.tidb.com.au/

Tasmania *Together* 2020 website viewed in February 2009
http://www.tasmaniatogether.tas.gov.au/

Tasmanian State of Environment Reporting website viewed in March 2009
http://www.rpdc.tas.gov.au/soe

Tasmanian Water Use Management Project website viewed in April 2010
http://www.taswater.com.au/

Tasmanian Water Metering Initiative website viewed in April 2010
http://www.dpiw.tas.gov.au/inter.nsf/WebPages/JMUY-4YB2AB?open

Tasmanian Water Use Management Project website viewed in April 2010
http://www.taswater.com.au/

The Australian Natural Resources Atlas website viewed in March 2009
http://www.anra.gov.au/about/index.html

The Public Health Act 1997 Drinking Water Quality Guidelines (latest version):
http://www.dhhs.tas.gov.au/__data/assets/pdf_file/0020/8723/drinking_water_quality_guidelines17_nov_05.pdf

Appendix 1 – Tasmanian Named Parties in *Water Regulations 2008*

1. Ben Lomond Water, (Category D,F,H)
2. Clarence City Council, (Category F)
3. Cradle Coast NRM, (Category G)
4. Cradle Mountain Water, (Category D,F,H)
5. Department of Primary Industries, Parks, Water and Environment, (Category A, Category D, Category H)
6. Devonport City Council, (Category F)
7. Forestry Tasmania, (Category B)
8. Glenorchy City Council, (Category F, Category H)
9. Hobart City Council, (Category F, Category H)
10. Huon Valley Council, (Category H)
11. Hydro-electric Corporation (Hydro Tasmania), (Category C, Category D, Category H)
12. Inland Fisheries Service, (Category B)
13. Launceston City Council, (Category F, Category H)
14. NRM North, (Category G)
15. NRM South, (Category G)
16. Onstream, (Category D,F,H)
17. Southern Water, (Category D, Category F)
18. Tasmanian Irrigation Schemes, (Category D)

Appendix 2 – Legislation, Programs and Projects (from Table 1)

2.1 *Tasmanian Water Management Act 1999*

The *Water Management Act 1999* is part of the state's integrated resource management and planning system and provides for the management of Tasmania's freshwater resources.

In particular the Act is to provide for the use and management of freshwater resources in Tasmania having regard to the need to:

- Promote sustainable use and facilitate economic development of water resources;
- Recognise and foster the significant social and economic benefits resulting from the sustainable use and development of water resources for the generation of hydro-electricity and for the supply of water for human consumption and commercial activities dependent on water;
- Maintain ecological processes and genetic diversity for aquatic and riparian ecosystems;
- Provide for the fair, orderly and efficient allocation of water resources to meet the community's needs;
- Increase the community's understanding of aquatic ecosystems and the need to use and manage water in a sustainable and cost-efficient manner; and
- Encourage community involvement in water resources management.

Water Management Regulations 1999 and Water Management (Safety of Dams)

Regulation 2003

Under the *Water Management Act 1999*, there are two separate sets of regulations, the *Water Management Regulations 1999* and the *Water Management (Safety of Dams) Regulations 2003*.

The *Water Management Regulations 1999* set limits on the taking of water for specific uses and set fees for water licences. They also set fines for contravention of, or failure to comply with, any regulations.

The *Water Management (Safety of Dams) Regulations 2003* set the level of competency required for construction teams to be authorised to work on dams of different hazard categories and dimensions.

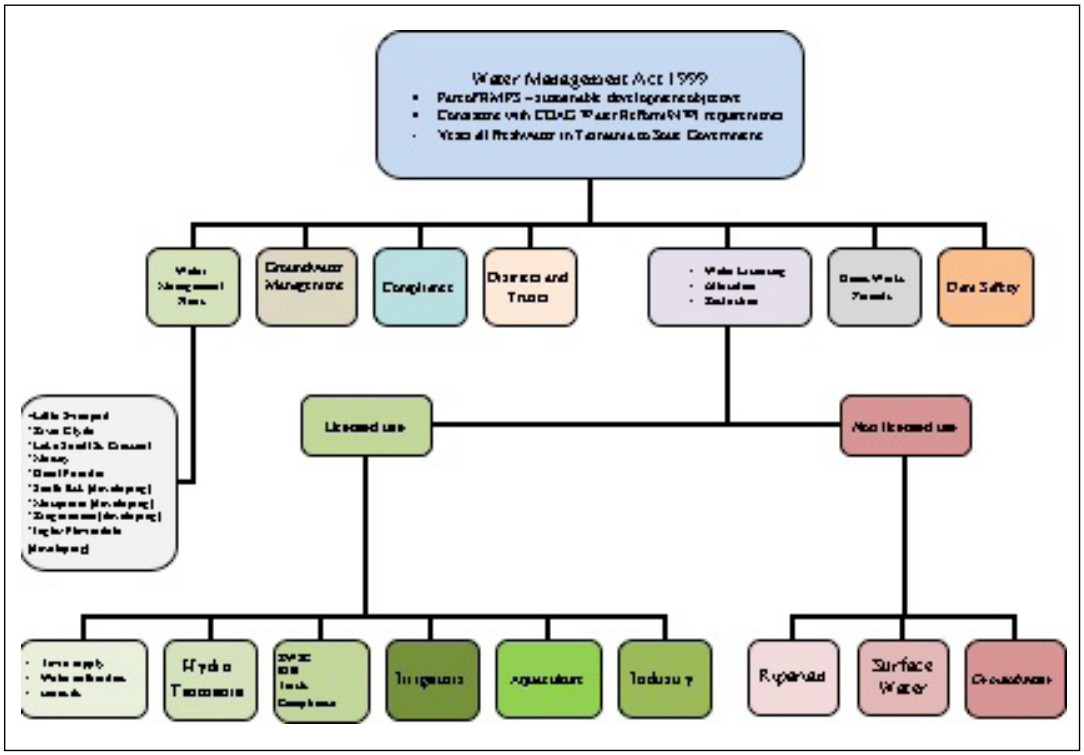


Figure 22 – The *Water Management Act 1999* is part of the state's integrated Resource Management and Planning System and provides for the management of Tasmania's freshwater resources.

General Water Management – Regulation/Compliance

Licensing, Allocation and Dam Permits

In Tasmania, before water can be taken from a river or stream or stored in a farm dam for commercial purposes, a licence must be obtained from the Department of Primary Industries, Parks, Water and Environment.

Once a person has established a water allocation under the *Water Management Act 1999*, an allocation may be attached to the licence. A water allocation can be obtained by either establishing a right to take water from the stream at the licence location, or by transferring water from another licence.

Conditions can be placed on both the water licence and/or allocation. Conditions are included to enable the water resource to be sustainably managed and to protect both water quality and environmental needs of waterways.

Dam Works

Under the *Water Management Act 1999* a dam permit is generally required for all dams except in circumstances such as:

- A dam that is not on a watercourse and that holds less than one megalitre of water; and
- A dam constructed for the primary purpose of storing waste as defined in the Act.

In addition to a barrier across a watercourse, a 'dam' includes an excavation in a water course and a flood levee, both of which also require a permit under the Act.

Water Meters

The Tasmanian *Water Management Act 1999*, under which water licences are issued, provides that the Minister may require the installation of a meter by any person taking water from a state resource, but until 2003 it had only been required in specific cases. Since 2003, DPIPWE has extended metering more broadly in recognition of its importance for water management and planning.

The move to ensure that all licenced water users are metered follows a commitment made when Tasmania became a signatory to the National Water Initiative (NWI) in 2005. The NWI is a comprehensive strategy driven by the Australian Government to improve water management nationwide, and sets out objectives, outcomes and actions and time lines for ongoing water reform. Improving water metering and measuring are among its goals.

Water Metering Program

The intention is that all water taken for commercial purposes under a licence issued by DPIPWE will be metered within the next two years. Once informed in writing by the Department, licence holders are required to install the necessary water meters within a time period specified by the Department.

In May 2008, the first group of licencees (approximately 600) in four catchments were issued with a formal Notice to Affix Water Meters. All other licencees who take water for commercial purposes can expect to be similarly informed of the requirement to install water meters at some point during 2008 to 2010

In the case of the issue of new water allocations and the transfer of allocations, licence holders are required to act by installing meters as part of the relevant allocation and transfer procedures.

By adopting this process it will be expected that all water taken under a DPIPWE licence for commercial use will be metered by June 2012.

Water Management Regions

Tasmania is divided into eight water management regions, with major offices in Hobart, Prospect, Devonport and Elliott. Licensing administration and support is provided by the Hobart office.

The Department's activities in each region includes:

- Technical support for and assessment of applications for water licences and dam permits;

- Managing flows in rivers and streams;
- Provision of information on water resource matters in regional areas; and
- Compliance monitoring and enforcement.

Water Restrictions

Water restrictions on rivers and streams are implemented in accordance with a priority of rights under the *Water Management Act 1999*.

When there is insufficient water available to look after the rights of all users, restrictions are implemented by starting with the lowest priority user group.

Generally, the highest priority is given to:

- Stock and domestic use; followed by
- Water for ecosystem protection;
- Water licences converted from old registered rights;
- Rights of special licences; and then
- Irrigation and other commercial users; and
- Groundwater usage may also be restricted if necessary.

Restriction Notices

Restriction Notices are advertised in the Public Notices section of Tasmania's major newspapers advising when water restrictions are in force.

Notices may also be served (personally or by post) on a person, prohibiting or restricting the taking of water from a water resource.

The Notice takes effect at a time that is specified in the notice and remains in force for such period not exceeding 12 months.

A person who contravenes a notice is guilty of an offence under the *Water Management Act 1999*. See the *Water Regulations* on the Tasmanian legislation website for penalties: www.thelaw.tas.gov.au

Water Management Planning

The *Water Management Act 1999* provides for the development of Water Management Plans. Water Management Plans are developed in consultation with stakeholders to ensure the sustainable development and management of a water resource.

A Water Management Plan is generally implemented by the Department of Primary Industries, Parks, Water and Environment. However, the Minister for Primary Industries and Water may approve an application by a Water Entity to take over the implementation of the Plan.

Water Management Plans provide the opportunity for catchment communities and other stakeholders to have a direct say in how a catchment's water resources are best allocated and managed to achieve the community's economic, social and environmental objectives.

DPIPWE recognises the need to accelerate the development of Water Management Plans to provide certainty to water users and to protect the state's water resources. To this end, DPIPWE has used the experience gained over the last 4-5 years in water management planning to establish generic principles for planning.

The generic principles detail the approach to be used when dealing with planning matters outside the requirements of the *Water Management Act 1999*. These matters fall into two basic areas:

1. Providing opportunities for community input into plan development, implementation and review; and
2. Resolving water management issues common to all or many water catchments.

The generic principles are not set in concrete, rather they are the default principles that will be applied unless there are specific circumstances in a water management planning catchment that necessitates an alternative approach.

Water Information System of Tasmania

The Water Information System of Tasmania (WIST) is a single point of access to Tasmanian freshwater related information.

You can select, display and download information on stream flow, water quality and fresh water related documents. WIST is accessed via: www.water.DPIPWE.tas.gov.au/wist/au

With development of the Conservation of Freshwater Ecosystems and Water Allocation modules now complete and the planned addition of Groundwater, Fish and River Health modules, WIST will be a comprehensive access point for information on Tasmania's freshwater resources.

Annual Waterways Monitoring Reports

The Waterways Monitoring Reports process has been developed by the previous Water Resources Division of the Department of Primary Industries, Parks, Water and Environment as a mechanism to report on the data it collects from Tasmania's rivers and streams as part of its Baseline Monitoring Network.

This network has been designed to provide current data on streamflow, water quality and riverine health that will support planning and decision-making processes for water management agencies, Tasmanian three Natural Resource Management regions and locally focused catchment groups that monitor Tasmanian waterways or have an interest in water information.

Up until recently the Waterways Reports were published annually with the last report completed for 2008. They provide information on a catchment basis, with reports for 40 of the 48 Tasmanian Land and Water Management Catchments.

For each of the catchments, the report includes:

1. A land-use map and summary information about the catchment;
2. Streamflow and water allocation information;
3. Water quality data for monitoring stations located in the catchment; and
4. A report on 'riverine health' for monitoring sites located in the catchment.

This information also assists in gauging Tasmania's environmental performance against the Tasmania *Together* Environmental Benchmarks and supports Tasmania's contribution to the 'State of Environment' report and other national reporting frameworks.

NRM in Tasmania: Tasmanian NRM Framework and Legislation

Tasmania has adopted an approach to natural resource management that aims at bringing together industry, resource users, land managers and conservation interests. The Tasmanian Natural Resource Management Framework 2002 and the *Natural Resource Management Act,* provide a structure and mechanisms for delivering effective management of natural resources in the state.

In June 2008, the government considered a report examining the effectiveness of the Tasmanian framework after five years of operation and reaffirmed its commitment to retain, and to strengthen, the Framework and the Act.

Tasmania has been divided into three regions to develop localised approaches – northern, southern and north-west regions. The Regional Committees in consultation with the community, are developing strategies, targets and priorities for natural resource management in their regions.

The Tasmanian Environmental Flows Project

The TEFlows Project is being conducted by the Water Assessment Branch (Water and Marine Resources Division, DPIPWE) for NRM South and NRM North, and is funded under the National Action Plan for Salinity and Water Quality. The Project commenced in July 2006 and has now been completed.

It aims to test and refine the Framework by investigating the influence of flow change on the physical and biological structure of freshwater dependent ecosystems, including wetlands and estuaries. It will build on the known flow requirements of freshwater-dependent biota and processes, and will contribute to the development of appropriate indicators to measure the success of implemented environmental flows.

Project Catchments

The TEFlows Project will be conducted in six catchments across Tasmania. This represents a change in the design of the project which is explained in the Project Updates section. These catchments have been selected to represent the two extremes of the four hydrological 'types' which characterise Tasmanian river systems.

The Ringarooma River, the Great Forester River, and Dans Rivulet (a tributary of the upper South Esk) are all in the North-East and have a relatively predictable hydrology with low flow variability. They tend to display low flows in summer, high flows in winter, and floods generally occur in winter and spring.

The Little Swanport River, the upper Macquarie River, and Brushy Plains Rivulet (a tributary of the Prosser River) in eastern Tasmanian represent the other extreme, having a very unpredictable hydrology and high flow variability, with floods occurring any time of the year and cease-to-flow periods are a natural occurrence.

The third and fourth hydrological regions include rivers in the North-West and South-West, and will not be included under this project.

By using catchments representative of their hydrology, it is intended that findings can be used to guide assessments in catchments of corresponding hydrology.

Tasmanian River Health Monitoring

The Tasmanian River Health Monitoring Program is underpinned by state-wide river health predictive models and sampling protocols developed under the Monitoring River Health Initiative (a subprogram of the National River Health Program) and provides a means of assessing the ecological condition of rivers and streams by using macro invertebrates.

The Indicators

A major activity of this program is the sampling (bio-monitoring) of aquatic macro-invertebrates.

Aquatic macro invertebrates (such as insects, snails and worms) are now well recognised as powerful tools for monitoring river health. They can – by their presence or absence – tell us a lot about the condition of our waterways.

River macro invertebrates are sensitive to changes in habitat and water quality.

Some species are known to have particular tolerances to environmental factors such as temperature or levels of dissolved oxygen. Other information can be obtained from the number of species found at a site (diversity), and the number of animals found at a site (abundance).

By sampling aquatic macro invertebrates from relatively undisturbed rivers, researchers and community groups, such as Waterwatch, can find out the range of species that should be present in undisturbed and unpolluted river habitats.

Sampling Procedure

Each site is sampled using a rapid bioassessment technique. This involves collecting two types of biological sample as follows:

1. *Riffle Sample* – A sample is taken from shallow, fast flowing areas with a stony or rocky substrate. This type of habitat is called a riffle. In order to collect a sample, the stream bed is disturbed by the sampler's feet and dislodged animals are swept into a net by the current.
2. *Edgewater Sample* – A second sample is collected by sweeping the net along the edgewater or margins of the river and in backwaters and pools which have slow currents or no flow. Aquatic plants (macrophytes), which provide additional habitat for aquatic macro invertebrates, are often found in these edgewater habitats and are included in the sweep sample.

Physical (vegetation and substrate composition) and chemical (water quality) properties are also measured. The aquatic macro invertebrates are sorted and then taken back to the laboratory for identification.

Manual and Datasheets

The Ausrivas Tasmanian Sampling Manual and Datasheets are valuable tools for those undertaking macroinvertebrate bioassessment in Tasmania:

http://ausrivas.canberra.edu.au/Bioassessment/Macroinvertebrates/

Building a River Health Model

One of the main aims of the National River Health Program was the development of predictive models which could be used to assess river health. The Australian River Assessment System (AUSRIVAS) provides this platform.

Essentially, AUSRIVAS predicts the macro invertebrates that should be present in specific stream habitats under reference (undisturbed) conditions. It does this by comparing a test site with a group of reference sites that are as free as possible of environmental impacts but have similar physical and chemical characteristics to those found at the test site. The AUSRIVAS models in Tasmania are based on samples taken from over 200 reference sites (see map below). In addition, over 400 test sites have been assessed using the AUSRIVAS models.

Observed to Expected (O/E) Scores

The model outputs are expressed as a ratio: the number and type of animals found at the test site compares to the number and type of animals that were expected. This is expressed as an Observed to Expected (O/E) ratio. The O/E scores derived from the model can then be compared to bands that categorise the degree of biological disturbance at a particular site.

Stream Invertebrate Grade Number Level (SIGNAL)

Another biotic index incorporated into the model output to provide an insight into the nature of the disturbance or impact at a site is the Stream Invertebrate Grade Number Average Level (SIGNAL), a ratio of the observed (sampled) SIGNAL score to the expected signal score. The index is based on the sensitivity of macro invertebrates to pollution.

Each family of macro invertebrates is assigned a grade according to their tolerance to pollution or disturbance. A grade of 10 represents a high sensitivity to pollution and a grade of 1 represents a high tolerance to pollution.

The 'observed' SIGNAL score is the sum of the grades divided by the number of taxa collected and the 'expected' score is the sum of the grades divided by the number of taxa expected.

O/E is sensitive to a wide variety of disturbances provided they result in the loss of families of macro invertebrates from the habitats sampled at a site. Thus, this index should detect the:

- Loss of families due to deteriorated water quality; and
- Physical habitat degradation.

O/E SIGNAL weights the families by their sensitivity to water pollution. Accordingly, the O/E SIGNAL can detect situations where water pollution has resulted in the loss of only a few, but very sensitive, families of macro invertebrates.

Uses of the Model

The ratings produced by the model can be used to measure improvements or declines in river health at a site over time. This can be useful for community and Waterwatch groups monitoring the health of their catchments. On a broad scale the models are useful tools for river managers to assess the environmental benefit of catchment management practices.

2.2 Tasmania *Together* Benchmarks

Tasmania *Together* is a pioneering project that allows the people of Tasmania to not only say what they want, but to work together to achieve their long-term social, economic and environmental future.

As a world-leading system of community goal setting and measurement of progress it is enshrined in law (Tasmania *Together* Progress Board Act 2001) and used to guide decision-making in the government, business and community sectors.

Tasmania *Together* is a vision for the state based on the wishes of the people. It includes 12 goals and 143 benchmarks that reflect the concerns people expressed during two of the biggest community consultation processes ever undertaken in Tasmania (in 2000 and 2005).

It is an ambitious long-term plan – owned and driven by the community – that aims to change the status quo. Overwhelmingly, Tasmanians want to live in safe, clean communities, with jobs and prosperity for everyone, and we want the world to be aware of our tolerance and compassion and skills in areas such as the arts, education and technology.

The 12 goals and 143 benchmarks in Tasmania *Together* provide Tasmania's pathway to the future. They will help shape government policy, service delivery and budgets into the future and are being adopted by local government, business and industry, and community groups.

An independent statutory authority, the Tasmania *Together* Progress Board, monitors progress towards the achievement of the goals and benchmarks and results are reported to all Tasmanians through the Parliament.

This is a plan that belongs to the whole community, not a single government

DPIPWE's water monitoring network supports the reporting of Tasmania *Together* benchmarks associated with Goal 12 – sustainable management of our natural resources.

2.3 Irrigation Development

By 2015 Tasmania will need an additional 250,000 megalitres of irrigation water per year to underpin projected growth in agriculture and to improve the resilience of the industry in the face of drought and climate change. This represents around a 50% increase on existing irrigation supplies. Building on the success of the recently completed Meander Dam, a further $80 million has been committed by the Tasmanian Government to progress large-scale irrigation development in the state.

This funding, added to $140 million committed by the Australian Government, means that key projects identified through the SMART Farming Water Initiative can now be progressed under the aegis of the Tasmanian Irrigation Development Board (TIDB).

The TIBD, appointed in March 2008, is an expertise-based Board whose members are experienced in delivering major infrastructure projects, governance, negotiation, finance and agricultural development.

Tasmanian Irrigation Development Board (TIDB)

In early March 2008, the then Tasmanian Premier, Paul Lennon announced the establishment of the Tasmanian Irrigation Development Board.

The Board was established by the Tasmanian Government to provide the high level drive and governance needed to deliver a major suite of water infrastructure projects, primarily the eleven irrigation schemes investigated under the SMART Farming proposal.

The TIDB is an expertise-based Board whose members are well-qualified and experienced in major infrastructure projects, governance, negotiation, finance and agricultural development.

The Board comprises Chair, Mr John Lord; three external members – Mr Roger Gill, Mr Michael Perry and Mr Geoff Coffey; and, one Government member, Mr Kim Evans.

The Board reports directly to the Minister for Primary Industries and Water.

The Board will progress the irrigation development projects from the feasibility assessment stage to the construction and operational stages. In undertaking this work, the Board will need to aim for the schemes and projects to:

- Provide greater water security for farmers and regional communities and drought proof susceptible areas;
- Take account of the interests of local communities and key stakeholders;
- Be economically viable and technically feasible;
- Leverage appropriate investment by water users to augment public funds;
- Be facilitated in an efficient, cost-effective and timely manner;
- Ensure the ongoing environmental sustainability of Tasmania's water resources; and
- Comply with relevant State and Commonwealth legislation and policy.

In addition to the $220 million of public funds secured from the State and Federal Governments, the projects will also leverage substantial user contributions which could eventually take the scale of the irrigation development program to around $400 million.

The TIDB will also need to develop appropriate partnership and consultative arrangements with the Tasmanian Farmers and Graziers Association (TFGA), other key stakeholders and the local champions who have worked hard to bring these projects to the starting line.

2.4 Smart Farming Water Initiative

The Tasmanian Government's SMART Farming Water Initiative is designed to provide ongoing support for the farming sector. The Tasmanian Government's SMART Farming Policy recognises the vital role of the farming sector in the Tasmanian economy.

According to independent analysis, an additional 150,000 megalitres per annum of irrigation water (a 40% increase on existing levels) will be required in 2015 to meet the 10 year growth forecasts for agriculture.

The SMART Farming Water Development Project provides $3.1 million over four years (2006/7 – 2009/10) to develop existing and new water supplies to provide reliable and sustainable irrigation supplies for agriculture.

The Smart Farming Water Initiative provides $7.54 million in funding for the following programs:

- Enhancing targeted farm water development;
- Implementing the National Water Initiative (NWI);
- Increasing the availability and accessibility of surface water streamflow information;
- Ensuring sustainable access to groundwater supplies; and
- Improving farmer and public confidence in the safety of farm dams.

Through the SMART Farming Water Development Project, the Tasmanian Government provides funding for feasibility studies to progress large-scale water developments in partnership with private sector proponents. SMART Farming promotes farming practices that are ecologically sound, economically viable and socially responsible.

2.5 Tasmanian Surface Water Quality Monitoring Strategy (2003)

The Tasmanian Surface Water Quality Monitoring Strategy was finalised in January 2003 and outlines the role the Tasmanian Government can play in coordinating the collection, collation and reporting of water quality information.

The Strategy identifies some of the following actions to assist in the effective management and reporting of Tasmania's water resources:

- Increased baseline water quality and quantity monitoring system;
- The on-going maintenance and delivery of information from this system;
- The development of partnerships with industry, local government, NRM and community groups;
- The collection and delivery of information via a coordinated system; and
- The promotion of local and regional monitoring groups as the main community based method for monitoring.

2.6 Tasmania's Major Irrigation Schemes

The Rivers and Water Supply Commission (the Commission) is established under the *Rivers and Water Supply Commission Act 1999* and operates in accordance with the *Water Management Act 1999* and *Government Business Enterprises Act 1995.*

In accordance with its Ministerial Charter and the *Rivers and Water Supply Commission Act 1999* the Commission undertakes the following activities and functions:

a. To administer water districts in accordance with Section 5(2) of the Rivers and Water Supply Commission Act 1999;

b. To manage property of the Crown or the Commission and other property related to the administration of such districts;

c. To provide project management and project development services in the commercial water industry and related industries;

d. To undertake the necessary duties of a Government Business Enterprise; and

e. Such other functions related to the commercial water industry as the Minister directs.

Irrigation Schemes

The Commission owns and operates the South-East Irrigation Scheme supplying irrigation water to farmers along the Coal River from Craigbourne Dam to Richmond and via pipeline supply through to Cambridge.

The Commission was appointed by the Minister, in 2003, as the responsible water entity for the River Clyde Irrigation Scheme and operates the River Clyde Scheme for the benefit of the irrigation right holders. The Clyde Water Trust remains the owner of the scheme assets but has agreed to make the assets available for the Commissions' use.

The Commission owns the scheme infrastructure of the Cressy-Longford and Winnaleah Irrigation Schemes which are both now under agreement for management by the Cressy-Longford Irrigation Scheme Limited and Winnaleah Irrigation Scheme Limited respectively.

Irrigation Scheme Developments

On 1 February 2006 the Minister for Primary Industries and Water issued a Ministerial Direction to the Rivers and Water Supply Commission under section 6(2) of the *Rivers and Water Supply Commission Act 1999* to undertake the function of construction and operations of a dam on the Meander River for the purposes of irrigation and a mini hydro station.

2.7 Water Development Plan for Tasmania

The Water Development Plan for Tasmania identifies strategic initiatives to manage and develop the state's valuable freshwater resources. These initiatives include specific water development projects, improved environmental outcomes and streamlined administrative processes for water management.

The plan identifies the following key issues for Tasmania:

The need for a strategic approach to water development which integrates the needs of all users:

- The environment and our social and economic goals;
- Supplying clean water for people to use in their homes;
- Ensuring water is reused where possible;
- Making sure our streams, waterways, aquifers and wetlands are properly looked after;
- Continuing to make water the major source of our electricity needs;
- Managing our water resources so farming and other water-dependent industries can obtain reliable supplies to increase production and create more jobs; and
- Making better use of our water for recreation and tourism.

The provision of reliable water resources for rural, urban and environmental requirements necessitates the need to understand both the quantity and quality of the water provided and its effect on the receiving environment.

2.8 National Water Quality Management Strategy (NWQMS)

The National Water Quality Management Strategy (NWQMS) has been developed to coordinate a national approach to improving water quality in Australia's waterways. Development has progressed since 1992, the Australian Government working in cooperation with state and territory governments.

The NWQMS is part of the Council of Australian Governments' Water Reform Framework and is acknowledged in the National Water Initiative, the blueprint for water reform in Australia.

Participants in NWQMS are working to protect the nation's water resources by improving their quality, reducing pollutants and at the same time supporting the businesses, industry and communities that depend on water for their continued development.

The NWQMS recommends a three tiered approach (National, State/Territory, and regional or catchment) to achieve the sustainable use of water resources by protecting and improving water quality.

In 2000 the Australian Government's Australian Water Resource Assessment 2000, highlighted the need for the strategic design and implementation of water quality monitoring programs to assist in the management of riverine, estuarine and coastal regions with the need to collect water quality trend and loads information. At that time Tasmania lacked sufficient water quality data (minimum three years) to enable an assessment. Water quality monitoring in the state was disjointed and the ambient monitoring of baseline water quality by the state (DPIPWE) was limited to short term State of Rivers Projects and sporadic monitoring of continuous water quality (11 sites – electrical conductivity, temperature and turbidity) across the state.

2.9 State Policy on Water Quality Management (1997)

The State Policy on Water Quality Management 1997 provides the strategic and technical basis for the protection of water quality in Tasmania's inland, marine and ground waters. It is Tasmania's response to implementation of the National Water Quality Management Strategy (NWQMS) – a joint initiative by the Australian, state and territory governments aimed at achieving a national framework for water quality management.

The SPWQM establishes a framework for decision-making under environmental management and planning legislation.

The framework operates by:

- Determining the values and uses for which water quality should be managed (protected environmental values – PEVs) and the target indicators (water quality guidelines and objectives – WQ guidelines and WQOs) desirable to achieve or maintain those uses and values;
- Stating principles and criteria to be applied to the approval and management of discharges to water;
- Providing for the development of guidelines to manage various types of activities which affect water quality;
- Stating principles for water quality monitoring;
- Recognising the need for monitoring;
- Recognising the need for integrated catchment management;
- Adopting the NWQMS framework to measure the achievement of WQO's;
- Establishing the framework for setting mixing zone;
- Providing the requirements if recharging groundwater; and
- Establishing the framework for setting attenuation zones for groundwater.

2.10 National Water Initiative Implementation Plan (Tasmania)

Formal Implementation Plan

By signing the Intergovernmental Agreement on the National Water Initiative (NWI), Tasmania agreed that actions under the NWI will be implemented in accordance with the timetable set out in the Agreement and in accordance with a formal and accredited Implementation Plan. Such Plans are accredited by the National Water Commission.

The Implementation Plan (September 2006) sets out the actions that Tasmania has already completed and provides details information on the tasks and timelines to complete the remaining commitments, and the context within which these actions are being implemented.

It is important to note that in implementing the various actions, appropriate consultation will be undertaken with stakeholders.

New Actions

For many of the actions identified in Tasmania's NWI Implementation Plan it is business as usual; they are already undertaken through the state's existing water management arrangements. This is extremely important as it provides certainty and security for our existing and planned water dependent businesses.

2.11 Australian Government Water Fund Project – 'Better information for better outcomes – enhancing water planning in Tasmanian catchments'

Successful water planning must meet community and environmental needs within available hydrological restraints. This project provides the best available information on catchment hydrology and environmental values to ensure successful planning outcomes.

Better information provided by surface water and groundwater modelling tools and by identification of key freshwater ecosystems values will allow informed and expedient water management planning decisions based on sound science. It will also significantly improve Tasmania's ability to strategically manage water resources consistent with the objectives of the National Water Initiative.

The project objective is to enhance water planning and management in Tasmania through the provision of key hydrological and environmental values information.

It will achieve this objective by providing:

i. Surface and groundwater hydrological models for Tasmania's high priority agricultural catchments to enable water accounting which is able to meet the information needs of different water systems in respect to planning, monitoring, trading, environmental management and on-farm management; and

ii. freshwater ecosystem values data to ensure a water planning framework that identifies and acknowledges surface and groundwater systems of high conservation value and manages those systems to protect and enhance those values.

Expected outcomes are:

- Sustainable allocation and management of water resources (including implementation of a groundwater entitlements system);
- Implementation of appropriate environmental flow regimes for all key water resources;
- Ability to monitor the impact of land use changes on catchment hydrology at a broad scale;
- Ability to identify and conserve freshwater conservation value priorities based on sound information and strategic management tools;
- Derivation of hydrological disturbance indicators to assess river condition under the NRM Monitoring and Evaluation Framework; and
- Accelerated progress in the development and implementation of water management plans across the state.

2.12 Water Availability and Forest Land Use Planning Tool

Whilst it is known that certain land use change activities such as large-scale plantation forestry have the potential to intercept significant volumes of surface and/or ground water, to date there has been little quantitative information on the scale of this potential impact.

The Government has given a specific commitment to addressing the issue of water interception by forestry plantations through the signing of the National Water Initiative.

The Initiative recognises that certain land use change activities such as large-scale plantation forestry conversion have the potential to intercept significant volumes of surface and/or groundwater. This in turn may impact on the amount of water available in streams for other water users and the environment, and such impacts need to be taken into account in water management planning.

The National Water Initiative also recognises that the first step is to obtain robust information on existing and potential impacts, and assess the level of risk posed to the integrity of water access entitlements and the achievement of environmental objectives.

The Department of Primary Industries, Parks, Water and Environment, in partnership with the Forest Practices Authority, has developed the Water Availability and Forest Landuse Planning Tool that will provide the capability

to assess, in the first instance, the potential impact of water interception by plantation forests.

The Water Availability and Forest Landuse Planning Tool integrates plantation forest interception scenarios, utilising TasLUCaS functions, with water allocation scenarios (irrigation water use) and aquatic ecosystem condition. The tool incorporates surface water hydrological models, and the Conservation of Freshwater Ecosystem Values database to allow evaluation of the impacts of changes in water availability at the sub-catchment scale on current water allocation and high conservation value environmental assets.

A report on the development of the Water Availability and Forest Landuse Planning Tool has been prepared. The report describes the components of the tool, and provides results from its initial application in the Ringarooma catchment.

Also available are the technical report on the development of the tool, as well as the reports of two independent reviewers (ARM Consulting, and Freshwater Systems).

2.13 Tasmanian State of River Reports

The State of River Reports provided information on the quality, quantity and ecosystem health of Tasmanian waterways up until 2003. Since then the Waterways Monitoring Reports report on the data collected from Tasmania's rivers and streams as part of the Baseline Monitoring Network.

State of Rivers reports are a compilation of data from routine monitoring and investigative studies designed to describe the condition of water quality, hydrology, river habitat and riverine health at a catchment scale. The information from these four areas is analysed and reported in an integrated way to help identify issues for management and formulate potential actions that might alleviate problems in the future.

2.14 Power Generation

Hydro Tasmania generates approximately 10,000 gigawatt hours (GWh) of electricity annually, principally from an integrated hydro-power scheme located in high rainfall areas in the state of Tasmania, Australia. The scheme consists of 28 power stations, numerous lakes and over 50 large dams.

Natural gas supplements hydro generation from the Bell Bay Power Station, Tasmania.

Hydro Tasmania supply renewable energy and peak power the National Electricity Market (NEM), firstly to Tasmania, and exporting through Basslink, the undersea interconnector which runs under Bass Strait.

Hydro Tasmania is also 50% owner of wind farms in Tasmania, South Australia and Asia through a joint venture with CLP Power Asia Ltd, Roaring 40s.

2.15 Planning Releases from Hydro Generation and Irrigation Storages

2.16 *Environmental Management and Pollution Control Act 1994*

The *Environmental Management and Pollution Control Act 1994* (EMPCA) is the primary environment protection legislation in Tasmania. It was developed in the early 1990s to replace the *Environment Protection Act 1973*.

There was extensive consultation with key stakeholders and the public during the development of the new legislation. This included the active consideration of a number of alternatives, and the release of a draft Bill for public comment.

EMPCA is part of the Resource Management and Planning System of Tasmania (RMPS), established under the *State Policies and Projects Act 1993*. The RMPS comprises a suite of Acts with a common set of objectives based on the concept of sustainable development. These umbrella objectives form Part 1 of Schedule 1 to EMPCA, and are stated as:

a. To promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity;

b. To provide for the fair, orderly and sustainable use and development of air, land and water;

c. To encourage public involvement in resource management and planning;

d. To facilitate economic development in accordance with objectives a., b. and c.; and

e. To promote the sharing of responsibility for resource management and planning between the different spheres of government, the community and industry in Tasmania.

Part 2 of Schedule 1 of EMPCA sets out a more focussed set of objectives for the Environmental Management and Pollution Control System (EMPCS). The Part 2 objectives are to:

a. Protect and enhance the quality of the Tasmanian environment;

b. Prevent environmental degradation and adverse risks to human and ecosystem health by promoting pollution prevention, clean production technology, reuse and recycling of materials and waste minimisation programs;

c. Regulate, reduce or eliminate the discharge of pollutants and hazardous substances to air, land or water consistent with maintaining environmental quality;

d. Allocate the costs of environmental protection and restoration equitably and in a manner which encourages the responsible use of, and reduces harm to, the environment, with polluters bearing the appropriate share of the costs that arise from its activities;

e. require persons engaging in polluting activities to make progressive environmental improvements, including reductions of pollution at source, as such improvements become practicable through technological and economic development;

f. provide for the monitoring and reporting of environmental quality on a regular basis;

g. control the generation, storage, collection, transportation, treatment and disposal of waste with a view to reducing, minimising and, where practicable, eliminating harm to the environment;

h. adopt a precautionary approach when assessing environmental risk to ensure that all aspects of environmental quality, including ecosystem sustainability and integrity and beneficial uses of the environment, are considered in assessing, and making decisions in relation to, the environment;

i. facilitate the adoption and implementation of standards agreed upon by the State under inter-governmental arrangements for greater uniformity in environmental regulation;

j. promote public education about the protection, restoration and enhancement of the environment; and

k. coordinate all activities as are necessary to protect, restore or improve the Tasmanian environment.

All decision makers under the Act are required to further the RMPS objectives through having regard to, and taking action to ensure the fulfilment of, the EMPCS objectives.

These objectives are comparable with the objectives of other contemporary Australian and international environmental legislation.

2.17 National Water Initiative

The National Water Commission is an independent statutory body in the Prime Minister's portfolio. It was established under the *National Water Commission Act 2004*. It is responsible for driving water reform at the national level through the promotion of the National Water Initiative (NWI).

Tasmania became a signatory to the National Water Initiative on 2 June 2005. The NWI sets out objectives, outcomes and actions for the ongoing process of national water reform and timelines to achieve this reform.

The National Water Initiative outlines a number of key areas which will be critical to water reform:

- Water access entitlements and planning framework;
- Water markets and trading;

- Best practice water pricing;
- Integrated management of water for environmental and other public benefit outcomes;
- Water resource accounting;
- Urban water reform;
- Knowledge and capacity building; and
- Community partnerships and adjustment.

2.18 National Action Plan for Salinity and Water Quality

The National Action Plan for Salinity and Water Quality (NAP) was the first of its kind, a commitment by the Australian, state and territory governments to jointly fund actions tackling two major natural resource management issues facing Australia's rural industries, regional communities and our unique environment.

The Plan committed $1.4 billion over seven years to June 2008 to support action by communities and land managers in 21 highly affected regions. It supported practical remedies such as the protection and rehabilitation of waterways, improvements to native vegetation, engineering works, and land and water use changes.

NAP investment was largely facilitated at a regional level through regional planning. At this level, the NAP was jointly delivered with the Natural Heritage Trust (the Trust).

The National Action Plan for Salinity and Water Quality ceased on 30 June 2008. It has been replaced by Caring for our Country.

2.19 Commonwealth Environmental Facilities Scheme – Landscape Logic Research

Landscape Logic is a research hub under the Commonwealth Environmental Research Facilities scheme, managed by the Department of Environment, Water, Heritage and the Arts. It is a partnership between six regional organisations, five research institutions and state land management agencies in Tasmania and Victoria.

Projects

The Landscape Logic research Hub is structured into three themes:

- Knowledge Discovery;
- Knowledge Integration; and
- Knowledge Broking.

Knowledge Discovery

The Knowledge Discovery theme will generate new knowledge through five projects.

- The Spatial Analysis and Database project (Project 1) led by Prof. Tony Norton (UTAS) will find and analyse spatial data such as time-series aerial photography and remote sensed data, and relate this to historic data on changes in environmental condition. It will also examine ways to improve access to spatial information for catchment and property level planning.
- The Social Research project (Project 2) will collect local knowledge to complement the formal history of the study areas to understand the context of past interventions – who did what, where and why? It will also carry out research into the motivations for land use change and conservation practice to improve understanding of adoption processes and likely response to incentive schemes.
- The Victorian and Tasmanian Retrospective studies (Projects 3 and 4) will test the effectiveness of past environmental management programs using the information from the Spatial and Social projects. The emphasis in Victoria will be the effectiveness of past programs directed at native vegetation condition, while in Tasmania it will be on the effects of land use and land management on water yield, river condition and estuarine health. The retrospective projects are led by Dr Bill Cotching (TIAR/CSIRO) in Tasmania and Adam Hood(DSE Victoria).
- The Catchment Nutrient and Sediment Management project (Project 5) led by Dr. Hamish Cresswell (CSIRO) will develop a conceptual approach to understanding water quality by breaking catchments up into likely source areas for sediment and nutrients, and testing this using new high frequency water quality monitoring equipment. The aim is to develop a rules-based approach to investing in water quality management in catchments.

Knowledge Integration

The Knowledge Integration theme (Project 6) led by Prof. Tony Jakeman (ANU) will use a range of integration approaches including Bayesian Decision Networks to develop decision networks that can capture knowledge about environmental assets, management actions, incentive programs, rates of adoption to explore their net effect on resource condition. They will also incorporate the inevitable uncertainty that surrounds environmental management, the associated processes and information. These decision networks are being developed with catchment managers to ensure they meet their practical needs.

Knowledge Broking

The Knowledge Broking theme (Project 7) is led by Geoff Park (North Central CMA). It will be responsible for ensuring a shared understanding of the project activities and purpose amongst the partners, and managing an outreach and training program for partners and other regional organisations.

2.20 State of the Environment Reporting In Tasmania

State of the Environment reporting is one of the features of the Resource Management and Planning System (RMPS) of Tasmania. State of the Environment reports are prepared as a requirement of section 29 of the *State Policies and Projects Act 1993.*

This legislation requires the Commission to produce a consolidated State of the Environment Report as soon as reasonably practicable after the commencement of the Act and thereafter at intervals of five years relating to:

- The condition of the environment;
- Trends and changes in the environment;
- The achievement of resource management objectives; and
- Tecommendations for action to be taken in relation to the management of the environment.

The first State of the Environment Report was completed in 1997, and the second report was completed in November 2003 and tabled in Parliament in April 2004.

State of the Environment reporting provides a way of assessing how well Tasmania is progressing in terms of achieving the sustainable development objectives of the resource management and planning system. It aims to provide information to support an effective management cycle: assessing condition, recommending actions, and then reviewing their implementation.

The Commission has established a State of the Environment Report Panel and work has commenced on compiling the third State of the Environment Report for Tasmania. The Commission is looking for contributions from environmental and natural resource agencies and organisations to support its assessment of conditions, trends and changes, and the achievement of resource management objectives.

2.21 Australian Natural Resource Atlas

The Australian Natural Resources Atlas was developed by the National Land and Water Resources Audit to provide online access to information to support natural resource management. The Atlas is managed and maintained within the Department of the Environment, Water, Heritage and the Arts. The Atlas comprises of a number of tools and information on Australia's natural resources:

- Australia's Resources Online: Generate a report containing the latest available data on Australia's natural resources against the Natural Resource Management Monitoring and Evaluation framework (see below).
- Map Maker: View and query the data from the Atlas or make a map of a region of interest.
- Natural Resource Topics: View national, state and regional theme assessments of Australia's natural resources undertaken by the National Land and Water Resources Audit in 2000-2002, and find links to other sources of natural resource data.

The information in the Atlas was developed to involve a broad cross section of government and private sector groups interested in natural resource management issues. The Atlas can be accessed and used by managers and community groups to help in their planning and management activities. The information in the Atlas is organised by topic and geography. There are eleven topics to choose from in the Atlas:

- Agriculture – agricultural resources;
- Coasts – coastal environments;
- Dryland salinity – causes and impacts of dryland salinity;
- Irrigation – sustainable irrigation;
- Land – land resources;
- Natural resource economics – economics and natural resource management;
- People – Australians and the management of natural resources;
- Rangelands – monitoring the status and trends in the rangelands;
- Soil – Australian soil properties;
- Vegetation and biodiversity – biological resources; and
- Water – use, availability, quality and management.

Each topic provides access to a set of information products. For example, the information products available for the water topic include water resources, water availability, water quality, water resource management and development, water use and allocation.

For many topics, the information is available at national, state/territory and regional level. Examples of the regions include:

- River basins;
- Australian biogeographic regions (IBRA) version 5.1;
- Statistical divisions/sub-divisions; and
- Surface water basins and management areas and groundwater provinces and management units.

2.22 *National Water Act 2007* and Water Regulations 2008

The Act makes provision for:

- The management of the water resources of the Murray Darling Basin; and
- Other matters of national interest in relation to water and water information.

One of the objectives of the Act is:

'To provide for the collection, collation, analysis and dissemination of information about:

- Australia's water resources; and
- The use and management of water in Australia.'

The Act prescribes the Bureau of Meteorology with additional functions to those under the *Meteorology Act 1955*, including:

a. Collecting, holding, managing, interpreting and disseminating Australia's water information;

b. Providing regular reports on the status of Australia's water resources and patterns of usage of those resources;

c. Providing regular forecasts on the future availability of Australia's water resources;

d. Compiling and maintaining water accounts for Australia, including a set of water accounts to be known as the National Water Account;

e. Issuing National Water Information Standards;

f. Giving advice on matters relating to water information;

g. Undertaking and commissioning investigations to enhance understanding of Australia's water resources; and

h. Any other matter, relating to water information, specified in the regulations.

The *Water Regulations 2008* sets out those persons who must supply the Bureau of Meteorology with their water information, in what format and at what frequency.

2.23 *Commonwealth Meteorology Act 1955*

This Act provides for the existence of a Commonwealth Bureau of Meteorology, and sets out the functions of the Bureau. This includes:

'The issue of warnings of gales, storms and other weather conditions likely to endanger life or property, including weather conditions likely to give rise to floods or bush fires.'

2.24 Tasmanian Flood Warning Network

The Bureau of Meteorology administers the Tasmanian Flood Warning Program in Tasmania. The Department of Primary Industries, Parks, Water and Environment and Hydro Tasmania also provide the Bureau with flood water data.

In Tasmania, floods mainly occur in autumn, winter and spring. However, they can occur at any time of the year and some of the most significant floods have occurred in summer.

One river system that experiences serious flooding is the South Esk River. This, along with the Macquarie, Meander and the North Esk rivers, forms the Tamar River Basin, with a combined catchment area of nearly 9,000 square kilometres.

Minor floods in the Derwent, Forth and Mersey rivers do not occur with the same regularity as in the South Esk, because of the Hydro-Electric Corporation power generation storages. However, these storages have little effect during major floods. Record floods swamped New Norfolk in April 1960.

Many of the smaller river systems in the North and North-West, about the East Coast and the South-East are subject to flash flooding. The rapid rise and fall of these fast flowing systems can cause significant damage:

- The Hobart floods of April 1960 caused an estimated £546,000 damage.
- Flash floods about the South-East in February 1996 caused an estimated $10 million damage.

River levels in the Huon River can also rise very quickly, particularly during spring when snowmelt can be significant. Flooding of rivers in the west and south of the state go largely unnoticed as they pass through rugged and sparsely populated regions.

2.25 *Water and Sewerage Industry Act 2008*

An Act to provide for the establishment of an economic regulatory framework for the water and sewerage industry, including the establishment of a licensing regime and providing for the regulation of prices, customer service standards and performance monitoring of that industry and for related matters.

2.26 Climate Futures for Tasmania

The Climate Futures for Tasmania project builds on an earlier project, funded by Hydro Tasmania, which provided a glimpse of one potential future climate for Tasmania. That project used a well-tested CSIRO model to create local-scale projections, attuned to the complexities of the Tasmanian climate.

That work was the proof-of-concept needed to establish the way forward for locally-applied modelling, and the new Climate Futures for Tasmania project now starts with this established method for fine-scale climate projections.

The new Climate Futures for Tasmania project will provide climate information under a range of credible projections for the most likely global scenarios of greenhouse gas emissions.

The resulting base of local-scale assessments will be available to local government, emergency services, water authorities, power companies, farmers, graziers, fruit growers, vignerons and researchers.

The project also will provide an accessible basis for subsequent climate change research, by archiving fine-scale climate model outputs for the entire state of Tasmania.

2.27 Derwent Estuary Program

The Derwent Estuary Program (DEP) is a regional partnership between local governments, the Tasmanian state government, commercial and industrial enterprises, and community-based groups to restore and promote our estuary. The DEP extends beyond the tidal zone and includes a region of the Derwent River catchment incorporating monitoring programs that involve freshwater systems.

2.28 *Natural Resource Management Act 2002*

An Act to establish the Tasmanian Natural Resource Management Council and regional committees for natural resource management and to provide for the development of regional strategies for natural resource management.

The objectives of the resource management and planning system of Tasmania are:

a. To promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity;

b. To provide for the fair, orderly and sustainable use and development of air, land and water;

c. To encourage public involvement in resource management and planning;

d. To facilitate economic development in accordance with the objectives set out in paragraphs a., b. and c.; and

e. To promote the sharing of responsibility for resource management and planning between the different spheres of government, the community and industry in Tasmania.

2.29 CSIRO Tasmanian Sustainable Yields Project

The objective of the CSIRO Tasmania Sustainable Yields Project was to undertake an assessment of the current and likely future extent and variability of surface water and groundwater resources in Tasmania. This information will help governments, industry and communities consider the environmental, social and economic aspects of the sustainable use and management of the precious water assets of Tasmania based on the best available information.

For the first time, the impacts of catchment development (commercial plantation forests and future irrigation development), changing groundwater extraction, climate variability and anticipated climate change on water resources at a whole-of-region scale have been assessed. This was achieved through the most comprehensive hydrological modelling ever attempted for Tasmania, using rainfall-runoff models, groundwater recharge models, river models and groundwater models. Tasmania was divided into five project regions for which assessments

were undertaken: Arthur-Inglis-Cam (including Flinders and King islands), Mersey-Forth, Pipers-Ringarooma, South Esk and Derwent-South-East (collectively referred to as the project area, it covers 49,411 km^2 which is about 72 percent of Tasmania). The West Coast region shown on the map was not covered by the project. The assessments considered four scenarios of historical, recent and future climate with current development, and future climate with future development.

2.30 Tasmanian Water Use Metering Project

The Tasmanian Water Use Metering Project will collect and manage water use data for all irrigation licencees through the installation of 3000 telemetry units on farm water meters which are being rolled out across Tasmania. The water use data from the on-farm meters will be stored on a central web-based database and licencees will be able to access their own daily water use, total use and use against their allocation on line. A training program will be offered for irrigators, and will link with existing state-wide research and extension programs on water use efficiency. The project will provide water users and managers with reliable water use data for water management and planning purposes across Tasmania. Licencees will have real time access to accurate water use data which will result in more water efficient production. The project will advance the National Water Initiative objectives of improving water metering and measuring, and increase efficiency of water use in agriculture.

The project advances the National Water Initiative objective of improving metering and measuring.

2.31 Tasmanian Water Metering Initiative

The intention of the Tasmanian Water Metering Initiative is to meter in the near future all those DPIPWE water licence holders whose allocated take under licence represents a significant proportion of the total water allocated in a given catchment. This program will be undertaken on a catchment basis. The relevant licencees will be informed in writing of the process that will be applied, including a broad indication of the timetable for their catchment. Following a visit from a DPIPWE Officer, the licencee will be advised of the locations at which meters are required and a date by which they will need to be installed. In the case of the issue of new water licences and the transfer of allocations, licence holders may be required to act by installing meters as part of the relevant allocation and transfer procedures. In addition some licencees may be required to install meters in order to address specific management or compliance needs. By adopting this process it is planned that all significant water taken under a DPIPWE licence for commercial use will be metered within the next few years

2.32 The *Public Health Act 1997* Drinking Water Quality Guidelines

The Department of Health and Human Services (DHHS) regulates the quality of drinking water from all public reticulated drinking water supply systems. All water suppliers of public reticulated drinking water supply systems must meet the requirements of the *Public Health Act 1997* ‘Drinking Water Quality Guidelines’ to

ensure the water is safe to use, or that consumers are advised if it is not regarded as potable. The Guidelines require that water authorities develop drinking water quality management plans, to help ensure that each step in the drinking water supply system assists in eliminating, or reducing to an acceptable level, any undesirable contaminants which may be present in the source water. Drinking water suppliers provide the Department of Health and Human Services an annual report covering a range of matters relevant to public health. The annual water reports detail each drinking water supplier's compliance with the water quality guidelines for the water supply systems under its control and also describe the various systems in place for the protection of public health.

2.33 Pesticide and Herbicide Monitoring Project

A program to monitor Tasmanian water catchments for a range of herbicides and other pesticides was launched by the Minister for Primary Industries and Water on 19 January 2005. The baseline monitoring program measures pesticide levels in rivers and streams at a number of testing station locations across Tasmania on a quarterly basis. The flood monitoring program measures pesticide levels in water samples collected during flood events at specific sites. The list of pesticides monitored includes those most commonly used in agriculture and forestry in Tasmania. Other pesticides have been chosen due to their high toxicity, or their potential mobility in the environment. The Spray Information and Referral Unit (SIRU) conducts extensive water testing throughout Tasmania whilst following up previous positive results from the pesticide monitoring program. SIRU also conducts sampling in public rivers and waterways in the course of investigations into chemical spraying incidents.

Appendix 3 – Gap Analysis (Industry Response)

The following information includes the unedited responses describing current gaps in monitoring networks and data management systems for each of the named parties (where provided). For the purpose of this document this gap analysis represents the situation at a point in time. Initial responses for many agencies were received in 2009. However, as successive SWIMP versions have been released under each funding round, to assist BoM with M&E project evaluation, named organisations were requested to provide an updated gap analysis to describe any additional deficiencies not previously reported. It should also be noted that some of these gaps have now been addressed through M&E funding and this section does not reflect gap closure. Section C2 of this document describes gap closure through M&E funding.

The following responses have been consolidated into Section C of the main report.

Department of Primary Industries, Parks, Water and Environment (DPIPWE)

Water Level Monitoring: surface water – streams and lakes

The sustainable development of Tasmania's water resources and effective ongoing management of water resources relies on accurate and rapidly available streamflow information to both water managers and irrigators.

Accurate and readily available streamflow information not only supports water management decision making on a daily basis but also supports hydrological modelling and environmental flow determination in the state's catchments which provide critical information to the Water Development Plan, SMART Farming Water Initiative and the ongoing development of catchment Water Management Plans in Tasmania.

DPIPWE's current streamflow monitoring network consists of 82 stream monitoring stations predominately located across the rural areas of Tasmania. Over the last three years the State Government has funded the expansion of the network from 56 stream flow monitoring sites to 82 sites.

Programs such as the Water Development Plan, SMART Farming Water Initiative and the ongoing development of catchment Water Management Plans are currently the major mechanisms for formalising lower surety water allocations and identifying potential water availability for irrigation opportunity. All these programs rely on comprehensive streamflow information for future water development planning and ongoing management during the irrigation season. Ideally, the current network needs further expansion as many catchments require further monitoring at finer spatial scales. In many instances only the bottom of catchments is being monitored which does not provide sub-catchment management points for regional water management staff to implement sub-catchment restriction rules. There are also many catchments that have no monitoring sites.

The recent expansion of the stream flow monitoring network continues the development of a more comprehensive set of streamflow data for sub-catchment water management and in catchments requiring more comprehensive management protocols that rely on local streamflow data. It has significantly enhanced the Water and Marine Resources Division's ability to manage water both on a daily basis, identify future water availability and provide information for daily irrigation management by farmers.

Funding will be required to underpin the investment made through the SMART Farming Water Program for the ongoing monitoring and maintenance of the 26 new stations after the cessation of the SMART Farming funding in 2009-10. These sites are identified in the following table (Table 23).

Water Level Monitoring Priorities for Tasmania

As mentioned previously the expansion of the stream flow monitoring network to 82 sites has shown considerable benefits in the Water and Marine Resource Division's ability to manage water both on a daily basis, identify future water availability and provide information for daily irrigation management by farmers. However many catchments in Tasmania still either have no stream flow monitoring or the stream flow monitoring that is carried out is still not sufficient to manage the water resource effectively into the future.

Table 23 – Provision of Ongoing Funding for the Below Stream Flow Monitoring Sites (New 26 sites)

Brid River upstream of Sledge Rd Bridge	Mountain River 600m upstream Huon River
Buttons Creek upstream of Bass Hwy	North West Bay river at Margate Water Supply intake
Cam River upstream Somerset Water Supply Intake	Macquarie River upstream of Lake River Junction
Chasm Creek upstream of Bass Highway	Mole Creek 400m downstream of Sassafras Creek
Claytons Rivulet upstream of old Bass Hwy	Panatana Rivulet upstream of tidal limit
Clyde River at Bothwell	Pipers River at Underwood
Don River upstream old Bass Highway	Ringarooma River upstream Branxholm Water Supply
Edith Creek 600 metres upstream of Duck River confluence	Rubicon river at Elizabeth Town
Elizabeth River downstream Lake Leake	Seabrook creek upstream bass highway
Gawler River at Cradle Coast Water Supply	South Esk River at Upper Esk Road Bridge
Legerwood Rivulet downstream of Ringarooma Road	St. Patrick's River at Nunamara Offtake
Liffey River Upstream of West Channel	Sulphur Creek 1.5 km upstream of Mouth
Little Forester downstream of Denison River	Western Creek at Bankton Rd Bridge

Table 24 – Establishment of Additional Stream Flow Sites Identified as Water Management Priorities

Agnes Rivulet	Little Brid River
Arthur River downstream Rapid River	Montagu River at Togari (mid Catchment)
Ben Lomond Rivulet	New Haven Creek upstream of Black River
Blythe River at Iron Mine Road	Nicholls Rivulet
Boobyalla River	Nile River in bottom of catchment
Browns River	North George River
Camp Creek at Wynyard Water Supply Intake	North West Bay River at Mt Wellington (upper catchment)
Clayton Rivulet at Sprent	Orielton Rivulet upstream of tidal limit
Clayton Rivulet at Thompsons Road – existing weir	Peak Rivulet 3.5km upstream of Esperance River
Clyde River upstream of Meadowbank	Pet River upstream of Burnie Water Supply
Coilers Creek at Coilers Crossing	Plenty River
Dasher River	Quamby brook downstream Eden Rivulet
Duck River in upper part of catchment	Riley's Creek upstream of dam
Edith Creek	Ringarooma above tidal limit
Emu River in bottom of catchment	Roger River
Ettrick River upstream of south Road (King Is)	Russell River
Flowerdale River in bottom of catchment	Samphire River upstream of Unavale Creek (Flinders Is)
Franklin Rivulet 1.5km upstream of tidal limit	Sisters Creek
George River in upper Catchment	South Pats River at Whitemark Water Supply Intake (Flinders Island)
Great Musselroe River 6.5km upstream of mouth	Styx River
Greens Creek	Supply River 0.5km upstream Tamar River River
Inglis River upstream of Flowerdale River Jctn	Tomahawk River upstream of tidal limit
Lake Crescent	Tooms Lake
Iron Creek	Welcome River at Redpa
Isis River	Western Creek downstream of Dale Brook
Jordan River at Bridgewater	Wilmot River upstream of Forth River
Kermandie River	South Esk above Trevallyn Dam
Lachlan River	Lake Sorell
Leven River in upper Catchment	Lake Leake

During the 1970s and 80s the Government's stream flow monitoring network (excluding Hydro Tasmania sites) exceeded 140 sites. Due to financial restraints in the early 1990s the network was reduced to around 30 sites. It is now considered that 140 sites best represents the required number of sites to manage the water resource sustainably (outside of the Hydro Tasmania Districts). As the number of DPIPWE stream flow monitoring sites is currently at 82 sites it is considered that to manage Tasmania's water resource sustainably an expansion of the network of approximately an additional 60 sites will be required in the foreseeable future.

The stream flow monitoring sites listed in Table 24 below have been collectively identified by water managers of various Tasmanian organisations as sites that are important to the ongoing management of Tasmanian water resources particularly in the rural areas of Tasmania.

Instrumentation

Issues with the Unidata loggers currently in use:

- Loggers approaching 10 years in age with no significant development or upgrade of the logger in that time.
- There are limits of what instrumentation can be used with Unidata loggers and what functionality can be used with those instruments.
- 4-20mA analogue channels are notoriously variable between loggers, making calibration difficult.
- The logger SDI-12 command set does not comply with all SDI-12 commands currently used in new instruments.

Ultimately DPIPWE will be exploring a new data logger type that provides the necessary features capable of improving data capture and data transfer.

Flood Gauging

DPIPWE's hydrometrics section within Water Assessment has recognised a gap in its current flood measurement plan. Three field parties each have Sontek doppler equipment to assist in low to medium flood measurements that are capable of measuring around 90% of most river situations in Tasmania. However, current limitations for a few larger river systems occur where the instruments currently being used can only measure depths of up to 6m. Whilst the currently owned Sontek instruments are fit for purpose and are excellent for most gauging situations, previously operated equipment that is outdated, time consuming to use and heavy to cart is still considered for larger river and flood situations.

It is now recognised that recent technological advancements in doppler gauging equipment is now capable of measuring beyond depths of 6m (now up to 80m) which would assist towards a 100% capture in measuring Tasmania's floodwaters.

Water Quality Monitoring: surface water – streams

The ability to maintain and enhance Tasmania's land and water resources is underpinned by the level of knowledge and information that exists to enable effective decision making in the management of natural resources. Water quality, measured by a range of parameters including the chemical, physical and biological, provides managers with the links between land and water use and the effects catchment management practices exert on estuarine and coastal zones. DPIPWE is responsible for the implementation and management of the state's Baseline Water Quality Monitoring Program (BWQMP). This responsibility is consistent with DPIPWE's role as the leading government agency for natural resource management and environmental protection.

DPIPWE's current Baseline Water Quality Monitoring Program consists of 52 monitoring sites predominantly located at the bottom of catchments across rural areas of Tasmania where current flow monitoring stations exist. Sampling is completed on a quarterly basis at all sites and includes basic physico-chemical parameters (temperature, electrical conductivity, dissolved oxygen, turbidity and pH).

At a subset of 37 sites, continuous recording instruments have been deployed which log electrical conductivity, temperature and turbidity at 20-minute intervals. The probes and loggers are maintained and calibrated during the monthly monitoring run. At 13 of the 37 sites dissolved oxygen is also continuously monitored. These sites were chosen based on a perceived risk of potential water quality issues.

The need for a baseline water quality monitoring program had been recognised for decades within Tasmania but due to a lack of resources and coordination water quality monitoring remained piece-meal in the state through the 1990s. In 2000 the Australian Government's *Australian Water Resource Assessment* highlighted that Tasmania lacked the required baseline monitoring to perform the required assessment and showed how much Tasmania was lagging behind the rest of the country.

In 2001 the Tasmanian Government developed the *Draft Tasmanian Surface Water Quality Monitoring Strategy* (finalised in 2003) which identified large information gaps and the need for a coordinated approach to monitoring and data management. It is this strategy which, to a large degree, has driven the expansion of the network. The *National Water Quality Strategy* to a large extent has provided major direction as to how data is analysed, reported and utilised. Recently this afforded the Water and Marine Resources Division with the ability to provide current trigger value status at each of its monitoring sites as a means by which long term trends in water quality can be assessed. This represents a significant milestone in the ability for the Water and Marine Resources Division to track water quality over time and provide an indication as to how water quality may be impacted either by climatic or anthropogenic influences.

Programs such as Water Management Plans, Natural Resource Management Plans, Tasmania *Together,* the National Action Plan for Salinity and Water Quality, State of Environment Reporting and Water Quality Objectives setting (as required under the State Policy on Water Quality Management) rely on comprehensive and accurate water quality information generated by the BWQMP for future maintenance and or enhancement of state water resources.

However, of major concern to the current BWQMP are issues related to continuous instrument malfunction, resulting in significant levels of lost and or poor data. The adequate maintenance of instrumentation to deliver accurate continuous data requires significant resources and funds are required to replace aging and/or malfunctioning equipment. Replacement of this instrumentation would assist in the production of higher quality and reliable data. Ongoing funds for staffing will be required to enable the maintenance and accuracy of water quality monitoring equipment.

Water Quality Priorities: Water Quality Baseline Monitoring Program

The expansion of the state water quality monitoring network has significantly enabled the Water and Marine Resources Division to manage water on a daily basis, identify future possible water quality issues and provide information for the management of Tasmania's land and water resources to internal and external agencies.

Unlike the baseline streamflow monitoring program, the BWQMP (which provides the foundation for water quality monitoring in Tasmania) is overlayed with a higher density network of NRM monthly water quality monitoring sites. While this provides an excellent level of coverage for the monitoring of ambient water quality, these additional networks exist predominantly in the North-West and North-East of Tasmania with significant gaps in the southern Midlands and southern regions of the state. Therefore there are some catchments in Tasmania which either have no water quality monitoring or insufficient water quality monitoring required to sufficiently manage the water resource (outside Hydro Tasmania districts). The integration of surface water data sets through data sharing network arrangements is presently being investigated with the roll-out of software developed by EPA Division from a previous BoM funding program.

Other gaps include the need for reference sites for the development of low risk trigger values to be used as aspirational WQ targets at downstream sites. Current BWQMP sites are located at the bottom of catchments in rural areas and are therefore predominantly modified to some extent. Hence the current values provide only a 'current status trigger values' are utilised as a benchmark range to monitor against change. They cannot be utilised as an aspirational value for site should stakeholders want to improve WQ. In essence it is recommended that the BWQMP further extend its monitoring to include reference condition sites for the development of low risk trigger values – these are values at which there is a low risk of environmental harm. Therefore funds would be required for additional staff and analysis and reporting.

The EPA is continuing the enhancement of its data management system. Two areas which are being considered for future focus are the development of processes to:

- Establish a centralised metadata database to assist in identifying data sources to further our understanding of data gaps and optimize monitoring programs; and
- Integrate databases to facilitate the populating of data through sharing data.

Future populating of the EPA Division's data management system is considering the importing of hard copy data through digitisation programs. The implementation of future programs above are dependent on funding priorities in the EPA Division.

Database Management System

The Time Studio software is now at the end of its life cycle and vendor support for it will cease in the near future. DPIPWE will have to replace Time Studio with a fully supported application. The costs associated with this are likely to be substantial and represent a significant risk to DPIPWE's ability to carry out a replacement. DPIPWE intends to seek assistance with the cost of replacing the TSM application in the next 12 months.

A public interface to DPIPWE water resource and licensing information is provided by the WIST web portal http://www.water.dpiw.tas.gov.au/

WIST is a web application which allows the viewing and downloading of water resource and allocation information. Ground water information access will be added in the near future.

Water quality information is also accessed via WIST and data stored in Hydstra for other organisations e.g. Derwent Estuary Program, Tasmanian Aquaculture and Fisheries Institute, NRM data is also available.

A secure web service link between DPIPWE and Hydro Tasmania's Ajenti Data Management System is also close to production to facilitate the Tasmanian Water Use Project's data exchange and collection capability. Water use data collected via this system will eventually be added to the BoM WDTF data set when required by the Bureau together with any untelemeterd data.

Groundwater Section

The future maintenance and operation of the state-wide groundwater monitoring network (SGMN) will require a number of issues to be addressed including:

- Securing capital funding to install additional/upgrade existing monitoring bores to meet current and future requirements;
- Securing capital funding to purchase, install and maintain logging equipment and telemetry systems on all monitoring bores (the first stage of this has been achieved through the 2009-2010 Bureau of Meteorology (BoM) Modernisation and Extension of Hydrologic Monitoring systems Program Fund); and
- Technical support to undertake routine chemical analysis of groundwater.

There is a need to address, at state level, the management and abandonment of a number of local groundwater monitoring networks for which DPIPWE is not the custodian. Localised groundwater monitoring networks (for example in the Midlands and Coal River valley) were installed by a number of government and non-government organisations (e.g. NHT) and are currently un-monitored. The upgrade of instrumentation and inclusion of these bores into the monitoring network would greatly increase the coverage of the SGMN across Tasmania. These bores would require the installation of new level loggers and telemetry, in line with the rest of the monitoring network.

There is a requirement for an increased level of groundwater monitoring on the West Coast of Tasmania, which has to date been largely overlooked due to low pressure on these systems from agricultural development. This issue may be addressed through the management/integration of existing bore data held by mining (or other local) companies. The integration of groundwater data sets through data sharing network arrangements is presently being investigated with the roll-out of software developed by EPA through a previous BoM funding program.

The majority of older groundwater bores were drilled on private land. In these cases, no formal long term access arrangements have been legally secured between the State and landowners. In the interest of maintaining continuity and security of groundwater monitoring information, this needs to be addressed, particularly after the substantial recent investment in new water level logging and telemetry equipment as part of BoM modernisation program 2009/2010.

Groundwater Data Management

There are a number of issues relating to the development and operation of the groundwater database. Groundwater database infrastructure needs to be developed that will enable primary, secondary and tertiary groundwater data to be stored, managed and accessed in an efficient manner and have the ability to incorporate third party network data. All future monitored groundwater level, pump test and water quality data should be stored in a central groundwater database together with other relevant groundwater feature information.

It is important to ensure that all time series groundwater data stored in Hydstra retains the unique identity inherited by the GWIMS database from the Tiger database. This is critical to preserve the link with original source information required for the accurate interpretation of monitoring data.

The identification and recovery of historical bore and groundwater information would provide invaluable data for the inclusion in the groundwater database. This would involve sourcing information from bore drilling logs and historical water level information from a number of agencies and companies which have installed bores, for a number of purposes in Tasmania. There is the potential for large amounts of data, previously held outside of the Department, on groundwater resources to be identified and integrated into the Department's database.

There is also an issue with the digitisation of historical groundwater information. The data entry from large volumes of hard copy drill logs and information into the Department's newly renovated database is required.

Groundwater/Surface Water Interactions

The continuing integration of the SGMN with surface water monitoring programs within DPIPWE is essential to ensure compatibility of hardware and software, and of data collection, storage and reporting systems.

Future co-location of surface water gauging sites with groundwater monitoring should be considered, in order to acquire data for the assessment and

management of surface water and groundwater connectivity. The majority of the potential surface water sites identified in the Strategic Water Information Monitoring Plan would be suitable for the establishment of new groundwater monitoring bores, and would complement the current monitoring network.

Newly proposed or expanding irrigation developments will require additional monitoring. The establishment of new surface and groundwater monitoring sites in these areas is required to facilitate the sustainable management of water resources and ensure schemes do not have a negative impact on local water balance and environmental processes.

The development of standard water analysis (including all major cat ions and anions) should be adopted for both surface water and groundwater testing. This is required in order to compare and identify water types of different origins/sources.

Extension of the monitoring network may be required to include the assessment and management of springs.

The assessment of Groundwater Dependent Ecosystems (GDEs) will need to be done in collaboration with CFEV administrators, in order to formalise management of all GDE data collected across the agency.

With the implementation of the EPA data management system and roll out of the software packages to industries and NRM groups, integration of data and the use of standards and best practice will be facilitated. Also the opportunity for understanding groundwater and surface water interactions will be enhanced with improved knowledge through metadata.

Irrigation Development

It is anticipated that by 2015 Tasmania will need an additional 250,000 megalitres (ML) of irrigation water per year to underpin projected growth in agriculture and to improve the resilience of the industry in the face of drought and climate change. This represents around a 50% increase on existing irrigation supplies.

Tasmania has 12% of the total annual run-off for Australia from less than 1% of the total land area. By comparison the Murray Darling Basin, the historical food bowl of Australia, has 6% of average run-off for 14% of the land area. Climate change modelling indicates that this difference will grow in coming years. Tasmania has a mean annual runoff of around 47 million ML. While Tasmania benefits economically from the use of around a fifth of this annual runoff, mainly through hydro-electricity generation, Tasmania actually consumes only around 2% of it. To provide the additional 250,000 ML per annum of irrigation water, Tasmania would only need to harvest an extra 3% of the currently uncaptured winter flows in catchments in agricultural areas.

In early March 2008 the Tasmanian Irrigation Development Board was established to deliver a major suite of water infrastructure projects, primarily the 11 irrigation schemes identified under Tasmania's SMART Farming Water Initiative as feasible. These projects are currently being further assessed. If

these projects are constructed a considerable number of water monitoring sites will be required to assure that these irrigation schemes are operated sustainably now and into the future.

Rivers and Water Supply Commission (RWSC)

RWSC currently stores all water records on Excel spreadsheets. As RWSC has limited monitoring stations at present a fully automated database system is not deemed necessary, although as more irrigation schemes and thus monitoring stations come on line in the future this will need to be looked at to come in-line with other existing databases for ease of transfer and integration of data.

Currently the Craigbourne Dam levels are hand recorded. Automation and telemetry of the dam level would allow accurate and up-to-date readings for data input and allow for better stream management practices.

There is a critical information gap in the flow rates of water in Leith Creek. Tasmanian Irrigation Schemes (TIS) releases water into this creek for irrigators to pick up with extra flows released out into Western Creek. Flow monitoring equipment would allow accurate measurement of flows released into the Western Creek from Leith Creek.

Opening back up, automation and telemetry of the DPIPWE's stream flow sites (Quamby Brook downstream of Eden Rivulet (Station No. 18226) and Western Creek downstream of Dale Brook (Station No. 18213)) would allow for accurate environmental stream flow management within the Meander Irrigation Scheme.

As future schemes come online more monitoring sites may be required to monitor for sufficient environmental flows downstream of the irrigation schemes.

Hydro Tasmania (Entura)

Telemetry Upgrade

Boggy Marsh Creek

This station supplies inflows and water quality data for the Ouse River and the data is currently retrieved on a 10 week cycle. The availability of up to date data would augment the use of the information and potentially provide early warning of any water quality issues that may occur in the Ouse River over summer due to blue green algae issues.

Gordon River monitoring sites

Gordon 4 and Gordon below Denison is also currently downloaded on three-monthly helicopter trips. The data is useful for the assessment of environmental flows in the Gordon River and would be enhanced with the availability of a telemetry system. Satellite phones (because of the remote location) would be required at each location.

Idaho Creek

This site is being manually downloaded on a ten-week cycle. The long periods between data collection contribute to potential missing record periods and the delay in producing reports on catchment inflows.

Loudwater Pluvio

Data from this site is only available every six months when a field calibration is carried out. The installation of a NextG telemetry system would add to the rainfall data network being used for cloud seeding and catchment inflows.

Argent River

Data from this site is used by mining companies and Hydro Tasmania to monitor the water flow and quality entering Lake Pieman. The installation of a NextG telemetry system would improve the delivery of data to the Bureau of Meteorology and contribute to the determination of inflows and water quality issues in a more timely manner.

Instrumentation

Bronte Lagoon

Data quality is deteriorating due to the type of sensor currently installed. A DRUCK probe has been in place for a long period of time and the data may well become unreliable without an upgrade in the not too distant future.

Derwent below Meadowbank

This site is below the last Hydro Tasmania dam on the Derwent River. The water quality instrumentation has been in place for a number of years. The number of clients requesting data from this site for fish farms, environmental flows, CSIRO modelling and drinking water supply has increased significantly over the last five years. To ensure reliable quality data is being provided to all agencies, an upgrade to the latest water quality instrumentation would be extremely beneficial.

Shannon River at Hermitage

Current instrumentation suffers from the effects of silt in summer time. An upgrade to a HS 55 would eliminate these problems ensuring reliable data is available through the low flow irrigation periods.

Macquarie River at Westmore

This station also has an old hydrostatic depth probes that is suffering from silt and scaling issues. The station is critical for irrigation in the area and needs to be upgraded to provide quality data. The HS 55 would be an appropriate instrument for this station.

Woods Lake

This station is used for operating the Lake river irrigation system. The quality of data has decreased over the years due to the age and reliability of the

current hydrostatic depth probe. New instrumentation will ensure the amount of water being released is what is required for the farming community and the environmental flow.

Arthurs Lake Outflow

This station releases water to the Lake river irrigation scheme during dry periods. The site currently only has a weir that is intended for the measuring of leakage for Dam Safety purposes. To provide an accurate measure of what flows are being released, an upgrade to the weir and the installation of monitoring equipment would be useful.

Rainfall Stations

Throughout Tasmania approximately 20 rainfall stations will be due for upgrade from the old 200mm (various brands) to the Met Bureau standard of RIMCO 203mm units in the next few years.

Infrastructure

Stitt River at Rosebery

This station has been continually vandalised and is need of significant upgrade to ensure the continuity and reliability of the data. A besser brick structure has been suggested as a means of securing the site.

Brumby's Creek below Palmers

Hydro Tasmania has re-opened this station to monitor the flow and water quality after the construction of the Poatina Regulation Pond. Current gauging facilities are suitable at low levels, but during high flows it has been difficult getting a boat into the site. There is an old cableway at the station. It would improve the quality of the data being provided to install a new winch at this site to allow safer access. The availability of reliable equipment would make it possible to measure the higher flows.

Re-establishment of Existing Stations

Gordon River below Huntley

This station has been vandalised and the site has been closed. This site measured the major inflow to Lake Gordon and would be useful for assessing catchment yields, and storages. Apart from some Forestry activities, it would almost be a significant natural catchment.

Power Supply Issues

South Esk River at Llewellyn

This is one of the key stations in Tasmania used by all the agencies for power station inflows, irrigation flows and flood warning. Critical decisions on the use of water are made based on the flow at this station. Recent damage to the site has

been caused by vandals stealing solar panels. An upgrade to a 240v (nearby) power supply would mitigate this risk ensuring the availability and continuity of the data.

Pieman River below Stringers

This site is just below a power station. The supply of 240v power would improve the quality of data by allowing extra logging over time and remove the risk of the station being interfered with by vandals attempting to steal solar panels.

Derwent River below Meadowbank

This site too is within 200 metres of a power station. It has a satellite phone for communication and the connection of 240v supply would allow the logging frequency to be increased along with the number of times the site is polled as there would not be an issue with the Satellite phone consuming power.

Nive River at Lyell Highway

Being in close proximity to the road and an existing power supply, 240v at this site would improve the security of the station and the integrity of the data as there would be less reason for the site to be vandalised in the process of stealing solar panels.

Opportunities

Climate Data

Hydro Tasmania and DPIPWE have a network of sites throughout Tasmania. The majority of these stations are on a telemetry system and have all the infrastructure required to record additional parameters. An opportunity exists to add value to BoM data with the addition of – for example – air temperature at every station.

Water Quality

The Hydro Tasmania network of water quality stations has a range of sensors that are not all referenced to supply the same quality data. To standardise the entire network would require the purchase of eight Hydrolabs. These eight would go with the Department's ten that are already installed making the calibration and replacement of instruments much more efficient, and ultimately leading to better quality data.

The efficiencies gained from the standardising of the one instrument, be it RIMCO rain gauges or Hydrolabs, would also help to offset the ongoing reduction in operation and data management budgets.

Water Quality – Tasmania as a Pilot-scale Centralised Database

A centralised and accessible national water quality database is very important for the land management and the management of water resources. While the collation of this information is the role of BoM, it will be important that the information and tools available to view and utilise the database meet the requirements of users of the data.

Particular requirements of a centralised database to meet these requirements include:

- Data monitoring sites linked by a robust GIS interface;
- Water quality sample data seamlessly integrated to time series databases, including flow and water quality;
- Inclusion of ground water data;
- Surface water quality database includes data from both waterbodies (lakes) and waterways (stream, rivers);
- Potential to review and analyse the data by sub catchment to ascertain or define trends and triggers;
- A standardised quality assurance method for water quality data;
- A standardised reporting format;
- Web-based access to all available data; and
- The use of data management systems, such as the EPA's, that facilitate data transfer and integration.

The task of creating a national database of this information is very large. It is therefore proposed that a pilot-scale operation of BoM database first be developed in Tasmania. Tasmania is in a unique position, in that the vast majority of available water quality data is held by Government Agencies or Government Business Enterprises (i.e. DPIPWE and Hydro Tasmania), while additional data may be obtained from other smaller data holders (NRM regions, Local Councils, and Forestry Tasmania). Through the combined co-operation of the major data holders, Tasmania has the opportunity to refine BoM database requirements and create a working pilot-scale database framework that can then be used as the basis for a national database.

A basis exists for the development of the pilot scale database in Tasmania. Specifically, Hydro Tasmania is in the final stages of upgrading its extensive database to new software. A significant amount of work has been undertaken over several years, to work with software developers and end-users to incorporate many of the above mentioned components. The EPA, with the roll-out of software packages to organisations including industries and NRM groups, is facilitating the development of a network with data sharing capacity with integration opportunities.

Review of Water Quality data

The collection of water quality data and its use in Tasmania needs to be undertaken. There are a number of potential gaps in data collection, and possible duplication that need to be determined. A review would:

- Assess the current network of sites and data collected;

- Review and analysis WQ data by sub-catchment to determine current trends and establish accepted triggers;
- Determine the possible uses for water quality data;
- Provide recommendations on a network of sites to be established, based on catchment land-use and planning;
- Prioritisation of sites by need and planning requirements and/or land-use (forestry, agriculture, irrigated agriculture).
- Data acquisition based on land-use for use in future land-use planning requirements – i.e. building of model based scenarios to examine impacts of land-use on water quality;
- Collection with regard to land-use and catchment planning, to determine impacts of land-uses on WQ;
- Creation of understanding of cumulative impacts within catchments;
- Establish the need for quantification of relationships – e.g. Turbidity-TSS, Turb-TP, that may be simple to continue collecting and used for future modeling requirements;
- Establish requirements and sites for groundwater monitoring that will provide an understanding of surface water/groundwater interactions; and
- Be facilitated with the development of a centralised metadata database.

Water Extractions Measurement

Measurement of water extractions should be incorporated into a BoM database. This will be important in tracking how this may be impacting upon water quantity and quality.

Hydro Tasmania Modelling Gaps and Improvements

Tasmanian Catchment Model Upgrades (developed for DPIPWE 2006)

It is proposed that these models be upgraded to be consistent with the models developed later for the DPIPWE TasCatch project that incorporated seasonal calibrations and achieved improved volume balances.

These models are utilised by DPIPWE for surface water assessments of catchments within Tasmania, including the assessment of proposed irrigation changes within the catchments.

Web-based Catalogue of Catchment Metadata for Tasmanian Catchments.

This would sit as a sister product to the AWRIS database, and the proposal also incorporates the development of a method or framework that could be utilised across all other states.

The gap is that whilst the AWRIS database will contain all time series information, it may not be immediately clear on related relevant information that is required when trying to discover information on a catchment, ie such as when developing a model for a catchment.

Anticipated information could include:

- The rainfall runoff models available for this area (if any), and who owns them (e.g. TasCatch-DPIPWE, DRIP-HT, etc.);
- Flood models available for this area, and who owns them;
- Hydrological information, such as specific yields, average annual rainfall evaporation, etc.;
- Nearby reliable (and current) flow and rainfall/pluvio/evaporation gauges, and who owns them;
- Pertinent information about the catchment, including;
- Names of major storages, and owners of these storages;
- The existence of irrigation rights/allocations in that catchment, and who administers them;
- Interbasin transfers, and who controls them;
- Major water users (pulp mills, etc.), and who owns them;
- Land-use details that affect hydrology (i.e. % land used for agriculture, forestry, etc.);
- Soil Types;
- Average main channel slope of the catchment; and
- Information on surface water\ground water interactions within the catchment.

Real time gridding of rainfall based on telemetred gauges

One of the major deficiencies of the Hydro Tasmanian flow forecasting models (for trading and dam safety purposes) is the spatial variability of rainfall and the inability of current techniques to adequately account for this when using numerical algorithms that relate only to the telemetered raingauge network. We propose that real time processing of a grid of rainfalls across Tasmania using GIS spatial analysis systems, not only incorporate rainfall telemetry measurements, but topography and perhaps remote sensing information (if it is available, or build functionality into the system to readily utilise it when it becomes available).

Comprehensive document review associated with all in house models

This relates to the catalogue gap identified above. The proposal is that each model have its documentation reviewed and updated, in particular incorporating AWRIS references to all input information.

3D ratings for all power stations for the conversion of MW to flow

Currently much of the hydrological modelling that is done at Hydro Tasmania utilises average MW to flow conversion factors for the inclusion of power station flows in models. This is less than desirable as often the average factor is inaccurate particularly if the power station operation has a greater degree of sensitivity to the available head in the storage.

It is proposed that 3D rating be developed for all Hydro Tasmania power stations for the accurate conversion of power station MW to power station discharge.

Utilising tradings power station scheduled operation for NEM as inputs to hydrological damsafety models

Current dam safety forecast models have crude rules for attempting to forecast the operation of power stations. The inclusion of estimates from the NEM traders schedules would improve the ability of the forecast models to perform accurate storage routing and hence better determine forecast maximum levels during flood events.

Revised calibration for the HT iInflow forecasts models

Hydrologists have identified that on occasions the flows from HT forecast models are poorly calibrated for current applications. Some of the calibrations are in the order of 5-10 years old. In some cases regional calibrations are adopted and in all cases current calibration methodology is considered better, with a greater emphasis on performance criteria and statistical methods. It is proposed that the calibrations of all HT inflow forecast models be reinvestigated, and that the different calibration parameters be investigated for flood vs normal flows.

R&D on error correction methodologies

Current error correction mythologies applied within HT forecast model have proven to be problematic, often introducing larger errors. As a result often error correction is disabled and this can cause issues relating to discontinuity in the flow between observed and modeled data.

Performance monitoring report of telemetry timeliness for HT forecast models

Often HT forecast models have their modelling performance impacted by poor timeliness of critical telemetered rainfall information. The proposal is to produce a report listing all telemetered rain gauges used by HT in flow forecasting applications where this report indicates the time since the telemetered rain gauge last value (of acceptable quality for modelling purposes). This document could be produced at run time of the forecast models and could be archived for review purposes. In addition the most recent report could be displayed on a relevant intranet (dam safety) and operator favourite's screens.

Archival of imagery relating to flood forecasts

It is often difficult to review a flood event in hindsight due to the continuous correction methodologies that are employed. In addition manual data management

activities, unknown to the hydrologist, can correct data and it is then difficult for the hydrologist to determine the cause of an event false alarm. The proposal is to archive all imagery related to dam safety flood forecasts. This will then assist in diagnosis, and performance review.

Lack of Hydro Tasmania's historical log book information and Department of Environment's historical paper records in a digital form

Vast quantities of Hydro Tasmania's hydrological time series data are yet to be digitised. Prior to the installation of automatic monitoring systems, Hydro Tasmania's power station operators were responsible for manually logging time series information up to a frequency of 30 minutes. Much of this data has been entered into the Timestudio database as a 9:00am daily reading only and in many cases not entered at all.

At most of Hydro Tasmania's sites there is significant daily variability of time series information within a day. As a result, for all time series that have been previously digitised on a daily time step, the accuracy can be greatly improved by entering all the data within the day.

NRM North

- Installation of a new data management system to improve water data and metadata management sharing with other agencies such as DPIPWE and BOM.
- Purchase of technology to allow for electronic data entry.
- Installation of new software to allow electronic data uptake.
- Develop web access to data stored on new data management system.
- Train key personnel in the use of the new data management system.
- Conversion of archived data from existing databases to a new data management system to ensure that no data is lost.
- Dissolved oxygen meter for monthly water quality and seasonal AUSRIVAS and wetland monitoring.
- New water monitoring sites to be established as reference sites in key catchments (Note: Key catchments and reference sites are still to be identified).
- Data to be collected monthly on nutrients, electrical conductivity, dissolved oxygen, pH and turbidity.

Launceston City Council

2009/10 monitoring gaps

New site Lilydale stream gauging station and rain gauge

The purpose of the site is to develop a flood frequency curve for Lilydale, improve flood warning, and provide data for the calibration of 1D or 2D hydraulic and

RORB models to aid the development of flood plain mapping for Lilydale and for low flow monitoring in drought conditions. The rain gauge can be located in the catchment but if this is not practical at the stream gauging site.

Proposed Station coordinates: 518236; 5433400, Rocky Creek which is part of the Pipers River catchment.

Currently, LCC data from its own rain and river gauges is collected via Serck controls SCADA system. The FTP protocols are not in place to transfer this data to BoM. It might be better to transfer the collection of this data to the Hydro which can then transfer data to BoM via Hydstra, manage data for quality control and archive data. Alternatively, the collection of data could continue and be transferred to Hydro for data management. Further work is still required to find the best solution for collection, storage and transfer of data to BoM.

LCC's current systems are probably not suitable for long term storage, collection and auditing of data. The implementation of the Water and Sewage Corporations will bring challenges. The Corporation will not have direct interest in flooding, flood warning etc, and Council is likely to be stripped of human resources with the requisite knowledge on 1 July 2009.

In the wastewater treatment area, there are issues in relation to storage collection and retrieval of data as the WWTP's utilise the Citect system. Citect and Serck SCADA do not communicate. Ben Lomond Water use Serck and this issue is not likely to be resolved any time soon. There is a possibility that the new Water and Sewage Authority may opt for the Serck Controls system and will not start to resolve these issues until after 1 July 2009 when the Authorities assume active control of these systems which will then no longer be Council assets.

Three flood warning sites within the Launceston City Council may need upgrading under the new Water Reform. Sites that currently operate under a SCADA system may require upgrading to an improved system that will be operated by the amalgamated Northern Region.

2010/11 monitoring gaps

New Low Head telemetry site

The flood level at Launceston for flood discharges of 3,000 cumecs or less is a function of the tidal level downstream which provides a tail water level. The tidal height for astronomical constituents is predicted for Low Head and the estuarine amplification can be estimated but the effects of wind, low pressure and surges in the Bass Striate cannot be predicted easily. The provision of a telemetry site for tidal flood level at Low Head will provide an estimate of tail water tidal level at Stephenson's Bend for use with river model results at Launceston to determine likely flood levels. The travel time down the river of the tidal wave is about 1.5 hours so the telemetry information will also provide a direct warning of approaching storm surges.

New Kings Wharf site

An additional Tamar river level gauge will be used to assist in the calibration of river models used in flood warning predictions and to refine the relationship between Low Head surges and flood levels at Launceston. It will also be used to issue direct SMS alarms relating to the imminent flooding of critical infrastructure points such as roads and floodgate closures.

Inland Fisheries Service

Automation of existing lakes Crescent and Sorell water level sites

Current readings are taken from surveyed gauge boards located at each lakes outflow. Readings are taken periodically. Upgrading to a telemetry water level/ temperature-monitoring site would be desirable to provide accurate and regular lake levels updates. As these lakes are utilised as a source of irrigation water, accurate level data is required for effective water management.

Upgrade of rainfall monitoring site

Currently, IFS has a basic rain gauge at our base station at Lake Crescent. Data from this site should be treated as low quality due to nearby vegetation interference and infrequent reading. The site provides anecdotal data only. A telemetry site exists at nearby Interlaken Station however it is frequently inoperable for long periods. The reason for this is unknown.

Upgrading of the existing site or the construction of new facilities is required to provide rainfall data of high quality.

Southern Water (previously Hobart Water)

- Amalgamation of council water information databases with new database product as part of water reform.
- Improved monitoring and telemetry of North West Bay River and potentially other selected springs within Mount Wellington Park.
- New monitoring sites in the River Derwent including monitoring for pesticides, flow, turbidity in stream probes, and other key water quality parameters. Possibility of installing a Sontek Argonaut to determining flow at a key point in catchment near Bushy Park.
- New monitoring sites in key tributaries to the Derwent including the Tyenna, Styx and Plenty rivers.
- Expansion of telemetry networks to council sites to be inherited by the new water and sewerage corporation.
- Expansion of monitoring programs as part of improved drinking water catchment management as part of water industry reform.
- Upgrades of water monitoring equipment at key treatment and extraction points and wastewater discharge points as required for new water authority. Sites as yet unidentified.

- Expansion of ‘tuffbook’ network for improving efficiency of water information gathering.

The Tasmanian State Government has put in place the framework and amalgamation of the regional bulk potable water authorities: Esk Water, Hobart Water and Cradle Coast Water with the numerous councils within its regions who reticulate potable water to retail customers. The intent of the amalgamation is to provide better management of potable water and sewerage within Tasmania to enable expansion and improvement of supply to customers through greater capacity to undertake essential large scale infrastructure projects. At present some townships have been significantly affected by the dry conditions experienced over the past decade and have water restrictions and boil water alerts required continuously.

The three new water and sewerage entities came into existence 1 July 2009 and exclusively service the north-eastern, southern and north-western areas respectively. A fourth entity sits above these organisations to ensure a consistent approach to water management across the state occurs, and provide state-wide strategic planning, IT support and billing for customers.

Currently ten local councils provide source to tap potable water and sewer reticulation, yet are either not listed in the regulations at all or only for Section D or Section H. Eighteen councils are provided with bulk water from either Hobart Water, Cradle Coast Water or Esk Water which they reticulate to retail customers. These councils also provide sewerage reticulation for its municipality, but only five (5) of these 18 are listed in the regulations for Section F – Urban Water Utilities. This is especially significant given that some councils provide services to major cities, such as Kingborough and Brighton Councils who service Greater Hobart. Many of the councils not listed in the regulations manage reservoirs, waterways, sewerage treatment plants and sewer discharges which form some of the water pathways required for accurate water resource assessments to be undertaken. In many cases the justification for not listing the councils in the regulations is due to the size of the customer base being less than 10,000 customers; however this justification will be obsolete once the amalgamation occurs in July 2009 and in some instances there are some unlisted councils whose customer base is significantly greater than 10,000.

When the amalgamations occur the new organisations will be more concerned with the re-organisation of operations, emergency repairs, asset management and strategic planning than concentrating on data provisions required under the Water Act 2007. There is a real requirement to facilitate and coordinate the continued provision of data currently requested from existing organisations listed under the Act and the identification of data which will be required to be provided under the Water Act 2007, but was previously managed by councils not listed in the regulations. Combine this with the lack of water metering in numerous parts of the state and the inability of existing councils to quantify consumption creates a challenge requiring external independent coordination and facilitation.

Forestry Tasmania

Gap Analysis for 2008

1. Database upgrade for time series data collected at Warra, Swanson and King Weirs.
2. Automation of data transfer to BoM.
3. Telemetry, power and datalogger and sensor upgrade at Warra, Swanson and King Weirs.
4. Telemetry for weather station at Southwood.
5. Potential for gauging of streamflow in catchment dominated by plantations, but no firm plan at this stage.

Gap Analysis 2010

1. Water quality monitoring in two locations in Kansas Creek to assess the impact of forest harvesting on WQ with respect to water flowing into karst groundwater systems.
2. Upgrade database and enable easy data transfer from Forestry Tasmania to BoM.
3. Telemetry and data logging for water off take at Perth Nursery.
4. Statewide, multi-agency water quality synoptic sampling program to provide a snapshot of water quality in a number of streams in different land uses, catchment sizes, climate zones, geological types etc. to identify most important parameters affecting WQ and to map WQ in true State-inform modelling and decision making for remediation.

Ben Lomond Water (previously Esk Water)

Possible future expansion to monitor river flows and water quality at North Esk intake at Watery Plains on the North Esk River

Ben Lomond Water may also look at expanding the new DPIPWE monitoring of the St Patricks River at Nunamara to include water quality monitoring.

Preliminary thoughts for upgrades at Watery Plains intake on the North Esk River:

At this stage we are envisaging a gauging station/weir just downstream of the intake to measure the water passing the diversion. This site will need to be particularly accurate in the range of 7-15ML/day to suit our water licence requirements for Surety 1 and 4. We would install instrumentation to suit offsite monitoring. We would also install flow instrumentation in the diversion pipeline to enable complete flow balancing at the site. Water quality instrumentation would also be installed to sample from the diversion pipeline. An RTU would be needed for remote monitoring of the river flow downstream of the diversion, the diversion flow rate and water quality parameters.

- *At this stage we would be guessing at a budget of:*
- *Weir/gauging station $30,000;*
- *Diversion flow measurement $20,000; and*
- *RTU $30,000.*

EPA Division (DPIPWE)

1. Integrated data collection, processing, storage for all branches within the Environment Division
2. Integration of 'stand-alone' data sets through data sharing agreements and web service development within and between agencies and other organisations including NRM groups and industries to enable data usage but not necessarily centralised storage.
3. Improve analysis, presentation and distribution of water data including the spatial delivery (through a web page) of metadata and monitoring data by stakeholders.
4. Web page development to provide an interactive environment with spatial connectivity for sites and areas using techniques such as linear referencing.
5. Using linear referencing to facilitate an optimal environment for interpretation and management of water data. The attributes to point and line data connected to stream segments would include point source locations (sewage treatment and industrial wastewater discharge, water intakes for drinking water, aquaculture and industrial water supply, groundwater bores), in-stream storages, water sampling points both surface and groundwater, specific riverine geographical features such as surrounding land-use, Karst areas, geological regions that produce acid rock drainage, and water quality features including protected environmental values, water quality objectives, and water quality targets. Also NRM management action targets, resource condition targets and aspirational targets would be included.
6. Augmentation of existing water monitoring sites to assist in the process in site specific establishment of water quality objectives consistent with NWQMS and State Policy on Water Quality Management (1997).
7. Develop centralised metadata database containing data owners, sites, locations, parameters, date range, and access status. Spatial presentation of monitoring site is also a priority.

Clarence City Council

Back Tea Tree Road Dam

This will be the next phase of the Clarence Recycled Water Scheme. The dam will provide 900ML of storage for treated effluent from Clarence. It is located at GPS reference 529668.80 : 5268116.41 and is due for completion in March 2010.

A flow meter and associated telemetry equipment will be installed to measure dam inflows and outflows and this data will be captured and stored in council's SCADA system.

Cambridge Sewage Treatment Plant

This is a new sewage treatment plant currently being constructed. It is located at GPS reference 541642.59 : 5256547.39 and will become operational in January 2009.

Flow meters and associated telemetry equipment will be installed to measure discharge flows and flows diverted to the Clarence Recycled Water Scheme and this data will be captured and stored in council's SCADA system.

Cradle Mountain Water (CMW)

CMW has identified 16 sites in the following table (Table 25) that it would like to have real time data from. These sites have been prioritised to a list of eight critical stations that are required to provide CMW with the data needed to manage these water supplies.

Table 25 – CMW Sites Requiring Real Time Data

Site	Priority
Dasher Creek-Sheffield	A
Waratah Water Supply	C
Gawler River-Pump station Upstream	A
Gawler River-Pump station Downstream	A
Manuka Creek-Strahan	A
Mt Creek-Rosebery	C
Stitt River-Rosebery	B
Conglomerate Dam-Queenstown	A
Conglomerate River-Queenstown	A
Zeehan Water Downstream of Weir	C
Zeehan Water Upstream of Weir	A
Queenstown River-New Sewer TP	C
Railton Creek-Sewer	A
Ridgley River-Sewer Outfall	A
Dowlings Creek-Yolla	C

Tasmanian Bureau of Meteorology

Notwithstanding the issues and opportunities raised by other parties (e.g. rating curves) the following is a draft assessment of the present gaps in the Bureau's information ladder to the provision of flood and forecasting warning services.

Lack of networks

The increasing level of tourism in the state from a few specific seasonal visitors 10 to 15 years ago to large numbers of visitors constantly throughout the year,

and of independent means, is putting pressure on the Bureau to deliver services into areas often thought of as being remote and having a low concern during flood episodes. These areas are the far North East, East Coast and West Coast. There is a paucity of rainfall and river height/flow data in these areas to delivering an effective flood warning service.

Flash flooding

Like the areas devoid of a flood network, the same areas are also subject to strong flash flooding so there is a strong need to have real-time networks operating in these areas.

FTP process

There is an agreement amongst the three main water resource agencies to share its data, and for this data to be shared via FTP. In the main, this system works well, but it is apparent now that during flood periods the interrogation/transmission interval used is inadequate for operational forecasting purposes.

The Bureau's operational systems require data in near real-time to the time forecasting is undertaken. A few recent events highlights a concern that the forwarding of non-Bureau data at present time scales is inadequate for our forecasting needs.

Either agencies increase its interrogation/delivery rates, or consideration is given to upgrading the critical non-Bureau sites to perform in real-time.

Data duplication

The Bureau is acutely aware that named agencies are duplicating efforts in the provision of data to comply with the Water regulations and to support the flood forecasting and warning services. Much of this data is never made public but is incorporated into the Bureau's products and outputs. Security of this supply is paramount, particularly with a significant proportion of the data streams now being ftp'd. There is an imperative to examine the disaster recovery processes of these external agencies, and to strengthen these processes or infrastructures where found wanting. Certainly there exists scope to consider other transfer mechanisms like web services.

Unknown data

Inflows from ungauged catchments and large data abstractions and storages are a known source of error to defining our system inputs and outputs.

Forecasting performance

The Bureau supports the River Alert system that sends an advisory, mainly to farmers, whenever key rainfall and river height stations exceed specific criterion. In recent years there has been a progressive field and office upgrade to automate the process with minimal manual intervention. There are a few sites still requiring real-time telemetry upgrades and robust infrastructures.

In the area of operational forecasting our modelling systems could be improved with further rainfall observations or access to gridded observations from the numerical weather products to better estimate the mean temporal patterns over model nodes. Further model improvements can be made from access to improved GIS thematics. Current model network delineations are based on 3' SRTM DEM data that are hydrologically conditioned. The addition of soil and vegetation mapping could improve the efficiency of these model networks.

Further improvements in forecast performance can be made with access to performance characteristics of major storages. It is recognised there is sensitivity around this information, as there is with some of the data streams provided to the Bureau. Security of this data away from systems with links to the Internet is critical to maintaining the confidence of data suppliers.

Occupational health and safety

The management of any water resource monitoring system also requires some investment into the OHS requirements of that system, whether this is attention to the field aspects of having people work in remote locations or the way information is processed in the office.

Minimising the time spent managing the information process is an important factor not only from a management perspective to reducing operating costs but also in the safety of staff by minimising its exposure to risk.

Upgrading field stations to have plug and play instrumentation and robust technologies is a direction the Bureau is heading, and certainly this technology should be compatible with the other water information stakeholders in Tasmania.

Service delivery

Apart from service delivery aspects associated with flooding there is the service aspect related to supporting the engineering and design community with information on large rainfall events. Although the Bureau has a reasonable network of rain gauges the density of the pluviographic network is quite limited.

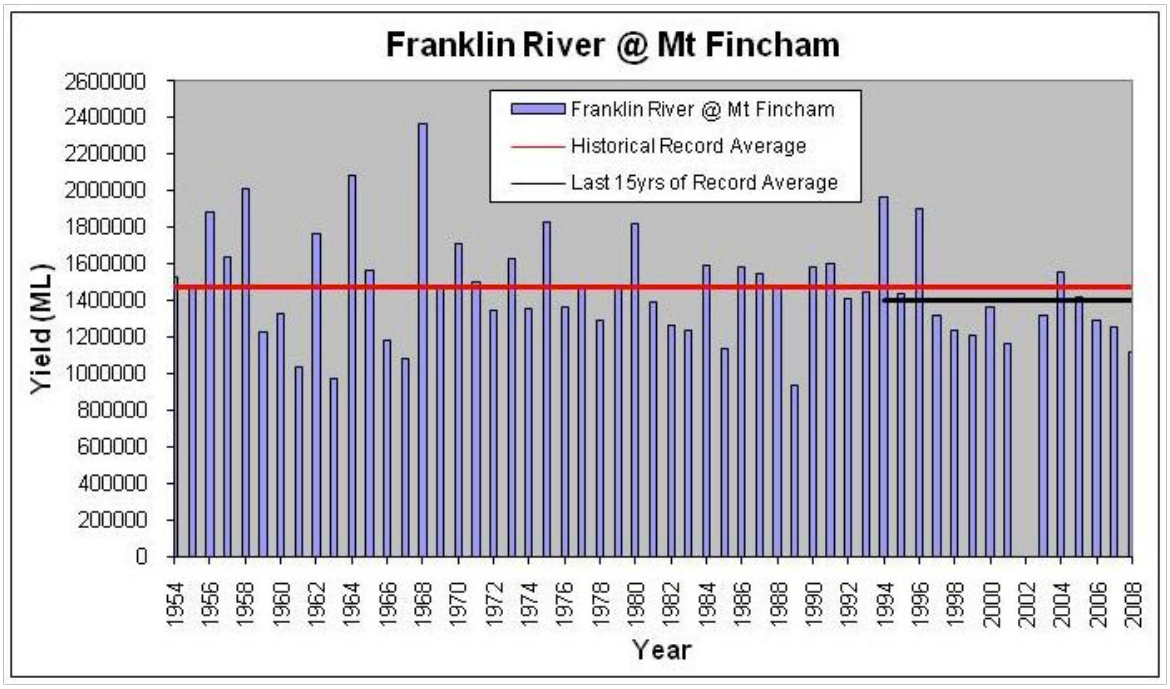
In addition, the pluviographs are limited to measurement of defined volumes on an interval basis or an event basis. There is not the ability to estimate variable rainfall rates over very short intervals.

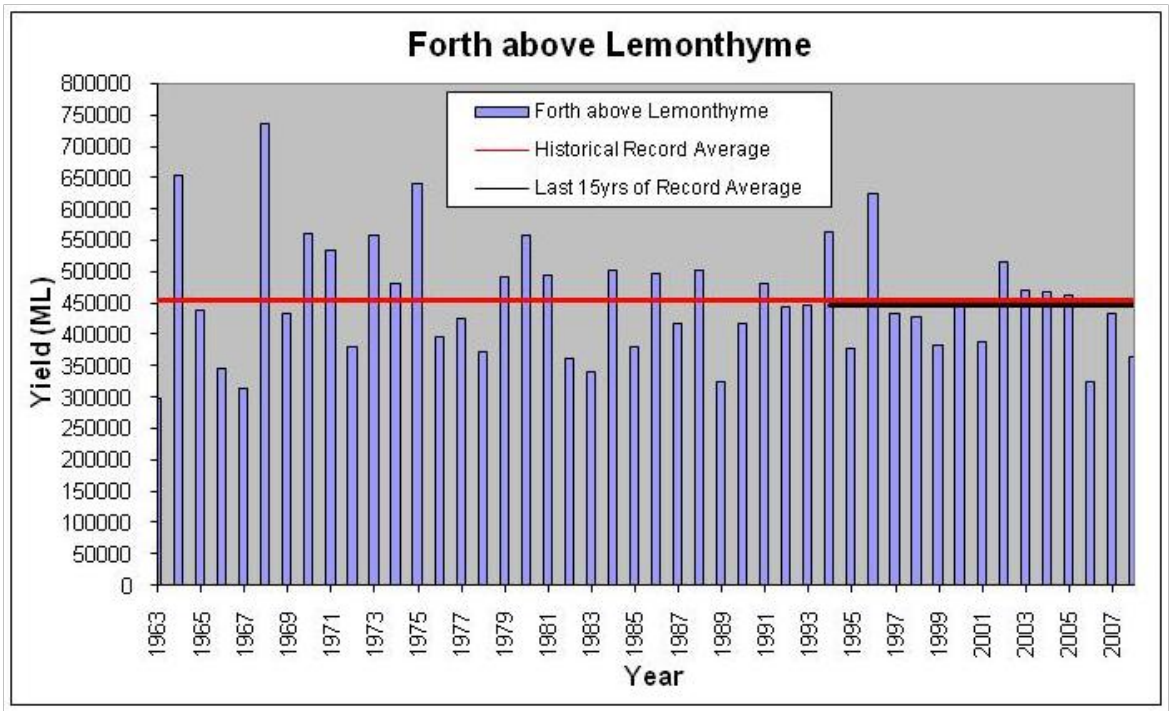
Expanding the pluviographic network to have clusters of standard gauges supporting high-end droplet measuring gauges is seen as a cross-cutting activity to not only improve the service delivery function but quasi-research activity, and the development of water information standards.

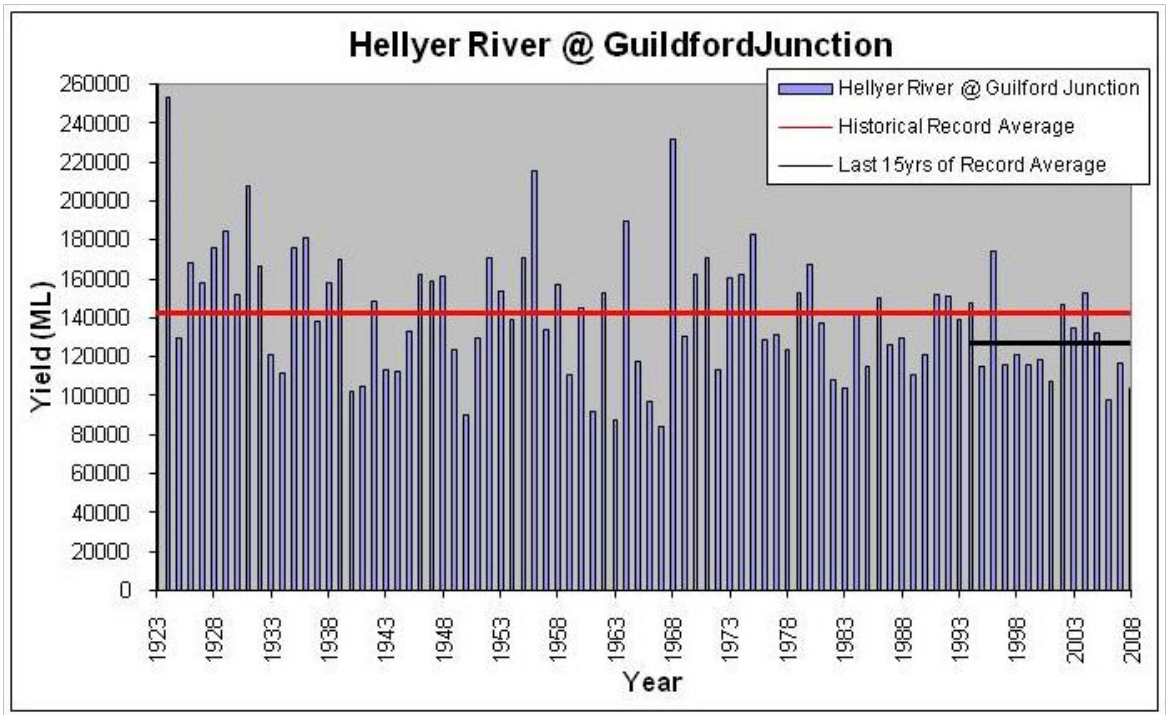
Other gaps identified within the SWIMP working group

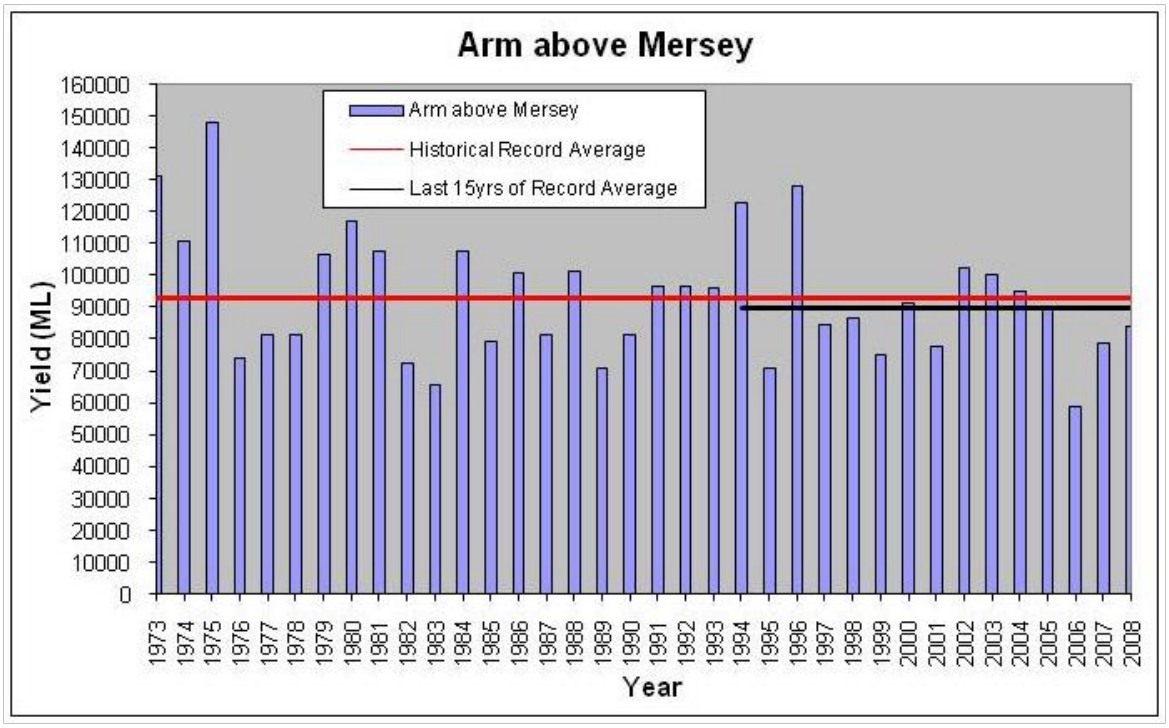
Identify and establish 50 to 75 key reference sites that will become priority sites for Tasmania. These sites will meet the needs for a range of users and provide quality data possibly in 'real time'. The sites will become a priority for repair and maintenance for the responsible organisation managing them. Distribution will possibly be on a catchment basis.

Appendix 4 – Historical river flow plots (yield) that represent climate change for some Tasmanian rivers






Hellyer River @ GuildfordJunction
Hellyer River @ Guilford Junction
Historical Record Average
Last 15yrs of Record Average
Yield (ML)
Year


Arm above Mersey
Arm above Mersey
Historical Record Average
Last 15yrs of Record Average
Yield (ML)
Year

Appendix 5 – Past funding agreements for Tasmania Rounds 1 to 4

Table 26 – Round 1 2007/2008 Funding Agreements Summary

Recipient	Purpose	Value (inc GST)
Department of Primary Industries and Water	07-08 DPIW 7 – Purchase of satellite modems at key non-telemetered stream flow sites	$23,100
Department of Primary Industries and Water	07-08 DPIW 6 – Field trial of ground water level and temperature loggers	$26,400
Department of Primary Industries and Water	07-08 DPIW 5 – Purchase an upgrade of instruments at selected water monitoring flow sites	$132,000
Department of Primary Industries and Water	07-08 DPIW 4 – Water resources division data high availability server installation	$96,250
Department of Primary Industries and Water	07-08 DPIW 3 – Purchase of a new telemetry system	$55,000
Department of Primary Industries and Water	07-08 DPIW 2 – Purchase of an electric cableway system for using an acoustic Doppler discharge measuring unit	$22,000
Department of Primary Industries and Water	07-08 DPIW 1 – Purchase of an Acoustic Doppler Discharge Unit	$33,550
Hobart Water	07-08 Hobart Water 1 – Hobart Water to the Bureau data provisioning tools and hardware – server infrastructure upgrades, database modifications, data collation and tools to deliver archived, daily, weekly and annual water quality data to the Bureau	$102,508
Hydro Tasmania	07-08 Hydro Tas 2 – Upgrade of telemetry at 21 rainfall sites	$190,080
Hydro Tasmania	07-08 Hydro Tas 1 – Scoping Study for SCADA Data Conversion and Capture	$141,240
	Total	**$822,128**

Table 27 – Round 2 2008/2009 Funding Agreements Summary

Recipient	Purpose	Value (inc GST)
Department of Environment, Parks, Heritage and the Arts	08-09 Tas 8.1 – Enhance Data Management and Transfer to the Bureau	$198,000
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.0 – Strategic Water Information and Planning Co-ordination	$242,000
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.2 – Upgrade and enhancement of DPIW s surface water monitoring network	$614,900
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.3 – Improving the quality of metadata at all Tasmanian stream flow and groundwater monitoring sites	$408,980
Forestry Tasmania	08-09 Tas 2.1 – Installation of telemetry for Warra, Swanson and King Creek streamflow and water quality gauging	$45,111
Hobart Regional Water Authority	08-09 Tas 3.1 – Server infrastructure upgrade, database modifications, data collation and tools to deliver archived, daily, weekly and annual water quality data to the Bureau	$257,279
Hydro Tasmania	08-09 Tas 5.1 – Develop Quality Control/Quality Assurance processes on data transfer to the Bureau	$557,920
Hydro Tasmania	08-09 Tas 6.1 – Infrastructure and software services for the provision of Water Information to the Bureau	$88,000
Launceston City Council	08-09 Tas 7.1 – Upgrade 5 rainfall stations	$19,910
	Total	**$2,432,100**

Table 28 – Round 3 2009/2010 Funding Agreements Summary

Recipient	Purpose	Value (inc GST)
Department of Primary Industry, Parks, Water and Environment	09-10 TAS 1.1 Strategic Water Information Coordination	$137,500
Department of Primary Industry, Parks, Water and Environment	09-10 TAS 1.2 – Continued Upgrade and Enhancement of Water Monitoring Network	$346,280
Department of Primary Industry, Parks, Water and Environment	09-10 TAS 1.2b – Provision of equipments for continued upgrade and enhancement of Water Monitoring Network	$108,020
Department of Primary Industry, Parks, Water and Environment	09-10 TAS 1.3 – Evaluation Prior to Purchase and Migration to New Database (Hydstra TSM Replacement)	$44,550
Department of Primary Industry, Parks, Water and Environment	09-10 TAS 1.4 – Modernisation of Groundwater Monitoring in Tasmania	$412,459
Hydro-Electric Corporation	09-10 TAS 2.1 – Collaborative Automated Trial	$430,100
Hydro-Electric Corporation	09-10 TAS 2.3 – Hydro Tasmania Instrumentation Upgtrade 2009	$44,737
Rivers and Water Supply Commission (Tasmanian Irrigation Schemes)	09-10 TAS 4.1 – Craigbourne Dam Storage Measurement, Telemetry and Data Management	$27,500
Tasmanian Water and Sewerage Corporation – Common Services (Onstream)	09-10 TAS 3.2 – Extension of Water Information Database and Reporting Tools Across Northern Tasmanian Utilities	$310,109
Tasmanian Water and Sewerage Corporation – Southern Region	09-10 TAS 3.1 – Upgrade and Extension of flow and Extraction Measurement and Water Management Database	$119,295
	Total	**$1,980,550**

Table 29 – Round 4 2010/2011 Funding Agreements Summary

Recipient	Purpose	Value (inc GST)
Department of Primary Industry, Parks, Water and Environment	4TAS01.01 – Strategic Water Information Co-ordination	$137,500
Department of Primary Industry, Parks, Water and Environment	4TAS01.02 – Extension of the statewide Groundwater Monitoring Network in Tasmania	$308,000
Department of Primary Industry, Parks, Water and Environment	4TAS01.04 – Continued Upgrade and Enhancement of Water Monitoring Network and Generation of Missing Historical Data	$220,000
Department of Primary Industry, Parks, Water and Environment	4TAS01.05 – Integration of historical borehole data into the Department's groundwater database	$111,100
Department of Primary Industry, Parks, Water and Environment	4TAS01.08 – State-wide Hydrological Geospatial Fabric (THGF) Project	$242,275
Hydro-Electric Corporation	4TAS02.05 – Training in Hydrographic Procedures	$50,402
Hydro-Electric Corporation	4TAS02.06 – Tasmanian Metadata Collection	$158,400
Hydro-Electric Corporation	4TAS02.07 – ADCP Procurement and Instrumentation Improvements for Hydro Tasmania	$91,630
Launceston City Council	4TAS06.01 – Data Collation, Transfer, QAQC and Storage for Launceston City Council (LCC) Flood Warning Sites	$55,000
Tasmanian Irrigation Schemes	4TAS03.03 – Dam Storage Monitoring and Telemetry	$36,399
Tasmanian Water and Sewerage Corporation (North Western Region) Pty Ltd	4TAS05.01 – Installation of water level instrumentation at 5 sites to enhance the quantity and quality of data retrieval for water catchments in the Cradle Mountain Water District	$220,000
	Total	**$1,630,706**

Appendix 6 – Inventory of Tasmanian Monitoring Sites

Each of the named organisations in the Water Regulations where requested to complete an inventory of their database containing any data fitting under five of the BoMs ten categories and sub categories of water information. The BoM's main categories of information included in the inventory are as follows:

Category 1 – Surface water information;

Category 2 – Groundwater resource information;

Category 3 – Information on major and minor storages;

Category 4 – Meteorological information; and

Category 9 – Water quality information.

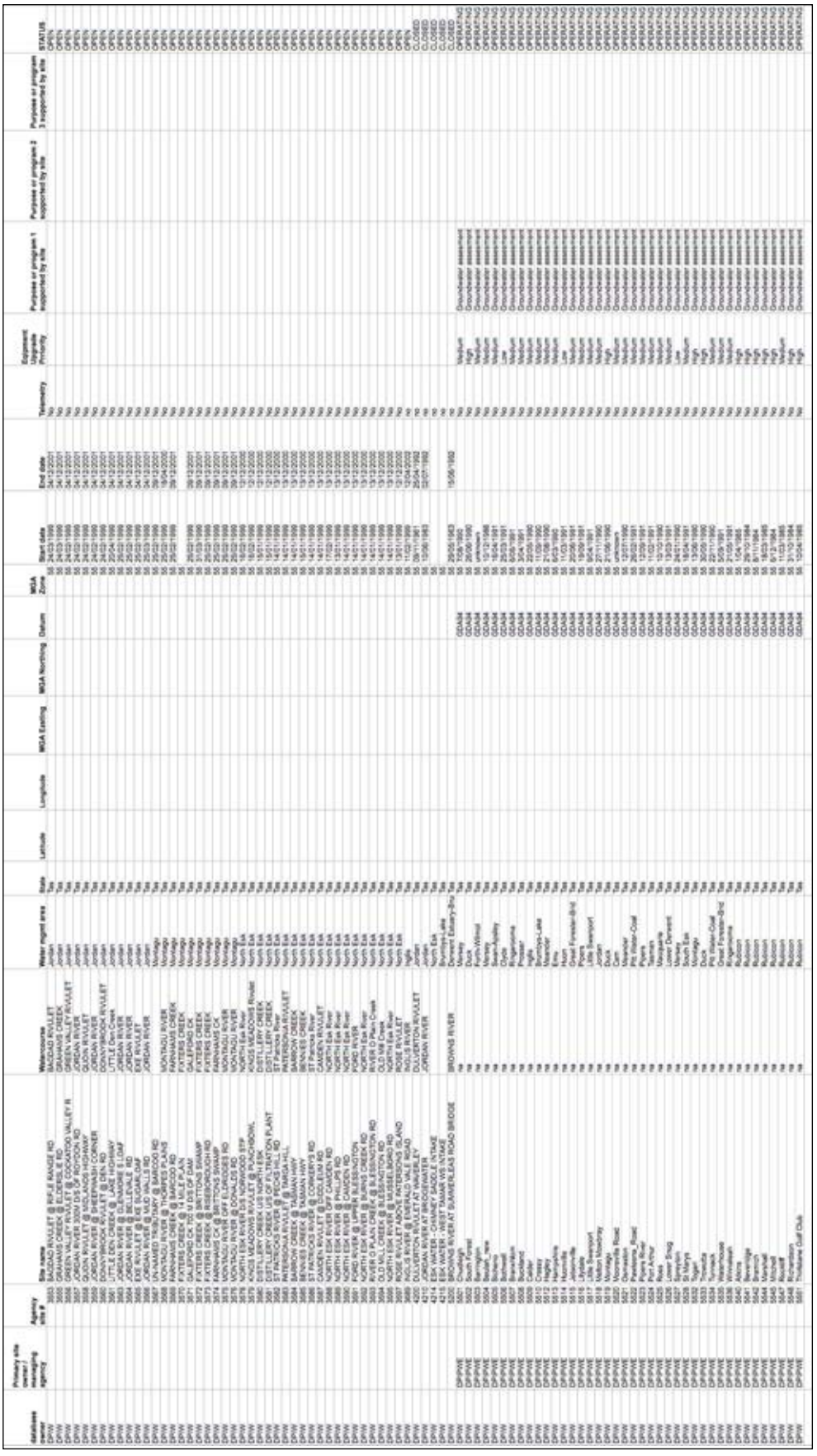
The inventory template in Microsoft Excel format comprised of three spreadsheets including:

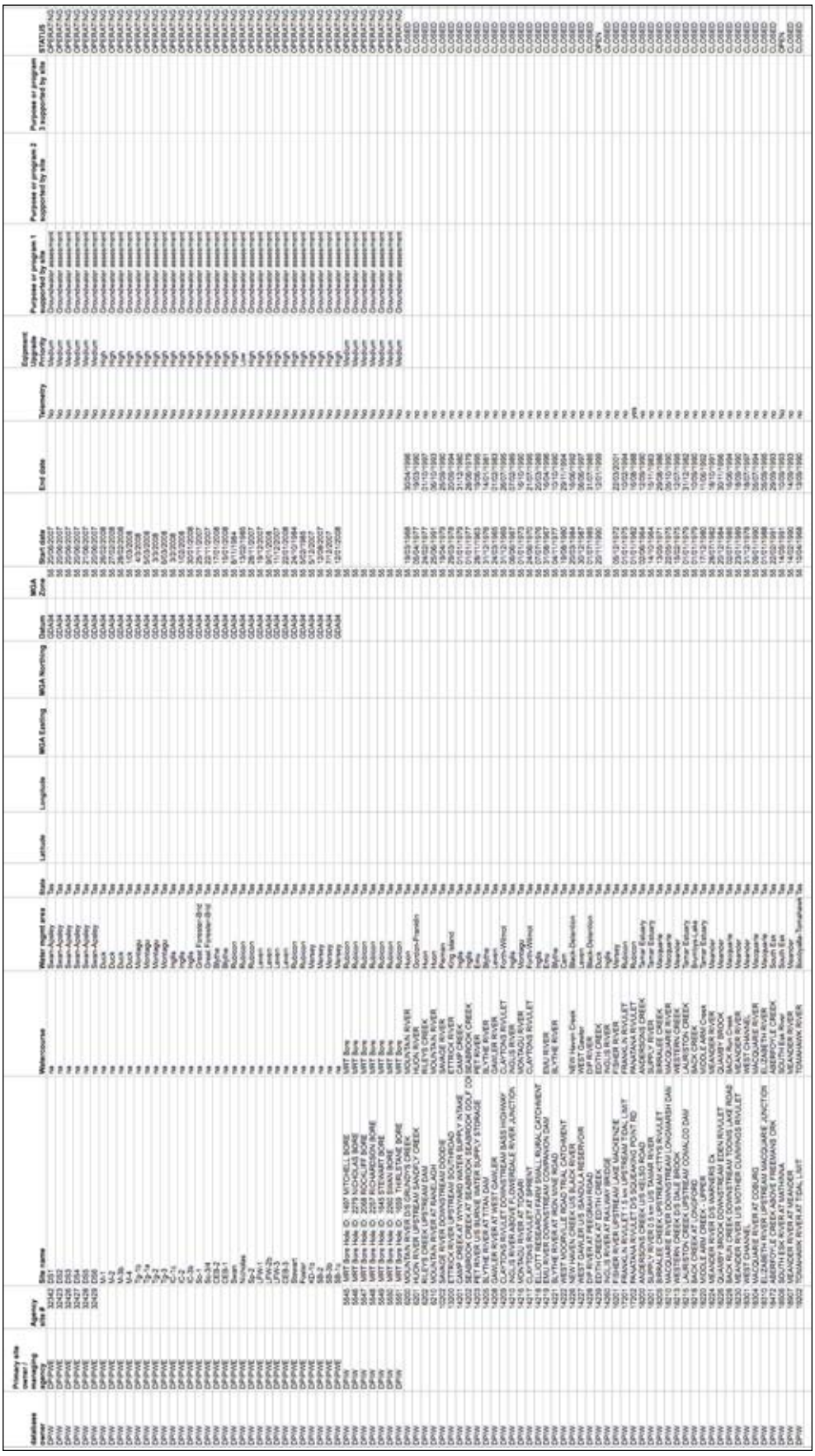
1. Site details;
2. Water Information; and
3. Meteorological information.

Due to the amount of information contained within the Water Information Spreadsheet, the Site Details spreadsheet has only been included for this version of the document. Information that has not been included can be obtained from BoM or the Water Assessment Branch at DPIPWE. In addition, site coordinate information has been removed from the columns within the inventory as it was viewed as sensitive information for some organisations.

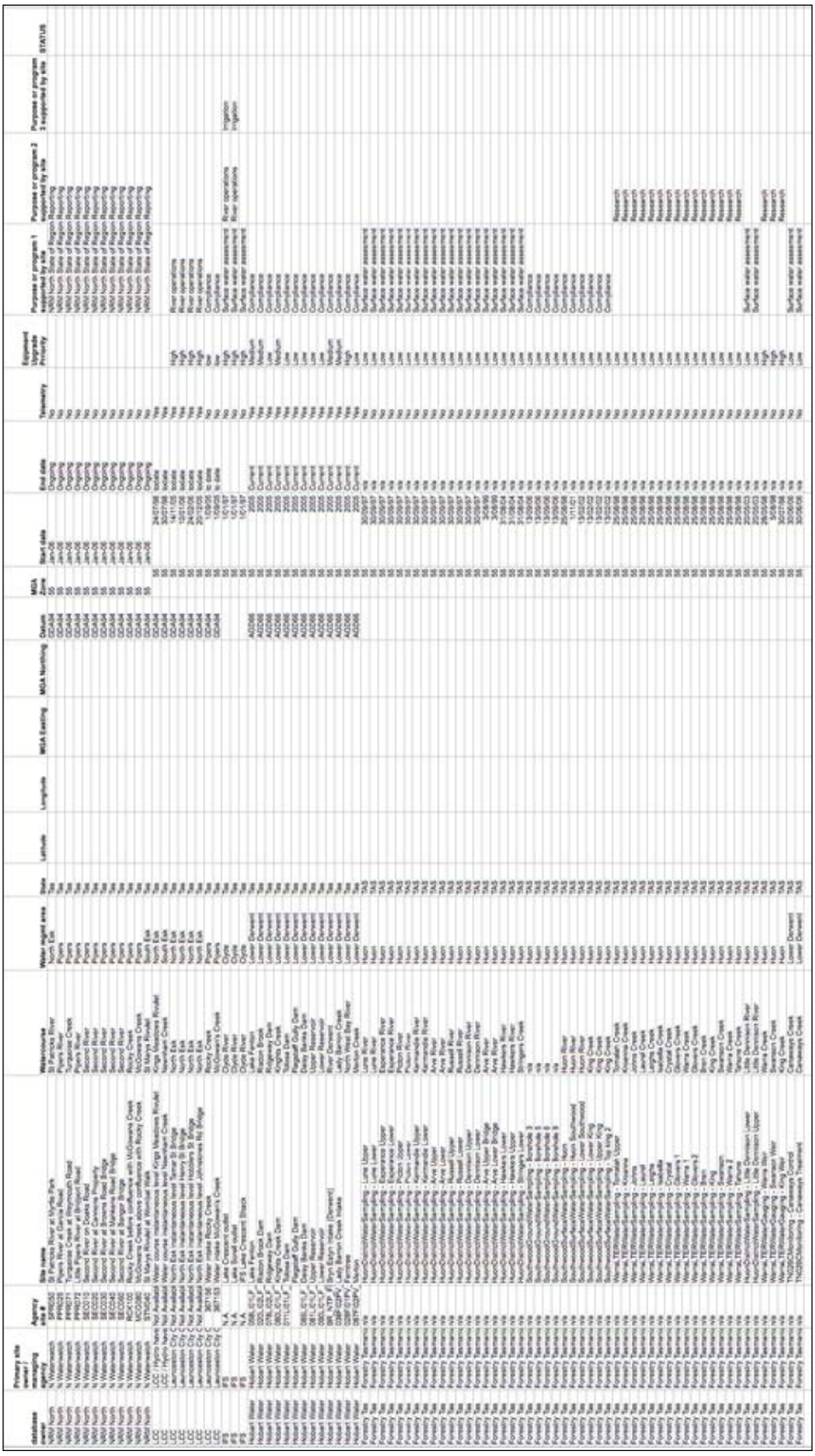
database owner	Primary site owner / managing agency	Agency site #	Site name	Watercourse	Water mgmt area	State	Latitude	Longitude	MGA Easting	MGA Northing	Datum	MGA Zone	Start date	End date	Telemetry	Equipment Upgrade Priority	Purpose or program 1 supported by site	Purpose or program 2 supported by site	Purpose or program 3 supported by site	STATUS
DPIW	DPIW	25	NILE RIVER AT DEDDINGTON	NILE RIVER	South Esk	Tas					GDA94	55	03/06/1962	current	Yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	30	RINGAROOMA RIVER UPSTREAM MOORINA BR	RINGAROOMA RIVER	Ringarooma	Tas					GDA94	55	08/06/1977	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	54	CLYDE RIVER AT BOTHWELL	CLYDE RIVER	Clyde	Tas					GDA94	55	18/01/1979	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	79	NORTH ESK AT BALLROOM	NORTH Esk River	North Esk	Tas					GDA94	55	19/03/1923	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	116	PIPERS RIVER AT UNDERWOOD	PIPERS RIVER	Pipers	Tas					GDA94	55	03/04/1962	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	119	HUON RIVER ABOVE FRYING PAN CREEK	HUON RIVER	Huon	Tas					GDA94	55	03/04/1948	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	164	LIFFEY RIVER AT CARRICK	LIFFEY RIVER	Meander	Tas					GDA94	55	01/01/1982	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	181	SOUTH ESK ABOVE MACQUARIE RIVER	SOUTH Esk River	South Esk	Tas					GDA94	55	18/12/1986	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	191	BREAK O'DAY RIVER AT KILLYMOON	BREAK O'DAY RIVER	South Esk	Tas					GDA94	55	04/11/1983	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	444	St Patricks River at Nunamara	ST Patricks River	North Esk	Tas					GDA94	55	14/11/91	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	447	MERSEY RIVER AT LATROBE	MERSEY RIVER	Mersey	Tas					GDA94	55	01/11/1962	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	456	Nunamara Diversion Flume at St Patricks Weir	Offtake	North Esk	Tas					GDA94	55	26/08/08	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	473	DAVEY RIVER B/L CROSSING RIVER	DAVEY RIVER	Port Davey	Tas					GDA94	55	26/02/1964	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	489	TYENNA RIVER AT NEWBURY	TYENNA RIVER	Lower Derwent	Tas					GDA94	55	19/05/1964	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	835	HUON RIVER D/S JUDBURY RD BRIDGE	HUON RIVER	Huon	Tas					GDA94	55	27/06/1990	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	852	MEANDER RIVER AT STRATHBRIDGE	MEANDER RIVER	Meander	Tas					GDA94	55	26/08/1985	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	1088	BUTTONS CK U/S BASS HWY	BUTTONS CK	Leven	Tas					GDA94	55	04/12/2007	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	1307	NELSON BAY RIVER AT TEMMA ROAD	NELSON Bay River	Nelson Bay	Tas					GDA94	55	01/02/1985	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	1309	LEGERWOOD D/S RINGAROOMA ROAD	LEGERWOOD	Ringarooma	Tas					GDA94	55	07/05/2008	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	1335	RINGAROOMA RIVER U/S BRANXHOLM WATER SUPPLY	RINGAROOMA RIVER	Ringarooma	Tas					GDA94	55	07/05/2008	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2200	SWAN RIVER AT THE GRANGE	SWAN RIVER	Swan-Apsley	Tas					GDA94	55	29/05/1964	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2202	PROSSER RIVER UPSTREAM LOWER DAM	PROSSER RIVER	Prosser	Tas					GDA94	55	11/02/1965	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2204	APSLEY RIVER U/S COLES BAY ROAD BRIDGE	APSLEY RIVER	Swan-Apsley	Tas					GDA94	55	30/05/1968	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2205	GEORGE RIVER AT St HELENS WATER SUPPLY INTAKE	GEORGE RIVER	George	Tas					GDA94	55	10/04/1968	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2206	SCAMANDER RIVER U/S SCAMANDER WATER SUPPLY IN	SCAMANDER RIVER	Scamander-Douglas	Tas					GDA94	55	10/04/1968	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2208	MEREDITH RIVER AT SWANSEA	MEREDITH RIVER	Swan-Apsley	Tas					GDA94	55	16/03/1970	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2209	CARLTON RIVER AT TIDAL LIMIT	CARLTON RIVER	Tasman	Tas					GDA94	55	13/03/1963	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2212	LITTLE SWANPORT 800m D/S EASTERN MARSHES RIVUL	LITTLE Swanport	Little Swanport	Tas					GDA94	55	21/01/2004	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2214	ANSONS RIVER D/S BIG BOGGY CREEK	ANSONS RIVER	Musselroe-Ansons	Tas					GDA94	55	23/05/1979	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2216	ALLANS RIVULET UPSTREAM TARANNA	ALLANS RIVULET	Tasman	Tas					GDA94	55	21/03/1983	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2217	RANSOMS RIVER AT SWEETS HILL	RANSOMS RIVER	George	Tas					GDA94	55	16/02/1983	current	no	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2218	DOUGLAS RIVER UPSTREAM TASMAN	DOUGLAS RIVER	Scamander-Douglas	Tas					GDA94	55	04/09/1983	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2219	SWAN RIVER U/S HARDINGS FALLS	SWAN RIVER	Swan-Apsley	Tas					GDA94	55	30/08/1983	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	2220	LITTLE SWANPORT RIVER 150m D/S OLD WEIR	LITTLE SWANPORT RIVER	Little Swanport	Tas					GDA94	55	22/03/2004	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3203	COAL RIVER AT BADEN	COAL RIVER	Pitt Water-Coal	Tas					GDA94	55	13/07/1971	current	no	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3206	COAL RIVER DOWNSTREAM CRAIGBOURNE DAM	COAL RIVER	Pitt Water-Coal	Tas					GDA94	55	28/10/1986	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3208	COAL RIVER AT RICHMOND	COAL RIVER	Pitt Water-Coal	Tas					GDA94	55	25/01/1995	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3209	WHITE KANGAROO RIVULET	WHITE KANGAROO Rivulet	Pitt Water-Coal	Tas					GDA94	55	08/05/1990	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3364	SOUTH ESK AT UPPER ESK ROAD BRIDGE	SOUTH Esk River	South Esk	Tas					GDA94	55	20/09/2007	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3365	WESTERN CRK @ BANKTON ROAD BRIDGE	WESTERN CRK	Meander	Tas					GDA94	55	19/04/2007	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	3703	MOLE CREEK 400M D/S OF SASSAFRAS CREEK	MOLE CREEK	Mersey	Tas					GDA94	55	18/06/2008	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	4201	JORDAN RIVER AT MAURICETON	JORDAN RIVER	Jordan	Tas					GDA94	55	29/11/1965	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	4202	CLYDE RIVER DOWNSTREAM LAKE CRESCENT	CLYDE RIVER	Clyde	Tas					GDA94	55	01/01/1979	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	5201	NORTH WEST BAY RIVULET AT MARGATE WATER SUPPL	NORTH WEST BAY RIVULET	Derwent Estuary-Bru	Tas					GDA94	55	02/07/1985	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	5202	SNUG RIVULET U/S SNUG TIERS ROAD BRIDGE	SNUG RIVULET	Derwent Estuary-Bru	Tas					GDA94	55	24/08/1965	current	no	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	6203	MOUNTAIN RIVER	MOUNTAIN RIVER	Huon	Tas					GDA94	55	26/06/2008	current	yes	Low	Surface water assessment	River operations		open
DPIW	DPIW	7200	ESPERANCE RIVER AT DOVER WATER SUPPLY INTAKE	ESPERANCE RIVER	Huon	Tas					GDA94	55	30/03/1965	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14200	MONTAGU RIVER AT STUARTS RD	MONTAGU RIVER	Montagu	Tas					GDA94	55	27/05/1965	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14206	SULPHUR CREEK 1.5 km UPSTREAM OF MOUTH	SULPHUR CREEK	Blythe	Tas					GDA94	55	23/01/1964	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14207	LEVEN RIVER AT BANNONS BRIDGE	LEVEN RIVER	Leven	Tas					GDA94	55	18/06/1963	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14212	CAM RIVER U/S SOMERSET WATER SUPPLY INTAKE	CAM RIVER	Cam	Tas					GDA94	55	20/03/1968	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14213	BLACK RIVER AT SOUTH FOREST	BLACK RIVER	Black-Detention	Tas					GDA94	55	28/05/1968	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14214	DUCK RIVER UPSTREAM SCOTCHTOWN ROAD	DUCK RIVER	Duck	Tas					GDA94	55	22/04/1966	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14216	FLOWERDALE RIVER AT MOORLEAH	FLOWERDALE RIVER	Inglis	Tas					GDA94	55	21/03/1966	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14220	SEABROOK CREEK U/S BASS HIGHWAY	SEABROOK CREEK	Inglis	Tas					GDA94	55	04/05/1977	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14223	WELCOME RIVER AT WOOLNORTH	WELCOME RIVER	Welcome	Tas					GDA94	55	06/04/1981	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14237	CLAYTONS RVT U/S OLD BASS HWY	CLAYTONS RVT	Forth-Wilmot	Tas					GDA94	55	04/12/2007	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	14238	Edith Creek 800m U/S Duck River Confluence	Edith Creek	Duck	Tas					GDA94	55	18/06/08	current	yes	Low	Surface water assessment	River operations		open
DPIW	DPIW	14253	GAWLER RIVER AT CRADLE COAST WATER SUPPLY	Gawler River	Leven	Tas					GDA94	55	20/06/08	current	yes	Low	Surface water assessment	River operations		open
DPIW	DPIW	14261	CHASM CREEK U/S BASS HIGHWAY	CHASM CREEK		Tas					GDA94	55	20/08/2008	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	16200	DON RIVER UPSTREAM OLD BASS HIGHWAY	DON RIVER	Mersey	Tas					GDA94	55	21/07/1967	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	17200	RUBICON RIVER AT TIDAL LIMIT	RUBICON RIVER	Rubicon	Tas					GDA94	55	22/08/1967	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	17203	RUBICON RIVER AT ELIZABETH TOWN	RUBICON RIVER	Rubicon	Tas					GDA94	55	22/11/2000	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	17204	PANATANA RIVULET UPSTREAM OF TIDAL LIMIT	PANATANA RIVULET	Rubicon	Tas					GDA94	55	28/06/2007	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18206	TOOMS RIVER D/S TOOMS LAKE	TOOMS RIVER	Macquarie	Tas					GDA94	55	03/07/1973	current	Yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18209	LIFFEY RIVER UPSTREAM WEST CHANNEL	LIFFEY RIVER	Meander	Tas					GDA94	55	12/02/1975	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18211	ELIZABETH RIVER DOWNSTREAM LAKE LEAKE	ELIZABETH RIVER	Macquarie	Tas					GDA94	55	08/09/1976	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18217	MACQUARIE RIVER AT TREFUSIS	MACQUARIE RIVER	Macquarie	Tas					GDA94	55	11/07/1979	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18219	BACK CREEK @ WILMORES LANE	BACK CREEK	Brumbys-Lake	Tas					GDA94	55	17/02/2005	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18221	JACKEYS CREEK DOWNSTREAM JACKES MARSH	JACKEYS CREEK	Meander	Tas					GDA94	55	01/04/1982	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18309	MACQUARIE RIVER U/S LAKE RIVER JUNCTION	MACQUARIE RIVER	Macquarie	Tas					GDA94	55	26/06/2007	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18311	St. PAULS RIVER UPSTREAM SOUTH ESK	St. Pauls River	South Esk	Tas					GDA94	55	04/05/1988	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18312	MACQUARIE RIVER D/S ELIZABETH RIVER JUNCTION	MACQUARIE RIVER	Macquarie	Tas					GDA94	55	24/01/1980	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	18313	MACQUARIE RIVER 1.35 KM UPSTREAM ELIZABETH RIVE	MACQUARIE RIVER	Macquarie	Tas					GDA94	55	26/07/2004	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19200	BRID RIVER 2.6 km UPSTREAM TIDAL LIMIT	BRID RIVER	Great Forester-Brid	Tas					GDA94	55	26/06/1965	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19201	GREAT FORESTER RIVER 2 km UPSTREAM FORESTER R	GREAT Forester River	Great Forester-Brid	Tas					GDA94	55	19/02/1970	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19203	BRID U/S SLEDGE RD BRIDGE	BRID	Great Forester-Brid	Tas					GDA94	55	07/05/2008	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19204	PIPERS RIVER DOWNSTREAM YARROW	PIPERS RIVER	Pipers	Tas					GDA94	55	26/04/1972	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19206	LITTLE FORESTER D/S DENISON RIVER	LITTLE Forester River	Little Forester	Tas					GDA94	55	28/05/2008	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19224	GREAT FORESTER AT PROSPERITY RD	GREAT Forester River	Great Forester-Brid	Tas					GDA94	55	18/03/2003	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW	DPIW	19225	GREAT FORESTER RIVER @ FORESTER LODGE PUMP H	GREAT Forester River	Great Forester-Brid	Tas					GDA94	55	17/01/2004	current	yes	Low	Surface water assessment	River operations		OPEN
DPIW		2	BRUMBYS CREEK	BRUMBYS CREEK	Brumbys-Lake	Tas						55	01/03/1921	30/09/1930	No					OPEN
DPIW	BoM	9	ELIZABETH D/S LAKE LEAKE	ELIZABETH River	Macquarie	Tas						55			No					OPEN
DPIW		19	LAKE RIVER U/S CRESSY RD	LAKE RIVER	Brumbys-Lake	Tas						55			No					OPEN
DPIW		20	MACQUARIE RIVER AT ROSS	MACQUARIE RIVER	Macquarie	Tas						55	02/10/1990	19/11/1993	No					OPEN
DPIW		33	SOUTH ESK RIVER AT FINGAL	SOUTH Esk River	South Esk	Tas						55			No					OPEN
DPIW		61	HELLYER RIVER AT GUILDFORD JUNCTION	HELLYER RIVER	Arthur	Tas						55	25/01/1922	15/02/2001	no					CLOSED

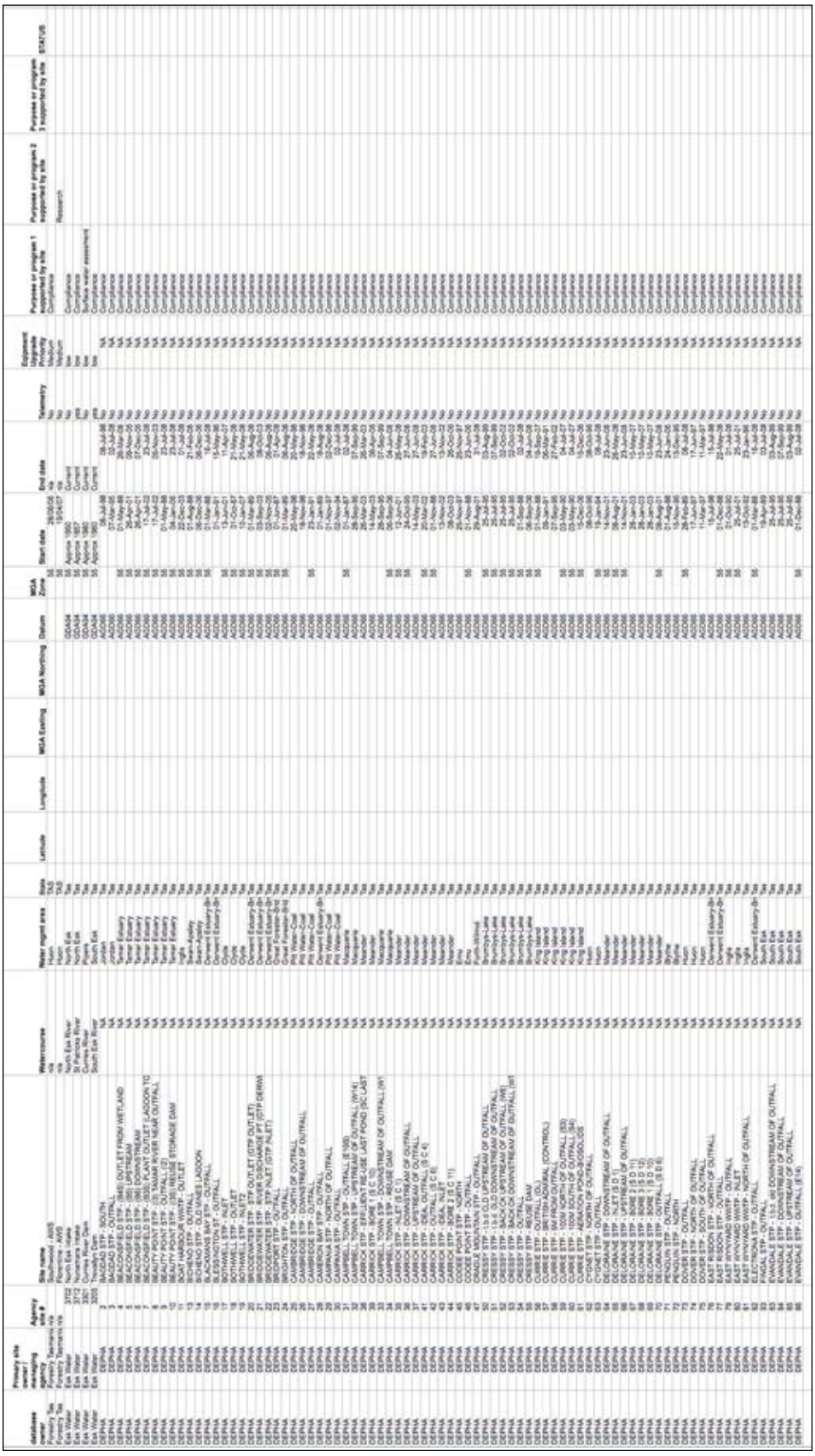
database owner	Primary site owner / managing agency	Agency site #	Site name	Watercourse	Water mgmt area	State	Latitude	Longitude	MGA Easting	MGA Northing	Datum	MGA Zone	Start date	End date	Telemetry	Equipment Upgrade Priority	Purpose or program 1 supported by site	Purpose or program 2 supported by site	Purpose or program 3 supported by site	STATUS
DPIW	Hydro Tas	107	SOUTH ESK RIVER AT AVOCA	SOUTH Esk River	South Esk	Tas						55	11/02/91	30/06/93	No		Surface water assessment	site closed	daily read for BoM	OPEN
DPIW		150	SOUTH ESK RIVER AT LLEWELLYN	SOUTH Esk River	South Esk	Tas						55	18/11/1952	17/07/2003	No					OPEN
DPIW		159	ARTHUR RIVER BELOW RAPID	ARTHUR RIVER	Arthur	Tas						55	25/05/1955	12/09/1996	no					CLOSED
DPIW		162	MEANDER RIVER AT DELORAINE	MEANDER RIVER	Meander	Tas						55	21/09/1954	25/07/2002	No					OPEN
DPIW		268	MACQUARIE RIVER AT Mt Morriston	MACQUARIE RIVER	Macquarie	Tas						55	23/04/1991	19/11/1993	No					OPEN
DPIW		334	AGNES RIVULET @ SCOUT HALL	AGNES RIVULET	Huon	Tas						55	08/02/1991	Future	no					CLOSED
DPIW		341	KERMANDIE RIVER AT GEEVESTON	KERMANDIE RIVER	Huon	Tas						55	16/01/1991	20/01/1994	no					CLOSED
DPIW		350	WHYTE RIVER ABOVE ROCKY CREEK	WHYTE RIVER	Pieman	Tas						55	05/05/1960	16/06/1992	no					CLOSED
DPIW		353	HOBART RIVULET AT GORE STREET	HOBART RIVULET	Derwent Estuary-Bru	Tas						55	13/09/1985	29/03/1997	no					CLOSED
DPIW		354	HOBART RIVULET AT ARGYLE STREET	HOBART RIVULET	Derwent Estuary-Bru	Tas						55	17/12/1984	04/01/1994	no					CLOSED
DPIW		412	NORTH WEST BAY RIVULET AT Mt WELLINGTON	NORTH WEST BAY RIVULET	Derwent Estuary-Bru	Tas						55	21/02/1962	11/12/1972	no					CLOSED
DPIW		465	CLYDE RIVER ABOVE HAMILTON	CLYDE RIVER	Clyde	Tas						55	16/07/1963	10/03/2006	no					CLOSED
DPIW		524	WILMOT RIVER ABOVE FORTH	WILMOT RIVER	Forth-Wilmot	Tas						55	13/07/1966	25/06/1997	no					CLOSED
DPIW		560	FORTH RIVER UPSTREAM FORTH PUMPS	FORTH RIVER	Forth-Wilmot	Tas						55			no					OPEN
DPIW		635	BUFFALO BROOK BELOW BLACK ROCK	BUFFALO BROOK	South Esk	Tas						55	30/12/1984	09/08/1990	no					CLOSED
DPIW		1012	PEAK RIVULET 3.5 km U/S ESPERANCE RIVER	PEAK RIVULET	Huon	Tas						55	17/04/1975	17/07/1997	no					CLOSED
DPIW		1200	SOUTH PATS RIVER AT WHITEMARK	SOUTH Pats River	Furneaux	Tas						55	09/06/1969	06/11/1990	no					CLOSED
DPIW		1203	LEVENTHORPE CREEK	LEVENTHORPE CREEK	Furneaux	Tas						55	10/05/1979	11/07/1994	no					CLOSED
DPIW		1204	SAMPHIRE RIVER UPSTREAM UNAVALE CREEK	SAMPHIRE RIVER	Furneaux	Tas						55	21/01/1980	07/08/1996	no					CLOSED
DPIW		1270	MACQUARIE RIVER AT STEWARTONS BRIDGE	MACQUARIE RIVER	Macquarie	Tas						55			No					OPEN
DPIW		2203	IRON CREEK UPSTREAM ARTHUR HIGHWAY	IRON CREEK	Pitt Water-Coal	Tas						55	24/05/1962	01/07/1992	no					CLOSED
DPIW		2207	LITTLE SWANPORT RIVER 3 km U/S Tasman Highway	LITTLE Swanport River	Little Swanport	Tas						55	11/06/1971	22/02/1990	No					CLOSED
DPIW		2210	GREAT MUSSELROE RIVER 6.5 km UPSTREAM OF MOUTH	GREAT Musselroe River	Musselroe-Ansons	Tas						55	24/09/1969	07/02/1989	no					CLOSED
DPIW		2211	ORIELTON RIVULET U/S BRINKTOP ROAD	ORIELTON RIVULET	Pitt Water-Coal	Tas						55	22/08/1972	12/12/1996	no					CLOSED
DPIW		2213	GOATROCK CREEK DOWNSTREAM McNEILLS ROAD	GOATROCK CREEK	Swan-Apsley	Tas						55	17/06/1975	23/09/1996	no					CLOSED
DPIW		3201	COAL RIVER AT CRAIGBOURNE ROAD	COAL RIVER	Pitt Water-Coal	Tas						55	26/07/1961	01/01/1981	no					CLOSED
DPIW		3202	COAL RIVER UPSTREAM WHITE KANGAROO RIVULET	COAL RIVER	Pitt Water-Coal	Tas						55	23/07/1963	20/08/1993	no					CLOSED
DPIW		3204	COAL RIVER AT CRAIGBOURNE	COAL RIVER	Pitt Water-Coal	Tas						55	21/01/1980	08/01/1986	no					CLOSED
DPIW		3341	NICHOLLS RIVULET U/S TIDAL	NICHOLLS RIVULET	Huon	Tas						55			no					CLOSED
DPIW		3345	BACK CREEK AT RAILWAY BRIDGE	BACK CREEK	Brumbys-Lake	Tas						55			No					OPEN
DPIW		3370	QUAMBY BROOK AT BIRRALEE ROAD	QUAMBY BROOK	Meander	Tas						55			No					OPEN
DPIW		3496	DUCKHOLE RIVULET @ COLEBROOK RD	DUCKHOLE RIVULET	Pitt Water-Coal	Tas						55	5/02/98	18/07/00	No					OPEN
DPIW		3497	PAGES CREEK @ COMMERCIAL RD	PAGES CREEK	Pitt Water-Coal	Tas						55	2/02/00	18/07/00	No					OPEN
DPIW		3498	INVERQUHARITY RIVULET @ PROSSERS RD	INVERQUHARITY RIVULET	Pitt Water-Coal	Tas						55	23/03/1999	05/12/2001	No					OPEN
DPIW		3499	COAL RIVER @ ELDON RD BRIDGE	COAL RIVER	Pitt Water-Coal	Tas						55	23/03/1999	05/12/2001	No					OPEN
DPIW		3501	CRAIGBOURNE CREEK @ LINK RD	CRAIGBOURNE CREEK	Pitt Water-Coal	Tas						55	24/02/1999	05/12/2001	No					OPEN
DPIW		3502	HUNTERS SWAMP CREEK @ RHYNDASTON RD	HUNTERS Swamp Creek	Pitt Water-Coal	Tas						55	24/03/1999	05/12/2001	No					OPEN
DPIW		3503	COAL RIVER @ WATTLE HILL RD	COAL RIVER	Pitt Water-Coal	Tas						55	23/03/1999	05/12/2001	No					OPEN
DPIW		3504	AARONS CREEK @ STONOR RD	AARONS CREEK	Pitt Water-Coal	Tas						55	23/03/1999	05/12/2001	No					OPEN
DPIW		3505	COAL RIVER @ RIVER RD	COAL RIVER	Pitt Water-Coal	Tas						55	24/03/1999	05/12/2001	No					OPEN
DPIW		3506	COAL RIVER @ NEW COUNTRY MARSH RD	COAL RIVER	Pitt Water-Coal	Tas						55	24/03/1999	05/12/2001	No					OPEN
DPIW		3507	DUCK RIVER @ BASS HIGHWAY	DUCK RIVER	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3508	GAELES CREEK @ BASS HIGHWAY	GAELES CREEK	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3509	GAELES CREEK @ TROWUTTA RD	GAELES CREEK	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3510	DUCK RIVER @ TROWUTTA RD U/S GAELES CREE	DUCK RIVER	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3511	DUCK RIVER @ LADES RD	DUCK RIVER	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3512	COPPER CREEK @ TROWUTTA RD	COPPER CREEK	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3513	ALLENS CREEK @ ALLANDALE FARM	ALLENS CREEK	Duck	Tas						55	23/03/1999	21/12/2001	No					OPEN
DPIW		3514	DRIVE CREEK @ TROWUTTA RD @ EDITH CREEK	DRIVE CREEK	Duck	Tas						55	24/03/1999	21/12/2001	No					OPEN
DPIW		3515	EDITH CREEK @ QUARRY 1 OFF SOUTH RD	EDITH CREEK	Duck	Tas						55	24/03/1999	21/12/2001	No					OPEN
DPIW		3516	EDITH CREEK @ MOORES RD	EDITH CREEK	Duck	Tas						55	24/03/1999	21/12/2001	No					OPEN
DPIW		3517	EDITH CREEK @ QUARRY 2 OFF SOUTH RD	EDITH CREEK	Duck	Tas						55	24/03/1999	21/12/2001	No					OPEN
DPIW		3518	ALLENS CK @ WILSONS RD	ALLENS CK	Duck	Tas						55	08/04/1999	21/12/2001	No					OPEN
DPIW		3519	WHITE WATER CREEK @ POLLINNA RD	WHITE WATER CREEK	Duck	Tas						55	24/03/1999	21/12/2001	No					OPEN
DPIW		3520	DUCK RIVER @ POLLINNA RD	DUCK RIVER	Duck	Tas						55	24/03/1999	21/12/2001	No					OPEN
DPIW		3521	ROGER RIVER @ ROGER RIVER RD	ROGER RIVER	Duck	Tas						55	25/03/1999	21/12/2001	No					OPEN
DPIW		3522	ROGER RIVER @ BUFFS RD	ROGER RIVER	Duck	Tas						55	25/03/1999	21/12/2001	No					OPEN
DPIW		3523	ROGER RIVER @ CROLES RD	ROGER RIVER	Duck	Tas						55	25/03/1999	21/12/2001	No					OPEN
DPIW		3524	FAHEYS CK @ MAGUIRES RD	FAHEYS CK	Duck	Tas						55	31/08/1999	21/12/2001	No					OPEN
DPIW		3525	DUCK RIVER @ MAGUIRES RD	DUCK RIVER	Duck	Tas						55	25/03/1999	21/12/2001	No					OPEN
DPIW		3526	LAIRDS CK @ MAGUIRES RD	LAIRDS CK	Duck	Tas						55	25/03/1999	21/12/2001	No					OPEN
DPIW		3527	DEEP CREEK U/S LAKE VIVIANY	DEEP CREEK	Duck	Tas						55	25/03/1999	21/12/2001	No					OPEN
DPIW		3528	BIG CREEK @ WYNYARD	BIG CREEK	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3529	BIG CREEK @ NURSERY RD	BIG CREEK	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3530	BLACKFISH CREEK @ END OF BLACKFISH RD	BLACKFISH CREEK	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3531	INGLIS RIVER @ PUMP STATION RD	INGLIS RIVER	Inglis	Tas						55	24/02/1999	17/12/2001	No					OPEN
DPIW		3532	BLACKFISH CREEK @ STENNINGS RD	BLACKFISH CREEK	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3533	INGLIS RIVER @ INGLEFORD RD	INGLIS RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3534	CALDER RIVER U/S INGLIS RV	CALDER RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3535	INGLIS RIVER U/S CALDER RIVER	INGLIS RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3536	INGLIS RIVER @ TAKONE RD	INGLIS RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3537	RATTLER RIVER @ TAKONE	RATTLER RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3538	CALDER RIVER @ TAKONE RD	CALDER RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3539	INGLIS RIVER 2K SOUTH OF TAKONE	INGLIS RIVER	Inglis	Tas						55	23/02/1999	17/12/2001	No					OPEN
DPIW		3540	BLACKFISH CREEK @ LOWRIES RD	BLACKFISH CREEK	Inglis	Tas						55	24/02/1999	17/12/2001	No					OPEN
DPIW		3541	FLOWERDALE RIVER @ PREOLENNA RD	FLOWERDALE RIVER	Inglis	Tas						55	24/02/1999	18/12/2001	No					OPEN
DPIW		3542	FLOWERDALE RIVER OFF TEN FOOT TRACK	FLOWERDALE RIVER	Inglis	Tas						55	26/05/1999	18/12/2001	No					OPEN
DPIW		3543	COOPERS CREEK @ 10 FOOT TRACK	COOPERS CREEK	Inglis	Tas						55	24/02/1999	18/12/2001	No					OPEN
DPIW		3544	HARDMANS CREEK @ PREOLENNA RD	HARDMANS CREEK	Inglis	Tas						55	24/02/1999	18/12/2001	No					OPEN
DPIW		3545	FLOWERDALE RV @ MEUNNA RD	FLOWERDALE RV	Inglis	Tas						55	24/02/1999	18/12/2001	No					OPEN
DPIW		3546	HEBE RIVER @ MYALLA RD	HEBE RIVER	Inglis	Tas						55	24/02/1999	18/12/2001	No					OPEN
DPIW		3547	CAMP CREEK @ TERRA NOVA	CAMP CREEK	Inglis	Tas						55	24/03/1999	23/10/2002	No					OPEN
DPIW		3548	CAMP CREEK ON DEEP CK RD @VNOTCH WEIR	CAMP CREEK	Inglis	Tas						55	24/03/1999	23/10/2002	No					OPEN
DPIW		3549	STRATHALLAN RIVULET @ TEA TREE	STRATHALLAN RIVULET	Jordan	Tas						55	24/02/1999	04/12/2001	No					OPEN
DPIW		3550	TEA TREE RIVULET @ BACK TEA TREE RD	TEA TREE RIVULET	Jordan	Tas						55	26/05/1999	04/12/2001	No					OPEN
DPIW		3551	STRATHALLAN RIVULET U/S FORD @ PONTVILLE	STRATHALLAN RIVULET	Jordan	Tas						55	24/02/1999	04/12/2001	No					OPEN
DPIW		3552	JORDAN RIVER @ PONTVILLE	JORDAN RIVER	Jordan	Tas						55	24/02/1999	04/12/2001	No					OPEN

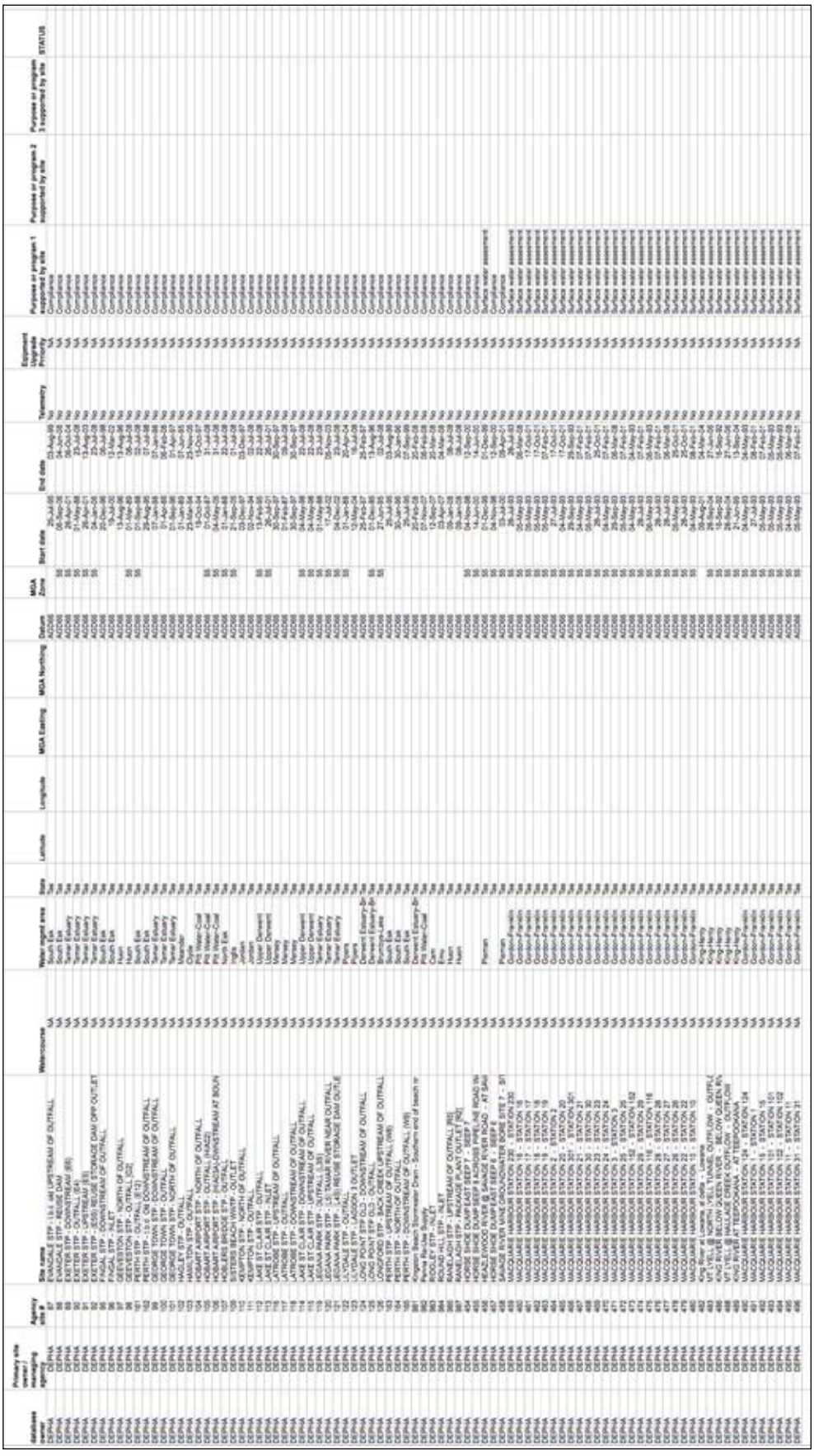


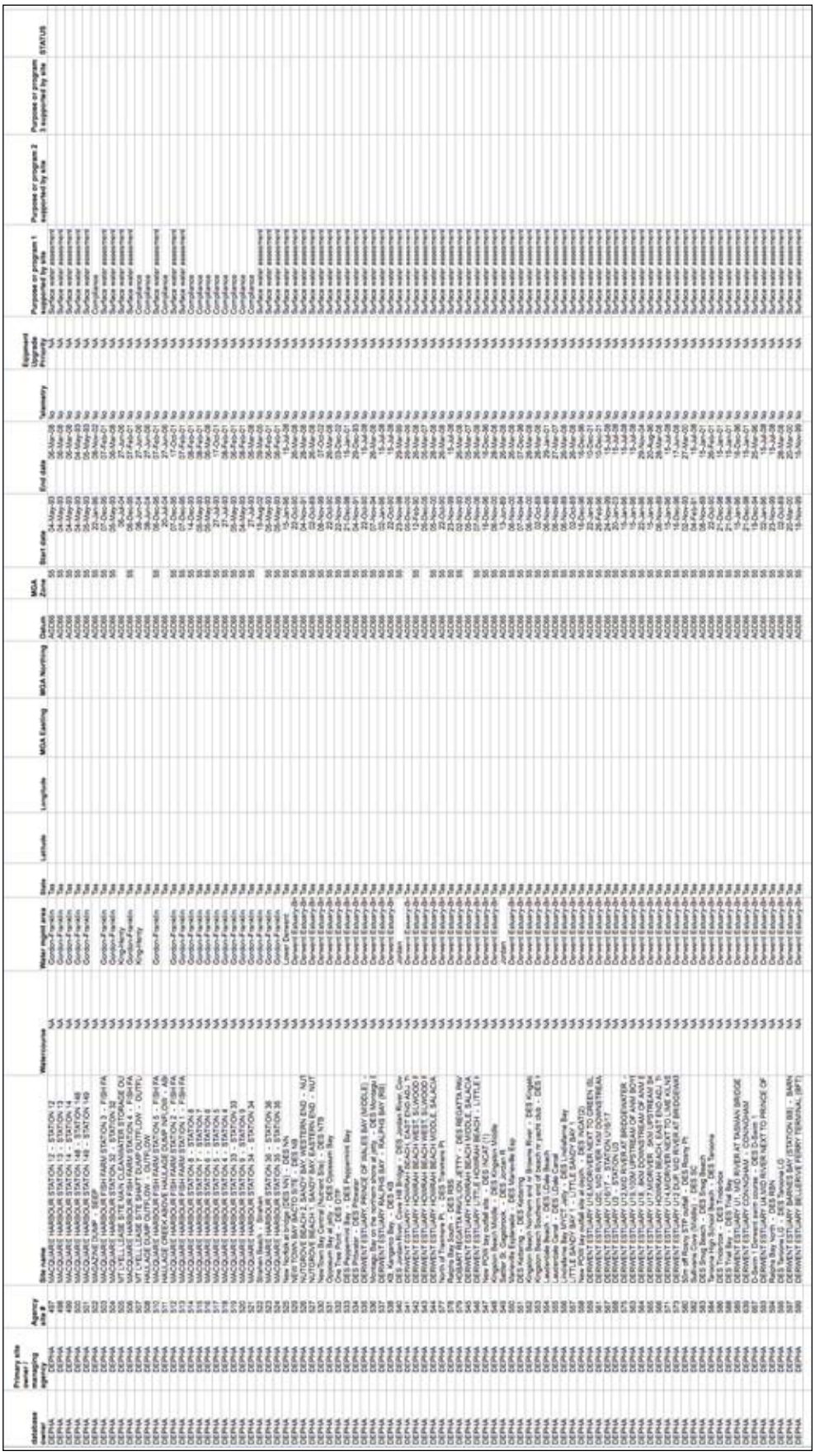


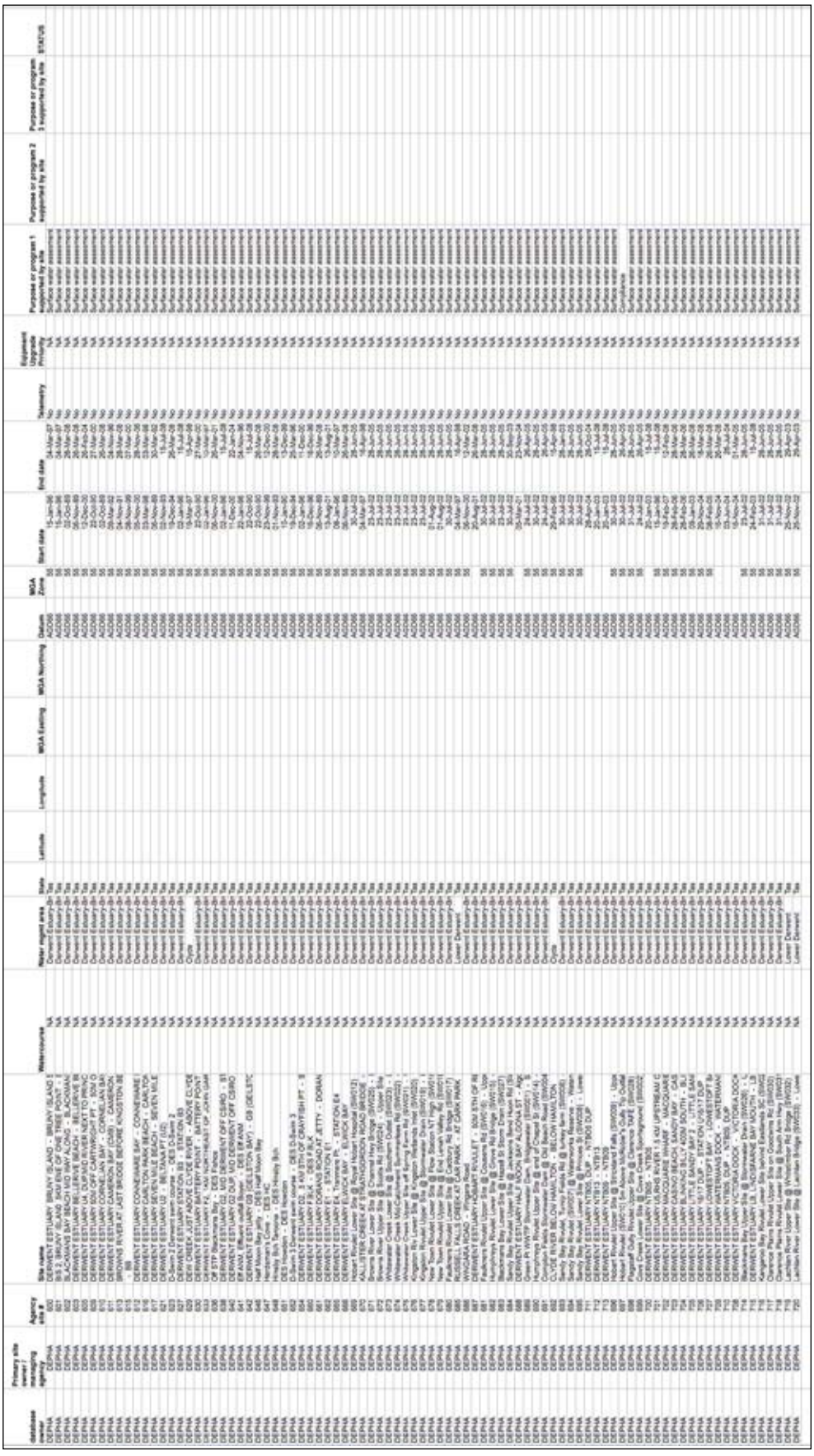
database owner	Primary site owner / managing agency	Agency site #	Site name	Watercourse	Water mgmt area	State	Latitude	Longitude	MGA Easting	MGA Northing	Datum	MGA Zone	Start date	End date	Telemetry	Equipment Upgrade Priority	Purpose or program 1 supported by site	Purpose or program 2 supported by site	Purpose or program 3 supported by site	STATUS
DPIW		19208	PIPERS RIVER UPSTREAM COLGRAVE	PIPERS RIVER	Pipers	Tas						55	17/12/1980	12/09/1990	no					CLOSED
DPIW		19209	BOOBYALLA RIVER UPSTREAM CAMPBELL CREEK	BOOBYALLA RIVER	Boobyalla-Tomahawk	Tas						55	10/02/1981	17/01/1989	no					CLOSED
DPIW		19210	CASCADE RIVER UPSTREAM CASCADE RESERVOIR	CASCADE RIVER	Ringarooma	Tas						55	05/01/1984	24/09/1996	no					CLOSED
DPIW		19211	CASCADE RIVER UPSTREAM Mt PARI	CASCADE RIVER	Ringarooma	Tas						55	18/07/1985	24/08/1994	no					CLOSED
DPIW		19212	TIN POT CREEK U/S DERBY JEEP TRACK	TIN Pot Creek	Ringarooma	Tas						55	19/07/1985	10/05/1990	no					CLOSED
DPIW		19213	CASCADE RIVER DOWNSTREAM CASCADE RESERVOIR	CASCADE RIVER	Ringarooma	Tas						55	01/08/1985	13/07/1990	no					CLOSED
DPIW		19218	MAURICE RIVER D/S OF SOUTH MAURICE RIVER	MAURICE RIVER	Ringarooma	Tas						55	31/12/1987	25/06/1992	no					CLOSED
DPIW		19223	FEDERAL CREEK	FEDERAL CREEK	Ringarooma	Tas						55	09/05/1990	25/06/1992	no					CLOSED
NRM North	NRM North	BOO070	Boobyalla River at Waterhouse Road	Boobyalla River	Boobyalla-Tomahaw	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	TOM070	Tomahawk River at Waterhouse Road	Tomahawk River	Boobyalla-Tomahaw	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	BRI070	Brid River at Bridport Road	Brid River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	BRI080	Brid River at Dunnaggan Road	Brid River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	BRI020	Brid River at Tasman Highway	Brid River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	LAK050	Lake River at Macquarie Road	Lake River	Brumbys-Lake	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MAC085	Macquarie River at Woolmers Lane	Macquarie River	Brumbys-Lake	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SSK065	South Esk River at Hadspen River Reserve	South Esk River	Brumbys-Lake	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SSK062	South Esk River at Pateena Road	South Esk River	Brumbys-Lake	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	GEO080	George River at Reids Road Bridge	George River	George	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	GRM030	Groom River at Anchor Road, Pyengana	Groom River	George	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	NOR020	North George River at Binns Road Bridge	N George River	George	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	NOR080	North George River at Roadhouse Bridge	N George River	George	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	POW050	Powers Rivulet at Terrivale Road Bridge	Powers Rivulet	George	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	RAN050	Ransom River at Mumbos Road	Ransom River	George	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SGR030	South George River at Dobsons Road Bridge	South George River	George	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SGR100	South George River at Pyengana	South George River	George	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	LFR070	Little Forester at Bridport Road	Little Forester River	Little Forester	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	LFR020	Little Forester River at Golconda Road	Little Forester River	Little Forester	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	ISI050	Isis River at Isis	Isis River	Macquarie	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	ELI010	Elizabeth River below Lake Leake	Elizabeth River	Macquarie	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	LIF070	Liffey River at Bracknell Lane	Liffey River	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MEA045	Meander River at Knights Bridge	Meander River	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MEA070	Meander River at Meander	Meander River	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MEA055	Meander River at Porters Bridge (Exton)	Meander River	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	QUA065	Quamby Brook at Rosford	Quamby Brook	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SWA050	Swamp Gum Rivulet at Osmaston Road	Swamp Gum Rivulet	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	WES065	Western Creek at Montana Road	Western Creek	Meander	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	COL065	Coilers Creek upstream of Mersey River near Kimberley	Coilers Creek	Mersey	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	LOB050	Lobster Rivulet at Mole Creek Road	Lobster Rivulet	Mersey	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MER030	Mersey River at Kellys Bridge	Mersey River	Mersey	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MER025	Mersey River at Union Bridge	Mersey River	Mersey	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MOL075	Mole Creek at Den Road	Mole Creek	Mersey	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	GMU070	Great Musselroe River at Browns Bridge Road	Great Musselroe River	Musselroe-Ansons	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	FOR070	Ford River at Upper Blessington	Ford River	North Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	JIN085	Jinglers Creek at Footbridge off Glenwood Road (St Leonards	Jinglers Creek	North Esk	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	JIN090	Jinglers Creek at Substation off Glenwood Road (St Leonards	Jinglers Creek	North Esk	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	KMR005	Kings Meadows Rivulet at Kate Reed Reserve	Kings Meadows Rivulet	North Esk	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	KMR070	Kings Meadows Rivulet at Punch Bowl Reserve	Kings Meadows Rivulet	North Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MSS010	Musselboro Creek at Burns Creek Road	Musselboro River	North Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	NSK010	North Esk River upstream Clarks Ford Bridge	North Esk River	North Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	PTR010	Patersonia Rivulet at Scotts Road	Patersonia Rivulet	North Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SPR040	St Patricks River at Corkery Road	St Patricks River	North Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	PPR030	Pipers River at Underwood	Pipers River	Pipers	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	RCK010	Rocky Creek at Lilydale Road	Rocky Creek	Pipers	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SEC070	Second River at Second River Road	Second River	Pipers	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	PPR020	Pipers River at Colgraves Road	Pipers River	Pipers	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	RIN080	Ringarooma River at Bells Bridge, Cape Portland Road	Ringarooma River	Ringarooma	Tas					GDA94	55	Jan-07	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	RUB020	Rubicon River 1.5 km upstream DPIW gauging station	Rubicon River	Rubicon	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	RUB030	Rubicon River at Avenue Road	Rubicon River	Rubicon	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SCA050	Scamander River at Upper Scamander	Scamander River	Scamander-Dougla	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	BEN050	Ben Lomond Rivulet at Nile Road	Ben Lomond Rivulet	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	BUF050	Buffalo Brook at Bonneys Plains Road	Buffalo Brook	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	NIL010	Nile River at Fishers Tier	Nile River	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	NIL050	Nile River at Nile	Nile River	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SSK045	South Esk River at Bonneys Plains Road	South Esk River	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	STM050	St Marys Rivulet at Cameron Street	St Marys Rivulet	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	STO050	Storys Creek below Aberfoyle Creek	Storys Creek	South Esk	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	MID070	Middle Arm Creek at West Tamar Highway	Middle Arm Creek	Tamar Estuary	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	NRM North	SPC075	Supply River above falls near mill	Supply River	Tamar Estuary	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	LWL010	Little Waterhouse Lake	Little Waterhouse Lake	Boobyalla-Tomahaw	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	BWL010	Big Waterhouse Lake	Big Waterhouse Lake	Boobyalla-Tomahaw	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	BLL010	Blackmans Lagoon	Blackmans Lagoon	Boobyalla-Tomahaw	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO013	Great Forester River at Scottsdale water supply intake	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO021	Great Forester River at Harris Road Bridge	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO022	Un-named Tributary of Great Forester River at 'Marrdale'	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO023	Un-named Tributary of Great Forester River at Beatties Road	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO024	Un-named Tributary of Great Forester River at Prosperity Roa	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO030	Great Forester River at 10 mile track near Beatties Road	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO032	Mackenzies Rivulet at Amelias Picnic Spot	Mackenzies Rivulet	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GFO036	Great Forester River at 10 mile track near Chinchellas Road	Great Forester River	Great Forester-Brid	Tas					GDA94	55	Jan-05	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	GRM050	Groom River at Ransleys River Flat	Groom River	George	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	BRT055	Brushy Rivulet at Mahoneys Hill	Brushy Rivulet	Meander	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	MEA040	Meander River at Edgmont Reserve	Meander River	Meander	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	MEA060	Meander River at Reedy Marsh	Meander River	Meander	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	QUA075	Quamby Brook at Westbury Village Green	Quamby Brook	Meander	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	DIS070	Distillery Creek at Waverley Lake	Distillery Creek	North Esk	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	SKE010	Bobs Wetland at Skemps	Skemps creek	North Esk	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			
NRM North	N Waterwatch	SKE020	Bottom Falls at Skemps Creek	Skemps Creek	North Esk	Tas					GDA94	55	Jan-06	Ongoing	No		NRM North State of Region Reporting			

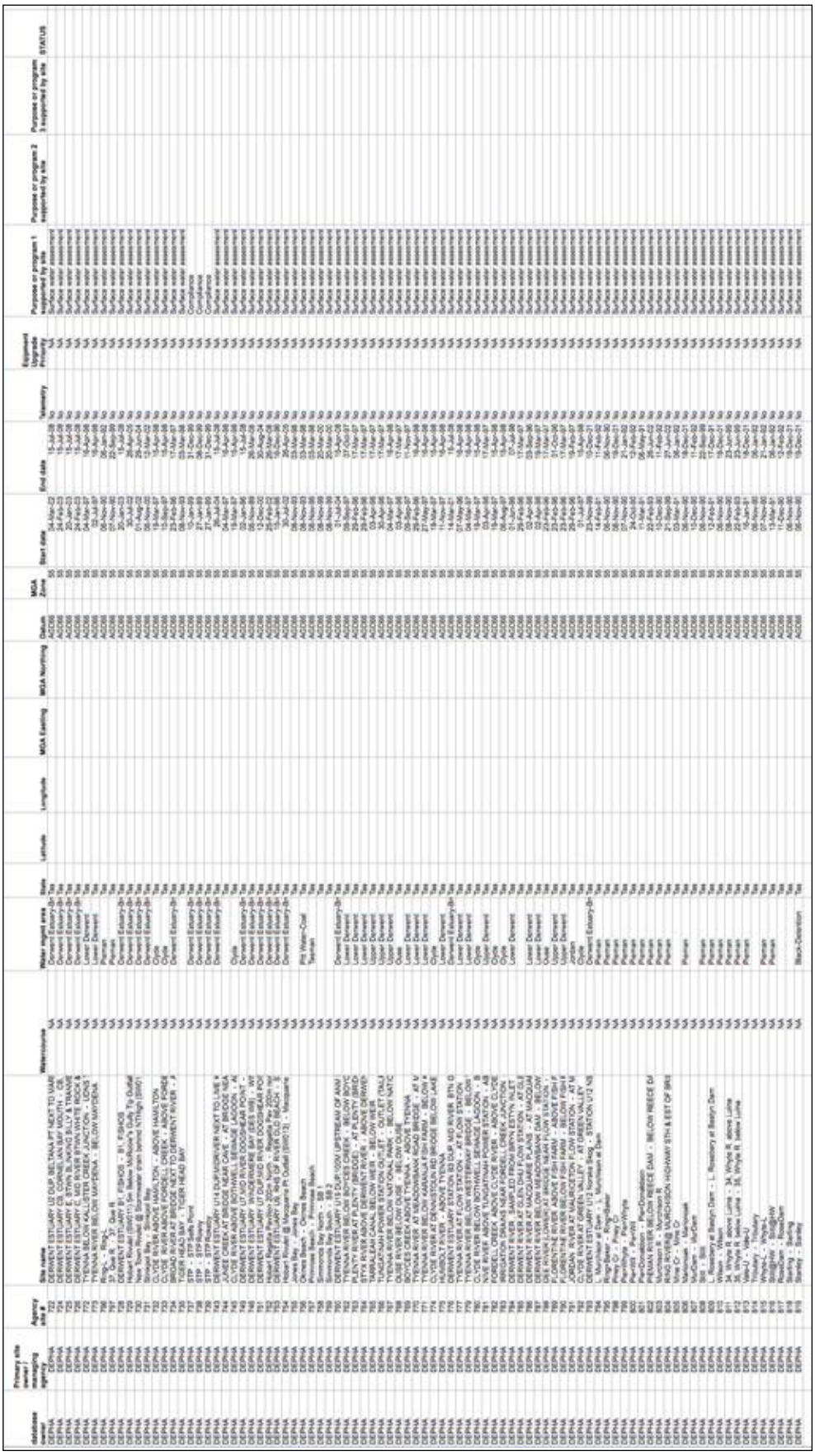


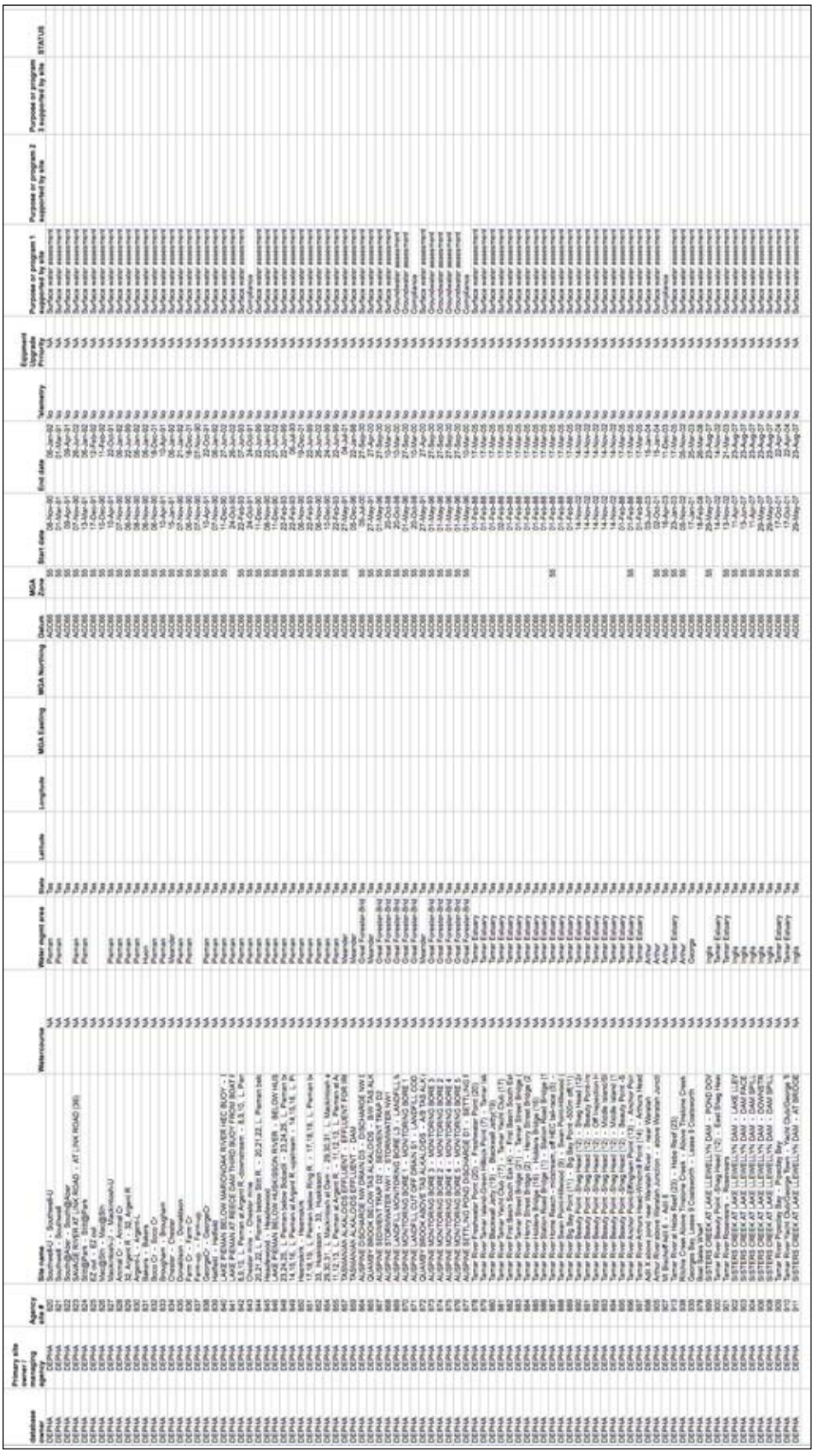


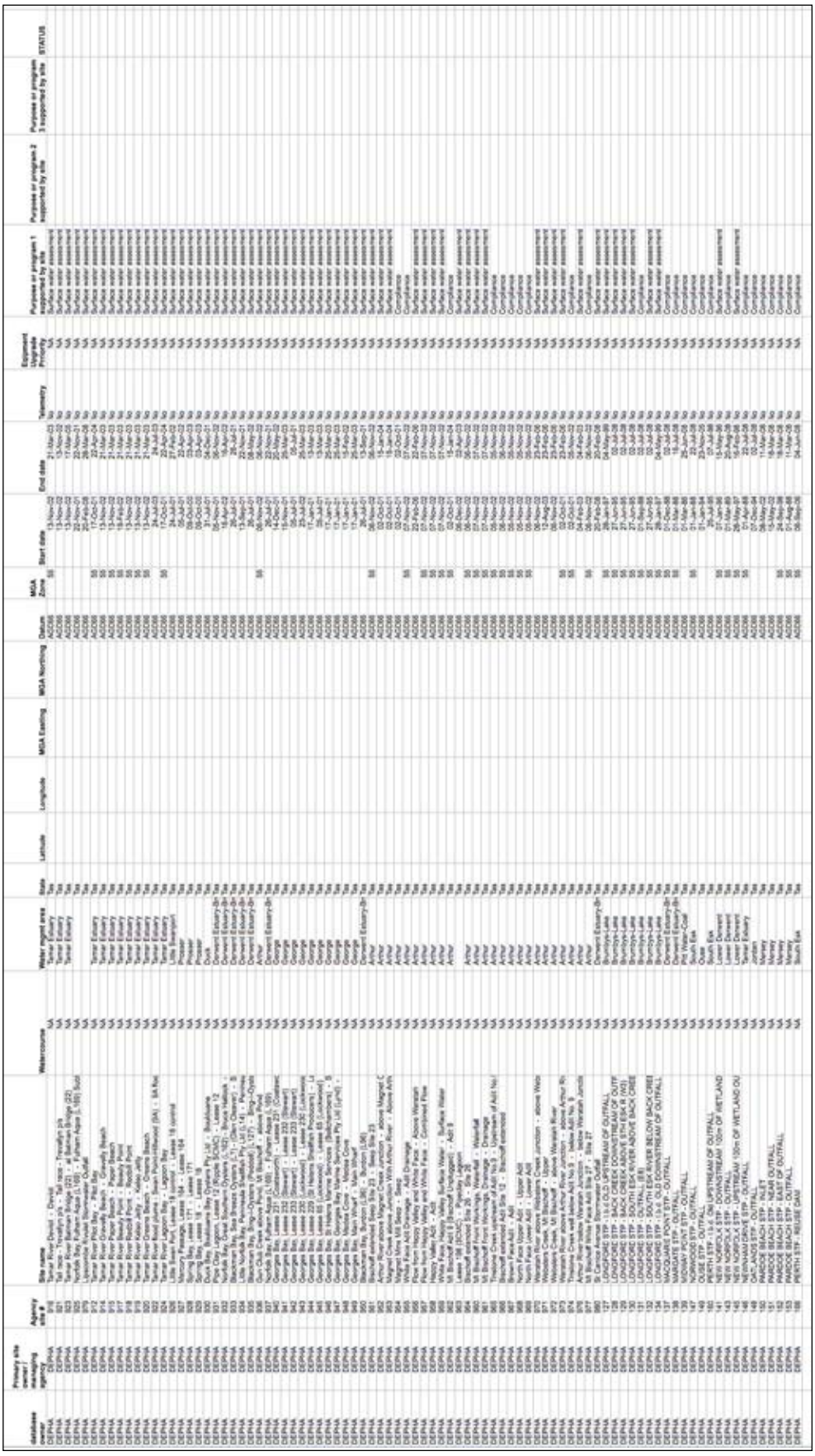




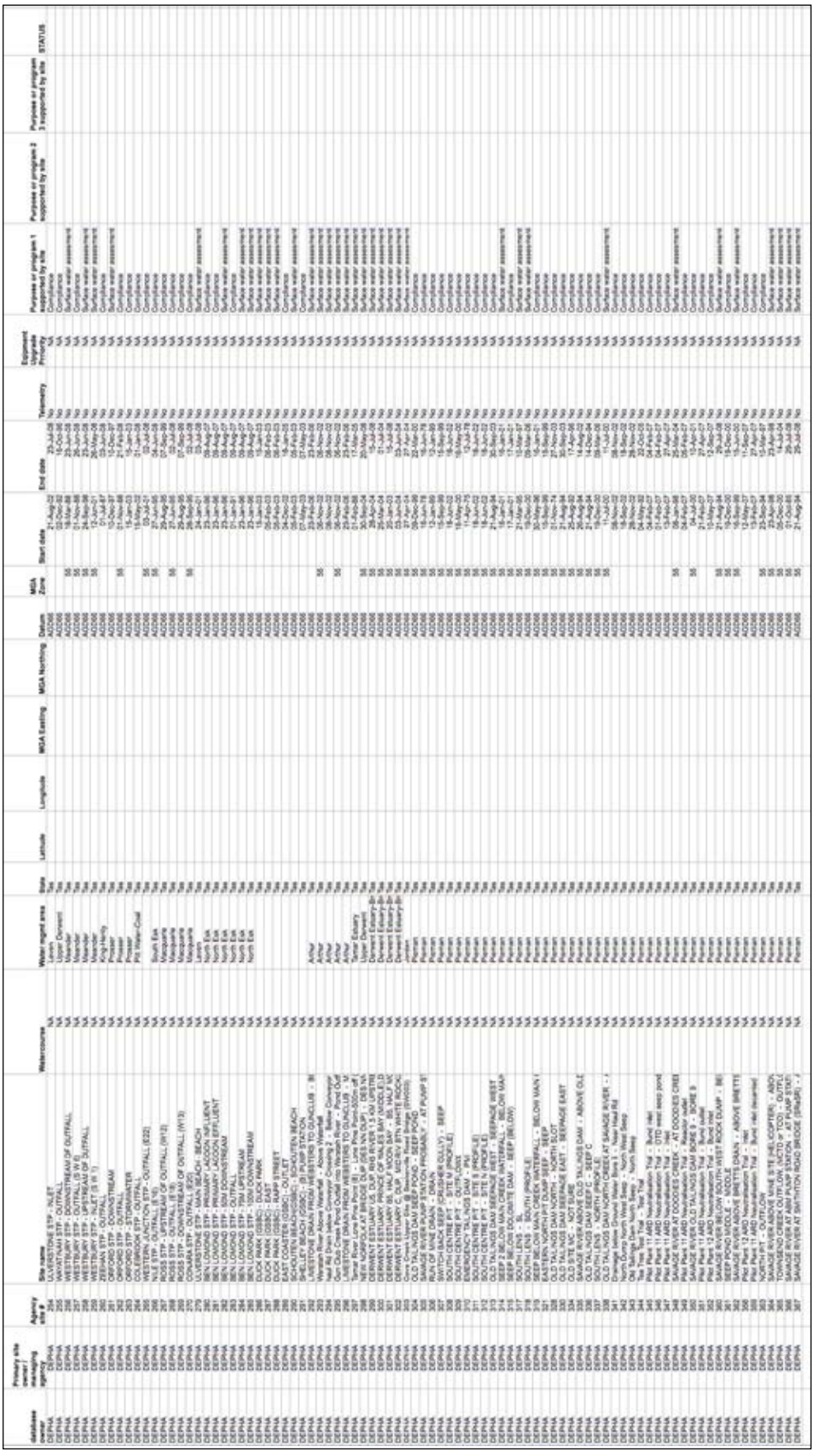


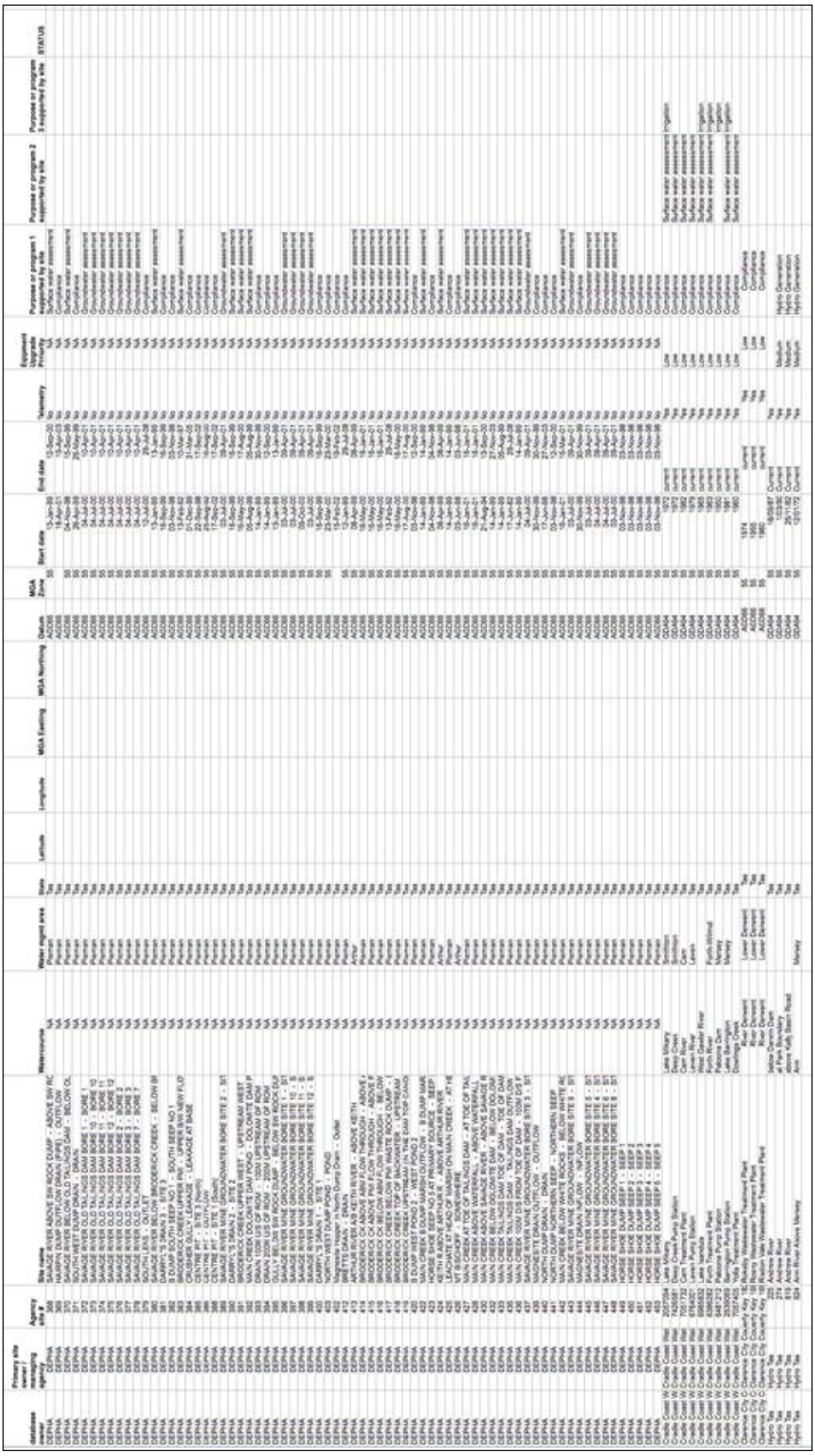


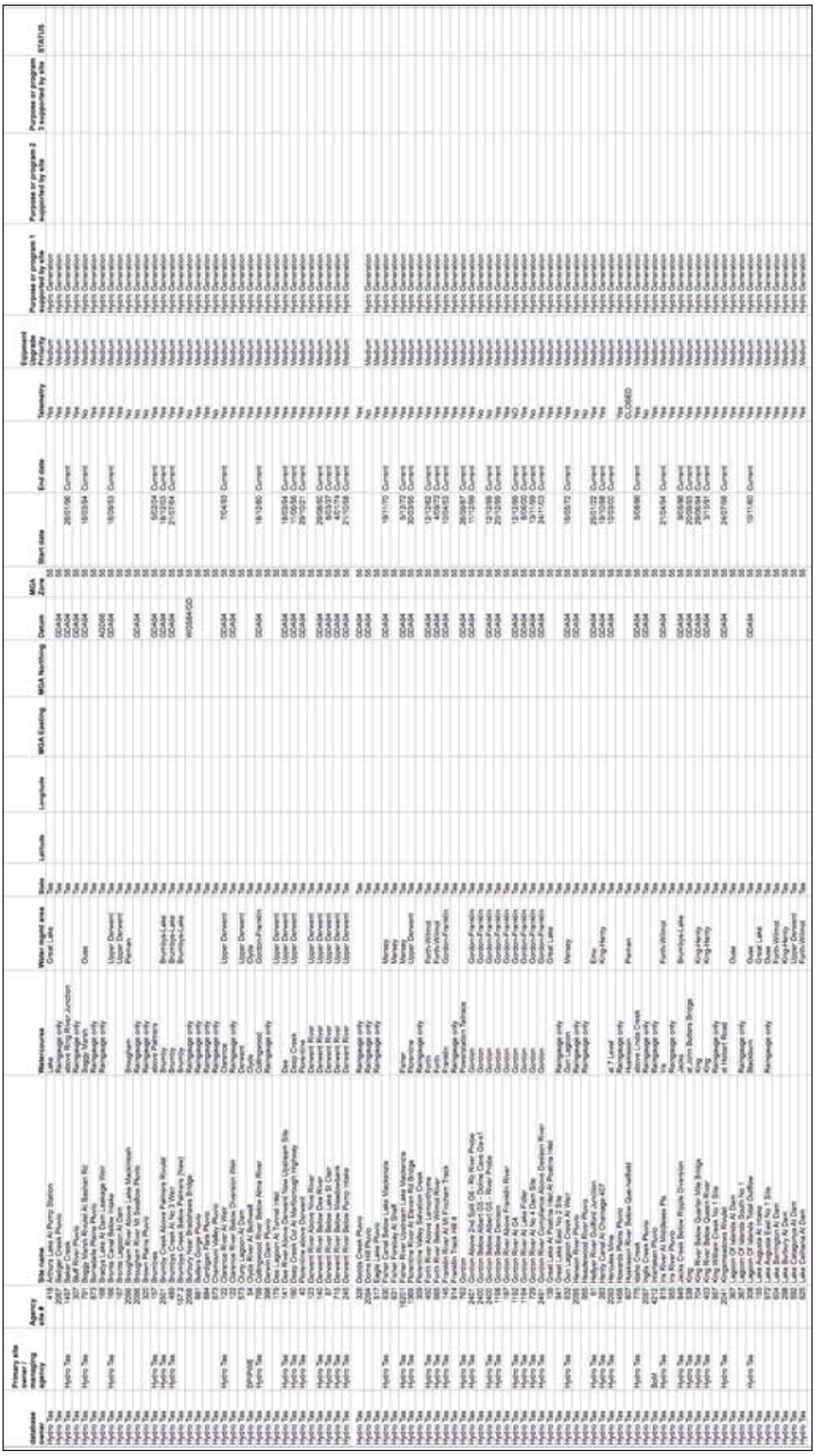


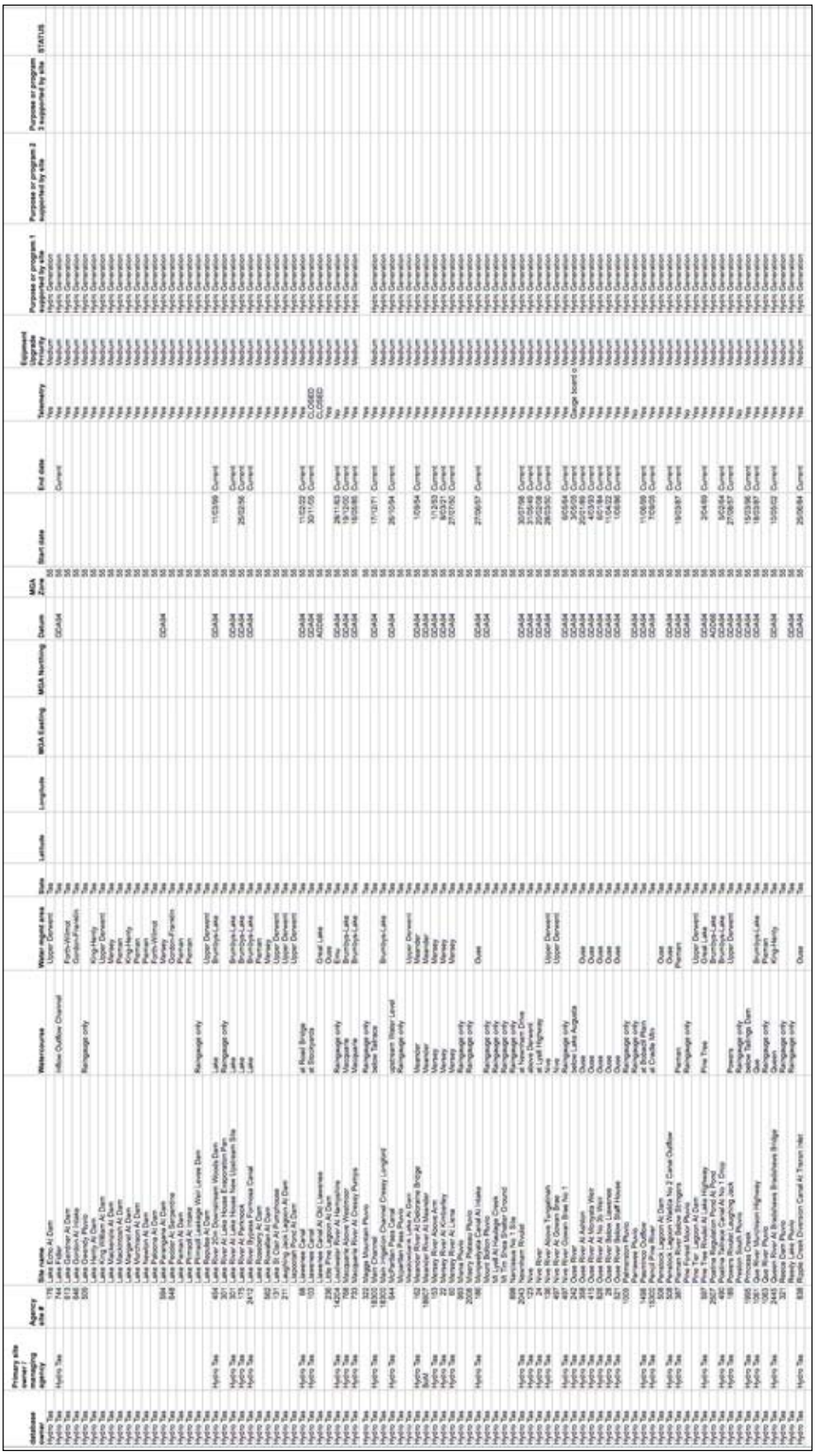


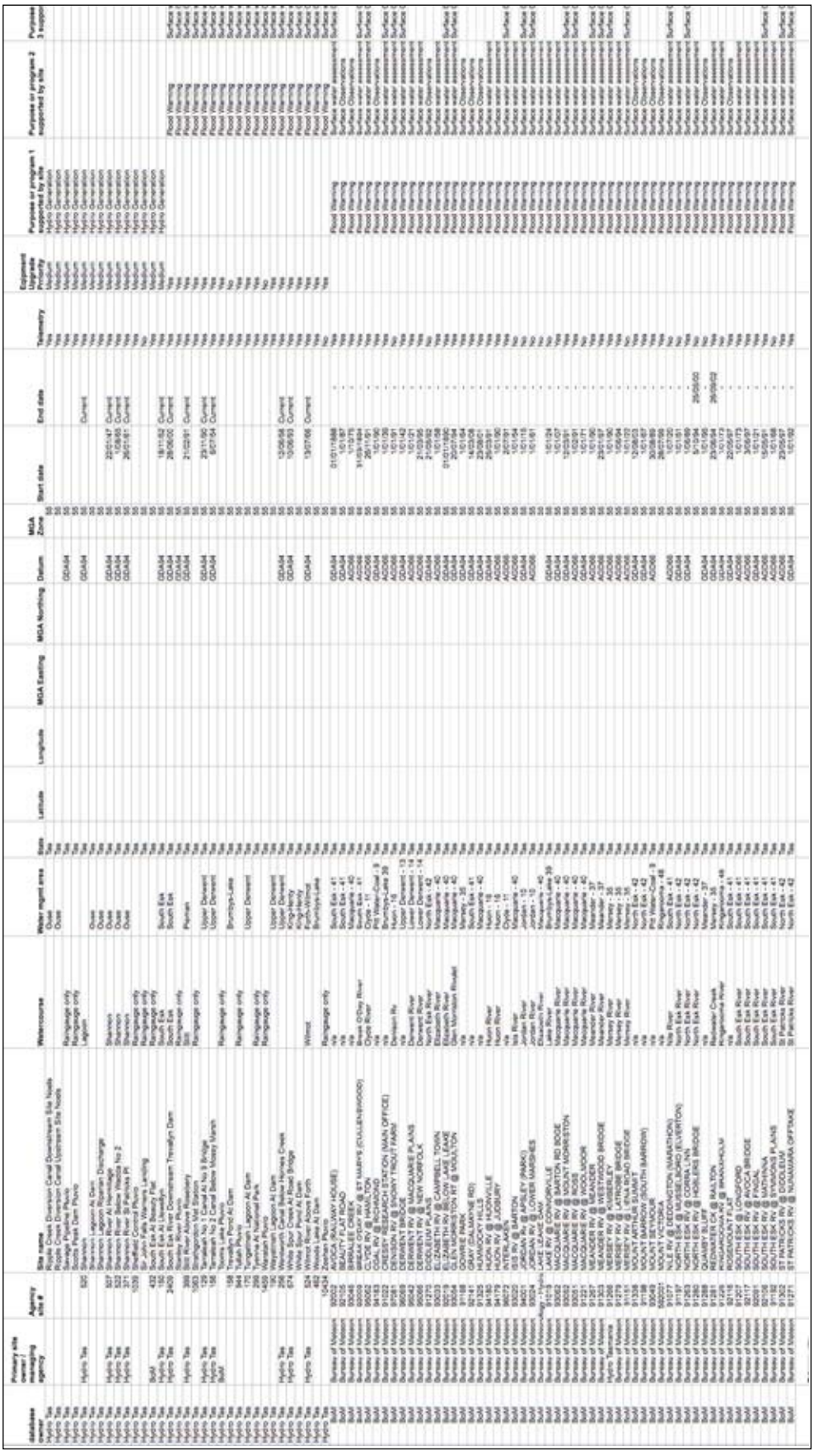
database owner	Primary site owner / operating agency	Agency site #	Site name	Watercourse	Water regard area	State	Latitude	Longitude	MGA Easting	MGA Northing	Datum	MGA Zone	Start date	End date	Telemetry	Equipped Gauging Station	Purpose or program 1 supported by site	Purpose or program 2 supported by site	Purpose or program 3 supported by site	STATUS
DEPHA	DEPHA	167	POINT ARTHUR STP - OUTFALL		Tamar	TA					AGD66	55	31-Jan-95	30-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	168	PORT SORELL STP - EAST OF OUTFALL		Rubicon	TA					AGD66		01-Jun-97	28-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	169	PORT SORELL STP - NORTH OF OUTFALL		Rubicon	TA					AGD66		01-Feb-97	28-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	170	PORT SORELL STP - WEST OF OUTFALL		Rubicon	TA					AGD66		01-Jan-96	28-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	171	PRINCE OF WALES STP - OUTFALL		Derwent Estuary-Bi	TA					AGD66		01-Jan-96	18-Aug-06	TA	TA	Compliance			
DEPHA	DEPHA	172	PROSPECT VALE STP - INLET (SPV 1)		South Esk	TA					AGD66		13-Jun-01	13-May-07	TA	TA	Compliance			
DEPHA	DEPHA	173	PROSPECT VALE STP - BORE 1 (SPV 10)		South Esk	TA					AGD66	55	14-May-03	24-Oct-07	TA	TA	Compliance			
DEPHA	DEPHA	174	PROSPECT VALE STP - BORE 2 (SPV 11)		South Esk	TA					AGD66		14-May-03	29-Jun-08	TA	TA	Compliance			
DEPHA	DEPHA	175	PROSPECT VALE STP - OUTFALL (SPV 9)		South Esk	TA					AGD66		19-Feb-02	21-Feb-08	TA	TA	Compliance			
DEPHA	DEPHA	176	PROSPECT VALE STP - DIAMOND POINT		South Esk	TA					AGD66		19-Jun-02	31-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	177	PROSPECT VALE STP - WETLANDS (SPV 13)		South Esk	TA					AGD66		19-Jun-02	30-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	178	WOODBRIDGE STP - OUTFALL		Derwent Estuary-Bi	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	179	PONC PONT, LLVERSTONE (aka WEST PONC PONT)		Leven	TA					AGD66		24-Jan-01	23-Jul-08	TA	TA	Surface water assessment			
DEPHA	DEPHA	180	WEST BEACH, LLVERSTONE (aka EAST PONC PONT)		South Esk	TA					AGD66		24-Jan-01	23-Jul-08	TA	TA	Surface water assessment			
DEPHA	DEPHA	181	PROSPECT VALE STP - DISCHARGE POINT OF		South Esk	TA					AGD66		19-Feb-03	19-Feb-03	TA	TA	Surface water assessment			
DEPHA	DEPHA	182	PROSPECT VALE STP - IDEAL OUTFALL (SPV 4)		South Esk	TA					AGD66		19-Jun-03	19-Jun-03	TA	TA	Compliance			
DEPHA	DEPHA	183	PROSPECT VALE STP - POLISHING LAGOON 1 (SPV 3)		King-Henty	TA					AGD66		19-Jun-03	19-Jun-03	TA	TA	Compliance			
DEPHA	DEPHA	184	RALTON STP - INLET - OUTFALL		Mersey	TA					AGD66		31-Jan-96	29-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	185	RALTON STP - DOWNSTREAM (REDWATER CREEK)		Mersey	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	186	RALTON STP - OUTFALL		Mersey	TA					AGD66		01-Feb-97	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	187	RALTON STP - UPSTREAM (REDWATER CREEK)		Mersey	TA					AGD66		01-Feb-97	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	188	RICHMOND STP - OUTFALL		Pit Water-Coal	TA					AGD66		14-Jul-00	23-May-08	TA	TA	Compliance			
DEPHA	DEPHA	189	RIDGLEY STP - OUTFALL		Cam	TA					AGD66		23-Jul-08	24-Mar-08	TA	TA	Compliance			
DEPHA	DEPHA	190	RIVERSIDE STP - OUTFALL (R1)		Tamar Estuary	TA					AGD66		23-Jul-08	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	191	ROSEBERY STP - INLET		Derwent Estuary-Bi	TA					AGD66		01-Dec-98	28-Mar-08	TA	TA	Compliance			
DEPHA	DEPHA	192	ROSNY STP - DOWNSTREAM OF OUTFALL		Derwent Estuary-Bi	TA					AGD66		14-Nov-96	14-Nov-96	TA	TA	Surface water assessment			
DEPHA	DEPHA	193	ROSNY STP - OUTFALL		Derwent Estuary-Bi	TA					AGD66		31-Dec-98	23-May-08	TA	TA	Compliance			
DEPHA	DEPHA	194	ROSNY STP - INLET		Derwent Estuary-Bi	TA					AGD66		25-Jul-08	25-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	195	ROSNY STP - NORTH		Derwent Estuary-Bi	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	196	ROUND HILL STP - NORTH		Emu	TA					AGD66		01-Mar-01	11-Mar-08	TA	TA	Compliance			
DEPHA	DEPHA	197	ROUND HILL STP - INLET		Great Forester-3rd	TA					AGD66	55	19-Feb-01	19-Feb-08	TA	TA	Compliance			
DEPHA	DEPHA	198	ROUND HILL STP - OUTFALL		Emu	TA					AGD66		01-Mar-01	21-Feb-08	TA	TA	Compliance			
DEPHA	DEPHA	199	SCAMANDER STP - OUTFALL		Scamander-Douglas	TA					AGD66		15-Nov-00	04-Mar-08	TA	TA	Compliance			
DEPHA	DEPHA	200	SCOTTSDALE STP - OUTFALL		Scottsdale-Ringarooma	TA					AGD66		15-Nov-00	15-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	201	SELFS POINT STP - OUTLET		Derwent Estuary-Bi	TA					AGD66		01-Dec-97	03-Aug-06	TA	TA	Compliance			
DEPHA	DEPHA	202	SELFS POINT STP - NORTH		Derwent Estuary-Bi	TA					AGD66		01-Dec-97	13-Dec-07	TA	TA	Compliance			
DEPHA	DEPHA	203	SELFS POINT STP - AFTER CHLORINATION		Derwent Estuary-Bi	TA					AGD66		01-Dec-97	26-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	204	SELFS POINT STP - DOWNSTREAM (DODDER RIVER)		Derwent Estuary-Bi	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	205	SHEFFIELD STP - DOWNSTREAM (DODDER RIVER)		Mersey	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	206	SHEFFIELD STP - UPSTREAM (DODDER RIVER)		Mersey	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	207	SHEFFIELD STP - OUTFALL		Mersey	TA					AGD66		01-Feb-97	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	208	SHEFFIELD STP - INLET		Mersey	TA					AGD66		01-Feb-97	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	209	STRAHAN STP - OUTFALL		King-Henty	TA					AGD66		21-Aug-02	21-Aug-02	TA	TA	Compliance			
DEPHA	DEPHA	210	SMITHTON STP - APX OUTLET		Duck	TA					AGD66		01-Aug-02	18-Jun-08	TA	TA	Compliance			
DEPHA	DEPHA	211	SMITHTON STP - OUTFALL		Duck	TA					AGD66		14-Mar-94	04-Jun-08	TA	TA	Compliance			
DEPHA	DEPHA	212	SMITHTON STP - OUTFALL		Duck	TA					AGD66		03-May-01	03-May-01	TA	TA	Compliance			
DEPHA	DEPHA	213	SMITHTON STP - INLET		Duck	TA					AGD66		01-Nov-97	21-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	214	SOMERSET WWTP - OUTFALL		Cam	TA					AGD66	55	01-Mar-96	21-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	215	SPRENT STP - OUTFALL		Pit Water-Coal	TA					AGD66		01-Feb-96	01-Feb-96	TA	TA	Compliance			
DEPHA	DEPHA	216	ST HELENS STP - INLET		George	TA					AGD66		20-Jun-01	23-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	217	ST HELENS STP - MAIN PUMP STATION		George	TA					AGD66		01-Feb-96	18-Jan-22	TA	TA	Compliance			
DEPHA	DEPHA	218	ST HELENS STP - NORTH OF OUTFALL		George	TA					AGD66		13-Nov-96	13-Mar-08	TA	TA	Compliance			
DEPHA	DEPHA	219	ST MARYS STP - INLET		South Esk	TA					AGD66		01-Jul-96	01-Jul-96	TA	TA	Compliance			
DEPHA	DEPHA	220	ST MARYS STP - OUTFALL		South Esk	TA					AGD66		19-May-06	19-May-06	TA	TA	Compliance			
DEPHA	DEPHA	221	ST MARYS STP - REIDS SCHEME OUTFALL		Back Dovedon	TA					AGD66	55	14-Dec-00	14-Dec-00	TA	TA	Compliance			
DEPHA	DEPHA	222	STANLEY STP - OUTFALL		Back Dovedon	TA					AGD66		01-Dec-00	16-Jun-08	TA	TA	Compliance			
DEPHA	DEPHA	223	STANLEY STP - NORTH		Back Dovedon	TA					AGD66		29-May-01	29-May-01	TA	TA	Compliance			
DEPHA	DEPHA	224	STEDULTZ STP - OUTFALL		George	TA					AGD66		26-Jul-96	26-Jul-96	TA	TA	Compliance			
DEPHA	DEPHA	225	STEDULTZ STP - INLET		George	TA					AGD66		26-Jul-96	26-Jul-96	TA	TA	Compliance			
DEPHA	DEPHA	226	SWANSEA STP - SALTWATER CREEK		Swan-Apsley	TA					AGD66		01-Jul-03	01-Jul-03	TA	TA	Surface water assessment			
DEPHA	DEPHA	227	SWANSEA STP - OUTFALL		Swan-Apsley	TA					AGD66		31-Jul-96	31-Jul-97	TA	TA	Compliance			
DEPHA	DEPHA	228	SWANSEA STP - BEJOE DAM (HISTORICAL DATA)		Swan-Apsley	TA					AGD66		31-Jul-96	24-Mar-97	TA	TA	Compliance			
DEPHA	DEPHA	229	SWANSEA STP - BEJOE DAM NO. 3		Swan-Apsley	TA					AGD66	55	31-Jul-96	14-Mar-07	TA	TA	Compliance			
DEPHA	DEPHA	230	SWANSEA STP - SWANSEA WETLANDS OVERFLOW		Swan-Apsley	TA					AGD66	55	31-Jul-96	27-Aug-03	TA	TA	Compliance			
DEPHA	DEPHA	231	SWANSEA STP - BEJOE DAM NO. 2		Swan-Apsley	TA					AGD66	55	31-Jul-96	15-Feb-07	TA	TA	Compliance			
DEPHA	DEPHA	232	SWANSEA STP - BEJOE DAM NO. 1		Swan-Apsley	TA					AGD66	55	31-Jul-96	23-Oct-02	TA	TA	Compliance			
DEPHA	DEPHA	233	TARRALEAH STP - INLET		Derwent	TA					AGD66		01-Jul-96	16-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	234	TARRALEAH STP - OUTFALL		Upper Derwent	TA					AGD66		01-Jul-96	14-Nov-01	TA	TA	Compliance			
DEPHA	DEPHA	235	TI-TREE BEND STP - OUTFALL		Swan Estuary	TA					AGD66		01-Feb-96	14-Nov-01	TA	TA	Compliance			
DEPHA	DEPHA	236	TRANSLINK - DOWNSTREAM OF OUTFALL		Derwent Estuary-Bi	TA					AGD66		01-Dec-98	14-Apr-99	TA	TA	Compliance			
DEPHA	DEPHA	237	TRANSLINK - OUTFALL		Derwent Estuary-Bi	TA					AGD66		01-Dec-98	14-Apr-99	TA	TA	Compliance			
DEPHA	DEPHA	238	TRIABUNNA STP - OUTFALL		Pittwater	TA					AGD66		01-Jan-96	21-Feb-08	TA	TA	Compliance			
DEPHA	DEPHA	239	TRIABUNNA STP - UPSTREAM OF OUTFALL (VICARY RIVE		Pittwater	TA					AGD66		14-Aug-02	31-Jul-03	TA	TA	Compliance			
DEPHA	DEPHA	240	KALANGADOO STP - OUTFALL		Pittwater	TA					AGD66		21-Jun-00	04-Mar-08	TA	TA	Compliance			
DEPHA	DEPHA	241	ORFORD STP - OUTFALL		Prosser	TA					AGD66		19-Jun-02	19-Jun-02	TA	TA	Compliance			
DEPHA	DEPHA	242	ORETHA STP - Outfall		Upper Derwent	TA					AGD66		01-Jun-02	23-Nov-06	TA	TA	Compliance			
DEPHA	DEPHA	243	SOUTHPORT STP - OUTLET		Huon	TA					AGD66		11-Jun-03	13-Mar-07	TA	TA	Compliance			
DEPHA	DEPHA	244	TRIABUNNA STP - DOWNSTREAM OF OUTFALL (SPRING I		Pittwater	TA					AGD66	55	14-Aug-03	31-Jul-03	TA	TA	Surface water assessment			
DEPHA	DEPHA	245	TRIABUNNA STP - INLET		Pittwater	TA					AGD66		14-Aug-03	03-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	246	TURNERS BEACH STP - OUTFALL		Forth-Wimot	TA					AGD66		01-Jan-96	28-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	247	ULVERSTONE STP - SMPLOT MIXED EFFLUENT		Leven	TA					AGD66		19-Jun-97	25-Jul-08	TA	TA	Compliance			
DEPHA	DEPHA	248	ULVERSTONE STP - OUTFALL		Leven	TA					AGD66		19-Jul-88	25-Jul-08	TA	TA	Compliance			











database owner	Primary site owner/ monitoring agency	Agency site #	site name	Watercourse	Water mgmt area	State	Latitude	Longitude	MGA Easting	MGA Northing	Datum	MGA Zone	start date	end date	Inventory	Expected Upgrade Priority	Purpose or program 1 supported by site	Purpose or program 2 supported by site	Purpose or program 3 supported by site	STATUS
BoM	Bureau of Meteorology	92220	STRAUSS RV @ LEWIS HILL	St Pauls River	South Esk – 41	TAS					AGD66	55	1/01/29	-	Yes		Flood Warning	Surface water assessment	Surface Observations	
BoM	Bureau of Meteorology	92221	TOOMS RV @ TOOMS LAKE DAM	Tooms River	Macquarie – 10	TAS					GDA94	55	1/01/57	-	Yes		Flood Warning	Surface water assessment	Surface Observations	Query location
BoM	Bureau of Meteorology	92222	TYENNA RV @ WITTERNAY	Tyenna River	Lower Derwent – 14	TAS					GDA94	55	1/01/71	-	Yes		Flood Warning	Surface water assessment		Query Location
BoM	Bureau of Meteorology	92109	UPPER ULVERSTONE	n/a	North Esk – 42	TAS					GDA94	55	16/07/92	-	Yes		Flood Warning	Surface Observations		
BoM	Bureau of Meteorology	92111	WARATAH (NO 2)	n/a	Blackwater – 41	TAS					GDA94	55	16/08/95	-	Yes		Flood Warning	Surface Observations		
BoM	Bureau of Meteorology	92039	WEYMOUTH CREEK	n/a	Blackwater – 41	TAS					GDA94	55	12/02/03	-	Yes		Flood Warning	Surface Observations		
BoM	Bureau of Meteorology	92024	WARRA	n/a	Huon – 15	TAS					GDA94	55	2/10/04	-	Yes		Flood Warning	Surface Observations		
BoM	Bureau of Meteorology	91130	WATERWORKS CREEK	Wye River	Inland Isolated – 5	TAS					GDA94	55	1/01/64	-	Yes		Flood Warning	Surface Observations		
BoM	Bureau of Meteorology	92242	WYE RV @ TARAMA (HWY BOX)			TAS					GDA94	55	1/01/58	-	Yes		Flood Warning	Surface water assessment		Query - Site not found in SiteDB

Appendix 7 – M&E Project Objectives and Outcomes

Round 1 2007-08

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
DPIW	07-08 DPIW 7 – Purchase of satellite modems at key non-telemetered stream flow sites Theme 2	Gap 2h ⇨	100% ⇨	50%	**Objectives:** Purchase seven satellite modems for high priority non-telemetered stream flow monitoring sites. **Outcomes (were objectives met):** The current use of satellite modems by DPIW has greatly improved the quality, accuracy and efficiency of collecting stream flow and water quality data. This has also lead to improvements in data quality, which has lead to even greater savings in terms of time and therefore money. DPIW considers that the objectives of the project have been fully achieved. **Gaps remaining (if any)** In 2010 some gaps still remain due to telemetry advancement using IP technology. All dial up telemetry systems are now viewed as having service charges compared to IP based systems. 13 sites require IP based sat modems. Seven of these have been funded by BoM in 2010 and 6 sites remain as gap.	$23,100	$23,100
DPIW	07-08 DPIW 6 – Field trial of ground water level and temperature loggers	Gap 4b ⇨	25% ⇨	50%	**Objectives:** Trial up to three different types of groundwater level collection devices that are telemetry capable. This project was implemented to give confidence in groundwater monitoring for a future roll-out of state-wide telemetry based on technology which has:	$26,400	$26,400

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
	Theme 1				• Water level and temperature loggers that provide reliable and accurate data • Effective and reliable transfer of that data to a centralised capture point **Outcomes (were objectives met):** DPIW were extremely pleased with the results that were collected from the three trial sites. The use of these instruments by DPIW has greatly improved the quality, accuracy and efficiency of collecting groundwater data at the three trial sites. This has lead to improvements in data quality, which has lead to even greater savings in terms of time and therefore money. The three trial sites and the anticipated upgrade and expansion of the network in the future will allow high quality data to be supplied to the Bureau of Meteorology as part of its task of developing a national water information service as outlined under the *Water Act 2007*. **Gaps remaining (if any)** Nil		
DPIW	07-08 DPIW 5 – Purchase and upgrade of instruments at selected water monitoring flow sites	Gap 2d ⇨	100% ⇨	50%	**Objectives** Purchase and upgrade instrumentation at selected water monitoring stream flow sites. These instruments were required to further enhance DPIW's ability to accurately measure stream flows. Twenty highly reliable and accurate dry pressure transducers with gas purge compressors for measuring water level (two different types) were purchased and deployed at high priority stream flow sites.	$132,000	$132,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
	Theme 1				**Outcomes (were objectives met):** DPIW considers that the objectives of the project have been fully achieved and that the results gained from the project will be invaluable in assuring that the quality, accuracy and efficiency of collecting stream flow data will be of the highest standard. **Gaps remaining (if any)** Nil		
DPIW	07-08 DPIW 4 – Water resources division data high availability server installation	Gap 5b **Gap6b*	100% *100%*	50% *?*	**Objectives:** To purchase and install a high availability data server to improve the Department of Primary Industries and Water (DPIW) capability to reliably supply water resource data. This infrastructure upgrade was required to further enhance DPIW's ability to supply data to the Bureau of Meteorology (BoM). The infrastructure upgrade has provided high availability, load-balanced, redundant, geographically-distributed solution, with redundant network paths into the state government internet network. It has provided a significant improvement in DPIW's existing and potential capabilities to provide timely data from a high availability and reliability system to BoM. **Ourcomes (were objectives met):** DPIW is aiming to collect all continuously logged data from its water monitoring network sites in near real time and then supply this data to BoM. Prior to this project DPIW had limited server space which	$96,000	$96,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
	Theme 4				restricted DPIW's ability to provide BoM with data in a timely manner. The new servers are now fully operational and are providing a significant improvement in DPIW's existing and potential capabilities to provide timely data from a high availability and reliability system to BoM. **Gaps remaining (if any)** Nil		
DPIW	07-08 DPIW 3 – Purchase of a new telemetry system Theme 4	Gap 6b ⇨	100% ⇨	75%	**Objectives:** To purchase a new telemetry system that would enable the Department of Primary Industry and Water (DPIW) to undertake its strategic hydrological and environmental telemetry requirements into the future. DPIW previously used a basic Magpie dial up system for undertaking its telemetry functions. DPIW evaluated three new telemetry systems (HydroTel, SODA and ClearSCADA) with a view to selecting a system that will undertake its hydrological and environmental telemetry requirements into the future. **Outcomes (were objectives met):** DPIW is aiming to collect all continuously logged data from its water monitoring network sites in near real time. Prior to this project DPIW undertook a trial of the three telemetry systems outlined above and were extremely impressed with the Clear SCADA system offered by Greenspan. This system is now fully operational and DPIW is progressing with the installation of packet data modems at each of its sites which will allow data to be retrieved in near real time.	$55,000	$55,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					Gaps remaining (if any) Nil		
DPIW	07-08 DPIW 2 – Purchase of an electric cableway system for using an acoustic Doppler discharge measuring unit. Theme 1	Gap 2k ⇨	100% ⇨	75%	**Objectives:** Purchase of an electric cableway system for using an Acoustic Doppler Current Profile instrument (ADCP) for the measurement of stream flow in rivers. **Outcomes (were objectives met):** Over the last four years DPIW has moved away from the more traditional methods of undertaking flood flow gauging using mechanical meters, weights and cableways to using 'state of the art' Acoustic Doppler Current Profile instruments. These instruments are used by being towed across the river using a travellerway or at a bridge location. Due to the size of the existing cableways on the Swan River at the Grange and South Esk River at Perth monitoring stations the electric winch system has allowed for the successful conversion of these cableways to travellerways. PDIW is extremely pleased with the results that have been collected using ADCP's and this project now allows these instruments to be used on these two high priority monitoring sites. **Gaps remaining (if any)** 2010 assessment requires the installation of hornet systems at two sites	$22,000	$22,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
DPIW	07-08 DPIW 1 – Purchase of an Acoustic Doppler Discharge Unit Theme 1	Gap 2j	⇨ 100%	⇨ 75%	**Objectives:** Purchase an additional mobile Acoustic Doppler Current Profile instrument (ADCP) for the measurement of stream flow in rivers. This instrument was required to further enhance DPIW's ability to measure flood flows. **Outcomes (were objectives met):** Over the last four years DPIW has moved away from the more traditional methods of undertaking flood flow gauging using mechanical meters, weights and cableways to using 'state of the art' Acoustic Doppler Current Profile instruments. These instruments are used by being towed across the river using a travellerway or at a bridge location. DPIW is extremely pleased with the results that have been collected using these instruments. The current use of ADCP's by DPIW has greatly improved the quality, accuracy, safety and efficiency of undertaking flood flow measurements. **Gaps remaining (if any)** 2010 assessment requires at least one additional M9, RTK/GPS system, stationary ADCP software, automatic traversing system for portable travellerway systems.	$33,500	$33,500
Hobart Water	07-08 Hobart Water 1 – Hobart Water to the Bureau data provisioning tools and hardware – server infrastructure	Gap 5b **Gap 6b*	⇨ 100% ⇨ *100%*	⇨ ? ⇨ *?*	**Objectives:** The project will involve writing scripts to draw data, primarily from SQL databases, and compiling these into flat CSV files in a format to be determined in consultation with BoM. Scripts will also be written to allow these files to be automatically sent to BoM's	$102,508	$102,508

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
	upgrades, database modifications, data collation and tools to deliver archived, daily, weekly and annual water quality data to the Bureau Theme 4				proposed FTP server at the required periodicies. These tools will be tested and checked to ensure the veracity of the data. Relevant metadata will also be complied for the identified measures. **Outcomes (were objectives met):** **Gaps remaining (if any)**		
Hydro Tasmania	07-08 Hydro Tas 2 – Upgrade of telemetry at 21 rainfall sites Theme 2	Gap 2h	100%	75%	**Objectives:** Hydro Tasmania (HT) propose to upgrade twenty of its existing pluvio (rain fall) sites to telemetry. **Outcomes (were objectives met):** All HT stations identified in this project are now on telemetry. **Gaps remaining (if any)** There are now only four HT stations that are not on telemetry in 2010	$190,080	$190,080
	07-08 Hydro Tas 1 – Scoping Study for SCADA Data Conversion and Capture Theme 4	Gap 5b **Gap 6b*	100% *100%*	75% 75%	**Objectives:** The output of the project will be a review of data outputs of the main SCADA packages used by the three dominant domestic water supply entities in Tasmania and the issues to be addressed if the data collected by the entities is to be made available in a usable format for BoM. The project should be considered as a pilot study on the issues associated with transferring SCADA data from water utilities to BoM in the longer term.	$141,240	$141,240

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 1 2007-08 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					Outcomes (were objectives met): A report was prepared for BoM confirming that the transfer of data from SCADA systems to BOM was achievable. **Gaps remaining (if any)** ?		
					Total	**$822,128**	**$822,128**

**Note: gaps in italics have been identified as secondary type gap that may overlap or relate to the primary gap.*

Round 2 2008-09

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Department of Environment, Parks, Heritage and the Arts	08-09 Tas 8.1 – Enhance Data Management and Transfer to the Bureau Theme 4	Gap 5b ⇨	70% ⇨	?%	**Objectives:** The vision for the data management system (DMS) is to have an integrated environmental monitoring database system that can bring all available data 'together' which is easily accessible to all authorised users. The bringing 'together' of data will be through data stored in different data bases by data owners or delegates, being shared through using middleware, such as web services. Integral to this is the population of the Environment Division's database through enhanced importing of data required through premises permits. **Outcomes (were objectives met):** Comment required on unfunded proponent of project and whether gap still exists. **Gaps remaining (if any)**	$462,000	$198,000
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.0 – Strategic Water Information and Planning Co-ordination Theme 9	Gap 6o ⇨	100% ⇨	25%	**Objectives:** • Development of a 'Strategic Water Information and Monitoring Plan' for Tasmania • Liaison with persons named in the Water Regulations to assist them in achieving compliance; • Liaison with the Bureau in assisting with the data ingestion process and resolving technical issues; • Supporting and coordinating the Programs applications under M&E; and • Assisting the Bureau with data capture tasks to support Water Resource Assessment, noting that	$242,000	$242,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Department of Environment, Parks, Heritage and the Arts	08-09 Tas 8.1 – Enhance Data Management and Transfer to the Bureau Theme 4	Gap 5b ⇨	70% ⇨	?%	**Objectives:** The vision for the data management system (DMS) is to have an integrated environmental monitoring database system that can bring all available data 'together' which is easily accessible to all authorised users. The bringing 'together' of data will be through data stored in different data bases by data owners or delegates, being shared through using middleware, such as web services. Integral to this is the population of the Environment Divisions database through enhanced importing of data required through premises permits. **Outcomes (were objectives met):** Comment required on unfunded proponent of project and whether gap still exists. **Gaps remaining (if any)**	$462,000	$198,000
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.0 – Strategic Water Information and Planning Co-ordination Theme 9	Gap 6o ⇨	100% ⇨	25%	**Objectives:** • Development of a 'Strategic Water Information and Monitoring Plan' for Tasmania • Liaison with persons named in the Water Regulations to assist them in achieving compliance; • Liaison with the Bureau in assisting with the data ingestion process and resolving technical issues; • Supporting and coordinating the Programs applications under M&E; and • Assisting the Bureau with data capture tasks to support Water Resource Assessment, noting that	$242,000	$242,000

Round 2 2008-09

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					the Bureau may need data additional to that specified in the Water Regulations. **Outcomes (were objectives met):** All objectives were met under this funding round. **Gaps remaining (if any)** Ongoing coordination requirements into the future		
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.2 – Upgrade and enhancement of DPIW's surface water monitoring network Theme 1	Gap 1a Gap 2b Gap 2c Gap 2d Gap 2e Gap 2h Gap 2g Gap 3a	100% 100% 100% 100% 100% 100% 100% 75%	? 75% ? 25% 75% ? ? 75%	**Objectives:** • Convert all of DPIW Next G telemetered stream flow sites to packet data ($68,200-2h); • Purchase 17 dry pressure transducers with gas purge compressors for measuring water level ($112,200-2d); • Purchase three side looking doppers ($66,000-2e); • Upgrade 28 DPIW stream flow monitoring sites. This work will include weir maintenance, general site maintenance/site improvements, logger upgrades and upgraded power supply (larger batteries and solar panels) that will lead to enhanced data quality ($164,450-2d). • Purchase and install tipping bucket rain gauges at 31 DPIW Water Monitoring Sites ($106,150-2g). • Installation of new monitoring sites($68,200-1a); • purchase an instrumentation and equipment tracking system to monitor the location of instrumentation across the State ($20,900-2?); • Funding of a short-term training course for DPIW Water Monitoring staff in advanced acoustic doppler training ($22,000-3a).	$614,900	$614,900

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					Outcomes (were objectives met): • Work had begun to convert the transfer of the telemetry data from sites located within the NextG network to packet data, however during the project DPIW became aware that IP telemetry was a more cost effective way to transfer data and have gone down this path instead of packet data. Objectives of the project have still been achieved through IP data transfer systems. • The 17 sites that have been upgraded to hydrostatic level sensors, HS 30s and HS 40s are all delivering high quality data. • The insitu acoustic doppler instrumentation is designed specifically to provide an alternative to measuring river discharges than traditional methods. The Argonaut side looking doppler units were chosen by DPIPWE's Water Monitoring section for the purpose of providing real time, accurate stream flow data. • Upgrade work at the 28 sites ranged from access track repairs, weir angle replacement and weir maintenance, entire new weir installations, excessive clearing of around the controls and gauging infrastructures, and the banks up and down the rivers between these infrastructures, travellerway conversion and upgrades at so that the new 'Sontek Rivercat' acoustic Doppler current meter could be used for carrying out high stage flow measurements, desilting of weir ponds, removal of willow trees from river level recorder sections. • The installation of 31 rainfall sites has created a more comprehensive monitoring network.		

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					• Lake level recording equipment has been installed at two new lake level sites allowing for near real time monitoring of storages. • The objectives were not fully met where the software that was supplied with the tracking instruments did not fully meet the requirements of DPIW. This is where the software did not allow for the tracking of history on items that were imported into the database. DPIW are still undergoing investigations into alternate software packages but have not yet found one suitable that meets all their requirements. • Advanced training for all DPIPWE's Water Monitoring staff in the installation of the Argonaut SL was undertaken on site in Eastern Tasmania from 2-4 June, 2009. • The addition of a new 'FlowTracker' has allowed much greater flexibility in the collection of wading gaugings. **Gaps remaining (if any)** • Software required for Instrument tracking system. • Further doppler training still required.		
Department of Primary Industries and Water (Tasmania)	08-09 Tas 1.3 – Improving the quality of metadata at all Tasmanian stream flow and groundwater monitoring sites	Gap 8b ⇨ 100% ⇨ 75% Gap 8c ⇨ 100% ⇨ ? Gap 8a ⇨ 0% ⇨ ?			**Objectives:** In a joint cooperation DPIW and HT staff combined to collect metadata from all stream flow and groundwater sited administered by each organisation. Metadata included confirmation of coordinate locations in GDA 94, Benchmark, CTF and gaugboard values in AHD, and cross sectional	$520,300	$408,980

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
	verification of uncertain farm dams Theme 6				surveys. This information will accurately confirm crucial metadata at nominated sites and convert all survey data at each site to Australian Height Datum (AHD). **Outcomes (were objectives met):** The completed final project has provided new or improved metadata for both Hydro Tasmania and DPIW's surface water streamflow and groundwater monitoring sites. DPIPWE has incorporated this information into four regional site information reports that now allow for access to accurate site description and metadata for their complete stream monitoring network. The outcomes of this project will also improve accuracy of information once BoM incorporate this improved metadata into their water information products such as AWRIS. There were a few sites that where metadata was not collected due to limitations on site access during the project period. **Gaps remaining (if any)** • Collection and verification of metadata at storage monitoring and rainfall sites (being addressed in 2009). • Metadata for the few remaining sites that were not accessible during project period. • Verification of farm dam locations (this part of the project was not funded by BoM in 2008, however it may be addressed in 2010 through the THGF project).		

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Forestry Tasmania	08-09 Tas 2.1 – Installation of telemetry for Warra, Swanson and King Creek streamflow and water quality gauging Theme 2	Gap 2h Gap 2d **Gap 5b*	100% 100% *100%*	?	**Objectives:** The proposal is to engage the Resource Investigation team within HTC to install telemetry systems at the three Forestry Tasmania sites, develop a database, set up communication and data transfer protocols with the sites, to archive data, and to transfer data to BoM and Forestry Tas. The proposal also includes a request for two new data loggers (one of which will be a spare) and a spare sensor to reduce data losses due to equipment malfunction. FT will retain responsibility for the ongoing operation and maintenance of the stations. **Outcomes (were objectives met):** Telemetry has been installed and is operational at the three sites. Data is being transferred to Forestry Tas and BoM. All objectives have been met. **Gaps remaining (if any)** Forestry Tasmania has advised that they have no gaps in their instrumentation and data collection program. However they will at some stage need to get their raw level data rated to enable the development of streamflow information. This will require a gauging program and production of streamflow ratings.	$45,111	$45,111

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Hobart Regional Water Authority	08-09 Tas 3.1 – Server infrastructure upgrade, database modifications, data collation and tools to deliver archived, daily, weekly and annual water quality data to the Bureau Theme 4	Gap 5b ⇨ *Gap 6a*	100% ⇨ *75%*	? ⇨ *75%*	**Objectives:** This project is intended to be Stage 2 of a systematically developed framework to improve data migration and information provision to BoM and other information customers. The project builds on earlier Stage 1 work which provided tools for extraction of information from databases and automatic dispatch to BoM. Another key element of the project is the purchase of several field computers, known as 'toughbooks'. They enable easy download from field data loggers which are not connected to telemetry and are useful in entering field data in the field into pre-set templates which then automatically upload when field staff return to base. **Outcomes (were objectives met):** **Gaps remaining (if any)** ?	$257,279	257,279
Hydro Tasmania	08-09 Tas 5.1 – Develop Quality Control/Quality Assurance processes on data transfer to the Bureau Theme 4	Gap 6a	75%	25%	**Objectives:** To assist in the development of an application to automatically undertake quality assurance/quality control (QAQC) processes on data being supplied to the Bureau of Meteorology by agencies, as a requirement of the *Commonwealth Water Act 2007*. In particular, this project aims to increase the accuracy of data provision to the Bureau by improving procedures for the management of water data within agencies through data harmonisation activities and reducing the administration burden	$557,920	$557,920

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					to the agencies. This project will address the Bureau's priority activity 'Procurement and implementation of software to enable the translation of existing data formats to formats suitable for the Bureau's processes' by providing consistent quality assurance procedures and quality coding across multiple agencies. The application will be developed initially for a pilot data set and WISKI database, with the aim of using this methodology to develop a product that will be able to be applied to a wide variety of databases and data formats within the agencies supplying data. **Outcomes (were objectives met):** Need comment **Gaps remaining (if any)** Need comment		
Hydro Tasmania	08-09 Tas 6.1 – Infrastructure and software services for the provision of Water Information to the Bureau Theme 4	Gap 5b	⇨ 75%	⇨ 25%	**Objectives:** To assist in the development of systems to automatically provide water information to the Bureau as a required by the *Commonwealth Water Act 2007.* Hydro Tasmania currently utilises the TimeStudio data management system to gather, maintain and distribute time-series data including water information required by the Bureau. Hydro Tasmania is currently migrating to the WISKI application and will be providing the required water information from this application.	$121,000	$88,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 2 2008-09 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					Outcomes (were objectives met): This project was completed and data is being delivered to BoM by HT as legislated. **Gaps remaining (if any)** WISKI still requires an application to deliver the data to BoM in WDTF format.		
Launceston City Council	08-09 Tas 7.1 – Upgrade five rainfall stations Theme 1	Gap 2g	⇨ 100%	⇨ 75%	**Objectives:** LCC is requesting funding to assist in the upgrading of rainfall instrumentation in the Launceston City Catchment as part of BoM project for funding under the M&E program. Under the new *Water Act 2007*, LCC is required to provide all hydrographic data that is recorded by LCC to BoM. LCC is currently working with HTC in developing a system to enable this data transfer to happen. LCC would like to ensure that the quality of data that is being given to BoM is of an acceptable standard. LCC have five current rainfall instruments that have no branding and their reliability and accuracy is questionable. LCC with support from BoM would like to upgrade these instruments to the BoM standard of the RIMCO rain gauge model number 7499020. **Outcomes (were objectives met):** All objectives to this project have been met. **Gaps remaining (if any)** No gaps remain in relation to rainfall data collection for LCC.	$19,910	$19,910
					Total	**$2,840,420**	**$2,432,100**

**Note: gaps in italics have been identified as secondary type gap that may overlap or relate to the primary gap.*

Round 3 2009-10

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Department of Primary Industries, Parks, Water and Environment	09-10 TAS 1.1 Strategic Water Information Coordination Theme 9	Gap 6o	100%	25%	**Objectives:** • Enhancement of the Strategic Water Information Monitoring Plan including consideration of information categories that were outside the scope of initial SWIMPs; • Liaison with persons named in the Water Regulations to assist them in achieving compliance; • Liaison with the Bureau in assisting with the data ingestion process and resolving technical issues; • Supporting and coordinating the Programs applications; and • The Bureau with data capture tasks to support Water Resource Assessment, noting that the Bureau may need data additional to that specified in the Water Regulations. **Outcomes (were objectives met):** All objectives of this project for the 2009/10 year have been met. **Gaps remaining (if any)** Ongoing coordination requirements into the future.	$170,500	$137,500
Department of Primary Industries, Parks, Water and Environment	09-10 TAS 1.2 – Continued Upgrade and Enhancement of Water Monitoring Network Theme 1	Gap 2d Gap 2a Gap 2j Gap 3a Gap 2b	100% 100% 100% 100% 100%	50% 75% 75% 75% 75%	**Objectives:** • Upgrade 30 priority sites stream gauging sites with loggers and shaft encoders. • Install vandal resistant shelters at four sites. • Purchase of an ADCP for measurement of streamflow. • Training of staff in new technologies.	$616,000	$346,280

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					• OH&S improvements at six sites incorporating the installation of stairs and platforms to A.S. • Engagement of an FTE technical assistant for six months. **Outcomes (were objectives met):** • With the original funding deed, plus reserve funding offered in December 2009 DPIPWE was able to completely upgrade its network of 82 sites with new dataloggers (plus an additional five spares purchased by DPIPWE). DPIPWE has also replaced ageing level shaft encoders at all stilling well sites (45 sites), with five spares. • OH&S upgrades have been carried out at the nominated six sites. • The installation of vandal resistant shelters at four nominated sites have been completed. • The funding also enabled DPIPWE to purchase two 'Sontek' M9 RiverSurveyor ADCP's used for stream flow measurement throughout Tasmania. • All project work was prioritised and resourced with existing Water Monitoring staff and one 0.5FTE funded by the Bureau. The 0.5FTE was paramount to the successful completion of the project. **Gaps remaining (if any)**		
Department of Primary Industries, Parks, Water and Environment	09-10 TAS 1.2b – Provision of equipments for continued upgrade and enhancement of Water	Gap 2d ⇨	100% ⇨	?	**Objectives:** Reserve funding obtained to purchase additional data loggers to complete the upgrade of logging equipment for whole DPIPWE stream gauging network.	–	$108,020

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
	Monitoring Network Theme 1				**Outcomes (were objectives met):** All objectives have been met. **Gaps remaining (if any)** Nil		
Department of Primary Industries, Parks, Water and Environment	09-10 TAS 1.3 – Evaluation Prior to Purchase and Migration to New Database (Hydstra TSM Replacement) Theme 4	Gap 5a ⇨	100% ⇨	25%	**Objectives:** This phase (during financial year 2009-10) will evaluate a minimum of two hydrological DBMSs, identify migration issues, and formulate a migration plan for financial year 2010-11 based on the evaluation process and results. **Outcomes (were objectives met):** **Gaps remaining (if any)**	$44,550	$44,550
Department of Primary Industries, Parks, Water and Environment	09-10 TAS 1.4 – Modernisation of Groundwater Monitoring in Tasmania Theme 1	Gap 4b ⇨ **Gap 2d* ⇨ **Gap 2h* ⇨	100% ⇨ *100%* ⇨ *100%* ⇨	? *?* *75%*	**Objectives:** To deploy high-quality and technically-sound instrumentation, and automation of data collection, across the State groundwater monitoring network of 70 wells. This will include: • Water level and temperature loggers with high reliability and data security; and • Effective telemetry and integration of data into the Department's Time Studio Database. Benefits include: • The addition of loggers into 24 new wells currently only monitored manually; • Replacement of existing data loggers on the remaining bores, which are of poor quality with high rates of failure and which cannot be telemetered;	$528,000	$412,459

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					• Improvement in the quality and reliability of data collected; • Lower long-term monitoring costs. **Outcomes (were objectives met):** The primary objectives of this project were successfully met. The installation of high quality water level and temperature loggers in all current groundwater monitoring bores has significantly improved the currency of the existing network through improved data quality and reliability. Previously, large data gaps were often present due to the lack of reliability and age of the loggers. At 24 sites, this project has enabled the installation of water level loggers for the first time, vastly improving the amount of data collected on groundwater resources from bi-annual site visits to hourly records of standing water level (SWL) and temperature. The completion of headworks has aligned the monitoring bores with Australian Specifications, with locakable steel covers greatly improving site security. The development of telemetered monitoring sites and the necessary software programs to facilitate automatic data transfer has significantly improved the ability of the Department to make informed management decisions on groundwater resources and to provide current groundwater data to BoM and meet its obligations under the Water Regulations 2008. **Gaps remaining (if any)** Extension of the monitoring network to increase coverage in priority areas is required (this is the focus of the 2010/2011 4TAS 01.02 project).		

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Hydro-Electric Corporation	09-10 TAS 2.1 – Collaborative Automated Trial Theme 4	Gap 6a ⇨	75% ⇨	25%	**Objectives:** Hydro Tasmania Consulting is currently developing QAQC algorithms in conjunction with CSIRO and implementing them in a prototype application framework for surface water data. This work was funded under the second round of funding. A second phase of QAQC is now proposed to develop the algorithms further and expand collaborative testing to other agencies. These algorithms will be tested against live data sets from Tasmania and copies of actual data sets from other agencies specifically Department of Water Land and Biodiversity (DWLBC), South Australia. WA Water Corp have indicated possible co-operation in future funding rounds. Databases to be piloted with the algorithms are Timestudio/Wiski and Hydsys (DWLBC). **Outcomes (were objectives met):** A pilot program has been developed and the final report is currently with BoM for review. **Gaps remaining (if any)** First phase of project only and still requires work to improve QA/QC automation and validation. HT (Entura) would like to continue to develop this project to a commercialisation stage with support from BoM and input from other Agencies. It would be advantageous to also run a trial comparing QA/QC results with that of a data management team within one of the water authorities.	$870,100	$430,100

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Hydro-Electric Corporation	09-10 TAS 2.3 – Hydro Tasmania Instrumentation Upgrade 2009 Theme 1	Gap 2d Gap 2g Gap 2c Gap 2j	0% 100% 25% 0%	? 75% 75% 75%	**Objectives:** To maintain the high quality of data provided by Hydro Tasmania (HT) to the Bureau of Meteorology (BoM) a number of HT's hydrographic stations will require instrumentation and power supply upgrades. In addition to be able to continue to carry out accurate high flow measurements, HT needs to utilise the latest technology available in Acoustic Doppler Current Profilers. The key areas of the funding submission are: • Upgrade of hydrostatic depth sensors to HS 40 Bubbler Units at 24 stations. • Old OTA and HS rain gauges to be replaced with BoM RIMCO standard at 14 sites. • Establishment of 240v power supply at three key stations. • Purchase of SONTEK ADCP flow Measuring equipment plus appropriate training. **Outcomes (were objectives met):** The area that achieved funding under this project was for the upgrade of rain gauges. All 14 sites have been installed. **Gaps remaining (if any)** • The hydrostatic depth sensors are still due for upgrade. • 240v would still enhance the quality of data at nominated key sites • A proportion of the Sontek request has received funding in Round 4 2010-11	$281,638	$44,737

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Rivers and Water Supply Commission (Tasmanian Irrigation Schemes)	09-10 TAS 4.1 – Craigbourne Dam Storage Measurement, Telemetry and Data Management Theme 3	Gap 1a *Gap 2h*	100% *100%*	? *?*	**Objectives:** To install a storage level measuring device and telemetry to get accurate, automated and current data of the 12,500ML Craigbourne dam. **Outcomes (were objectives met):** **Gaps remaining (if any)**	$27,500	$27,500
Tasmanian Water and Sewerage Corporation – Common Services (Onstream)	09-10 TAS 3.2 – Extension of Water Information Database and Reporting Tools Across Northern Tasmanian Utilities Theme 4	Gap 5a Gap 5b	100% 100%	25% 75%	**Objectives:** The project seeks to extend the recently implemented water information management system developed for Hobart Water/Southern Water in Tasmania to water and wastewater corporations in the North and North-West. **Outcomes (were objectives met):** **Gaps remaining (if any)**	$397,548	$310,109
Tasmanian Water and Sewerage Corporation – Southern Region	09-10 TAS 3.1 – Upgrade and Extension of flow and Extraction Measurement and Water Management Database Theme 4	Gap 5b Gap 2h Gap 1a Gap 2j	100% 0% 0% 0%	75% 75% 0% 75%	**Objectives:** The project is designed to improve measurement, collation and transmission of data for water treatment plant intakes, the River Derwent and smaller sources which form part of the water supply for Hobart and Southern Tasmanian towns and an expansion of the SWIMS water information database. The project will involve the following four elements. 1 Upgrade of telemetered intake flow meters (not funded?). 2 Construction of a water monitoring station on the River Derwent (not funded?).	$434,654	$119,295

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 3 2009-10 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					3 flow measuring equipment for monitoring campaigns in smaller streams and water sources (not funded?). 4 Expansion of the Southern Water Information Management System (SWIMS). **Outcomes (were objectives met):** **Gaps remaining (if any)**		
					Total	**$3,370,490**	**$1,980,550**

**Note: gaps in italics have been identified as secondary type gap that may overlap or relate to the primary gap.*

Round 4 2010-11

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Department of Primary Industries, Parks, Water and Environment	4TAS01.01 – Strategic Water Information Coordination Theme 9	Gap 6o ⇨	100% ⇨	25%	**Objectives:** SWIC tasks for 2010/2011 include the following: • Facilitate user acceptance testing and evaluation of Bureau Water Information products by major water data providers within the jurisdiction. • Validate Duplicate Data confirmation reports. • Provide assistance to the Water Standards and Policy Section in the development of high priority cross- jurisdictional WI standards and guidelines. • Assist the Bureau with information regarding organisational re-structures and liaison with new entities. • Assist the Bureau in administrative and prioritisation tasks related to Round 5 of the M&E Fund. • Limited work on updating and maintaining the current jurisdictional SWIMPs. • Participate in SWIC Workshops and in SWIC related teleconferences. • Other coordination activities as identified by the LWA which will assist the Bureau in fulfilling its water information objectives. **Outcomes (were objectives met):** All objectives of this project are being met. **Gaps remaining (if any)** Ongoing coordination requirements into the future.	$137,500	$137,500

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Department of Primary Industries, Parks, Water and Environment	4TAS01.02 – Extension of the statewide Groundwater Monitoring Network in Tasmania Theme 3	Gap 4a ⇨ Gap 2h ⇨	100% ⇨ 100% ⇨	25% 75%	**Objectives:** The current statewide groundwater monitoring network (SGMN) is inadequate in its coverage to provide the groundwater data necessary for the management of groundwater resources. Expansion of the SGMN can be achieved by: 1 The integration of existing localised groundwater monitoring networks, which were installed by other agencies, into the SGMN; and 2 The development of new groundwater monitoring bores in areas identified as having an urgent requirement for integrated water management plans and/or at high risk of over extraction. The upgraded/newly installed groundwater monitoring bores would have headworks completed to Australian specification, new level loggers installed and be telemetered (using the same setup as the existing SGMN). **Outcomes (were objectives met):** All objectives of this project are being met. Assuming the successful completion of this project, the Statewide Groundwater Monitoring Network will be expanded from 70 wells up to 120. The newly integrated groundwater wells, in key indentified priority areas, will significantly increase the data available to support water management planning and regulation. The entire SGMN has modern and reliable instrumentation installed, which supports IP telemetry and the automatic transfer of real-time data into the Department's database.	$358,600	$308,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					Gaps remaining (if any) There will be a small number of bores that are unable to be upgraded and/or telemetered. As network coverage improves this gap may need to be addressed. The coverage of the SGMN is still inadequate to provide sufficient data to support water management plans in all areas/catchments. As particular catchments or water management units come under increasing pressure for water resources, this may present a gap that will require attention.		
Department of Primary Industries, Parks, Water and Environment	4TAS01.04 – Continued Upgrade and Enhancement of Water Monitoring Network and Generation of Missing Historical Data Theme 1	Gap 2k ⇨ Gap 2h ⇨ Gap 6e ⇨	50% ⇨ 50% ⇨ 0% ⇨	75% 75% 0%	**Objectives:** • Upgrade automated travellerway systems at seven sites throughout Tasmania to carry out ADCP gaugings. • Provide satellite communications modems (packet data) or remote radio communications to Next G at 11 sites. **Outcomes (were objectives met):** Project is on track and it is expected that all objectives will be met. Note: generation of historical missing data was not funded. **Gaps remaining (if any)** Travellerway component of project only part funded by BoM and equates to 50% of gap filled from original request. 2010 assessment has identifies some additional sites that require travellerway installations +75% of gap resolved.	$476,410	$220,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					Telemetry component involving satellite modems and radio communications was only part funded by BoM. End of project will see around 50% of gap filled from original request. 2010 assessment of whole stream gauging network had identified an approx +75% of gap resolved. Generation of missing historical data component of project was not funded and remains as gap (6e).		
Department of Primary Industries, Parks, Water and Environment	4TAS01.05 – Integration of historical borehole data into the Department's groundwater database Theme 5	Gap 6f ⇨	75% ⇨	25%	**Objectives:** To identify, collect, collate and enter original hard copy historical groundwater and borehole drilling data from a number of Tasmanian agencies to the Groundwater Information Management System (GWIMS). This project is designed to undertake the physical transfer of hardcopy data relating to borehole data, monitoring events, pump testing results, chemical analyses, functional status and water use of groundwater bores into the newly upgraded borehole database. This would involve searching, locating and transferring records across a number of agencies to centralise groundwater data storage and therefore improve management. **Outcomes (were objectives met):** The successful completion of this project will result in the transfer of all historical groundwater data and borehole information into the Department's groundwater database (GWIMS). 950 borehole entry forms were entered into GWIMS and all data collected/held by other agencies was collated and	$111,100	$111,100

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					entered. This complete groundwater resource dataset is available to support water management and research. **Gaps remaining (if any)** Nil		
Department of Primary Industries, Parks, Water and Environment	4TAS01.08 – Statewide Hydrological Geospatial Fabric (THGF) Project Theme 6	Gap 8g ⇨ *Gap 8a ⇨	100% ⇨ *75%* ⇨	100% *75%*	**Objectives:** To provide an integrated and complete coverage of available watercourse and water body mapping held by government that will directly support the ongoing improvement of catchment, state and national scale water accounting and eater resource assessment. Includes: • Completing the capture and revision of farm dams at 1:25,000 scale; • Completion of a single consistent 1:25,000 scale database for Tasmania including natural watercourses and natural and man-made water bodies. **Outcomes (were objectives met):** **Gaps remaining (if any)**	$242,275	$242,275
Hydro-Electric Corporation	4TAS02.05 – Training and review of Hydrographic Procedures Theme 1	Gap3b ⇨ Gap 6m ⇨	100% ⇨ 0% ⇨	75% 25%	**Objectives:** In partnership with the Department of Primary Industries, Parks, Water and Environment, Forestry Tasmania and Southern Water, Hydro Tasmania will coordinate the delivery of a training course run under the leadership of the Australian Hydrographers Association. This will provide	$92,345	$50,402

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
					staff attending with Recognition of Prior Learning (RPL) for the first three units of competency from the Diploma course. This introductory session is seen as a means of getting all hydrographers up to a basic recognised standard and then encourage them to continue with the Hydrography Diploma course through the NSW TAFE. The second part to this project involves partnership with the Department of Primary Industries, Parks, Water and Environment (DPIPWE), and Hydro Tasmania (HT). HT will coordinate the development of procedures for hydrographers and data management staff to follow in the field and office. HT currently have a set of procedures that were written in 1996, they are in need of review and will be done in partnership with DPIPWE to ensure uniform standards across Tasmania. **Outcomes (were objectives met):** AHA training scheduled for February 2011 **Gaps remaining (if any)** • Formal training still required for some DPIPWE and HT staff. • Development of procedures was not funded within this project and gap still remains Some work has been done to date on development of Standards and Procedures within DPIPWE and HT.		

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Hydro-Electric Corporation	4TAS02.06 – Tasmanian Metadata Collection Theme 6	Gap 8d Gap 8e	25% 25%	50% 50%	**Objectives:** 1 In partnership with the Department of Primary Industries, Parks, Water and Environment (DPIPWE) and Southern Water, Hydro Tasmania (HT) will coordinate the surveying of all rainfall and lake level stations, plus pick up Southern Waters significant offtake points and major storages. The verification of sites by HT surveyors using GPS will accurately confirm the location of each site and the coordinates will be related to the Australian Height Datum (AHD). HT and DPIPWE completed a similar project in 2009 for all river level and groundwater stations in Tasmania; this would complement the previous project and contribute to the geospatial fabric project. Approximately 100 rainfall stations, 50 storages and 30 offtakes will be included. A complete list and definite cost will be available in April 2010. **Outcomes (were objectives met):** This project will begin at the end of 2010. Consultation with BoM has assisted in setting the scope of the project. **Gaps remaining (if any)** Project part funded. Gaps remain proportional to unfunded proponents.	$599,079	$158,400

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Hydro-Electric Corporation	4TAS02.07 – ADCP Procurement and Instrumentation Improvements for Hydro Tasmania Theme 1	Gap 2d ⇨ 0% ⇨ 75% Gap 2j ⇨ 50% ⇨ 50% Gap 2h ⇨ 0 ⇨ 75%			**Objectives:** • Hydro Tasmania (HT) is in the processing of standardising sensor equipment and upgrading where required. Water level probes and water quality instruments are required. • HT is limited in their ability to measure high flow events using the ADCP technology. HT is requesting funding for the purchase of two M9 and S5 packages from SONTEK which includes the RTK modules for remote data collection. • HT has remote streamflow monitoring stations in the South-West that are currently not on telemetry. Helicopter access currently required. **Outcomes (were objectives met):** **Gaps remaining (if any)** Project part funded. Gaps remain proportional to unfunded proponents.	$348,491	$91,630
Tasmanian Irrigation Schemes	4TAS03.03 – Dam Storage Monitoring and Telemetry Theme 1	Gap 1a ⇨ 75% ⇨ ? Gap 2d? ⇨ ? ⇨ ? Gap 2h ⇨ 50% ⇨ ?			**Objectives:** • To install level recorders to monitor three key dam levels with ANCOLD Hazard Categories of High C. • To improve the accuracy of two existing stream flow gauging stations. • To install telemetry on monitoring stations mentioned above. **Outcomes (were objectives met):** **Gaps remaining (if any)**	$69,399	$36,399

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Tasmanian Water and Sewerage Corporation (North Western Region) Pty Ltd	4TAS05.01 – Installation of water level instrumentation at five sites to enhance the quantity and quality of data retrieval for water catchments in the Cradle Mountain Water District Theme 3	Gap 1a ⇨ *Gap 2h* ⇨ *Gap 5b*	75% ⇨ *75%* ⇨ *75%*	? ⇨ *75%* ⇨ *75%*	**Objectives:** CMW will install water level instrumentation at seven stations listed in the proposal. All sites will be connected to the CMW SCADA system for use in determining the relevant water supply. Infrastructure – specifically weirs and enclosures – will also be installed to maintain the quality of data at each station. An AJENTI (data logger/modem) will also be installed to transfer the data to Hydro Tasmania. This will enable the development of streamflow ratings, quality coding of the data and assist in any potential fault identification. Hydro Tasmania can also arrange the transfer of the data to BoM in the required WDTF protocol. BoM will then have access to the data at the same retrieval rate as currently is supplied for existing Hydro Tasmania stations. **Outcomes (were objectives met):** Five new stations scheduled to be installed by March 2011. **Gaps remaining (if any)** Project part funded. Gaps remain proportional to unfunded proponents.	$313,005	$220,000

Organisation	Project ID, name and funding theme	Related gaps identified in SWIMP (Table 11)	% of gap resolved for Organisation	% of gap resolved for Jurisdiction (June 2011)	Round 4 2010-11 Project Objectives and Outcomes	Amount requested (inc GST)	Amount approved (inc GST)
Launceston City Council	4TAS06.01 – Data Collation, Transfer, QAQC and Storage for Launceston City Council (LCC) Flood Warning Sites Theme 4	Gap 5b **Gap 6a*	75% *75%*	*75%* *75%*	**Objectives:** Launceston City Council (LCC) has a number of hydrometric sites on major Northern Tasmanian rivers that they use as part of their flood warning and management systems. The sites are additional to BoM's existing flood network for Northern Tasmania and assist LCC to convey information on flood preparedness and response for the Launceston area to its residents. Currently the real time data from these sites is being collated and stored on an ad-hoc basis by the SCADA service provider, and data transfer and display is by manual processes only. There is also a lack of near real time tidal level monitoring in Northern Tasmania, which is critical for the determination of the impact of a combined river and tidal flooding in the Launceston area. The effectiveness to LCC and local emergency staff and the community during flood situations is being hindered due to these problems. LCC is now proposing to fix these problems through this project by: • Automating and streamlining data transfers and management including QAQC; and • Access to real time tidal data. **Outcomes (were objectives met):** Project to commence at the end of 2010 **Gaps remaining (if any)** Project part funded. Gaps remain proportional to unfunded proponents. Also LCC still require a Flood Warning station at Lilydale and would like to carry out a gauging program to determine flows at their flood warning stations.	$83,600	$55,000
					Total	**$2,831,804**	**$1,630,706**

**Note: gaps in italics have been identified as secondary type gap that may overlap or relate to the primary gap.*