



NSW

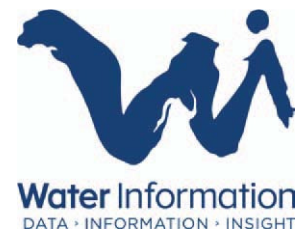
Strategic Investment Plan

for

Water Monitoring Systems

Water Resource Monitoring 2012-2017

July 2012



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*New South Wales strategic investment plan for hydrologic
monitoring, 2012-2017*

July 2012

Acknowledgements This Plan has been written with considerable assistance from a range of Organisations and Departments. The following are to be thanked for their input:

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With input from:

Cabonne Shire Council

Lismore City Council

Midwestern Council

Murrumbidgee Irrigation

Northern Rivers Catchment Management Authority

NSW Department of Primary Industries, Forestry

NSW Hunter Water Corporation

NSW Office of Water

Office of Environment and Heritage (Manly Hydraulics Laboratory)

Rous Water

State Water Corporation

Sydney Catchment Authority

Sydney Water Corporation

Wyong / Gosford Shire Council

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List of Acronyms

ADCP	Acoustic Doppler Current Profilers
AHD	Australian Height Datum
AWRIS	Australian Water Resources Information System
Bureau	Bureau of Meteorology
GDE	Groundwater Dependent Ecosystem
GDS	Groundwater Data System
GW	Groundwater
IP	Internet Portal
IPART	Independent Pricing and Review Tribunal
LAS	Licensing Administration System
LiDAR	Light Detection and Ranging
M&E	Modernisation and Extension of Hydrologic Monitoring Systems Program
MDB	Murray Darling Basin
MDBA	Murray Darling Basin Authority
MER	NSW Monitoring Evaluation and Reporting
NHGF	National Hydrological Geospatial Fabric
NOW	NSW Office of Water
NSW	New South Wales
NWMS	National Water Market Solution
NWC	National Water Commission
SWIMP	NSW Strategic Water Information and Monitoring Plan
WA	Water Act 1912
WMA	Water Management Act 2000
WQSMP	Murray Darling Basin Water Quality and Salinity Management Plan
WSP	Water Sharing Plans

1.0 Executive Summary

The Bureau of Meteorology funded a \$21M enhancement to water resources monitoring systems in NSW under its \$80M Modernisation and Extension to Hydrologic Monitoring Systems Program (M&E). Some sixteen NSW agencies and organisations received the funding which was spread over a five year period from 2008 to 2012.

The primary objective of this investment was to upgrade the existing monitoring networks and database systems to enable the state organisations to contribute their water data to the Bureau 'Improved Water Information Program' via the AWRIS database. This program was part of the Bureau's increased responsibility to develop and maintain a national water resource information system under the Water Act 2007 (C'wlth). Details of the objectives and deliverables can be found at www.bom.gov.au/water.

Quantum improvements have been made to several of the major water monitoring systems in this state in a relatively short period of time. Productivity gains were achieved in data capture, quality control, archival and dissemination of data to the Bureau and stakeholders. Much of the detail concerning the water resource monitoring systems in NSW and the improvements achieved are contained in a major report produced under the M&E program called the '*NSW Strategic Water Information and Monitoring Plan 2011-12*'. This report is at http://www.bom.gov.au/water/regulations/fundingProgram/document/swimps/nsw/2011_nsw_swimp.pdf. The report contains details on why water resource monitoring is undertaken, including the information drivers and objectives of the various agency water monitoring activities. For convenience some of this detail has been reproduced in this report.

Under the funding deeds signed by the state organisation with the Bureau, is agreement that organisations which received funding would continue to operate and maintain the upgraded monitoring systems into the future. This will require such organisations to fund upgrades to water monitoring, database and data transmission systems as the current assets depreciate and need replacing. A full listing of all projects funded under the M&E Program can be found at <http://reg.bom.gov.au/water/regulations/fundingProgram/index.shtml>.

A Gaps Analysis was undertaken of all the projects funded under the M&E program to provide a strategic direction for future priority setting and expenditure. The analysis reviewed the outcome of the projects against the Gaps to determine how they contributed to their closure. This analysis demonstrated what has been achieved through M&E and what still needs to be undertaken. Aspects of the detailed 'gap analysis' (SWIMP 2012) are repeated in this report.

The aim of this report is to highlight this need and identify the projects and the costs that should be undertaken to maintain the systems at their current level of operation and performance (Category 1 projects).

In addition to this work, some projects that were submitted for funding under M&E were unsuccessful, or the the funded projects did fully close the Gap. The highest priorities of these are also included in this report as areas where future funding will be required (Category 2 projects). The Category 2 projects could form the basis of a '*NSW Modernisation and Extension Program – Phase 2*'.

Table 1: Summary of estimated costs for Category 1 and 2 projects

Monitoring Infrastructure	Strategic Approach	Estimated Cost
Category 1	NSW Asset Management Plan 2012-2017	\$11.4 Million over five years
Category 2	NSW Modernisation and Extension Phase 2	\$14.1 Million over five years

The key recommendation of this report is that a '*NSW Asset Management Plan for Water Resources Monitoring to 2017*' be prepared (*see appendix one for more detail*). Options as to whether this should be undertaken on a state basis or individual agency will require management discussion and decision. A budget of approximately \$11.4M over the next five years will be required to maintain the monitoring systems at their present performance level, with some projects yet to be finally costed. This applies to those organisations that have contributed to this Strategic Investment Plan.

Various funding options will need to be considered in developing the *Asset Management Plan* and the *NSW M&E 2 Program*. These could include normal consolidated revenue funding for maintenance including technology upgrades, 'capital grants' from Treasury for new projects and possible ongoing cost sharing with the Bureau of Meteorology for improvements to data delivery systems. The Asset Plan would be developed with the understanding that some of the water monitoring organisations in NSW already have programs in place that fund the development and maintenance of their systems. Linking the existing agency plans with a statewide plan would form that part of the process.

2.0 Introduction:

Over the past five years there has been significant investment in water resource assessment and monitoring in NSW. This has been the result of two Federal government programs, namely;

- Bureau of Meteorology national \$80M 'Modernisation and Extension of Hydrological Monitoring Systems Program (M&E)', and
- National Water Initiative 'Hydrometric Network Expansion Program (HNE)'

These programs provided NSW with an opportunity to make quantum improvements in key areas of water resources assessment, especially monitoring activities to do with instrumentation, data acquisition, transmission, data management and QA/QC processes. This significant cash stimulus (\$21M for NSW) has allowed State agencies and other water monitoring organisations to upgrade their systems in a relatively short period of time. As a result there have been reductions in operation costs, increased productivity and improved data services to stakeholders from new technology.

The NSW Office of Water has undertaken the role of *Lead Agency* for this program and has assisted with priority setting for investment, provided coordination between many organisations and the Bureau and driven integration of systems for the measurement, transmission, storage and dissemination of data.

A key deliverable of the M&E Program is the *Strategic Water Information and Monitoring Plan (SWIMP)* that describes in detail water monitoring activities in this state. It sets out the work undertaken by a wide range of government agencies, corporations, Councils and other organisations that monitor water data for their requirements. The SWIMP identifies the key water management issues facing this State and describes the water information drivers that support water planning and policy development.

The SWIMP also describes 49 gaps in data and systems for the NSW water monitoring activities. All M&E projects in NSW had to address at least one of these gaps to be eligible for funding. A gaps analysis determined how the projects contributed to closing these gaps, and demonstrated what has been achieved in NSW, and what still needs to be done.

Much has been achieved in the past five years. This current report '*Draft Strategic Investment Plan for Hydrologic Monitoring Systems 2012-2017*' looks to the next five years and identifies essential work still to be undertaken.

The report builds from the \$21million NSW received under the M&E Program between 2008 and 2012. This funding supported upgrades to water information systems including their ability to disseminate that information to the Bureau and stakeholders. The benefits and outcomes of the M&E Program are described in detail in the *Final SWIMP 2011* http://www.bom.gov.au/water/regulations/fundingProgram/document/swimps/nsw/2011_nsw_swimp.pdf.

NSW has also spent an additional \$6 million between January 2009 and Sept 2011 on their water monitoring network through the *NSW Hydrometric Network Enhancement (HNE)* program. With work from both programs accounted for, it is estimated that around 70 percent of the identified improvements have been completed. This implies that not all the work is done and some outstanding work requires funding either from Federal or state government sources. In addition, further investment will need to be directed towards the maintenance or upgrading of the current system over the next three to five year.

The Final SWIMP 2011 concluded with a recommendation for the preparation of a '*Strategic Investment Plan in Water Monitoring*'. This Strategic Investment Plan describes where capital investment is required in order to maintain the information systems necessary to

underpin water resource management in NSW. This current report is the outcome of that recommendation and it outlines a strategic investment strategy for the NSW water monitoring organisations.

The report has a whole of State perspective and acknowledges that some organisations already have programs in place that fund the development and maintenance of their monitoring systems. For these organisations, their contribution to the Strategic Plan focuses on potential future projects that ensure that the monitoring networks remain vital, efficient and relevant to the planning and management requirements of the State.

3.0 Water management in NSW

Water management is one of the great issues facing all Australian states including NSW. Hydrological conditions vary significantly across NSW, from the high precipitation areas of the states east coast to the semi-arid and arid regions of the states western slopes and western division. As shown in Figure 1 around 70 percent of NSW lies within the Murray Darling Basin (MDB) so management of water is important to the other Basin states and impacts on water management in the MDB overall.

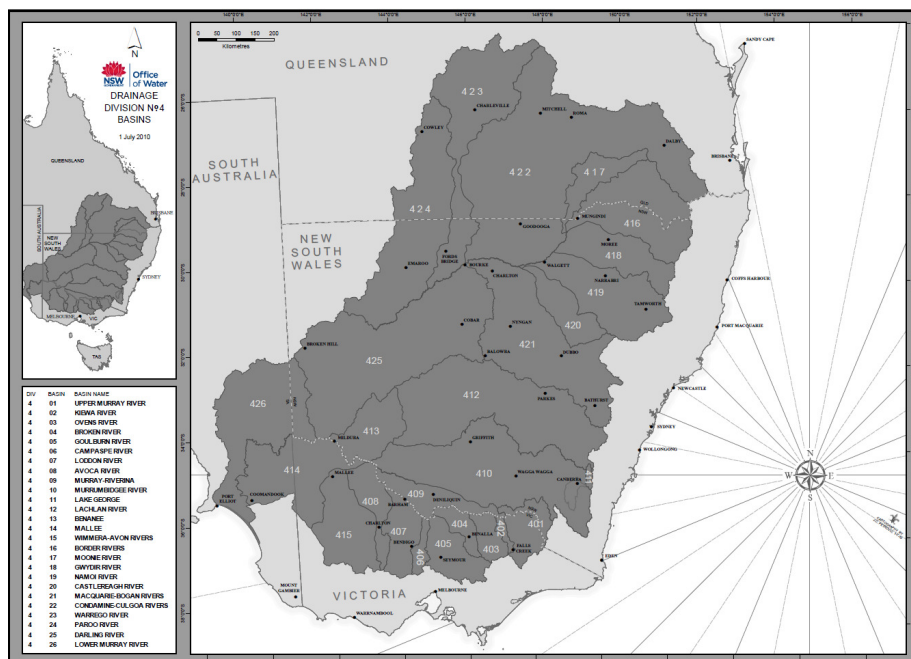


Figure 1: Murray Darling Basin

All areas, including the coastal zone that supports the major population of NSW, experience periods of drought and flood. Water resource management, therefore, involves dealing with a range of issues that concern planning, policy, allocation, water use and supply, and environmental water management.

The State's various water monitoring programs are being designed and adapted to provide the necessary information to describe the quantity, quality, distribution and variability of the State's water resources in order to satisfy these information drivers.

The monitoring of the water resources in NSW are consequently the building blocks for all water management policies including sharing the resource between productive and non-productive uses, as well as providing the technical background for the development of legislation and catchment operational issues. Flood mitigation and emergency flood response also relies on the monitoring networks. Six key information drivers (SWIMP 2012) have been developed to indicate the level of information needed to support water resource planning and management.

Driver 1. Planning for future sharing of the resource

- Sustainability — for water users and the environment
- Drought and flood management
- Competition for water
- Climate variability and climate change
- Medium and long-term forecasting.

Driver 2. Operational management

- River operations
- Operations efficiencies
- Flood operations

Driver 3. Compliance

- Auditing of compliance — MDB Cap, water shepherding and water sharing plans
- Access rules (cease to pump, etc.) particularly for unregulated systems
- Groundwater use — pumping drawdown, interference, trading
- Drought sharing and flood plain harvesting.
- Environmental monitoring

Driver 4. Public interest

- Reporting/internet — key stakeholders, e.g. river heights and flows, water quality, current storage levels, reliable and near real-time
- Recreation — e.g. water levels, predicted conditions
- Communication – Understanding of water information content and context.

Driver 5. Water accounting and assessment

Institutional Government requirements. NSW is a signatory to the following agreements:

- The National Water Initiative (including recent COAG updates)
- interstate agreements including the Murray-Darling Basin Agreement, and the NSW QLD Border Rivers Agreement
- Federal and State Legislation (Water Act 2007 (Cwlth), NSW Water Sharing Plans)
- Public disclosure of water management information
- Water Take — metering initiatives.

Driver 6. Special purpose water monitoring

- The NSW Office of Water and Manly Hydraulics Laboratory (MHL) are funded for water monitoring across NSW to support particular water management activities of other agencies, organisations and industry. Data collected by various agencies is stored with stakeholders.

4.0 Funding Priorities

The funding provided for 5 years by the Bureau of Meteorology through the M&E program, in combination with National Water Commission's HNE project has achieved significant technological and organisational gains for NSW. The priorities for future funding focus on ensuring that NSW monitoring networks remain vital, efficient and relevant to the planning and management requirements of the state. Significantly, use of new technologies funded under M&E has clearly demonstrated their value in improving the efficiency of data collection and storage. Detail on these improvements is contained in the SWIMP (NOW 2011). Future investment into water monitoring systems falls into two areas;

- Category 1 projects – data collection systems that were upgraded under M&E program that NSW organisations are obliged to operate and maintain, and
- Category 2 projects – new projects of high priority that were not funded or were partially funded under M&E but are considered essential for effective water resource management.



Figure 2: Surface Water Monitoring Site - Severn River at Ashford

4.1 Background

The Strategic Investment Plan aims to build from the success of the M&E program by supporting projects that aim to maintain the upgraded systems. The Plan also aims to focus on projects important for NSW that did not receive support from the Bureau. The information below is a summary of the Gaps Analysis for NSW that reviewed all M&E funded projects in NSW and reported on their outcomes. The intent of including this information is to display what has been achieved in NSW, but also identify what work is still outstanding and requires funding.

4.2 Gaps Analysis of the M&E Expenditure 2008-2012

The NSW Strategic Water Information and Monitoring Plan (SWIMP 2012) identified six information drivers (see section 3) and 49 gaps in knowledge and processes and the related monitoring and systems requirements for the various water natural resource agencies in the state. Many of these data and system gaps were closed as result of the M&E program. The outstanding gaps will be addressed by the Category 2 projects under a *NSW M&E Phase 2 Program*.

The outstanding gaps were identified through a Gaps Analysis that was undertaken to demonstrate how Modernisation and Extension of Hydrologic Systems Program (M&E) projects have helped address gaps in data, networks and systems as identified in the NSW SWIMP (2011-2-12). The analysis aimed to:

- Link M&E funded projects undertaken in Rounds 1 -5 with **gaps** as defined in the 2010 SWIMP (*49 Gaps in NSW*).
- Report on the extent to which gaps have been addressed **for individual organisations** through completion (or anticipated completion) of specific M&E projects.

In NSW 120 projects have been funded in five rounds of the M&E program at an expenditure of \$21 Million (not including in-kind contributions). Projects that carry over a few years are only accounted for as one project but include multi year funding. Each of the projects are linked to a Gap and Figure 3 shows that the greatest expenditure was on Gap 2 (approx. \$4,979,980), Gap 4 (approx. \$2,343,900) and Gap 36 (approx \$1,466,370). Gap 2 focuses on improving data accuracy for surface water data, while Gap 4 addresses the upgrade of loggers and modems to improve data transfer capabilities. Gap 36 focuses on the ability to transfer data to the Bureau.

The gaps with the highest number of projects against them have been a priority for the Bureau at the initiation of their Improving Water Information Program. These gaps address the accuracy and currency of the data, and the ability of each organisation to provide it to the Bureau in WDTF. NSW has benefited significantly from this funding as many stations have been upgraded and the data (including historic data) is generally more accessible.

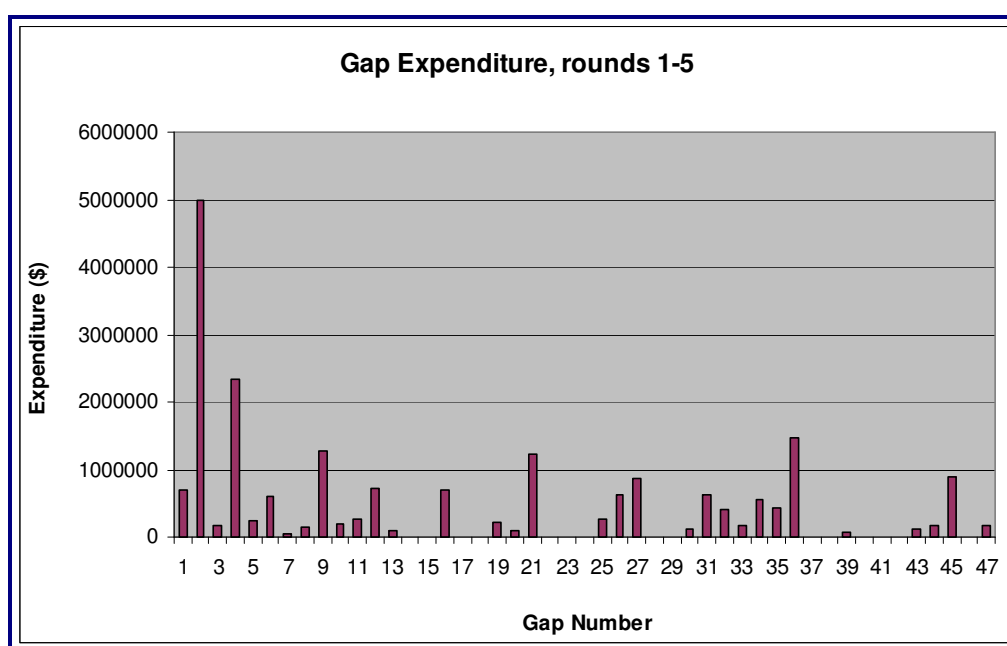


Figure 3 : NSW Gap expenditure from M&E program - rounds 1-5

The assessment of the 120 individually funded applications associated with 97 separate projects demonstrated how close the completed project was to closing a data gap. There are more funded applications than projects because several projects were funded over more than one funding year. The level of assessment was coarse, with the gap either closed, or addressed at 75%, 50% or less than 50%.

Table 2 is a summary of the results of the gaps analysis. The data shows that 65 of the 97 funded projects (67%) closed the gap for their organisation, leaving just over 30% requiring further funding. A further 15 of the 49 gaps have not been funded as the main gap addressed by a project (30% of the gaps). While 15 may seem to be a lot of gaps, several of the funded projects contributed to the resolution of more than one gap but the additional gaps were not considered as the analysis focused only on the main gap. In addition, the majority of the non funded gaps focused on issues not considered a priority by the Bureau. For example, many of the non funded gaps aimed to expand the coverage of the monitoring programs, as well significantly upgrading the water quality monitoring. Neither of these issues were priorities for funding by the Bureau. Other non-funded gaps have been addressed by separate Commonwealth funding programs. An example of this would be gap 37 that addresses issues with metering and this gap could be funded under the Sustaining the Basin Program. It is important to acknowledge that gaps were funded to address Bureau priorities.

Analysis	Number of projects
Total of projects (some projects carry over several years of funding).	97
Number of gaps addressed out of 49 gaps (one gap per project)	34 (69%)
gaps closed for individual organisations	65
# gaps 75% closed for individual organisations	11
# gaps 50% closed for individual organisations	18
# gaps less than 50% closed for individual organisations	4
# unfunded gaps	15

Table 2: Gaps Analysis

In summary, 16 organisations received funding under the M&E program. Figure 4 and Table 3 display the NSW expenditure from rounds 1-5 of the M&E program. Both the table and pie chart show the amount of money each of these monitoring organisations received over rounds 1-5 in the M&E program. The NSW Office of Water is the lead agency for water monitoring in NSW and subsequently received the highest amount of funding.

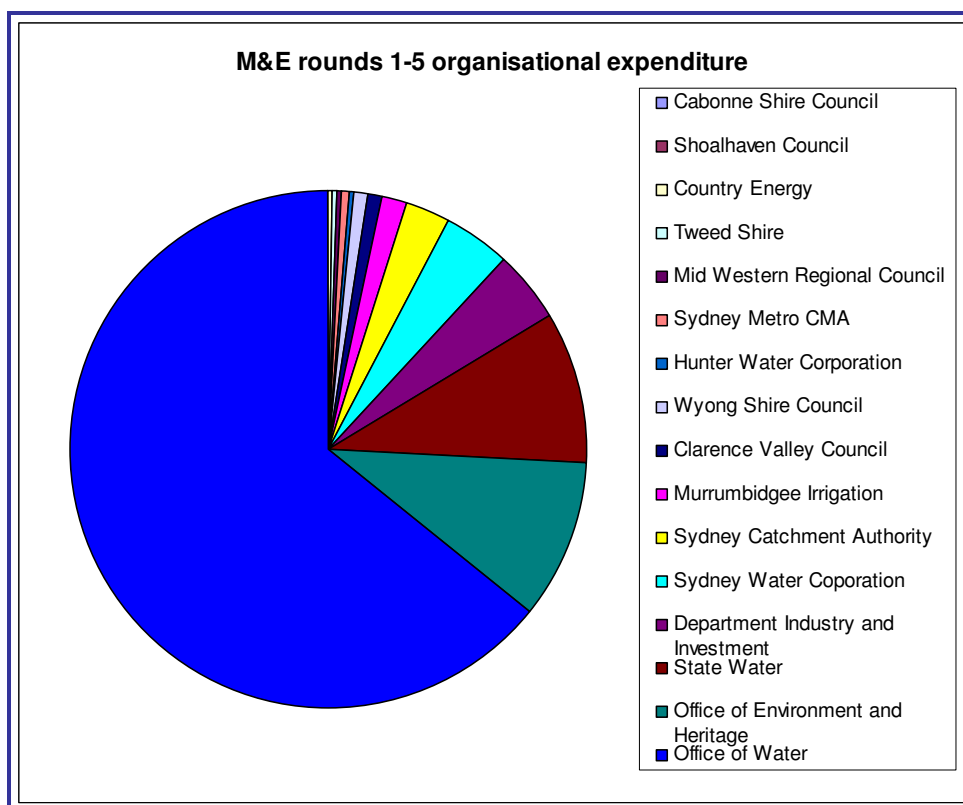


Figure 4: Organisational Expenditure on M&E funding

Organisation	Funding Received in rounds 1-5
Cabonne Shire Council	10,000
Clarence Valley Council	171,000
Country Energy	30,500
Office of Environment and Heritage	2,127,135
Department Industry and Investment	928,015
Hunter Water Corporation	93,000
Mid Western Regional Council	66,000
Murrumbidgee Irrigation	348,800
Office of Water	13,453,350
Shoalhaven Council	19,000
State Water	2,007,250
Sydney Catchment Authority	600,000
Sydney Metro CMA	90,000
Sydney Water Corporation	852,000
Tweed Shire	60,000
Wyong Shire Council	150,000
TOTAL	21,006,050

Table 3: NSW M&E Expenditure rounds 1-5

2.3 Future Funding Priorities

Section 2.2 has highlighted that there are outstanding funding requirements. Funding is still required to complete some of the partly funded or multi-faceted projects. In addition, some gaps were not funded as their key issue (eg. water quality) did not match with the Bureau funding priorities.

To draft future funding priorities all the key water monitoring organisations in NSW were contacted to identify water monitoring projects that require funding. The projects had to focus on key issues that make significant impacts on water management in NSW. Each of the projects were then be grouped into either category 1 or category 2 depending on their intent.

- Category 1 projects – data collection systems that were upgraded under M&E program that NSW organisations are obliged to operate and maintain, and
- Category 2 projects – new projects of high priority that were not funded or were partially funded under M&E but are considered essential for effective water resource management.

Of the 16 organisations that received M&E funding, 15 provided a strategic contribution to the preparation of this report. In addition, 10 organisations provided projects that require funding over the next five years. Together, this represents over 95 percent of the M&E funds allocated. Organisations that contributed to this report fall into the following categories;

- State government agencies,
- Catchment management authorities,
- State corporations,
- Private irrigation companies,
- Rural urban water utilities,
- Local government,

Projects for future investment for monitoring systems for NSW has been allocated into category 1 and category 2 (see above). For organisations that already have funded programs to develop and maintain systems, their projects will fall predominately into Category 2.

To maintain consistency with the SWIMP these projects have also been linked to funding themes that have directed the M&E expenditure, the themes are listed below. All the projects are identified and costed in Table 4 with a brief description of each project presented in **Appendix 1- Project Descriptions**. **Appendix 2 -Water monitoring strategic objectives**, summarises priorities and future projects for the NSW contributing organisations, and provides a strategic context for the Investment Plan. The collation of this information provides a clear starting point for the preparation of a:

- *NSW Water Monitoring Asset Management Plan (category 1 projects) and*
- *NSW M&E Phase 2 Program (category 2 projects).*

The Themes under which the Bureau allocated funds are as follows;

Theme one: Data Collection and Telemetry

Theme two: Collating and Reporting Water Information (includes National Water Account)

Theme three: Improving the Australian Hydrologic Geospatial Fabric surface water foundation dataset

Theme four: Improving the Australian Hydrologic Geospatial Fabric groundwater foundation dataset

Theme five: Development and Application of Data Standards for the collection, management and transfer of data (WDTF)

Theme six: Data provision and WDTF (includes dataset upgrades)

Table 4: Water Monitoring Projects (Data and Systems) 2012-2017

Project name	Category	Executive Sponsor	Cost (\$) Aprox.	Theme
ORGANISATION NSW OFFICE OF WATER				
Asset Management Plans (including monitoring and data management) for: a) surface water b) ground water c) water quality	ONE	Manager, Water Monitoring	450,000	1
Asset management – purchase replacement / upgrade equipment a. Surface water – includes acoustic Doppler b. Ground water – includes telemetry c. Water quality <i>(* see appendix one for further detail)</i>	ONE	Manager, Water Monitoring	7,500,000	1
NSW State-wide IP wireless network	ONE	Manager, Water Monitoring	125,000	1
EC Probes for groundwater monitoring	ONE	Manager, Groundwater Management	300,000	1
Development and Implementation of Webcam	ONE	Manager, Water Monitoring	100,000	1
Meta data – Water Dataset alignment with proposed metadata standard	ONE	Manager, Water Monitoring	20,000	5
Independent verification of Doppler data	ONE	Manager, Water Monitoring	50,000	5
TOTAL FOR CATEGORY ONE (maintenance and upgrades)			8,545,000	
Disaster Recovery and Field System Redundancy Planning	TWO	Manager, Water Monitoring	150,000	1
Remote Control Vessels	TWO	Manager, Water Monitoring	360,000	1
Low and High Flow rating accuracy	TWO	Manager, Water Monitoring	150,000	1
Evaluation of commercially available electrical conductivity sensors	TWO	Director, Environmental Evaluation and performance	193,000	1
Groundwater telemetry expansion	TWO	Manager, Groundwater Management	600,000	1
Adopting technological advancement of in-situ real time water quality monitoring	TWO	Director, Environmental Evaluation and performance	870,000	1
Groundwater telemetry expansion	TWO	Manager, Groundwater Management	600,000	1

Project name	Category	Executive Sponsor	Cost (\$) Aprox.	Theme
In-situ Doppler velocity	TWO	Manager, Water Monitoring	980,000	1
Unregulated Flow Class Announcements	TWO	Director, Water Systems	100,000	2
Historic data recovery – water use licensing	TWO	Manager, Surface Water Management	140,000	2
Review and develop standard procedures for converting height data to real time flow data (operational rating table development)	TWO	Manager, Water Monitoring	150,000	2
Inadequate spatial mapping of groundwater and surface access licences	TWO	Manager, Groundwater Management	70,000	3
NSW Statewide Hydrological Geospatial Fabric (NHGF) project - Namoi Catchments	TWO	Team Leader, Spatial Service and Information	400,000	4
Biological database – KIWQM extension and data population	TWO	Director, Environmental Evaluation and performance	615,000	6
Workforce Planning: Formal training in Hydrographic Practice (Diploma level) for NOW staff	TWO	Manager, Water Monitoring	800,000	6
Data quality framework for Australian water datasets	TWO	Manager, Water Monitoring	50,000	5
Environmental water holder needs – water shepherding	TWO	Project manager, Water Sheperding	Unknown	1
Lack of information about GDE	TWO	Manager, Groundwater Management	200,000	2
TOTAL FOR CATEGORY TWO (new projects)			6,428,000	
ORGANISATION NSW OFFICE OF ENVIRONMENT AND HERITAGE (MANLY HYDRAULICS LABORATORY)				
Asset Management Plan (Coastal Network)	ONE	Manager, Coast and Flood Policy.	200,000	1
Improved Flood Warning	ONE	Manager, Coast and Flood Policy.	400,000	1
Improved flood flow measurement	ONE	Manager, Coast and Flood Policy.	300,000	1
Improve data accuracy	ONE	Manager, Coast and Flood Policy.	240,000	1
TOTAL FOR CATEGORY ONE (maintenance and upgrades)			1,140,000	
Digitisation of historical data and metadata	TWO	Manager, Coast and Flood Policy.	350,000	2
Develop future gauging station	TWO	Manager, Coast and Flood Policy.	100,000	2
Real time quality codes	TWO	Manager, Coast and Flood Policy.	250,000	2
TOTAL FOR CATEGORY TWO (new projects)			700,000	

Project name	Category	Executive Sponsor	Cost (\$) Aprox.	Theme
ORGANISATION STATE WATER				
Upgrade instrumentation of weir level recording equipment, with improved accuracy in storage capacity tables	TWO	General manager, water delivery	200,000	1
Software development to automate the transfer of TT figures to the Bureau	TWO	General manager, water delivery	50,000	6
Installation of accurate measuring devices monitoring equipment, and confirm accuracy with NWI/Bureau standards	TWO	General manager, water delivery	600,000	1
Identification and automation of isolated manual data management systems	TWO	General manager, water delivery	50,000	1
Close gaps in current monitoring network	TWO	General manager, water delivery	1,200,000	1
Improved forecasting of water demands and river 'losses'	TWO	General manager, water delivery	250,000	1
Flood operation – rainfall runoff predictive capacity, improve timing of storage pre-release against tributary flows	TWO	General manager, water delivery	400,000	1
Seasonal forecasting – improve management of transfers between storages	TWO	General manager, water delivery	350,000	1
Seasonal forecasting - better management of environmental allocations	TWO	General manager, water delivery	300,000	1
Consistent and efficient handling of information at times of floods and low flow conditions	TWO	General manager, water delivery	100,000	2
TOTAL FOR CATEGORY TWO (new projects)			\$3,500,000	
ORGANISATION NSW DEPARTMENT OF PRIMARY INDUSTRIES (NSW AGRICULTURE)				
Increasing the accuracy of streamflow measurement	ONE	Research Leader, Water in DPI	160,000	1
Developing and implementing an asset management plan for replacement of surface and ground water measurement equipment	ONE	Research Leader, Water in DPI	500,000	1
Improving surface water sites to meet OHS and accuracy requirements	ONE	Research Leader, Water in DPI	100,000	1
Improving water mass balance information	ONE	Research Leader, Water in DPI	500,000	2
TOTAL FOR CATEGORY ONE (maintenance and upgrades)			\$1,660,000	

Project name	Category	Executive Sponsor	Cost (\$) Aprox.	Theme
Improving the groundwater water quality network coverage to meet water information requirements	TWO	Manager, Water in DPI	150,000	1
Improving water quality monitoring network for groundwater/surface water interaction	TWO	Manager, Water in DPI	200,000	1
Increasing water quality sensors in the surface water network	TWO	Manager, Water in DPI	200,000	1
TOTAL FOR CATEGORY TWO (new projects)			\$550,000	
ORGANISATION MURRUMBIDGEE IRRIGATION				
Flow measurement and remote communication upgrade of River Drain and End Of System sites.	ONE	Murrumbidgee Irrigation	25,000	1
Application to send data from SCADA Historian to the Bureau in WDTF	ONE	Murrumbidgee Irrigation	50,000	2
TOTAL FOR CATEGORY ONE (maintenance and upgrades)			75,000	
Upgrade of key water distribution and escape monitoring sites	TWO	Murrumbidgee Irrigation	325,000	1
Upgrade of key water distribution and escape monitoring sites	TWO	Murrumbidgee Irrigation	715,000	1
Upgrade of key water distribution and escape monitoring sites	TWO	Murrumbidgee Irrigation	255,000	1
TOTAL FOR CATEGORY TWO (new projects)			1,295,000	
ORGANISATION GOSFORD / WYONG COUNCIL				
Telemetry for Groundwater Monitoring Bores	TWO	Gosford and Wyong Councils	256,000	1
Mangrove Creek stream gauge and telemetry	TWO	Gosford and Wyong Councils	25,000	1
Installation of rain gauges	TWO	Gosford and Wyong Councils	50,000	1
Establish weather stations	TWO	Gosford and Wyong Councils	100,000	1
Water Data Transfer Format (WDTF) Schema Upgrade	TWO	Gosford and Wyong Councils	125,000	6
Continuous water quality monitoring at Wyong River and Ourimbah Creek Pump Stations"	TWO	Gosford and Wyong Councils	100,000	1
TOTAL FOR CATEGORY TWO (new projects)			656,000	

Project name	Category	Executive Sponsor	Cost (\$) Aprox.	Theme
ORGANISATION HUNTER WATER CORPORATION				
Improved metering of recycled water use	TWO	Hunter Water Corporation	50,000	1
Installation of telemetered groundwater level monitoring instruments at strategic locations at Tomago and Anna Bay	TWO	Hunter Water Corporation	120,000	1
Bathymetric Survey of Chichester Dam	TWO	Hunter Water Corporation	100,000	1
TOTAL FOR CATEGORY TWO (new projects)			270,000	
ORGANISATION LISMORE CITY COUNCIL				
Upgrade telemetry and rain gauges	TWO	Lismore City Council	Unknown	1
ORGANISATION ROUS WATER				
SCADA and Historical Database Upgrade	TWO	Rous Water	225,000	6
Emigrant Creek Dam Inflow Monitoring	TWO	Rous water	150,000	1
TOTAL FOR CATEGORY TWO (new projects)			375,000	
ORGANISATION MIDWESTERN COUNCIL				
Telemetry upgrade and monitoring program expansion.	TWO	Midwestern Council	Unknown	1
Improving data management	TWO	Midwestern Council	Unknown	2
ORGANISATION NORTHERN RIVERS CMA				
Implementation of Ecohealth Program	TWO	Northern Rivers CMA	150,000	1
Telemetry purchase for Ecohealth Program	TWO	Northern Rivers CMA	200,000	1
TOTAL FOR CATEGORY TWO (new projects)			350,000	

5.0 Conclusion

The \$21 million dollar cash stimulus provided to NSW from the Bureau of Meteorology “Modernisation and Extension Program” has allowed State agencies and other water monitoring organisations to upgrade their systems in a relatively short period of time. Outcomes include increased productivity and improved data delivery services to stakeholders and the community, with associated reductions in operating costs.

Under the funding deeds signed between the NSW organisations and the Bureau, is agreement that the organisations that received funding would continue to operate and maintain the upgraded systems into the future. The key recommendations from this report are that the NSW Office of Water, in conjunction with other water organisations in the state, prepares a;

- NSW Asset Management Plan for Water Monitoring to 2017 (category 1 projects) and a
- NSW Modernisation and Extension Program – Phase 2 (category 2 projects)

The NSW Office of Water (NOW) acted as Lead Agency for the Bureau and has concluded the M&E Program by preparing a ‘NSW Strategic Investment Plan in Water Monitoring 2012-17. This Investment Report has;

- estimated a five year cost of maintaining water monitoring systems in NSW at just around \$11.4 million (for organisations that have contributed to this report),
- collated detail on a wide range of projects (prioritised into two categories) that would provide a clear starting point for the preparation of the Asset Management Plan and the NSW M&E Program Phase 2.

Various funding options will need to be considered in developing the Asset Management Plan and the NSW M&E 2 Program. These could include normal consolidated revenue funding for maintenance including technology upgrades, ‘capital grants’ from Treasury for new projects and possible ongoing cost sharing with the Bureau of Meteorology for improvements to data delivery systems.

The next step in this process is for approval to be given to the preparation of the Asset Management Plan and this form the basis for funding submission for the ongoing maintenance and upgrade to the states major water resource monitoring networks.

6.0 Bibliography

NSW Office of Water (2012) "New South Wales Strategic Water Information and Monitoring Plan. Final Report 2012". NSW Office of Water, 10 Valentine Ave. Parramatta NSW.

APPENDIX ONE – PROJECT DESCRIPTIONS



NSW OFFICE OF WATER

CATEGORY ONE: Asset Management Plans (including monitoring and data management)

COST: \$450,000

Asset Management Plan to incorporate all the activities associated with;

1. surface water (currently \$20 Million in assets)
2. ground water (currently \$74 Million in assets)
3. water quality (currently estimated at \$2 Million in assets)
4. data management (currently estimated at \$1.6 million in assets)

NSW Office of Water currently undertakes a regular review of its hydrometric network and data management systems to ensure it meets water management information needs of stakeholders. The review identifies the Network objectives in terms of state, federal and community programs. This information forms the basis of submissions for Capital funding to finance technology upgrades or installation of new stations and database systems.

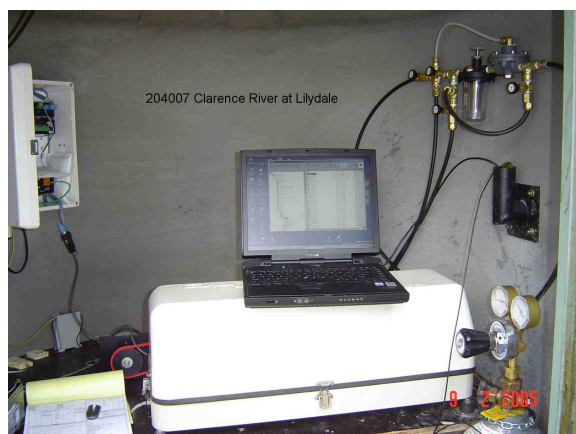


Figure 5: Water Monitoring Assets



NSW Office of Water will incorporate this review into an Asset Management Plan that highlights capital investment, maintenance and asset disposal issues over a five (5) year period. The NSW Office of Water will then review the Asset Plan annually obtain approval for the Plan from management and submit to the NSW Treasury and Department of Finance and Services as part of the annual capital works budget process. NSW Office of Water will develop separate components for the surface water, ground water and water quality networks and data management systems as part of the Plan. Each component of the Plan will address the capital investment required to ensure that the water monitoring and data management networks are efficient, effective and economic.

CATEGORY ONE: Asset management – purchase replacement / upgrade equipment
COST: \$7,500,000

NSW has millions of dollars of monitoring and data management equipment that needs replacement to ensure the networks continue to provide accurate data in within a reasonable time frame. As a general rule monitoring equipment needs replacement every five year, while gauging equipment will last for approximately twenty years.

The asset management plan developed as part of a high priority project 1 identifies what the capitol expenditure priorities are. This project implements the Plan and will likely focus on

- a. Surface water – includes acoustic Doppler
- b. Ground water – includes telemetry
- c. Water quality - sensors
- d. Data management – servers and database systems

An earlier project is looking to develop an Asset management Plan and as such will identify assets and develop a projected cost for the implementation of this plan

CATEGORY ONE: NSW State-wide IP Wireless Network
COST: \$300,000

MHL and NOW currently have their own VPN and this project aims to extend the network to other agencies. The IP network allows organisations to increase download frequencies. NSW Office of Water has moved from once daily downloads to hourly data capture and at a comparable cost. This priority project will significantly increase the proportion of IP sites.

CATEGORY ONE : Electrical Conductivity (EC) probes for Groundwater Monitoring
COST: \$300,000

Currently, there is no regular monitoring program for groundwater quality. In order to guarantee continuity in data collection program and assess the status of the resources, a three-tiered groundwater quality networks (Primary, Secondary and Special Networks) is suggested. The aim of the primary monitoring network is to provide long term groundwater quality data for trend analysis from selected sites in the region. The main purpose of the Secondary Monitoring Network is to complement the first category of network. Project oriented monitoring activities of short duration and limited in scope come under the third tier, Special Networks

The proposed primary network will consist of EC probes (measuring electrical conductivity and water temperature) at 68 sites, or about 10% of the current groundwater water level monitoring network. This project aims to complete this phase of the program..

The proposed monitoring network is consistent with the recommendations of the Water Sharing Plans. It supports the intended outcomes of the plans (economic and environmental). The estimated cost to implement the first tier of the proposed network is about \$24,000/year.

CATEGORY ONE Development and Implementation of Webcam
COST: 100,000

Webcams are a cost efficient way of installing a level redundancy at sites, with the additional benefit of providing imagery that has proved popular with the public. Being able to see when a stream ceases or begins to flow is critical in the Water Sharing Planning process. The webcams are programmable to take a set schedule of photos. For example a camera can take a photo of the gauge every hour during daylight (a manual gauge reading) and also the control (flowing - not flowing). These images are sent by a separate communication device and stored for later inspection, thereby giving a level of redundancy.

This technology has been successfully installed on a very small scale for testing and evaluation purposes. Installation of additional webcams will allow this technology to be placed in a broader range of conditions and also increase redundancy. An installation of this magnitude will allow agencies to more accurately determine installation and maintenance costs.

Each camera costs approximately \$8,000 and the installation of webcams on priority gauges will provide independent redundancy at key sites. The camera also provides accessible technology for the community so they can observe current flow conditions.

**CATEGORY ONE: Water database alignment with proposed
Bureau “metadata standards”**

COST: \$20,000 to update all data software and review all data.

For data to be truly useful people need to know where it is and whether the data will meet their needs. Metadata provides this information.

NSW has taken a lead role, with the Bureau of Meteorology, in the development of Data Standards for water monitoring. After data has been gathered issues associated with data quality, data standards and meta-data can arise. Changes to the Water Regulations reflect this expectation with new requirements for metadata to be enabled shortly. It is anticipated that with the development of these metadata standards the need to not only review part or all of NSW water data and the database systems but also populate this data will be required.

CATEGORY ONE: Independent verification of Doppler data
COST: \$50,000

Dopplers can provide a safe and accurate method of measuring flows.



Figure 6: Acoustic Doppler Gauging Equipment

The NSW Office of Water Hydrometric field teams were able to deploy Acoustic Doppler Current Profilers (ADCP) to measure flooded streams that could not have been achieved with traditional current meter technology. The ADCP provides a more accurate, much faster and safer methodology for undertaking flood measurements. ADCP are progressively replacing traditional stream flow gauging methodologies.

The Dopplers are supplied by the manufacturer calibrated. Currently the calibration cannot be independently tested or verified by agencies using this equipment. This single piece of equipment measures the horizontal (distance wire) the vertical (rods or winches) and the velocity (current meter). In traditional flow measurement each of these measuring devices is independently calibrated.

This project will provide a method for ADCP calibration-verification

CATEGORY TWO: Disaster Recovery and Field System Redundancy Planning

COST: \$150,000

NOW's real time data system provides the majority of the NSW's stream water level data required for flood forecasting, SES and dam storage operation during flood conditions. Continued delivery of this data during this time is crucial for the safety of life and property.

In accordance with business continuity planning requirements for NOW's critical real time data collection and dissemination systems NOW is looking at the development of both a disaster recovery plans for its backend IT systems and at redundancy of critical components of its monitoring systems in the field.

Disaster recovery is the process, policies and procedures related to preparing for recovery or continuation of technology infrastructure critical to an organization after a natural or human-induced disaster. Disaster recovery is a subset of business continuity. While business continuity involves planning for keeping all aspects of a business functioning in the midst of disruptive events, disaster recovery focuses on the IT or technology systems that support business functions.

Redundancy is the duplication of critical field components of a monitoring system with the intention of increasing reliability of these system, typically at monitoring sites. For the surface water, groundwater and water quality monitoring networks managed by NSW Office of Water, there may be redundancy required for:

- a. Communication
- b. Gauges
- c. network
- d. database
- e. power
- f. other...

Redundancy in these areas ensures that the system continues to operate when affected by poor or extreme weather events (e.g. floods), electricity failures, accidents, or mechanical breakdowns. Generally it is when the break-down conditions occur that the network is most needed. Having strategies first to develop a prioritised approach for redundancy ensures standards and procedures are in place to first plan for the situation and then sufficiently address it.

It is proposed that the first phase of this project involve an audit of measures NSW Office of Water have in place - particularly for the IT, network, database and power. With this clearly identified a Plan can be developed that focuses on priorities, opportunities and options.

As part of the Plan development, a workshop will be held with other relevant organisations to explore the development a NSW-wide strategic approach for redundancy. It is likely DEH/ MHL, State Water, SCA, the Bureau and the SES could be interested.

Communications and gauges are items that we can identify for minimum reliability at critical sites.

CATEGORY TWO: Remote Control Vessels

COST: \$360,000

This project will purchase 15 small remote control Doppler gauging vessels, at a cost of approximately \$24,000 per boat.

The NSW Office of Water has purchased, trialled and deployed a small number of remote controlled vessels. These vessels have an ADCP mounted in the hull allowing measurement of stream flows without the need for Hydrometric staff to enter the water or be exposed on road or rail bridges. This is a significant reduction in Occupational Health and Safety risk, particularly in time of floods. These remote controlled vessels have proved an efficient way to undertake stream flow measurements in most large streams. These vessels will be integrated into the hydrometric field equipment on a priority basis.

CATEGORY TWO: Low and High Flow rating accuracy.

COST: \$150,000

The project will aim to improve the accuracy of low flow data of existing surface water networks through the development of low flow control structure standards that will meet with the need for fish passages while maintaining the flow accuracy.. This enables NSW monitoring agencies (including NSW Office of Water) to install long terms viable control structures that will result in more accurate low flow data.

The project will also develop a suite of "Manning's "n" values" for differing natural channel characteristics as a means of extending and validating high stage: discharge relationships. Many site ratings are suspected to have gross errors and in many cases physical flow measurement (gauging) is impossible. There are many theoretical methods of deriving rating curves, most of which rely on good survey and other field data. The project will involve physical measurements, field verification, calculations, office analysis and formal report of the relationships between field characteristics and Mannings roughness

Recent floods in the Hunter and high level doppler gauging have shown a high variability in channel discharge characteristics and discharge relationships.

CATEGORY TWO Evaluation of commercially available electrical conductivity sensors

Cost: \$193,000

Electrical conductivity sensors (for Surface Water salinity measurement) commercially available for a number of reasons may not meet the needs of agencies requiring this important resource data. Such devices must be able to operate on low power, in rugged conditions and for extended periods with no human intervention.

It is proposed an independent survey be undertaken of National agencies using these products. The survey will be supported by research of market place; obtain product information, first hand experience from users, and where viable test and trial devices that meet the deliverables of the project, and the supplied technical specification.

If commercially available devices are lacking in agencies requirements, that a promotion of desired elements are engaged with existing industry providers to develop a commercial variant that delivers the data and functionality expected by the agencies – as per the project specification scope.

Relevance of this project is across state boundaries and in-principle support from the below agency representatives has been received.

At the commencement of the project a formalised technical specification of the brief through a technical working party would be sought.

In-kind contributions will include project management, and staff input and time to the technical working group for the formulised technical specification, and further assessment review meetings.

In principle support Manly Hydraulics – Kimbyl Mann, the Bureau Water Standards and Policy – Allan Baker, Hunter River Salinity Trading Scheme – David Hoey, WA Water – Neal Chapman.

CATEGORY TWO: Groundwater Telemetry Expansion

Cost: \$600,000

This project builds continues an upgrade of groundwater monitoring stations that was funded under round 5 of the Bureau of Meteorology M&E program. It focuses on priority work that is still outstanding and needs to be completed.

The New South Wales Office of Water Monitors in excess of 3,700 groundwater monitoring bores across the State. The majority of these are manually read varying in frequency from 6 to 12 weeks per year. A small proportion of these bores have loggers installed, with a smaller proportion approximately 4%, having telemetry. Manual reading of bores is extremely time consuming, inefficient and resulting in less accurate data than telemetered bores. Telemetered bores result in a greater density of data temporally and more accurate data because the risk of human error is reduced, therefore better management decisions.



Figure 7: Telemetered Groundwater Bores

In addition the National Water Commission and NSW Office of Water co-funded and extensive investigation into the dynamics of water exchange between rivers and aquifers to a value of nearly \$3 million, known as the "Losing Streams" project. It involved the construction of multi-level piezometer transects at 12 sites on six rivers in the NSW Murray Basin (72 bores total), and the temporary installation of instruments and telemetry to read time-series groundwater and surface water standing water levels. The project proved the value of the data for improving the quantification of water movement between rivers and aquifers. The first Phase of this project is to reinstate on a permanent basis the instruments and telemetry at some of these surface water, groundwater interaction sites and make the data publically available on the internet.

The major limitation of the groundwater monitoring network at present is the spatial distribution and number of telemetered bores across the State. These are limited to a small number of developed water sharing plan areas in inland NSW only. The number of water sharing plans will increase over the next few years with the overarching Murray Darling Basin plan also in development. NSW Office of Water has the statutory obligation of monitoring the effectiveness of the impacts of these water sharing plans but lacks data both spatially and temporally to complete its statutory and resource management obligations to the best of its ability. By upgrading more bores to telemetry systems this gap is gradually being closed. Hence the second Phase of this project is to expand the number of sites on telemetry if possible, in critical water sharing plan areas.

**CATEGORY TWO: Adopting technological advancement of
in-situ real time water quality monitoring**

COST: 870,000

To improve technological capture and efficiencies in water monitoring by combining both the water quantity and water quality monitoring programs at key specific sites within NSW, of which the Murray Darling Basin (MDB) is a large component, by installing insitu water quality instrumentation at telemetered water monitoring gauge locations.

These sites will be determined by a combined multi-level government approach to meet multiple level objectives of the NSW Algal Management Strategy, NSW Monitoring Evaluation and Reporting (NSW MER) Strategy, NSW Water Sharing Plan (WSP) implementation and evaluation, river operations, environmental flow releases, critical water quality management (blackwater and blue-green algae), Murray Darling Basin Authority (MDBA) Basin Plan implementation and evaluation, in particular the ability to monitor and evaluate water quality targets as part of the Basin's Water Quality and Salinity Management Plan (WQSMP).

The gathering of real time water quality data is instrumental in the development of quantity and quality models to enable more effective river operation and incident management in the Basin and water quality predictive models. This project is a trial to improve the effectiveness and efficiencies of current programs. The outcomes and evaluation of this trial will inform the future water quality monitoring programs in NSW, noting that technology in turbid streams can be troublesome.

The data will be telemetered and available real time to stakeholders and the public, through already established network systems. Analytes of initial interest are dissolved oxygen, pH (of interest for managing blackwater) and turbidity and Chlorophyll a (as a surrogate for nutrients, primary productivity and algae). These will be installed at already established telemetered gauge locations where temperature and electrical conductivity and real time data is currently collected.

The data will be stored in the department's real time management system (HYDSTRA) with appropriate metadata and source methods to meet Bureau quality code standards. This will require establishment of data management procedures and quality assurance.

Funding will be for project management (data management and procedures / calibration / correlation and quality coding establishment, equipment specification), sonde / instrumentation purchase / cabling / data-loggers, establishment at station, and development of training packages for key staff by the database supplier KISTAs. (HYDSTRA) in order to manage, store and code real time water quality data. Operating costs for maintenance will be included.

In-kind contributions will include overall project management, staff training, EFT support for maintenance and reporting.

CATEGORY TWO: In-situ Doppler velocity monitoring.

COST: \$980,000

Improving the accuracy of existing networks by acquiring and installing in situ Acoustic Doppler sensors at key poorly rated stations to improve the flow accuracy and support more accurate water accounting. Purchase and install 30 side looking in situ Dopplers. Milestone (1) Obtain quotes (2) Employ temporary or contract staff (3) Report site list (4) Survey and develop installation plans (5) Install systems (6) Quarterly reports on progress Criteria 2.1

CATEGORY TWO: Unregulated Flow Class Announcements

COST: \$100,000

Unregulated Water Sharing Plans currently rely mainly on user discretion for pumping access where flow classes are referred to in water licenses. Each water user needs to refer to gauge data output on the web to determine if they have water access.



Figure 8: Water Extraction on Unregulated streams

This project aims to provide automated web based information on flow class access to remove ambiguity for unregulated water users. Having the announcements automated also enables improved data management of the announcements that can contribute to water accounting process, modelling and water management.

CATEGORY TWO: Data Recovery – water use licensing
COST: \$140,000

When the NSW Licensing Administration System (LAS) was originally developed it did not include any licensing or use information for all Trusts and Irrigation Corporations (or Areas). These exclusions account for almost half the water use in NSW and include the majority of water use on the Murray, the Low Bidgee and the lower Darling. This historical (1983-1997) data is required for legislated information requirements including CAP assessment, river operation and water planning. However, as this information is not in a database, access to the data is difficult. NSW Office of Water staff currently refer to paper files and excel spreadsheets that are held in an ad hoc manner by individuals throughout NSW.

State Water is developing a new water accounting database (OPAL) which will be capable of integrating data from both the Water Act, 1912 and Water Management Act, 2000. The Federal Government is also developing a new water use database – National Water Market Solution (NWMS). Despite the likely improvements with the new data management systems, the data incorporated into these databases will be only be the available LAS data, which is post 2004. with a few Irrigation Corporation's included back to 1997. There will be no earlier data available.

If historic licensing and use data were sourced and then incorporated into the new databases it would facilitate increased efficiency for a range of required NSW Office of Water water modelling and model development.

This project aims to achieve the following:

1. Collate all historic licensing and use information for Trusts and Irrigations Corporations (Areas) in NSW
2. Resolve how the data needs to be represented in OPAL and NWMS
3. Ensure OPAL and NWMS are built to enable the historic data to be entered
4. Re-create the records to ensure efficient programming.

CATEGORY TWO: Review and develop standard procedures for converting height data to real time flow data (operational rating table development)

COST: \$120,000

There is currently no standard process for the generating of real time (or operational) flow data. This type of information is required for river operators and flood management and is the basis of decisions involving large amounts of money and risks to life and property.

Historically, flow data has been calculated some time after the events have occurred. This world wide recognised long term assessment approach of calculating flow was necessary due to the old manual methods of collecting data. This involved the collection of years of gauging data before determining and developing stage discharge relationships, collecting height data and the independent verification data to make adjustments to this data and quality code the data and then the combining of these two data sources to create flow data.

Today the need is to have as accurate as possible real time flow data from much of the network which requires near real time interrogation of height data and more timely changes to stage discharge relationships when changes in stream conditions occur. There are a

range of approaches being used throughout Australia and a range of expectations by clients. This project's objective is to document the variances in methodology used and then to develop and implement procedures to provide a consistent platform for the generation of and delivery of real time flow from the networks.

CATEGORY TWO: Inadequate spatial mapping of groundwater and surface access licences

COST:\$70,000

There is an urgent need to allocate resources to modify the Licensing Administration System (LAS) to reinstate bore site reference links lost since the commencement of the groundwater sharing plans. There are several parts to this phase of the project.

- The first is to a programming task to enable the link to be established between LAS (where licenses and conditions for works are stored) and Hydstra GW (where the details of the work as constructed and water level data are stored) at an individual bore level.
- The second is to get the data that has not been linked since the introduction of the WSPs cleaned up before it the final transferral of data to the new Hydstra GW system. The specifications for the new GW Hydstra database have included the link between the licensed extraction site/point and the bore, therefore cleansing of these data are required prior to transferring to the new database otherwise all these data will be lost.

Under the WA1912 there was one bore licence per bore. This relationship no longer applies under the WMA2000 where a number of bores may be under one approval. Consequently since commencement of the groundwater sharing plans the live link between the registered bore data and the associated licenses and approvals has been broken in these areas, i.e. NSW Office of Water's high priority management areas.

Groundwater site identifiers used by several corporate databases do not match with the bore works registry Hydstra GW. Without the Hydstra GW-LAS spatial link, database extractions require the data to be manually matched to an extraction from Hydstra GW in order to find the location and depth to which the data relates.

With increasing data demands from the Burea and MDBA the database link failures are causing unnecessary inefficiencies.

CATEGORY TWO: NSW Statewide Hydrological Geospatial Fabric (NHGF) project - Namoi Catchments

COST: \$400,000

The objective of the NSW State-Wide Hydrological Geospatial Fabric Project is to provide an integrated and complete coverage of available watercourse and water body mapping, and governance arrangements that will directly support the ongoing improvement of catchment, state and national scale water accounting and water resource assessment.

This project will commence more detailed mapping and integration of man-made and natural surface hydrography features over the Namoi catchments. The activity will build on knowledge and techniques gained from running a similar project in the Murrumbidgee, and will create the "next generation" of data aimed at catchment and local scale water accounting and water resource assessment in priority areas. This work would capture data from recent

LiDAR and high-resolution imagery surveys over these catchments, and will serve as a test-bed for seamlessly addressing local, catchment and national information requirements. Importantly it will guide the need to future investment in other catchments.

The project will be collaborative effort between the NSW Office of Environment and Heritage, NSW Land and Property Information, and Geoscience Australia (GA).

CATEGORY TWO: Biological database, KIWQM extension
Cost \$150,000

As part of a co-funded (Bureau M&E and NSW Treasury Capital project WMMIS) the NSW Office of Water had major enhancements made to a water quality database, KIWQM. As part of these developments, functionality was incorporated to enable the database to also be able to incorporate limited biological (algal) data as well. It is proposed that the current system be further developed to extend its capacity to store the full range of biological data required by NOW.

Development of this biological database will create a central, secure repository and single point of access for all aquatic or semi-aquatic biological data (e.g. macro-invertebrate monitoring information) within NOW and is a high priority as there is currently no corporate repository for this information. The database will be initially support NSW Office of Water data, but potentially could be used for data from other state agencies.



Figure 9: Biological Monitoring

The NSW Office of Water (and its predecessors) has collected data on a range of biological attributes to inform a range of projects since the early 1990s at a cost of several million dollars, representing an information investment by NSW. This data covers a broad range of metrics including: fish, macro invertebrates, periphyton, algae, vegetation, and geomorphology.

These datasets are critical for the analysis of flow response to the environmental provisions of water sharing plans and other flow response programs such as the Snowy River Program. The datasets represent work over a period of nearly 20 years and they are currently stored on various servers or hard drives on various databases, usually Excel.

A corporate database will ensure all data is stored on a single corporate database, with associated quality tagging and broader access to data across the NSW Office of Water. The project is a critical priority for NSW Office of Water and construction and population of the database is a specific IPART deliverable C01-05 "surface water quality and biological database management"

Ultimately a secure central repository with easy input & extraction and single point access for biological data will QA/QC, statistical analysis and reporting requirements. This will result in efficiency savings for staff time to access data, and to leverage value of investment in historical datasets from across NSW.

CATEGORY TWO: Workforce Planning: Formal training in Hydrographic Practice (Diploma level) for NOW staff.

COST: \$800,000 for Phase 1 and Phase 2

Total cost for Phase 1 and 2 over four years is \$800,000 - Funding of each phase could occur independently and be from differently sources.

NOW has a workforce of almost 80 hydrographic personnel involved in the important task of measuring and monitoring the states water resources. This includes surface and ground water quantity and quality data collection. Under the Bureau of Meteorology M&E Program, a course was developed (TAFE NSW - Open Training and Education - OFTEN) in Hydrographic Practice. The course is given as remote learning, supplemented with some face to face training in key modules. NOW has identified 63 staff that should undertake all or part of this training to support water resources planning and management in this state.

It is proposed that the training be split into two phases:

Phase 1 – Formal NSW TAFE Diploma course in Hydrographic Practice for 63 staff

cost \$485,000 over three years;

Phase 2 - Competency based field training for 63 staff

cost \$315,000 over three years;

CATEGORY TWO: Data Quality Framework for Australian water datasets

COST: 100,00

Many water data systems use a single "quality code". Although useful, a single code may not be optimal in meeting the requirements of all stakeholders.

The aim of this project is to develop a framework for data quality assessment & improvement in the water industry. Such framework will assist stakeholders in reviewing data quality requirements, guide the development of data quality metrics and offer a methodology for assessment and improvement of data quality in the water industry. It will further develop tools for benchmarking data quality outcomes for surface water, groundwater and water storage initiatives

CATEGORY TWO: Environmental flow monitoring / “water shepherding”

COST: unknown

Environmental water holdings held by the Commonwealth government are valued at close to \$3.2 billion and the distribution and monitoring of their water is important business for the Government. The Commonwealth has requested that the water available under its water licences be 'shepherded', that is, transferred and protected from extraction in one system for environmental watering downstream in another system.

Water shepherding is a new concept in water management for the Murray Darling Basin, and while transfers between the hydrologically connected and regulated Murray, Murrumbidgee and Lower Darling River systems are possible through NSW's normal water trading rules, the Commonwealth is seeking to extend this concept much further and beyond the current rules in NSW's water sharing plans. Issues including the monitoring and calculation of potentially environmentally beneficial water "losses" on the floodplain are adding to the complexity of the process, and are currently being resolved.

Initially, all project costs with water shepherding are likely to be met by the Commonwealth, including purchase and installation of new gauges. However, until all methods and processes are resolved it is not clear if NSW requires any new data collection, interpretation or management processes or systems. The following lists some potential projects.

- Installation of new gauges - \$25,000 a gauge
- Provision of usage data to Commonwealth through the recording of usage past a stream gauge based on a portion of flow above commence to pump conditions
- licensing system
 - the grouping of access licence extraction limits
 - recognition of water shepherding licence being only associated with a water shepherding work
 - limiting allocation assignments from a water shepherding access licences to other water shepherding licences

CATEGORY TWO Lack of information about Groundwater Dependant Ecosystems
COST: 200,000

There is currently a lack of information about Ground Water Dependent Ecosystems for their sustainable management. Information is required on their location, their values, the movement between groundwater and surface water systems for priority sites and how to best manage them.

Schedule 5 of all groundwater WSPs mandates the monitoring of any associated Groundwater Dependent Ecosystems ('GDEs'), together with appropriate performance indicators. WSPs for the Lower Macquarie, Lower Lachlan, and Lower Murray all require the NSW State Minister for Climate Change and the Environment and Water 'to determine, within the next 2 years, water requirements for the associated GDEs'.

This project will be a pilot for the known GDE's in the lower Lachlan catchment. The pilot will integrate information from 2D models that assess potential drawdown due to ongoing groundwater extraction with detailed field investigations on wetland plants and satellite image analysis.

The project outputs will include a series of maps identifying high probability groundwater dependent ecosystems and from this a subset of high ecological value groundwater dependent ecosystems for possible listing within the relevant water sharing plans.

OFFICE OF ENVIRONMENT AND HERITAGE (MANLY HYDRAULICS LABORATORY)

CATEGORY ONE: Asset Management Plan (Coastal Network)

COST: \$200,000

OEH manages an extensive data collection network in the NSW Coastal Zone that is operated under contract by Manly Hydraulics Laboratory. Over the past 5 years over \$5 million of State and Federal Government funding has been utilised to upgrade the data network and management systems. OEH proposes to develop an Asset Management Plan for all the instrumentation and data management systems under the network over a 5 year period.

The Asset Management Plan will set out the capital investment and maintenance required over the next 5 year period, to ensure the networks are maintained to deliver reliable, efficient and economic transfer of data. The Asset Plan can be used to prepare annual capital enhancement bids to the NSW Treasury and Department of Finance and Services to ensure the networks are maintained at an optimum level and meet the needs of the various stakeholders that use the coastal data.

CATEGORY ONE: Improved flood warning

COST: \$400,000

Supply and installation of more reliable sensors, loggers and communication systems at key flood warning sites along coastal NSW.

There is an increasing need for more reliable real time data at key coastal flood warning stations. The reliability is in terms of uptime and quality data. Although the current system provides an uptime on average of in excess of 95%, there is a growing need to improve the event reliably and accompany the data with a real time quality code. To achieve this task, it is proposed to identify the key sites, determine any potential design and site limitations, plan and implement appropriate installation solutions to achieve 100% uptime with accompanying quality codes. The design options would include; more robust sensors, back up components and self checking devices such as real time gauge height checks

CATEGORY ONE: Improved flood flow measurement

COST: \$300,000

The use of boat mounted ADCP current meters to measure discharges during flood events involves a significant Occupational Health and Safety risk to staff. The installation of horizontal mounted ADCP at key flood monitoring sites would significantly reduce the OH&S risk during flood events. These current meters sense cross-sectional current data in rivers giving an accurate discharge measurement over time. This is particularly suitable for waterways that do not have a strong stage-discharge relationship such as tidal rivers and estuaries in NSW. The project would involve the installation of a horizontal ADCP at up to five key flood monitoring sites in the Coastal Zone of NSW to monitor flows during various flood events. The flood discharge data will then be used to improve flood modelling and forecasting.

CATEGORY ONE: Improved data accuracy

COST: \$240,000

OEH manages an extensive network of water level stations in the coastal zone of NSW with the network operated by Manly Hydraulics Laboratory. There are a number of stations in the network with a survey accuracy of V4 or lower (based on SCIMS), and approximately 20 of these stations are on an assumed datum.

It is proposed that all stations will be surveyed to AHD using GPS levelling to at least SCIMS V3 or better. New permanent survey benchmarks (PM or SSM) will be installed adjacent to the station as required. The outcome of this project will be an improvement in the accuracy of the water level data and standardization of the datum network. All gauging stations will be referenced to a common datum incorporating all local, historical and port datums.

CATEGORY TWO: Digitisation of historical data and metadata

COST: \$350,000

Digitise station data and metadata from historical data collection projects that MHL has been involved in on behalf of numerous clients over the last 40 years. The majority of data and associated metadata from these monitoring stations is stored in various locations on paper and electronic files, with funding no longer available to maintain or digitise these data sets. This will include the update of Manly Hydraulics Laboratory's Wiski database and the provision of the data to the Bureau in WDTF format. It is expected that this complex review of monitoring stations will deliver data from at least another 280 monitoring stations (short and long term decommissioned stations).

CATEGORY TWO: Develop future gauging station

COST: \$100,000

MHL have been designing and installing hydrometric monitoring stations for the last 40 + years. During this time, MHL has developed extensive resources and knowledge that would assist in the design and construction of a gauging station that would be used in future applications. The development of a gauging station for the future would involve close co-operation with other leading water agencies.

The outcome of this project would be a low cost, low maintenance gauging station with improved data capture, data reliability and data quality. The design of the station would be optimised to achieve reduced OHS risk, self calibration and quality assurance, and redundant sensor and communications. Once completed and reviewed, information relating to this project would be made available to all relevant agencies involved in water monitoring

CATEGORY TWO: Real time quality coding

COST: \$250,000

The objectives are to undertake an initial scoping study, on the network of real time stations that are provided to the Bureau, to provide data in real time with accompanying quality code or quality verification, and to investigate the practicability of automated data correction with appropriate flags. The scoping study involves a range of different organisations experienced in real-time data collection to develop practicable processes for automated real time quality coding of data. The application of real time quality coding, automated data gap correction and flagging technology would then be implemented to stations in the OEH coastal network.

STATE WATER CORPORATION

CATEGORY ONE: Upgrade instrumentation of weir level recording equipment, with improved accuracy in storage capacity tables

COST: \$200,000, 40 sites at \$5 per site

Upgrade the level sensing devices in operable weir pools to reliable current technologies.

CATEGORY ONE: Software development to automate the transfer of TT figures to the Bureau.

COST: \$50,000

Upgrade State Water corporate systems to allow automated transfer of Water Allocation Assignment data to the Bureau in a format that can be used by the Bureau.

CATEGORY ONE: Installation of accurate measuring devices monitoring equipment, and confirm accuracy with NWI / Bureau standards

COST: \$600,000, 20 sites at \$30,000 per site.

Upgrade hydrometric monitoring stations that are used to account (and charge) for use of licenced environmental water.

CATEGORY ONE: Identification and automation of isolated manual data management systems

COST: \$50,000

Upgrade State Water corporate systems to automate remaining manual data entry sites.

CATEGORY TWO: Close gaps in current monitoring network

COST: \$1,200,000

Upgrade monitoring network to close gaps for rainfall runoff models and hydraulic routing.

CATEGORY TWO: Improved forecasting of water demands and river “losses”.

COST: \$250,000

Improved forecasting of water demands and river ‘losses’ to make river operation more efficient – telemetry or other methods to improve demand capture and compliance monitoring.

Feasibility study and pilot project into remote sensing of water use and cropping areas for monitoring water use and demand.

CATEGORY TWO: Flood operation

COST: \$400,000

To enhance flood operations, this project will improve the rainfall runoff predictive capacity and improve timing of storage pre-release against tributary flows. The project will develop and implement real time rainfall runoff models for the catchments with gated dams, i.e.

Lachlan (Wyangala Dam), Macquarie (Burrendong Dam), Namoi (Keepit Dam), and Gwydir (Copeton Dam).

CATEGORY TWO: Seasonal forecasting – improve management of transfers between storages.

COST: \$350,000

Develop hydrologic models (in eWater Source) to optimise the transfer of water between storages in the Namoi (Split rock Dam to Keepit Dam), Macquarie (Windamere Dam to Burrendong Dam), and Murrumbidgee (Eucumbene to Blowering Dam) catchments.

CATEGORY TWO: Seasonal forecasting – better management of environmental allocations

COST: \$300,000

Develop eWater Source models for the Macquarie and Gwydir valleys to advise Environmental Water holders on the likely range of seasonal scenarios for the following two seasons. The objective would be to optimise the outcomes from releases and the management of airspace operation of storages, while providing more flexibility in access for water users.

CATEGORY TWO: Consistent and efficient handling of information at times of floods and low flow conditions

COST: \$100,000

Develop water data systems specific to realtime emergencies (flood and drought) to publish dam operational information, consistent with the Bureau, and SES and State Water roles and responsibilities.

NSW DPI (AG NSW)

CATEGORY ONE: Increasing the accuracy of streamflow measurement

COST: \$160,000

The accuracy of flow information is important to understand the effect of land management on stream responses. For example, understanding the impact of changed land use on shared water resources.

Changes in stream bed dynamics following large flow events make older rating table inadequate and require urgent updating. For data to be accurate and able to be applied, accurate rating curves need to be developed.

CATEGORY ONE: Developing and implementing an asset management plan for replacement of surface and ground water measurement equipment

COST: Estimated replacement cost over 5 years \$500 000

There is no plan or investment process to maintain, repair or replace current instrumentation for surface and groundwater measurement equipment. Planned asset maintenance and upgrading is more efficient in terms of cost and time reacting to equipment breakdown. Reason

The current equipment has an operational life span of five years. There is no current process to maintain, repair or replace this equipment and ensure ongoing accuracy and availability of water data.

CATEGORY ONE: Improving surface water sites to meet OHS and accuracy requirements

COST: Estimate \$100,000.

(thorough inspections by qualified OH&S personnel is required).

Much of the surface water monitoring network was established in the 1960s–1970s. A significant number of these sites are nearing the end of their life and need to be replaced. Some of these sites have confined spaces and elevated structures making them more costly to maintain and are also at heightened OH&S risk.

A number of the sites we have re-instrumented fall into this category. Not only is this a concern for DPI employees but also members of the public that use the stream banks for recreational purposes and we may be liable if an accident happens at the site.

CATEGORY ONE: Improving water mass balance information

COST: \$500,000

Currently rainfall/evaporation data is not spatially dense enough nor accurate enough for water balance planning.

The Bureau and WMO see the need to restore Class A evaporation sites to the levels of years past. However they are likely to see reduce staffing at manned stations and consequently there will be less manual Class A sites. Over the last three years NSW DPI

(Ag NSW) has installed 18 automatic evaporation pans to overcome the issue of reduced staffing. Continued rollout of automatic evaporation pans will fill existing gaps in the spatial coverage and assist in more accurate water mass balance information.

CATEGORY TWO: Improving the groundwater water quality network coverage to meet water information requirements

COST: \$150,000 over 5 years

Groundwater extraction has the potential to induce leakage from adjacent saline aquifers causing a decline in higher quality groundwater aquifers.

Groundwater extraction from fresher systems, which are under pressure, can prevent saline system from leaking into the fresher aquifer. As predicted rainfall becomes less and more variable more water will be extracted from the fresher systems, possibly resulting in leakage from the saline systems into fresh systems.

CATEGORY TWO: Improving water quality monitoring network for groundwater/surface water interaction

COST: \$200,000

Stream temperature can provide an excellent dataset for the study of surface groundwater interactions.

When water levels in piezometers and the stream stage are measured concurrently, the combined data will enable assessment of water fluxes between the stream and the subsurface and quantification of streambed hydraulic properties. In conjunction with water level elevation measurements, temperature data collected in shallow piezometers and deep bores can be used to estimate the rate of streambed seepage, hydraulic conductivity and conductance of the geologic materials that surround them.

CATEGORY TWO: Increasing water quality sensors in the surface water network

COST: Estimate \$200,000 over 5 years

Enhanced data collection for better understanding and management of catchments for water quality outcomes.

There is a need to benchmark models to approximate quality and quantity levels to model associations between flows and EC values. However, there is currently limited information on streams to determine salt loads, and broad estimates are used with little understanding of whether groundwater/surface water interactions are affecting the loads.

MURRUMBIDGEE IRRIGATION LIMITED

CATEGORY ONE: Flow measurement and remote communication upgrade of River Drain and End Of System sites.

COST: \$25,000

Drainage and irrigation escape water can leave the MIA at four licensed sites along the Murrumbidgee River as well as along the Mirrool Creek Floodway towards the Lachlan River. At three of these sites, water that leaves the MIA is currently not measured accurately. This information is essential for the calculation of a water balance for the MIA.

The upgrade of these sites will allow for accurate data to be transferred to the Bureau on a near real-time basis which will provide improved operational data, contingency planning and management to ensure efficient distribution of high quality water as well as accurate water balance calculations.

CATEGORY ONE: Application to send data from SCADA Historian to the Bureau in WDTF

COST: \$50,000 (estimated)

In the 2008/09 funding round of the Bureau, MI received funding to purchase and install a data Historian to capture SCADA data beyond 12 months. The Historian was purchased and successfully installed. However, an application to convert SCADA Historian data to WDTF and ftp the data to the Bureau was never provided to MI.

Many enquiries have been made to the Bureau and CITECT (now Schneider Electric), the last ones on the 2nd and 3rd of February 2012, to find out if this application was developed and if so, if it would be available to MI.

It is believed that CITECT was asked to develop the module which would then be provided to all organisations having to provide SCADA Historian data.

The development of this application would not only assist MI but any other organisation using SCADA Historian to transfer data to the Bureau.____

CATEGORY TWO: Upgrade of key water distribution and escape monitoring sites

COST: \$325,000

The MIA covers an area of 660,000 hectares of which an average of 120,000 ha is irrigated. MI operates over 3,500 km of supply channels and 2,160 km of drainage channels. In order to increase our control over the system and in doing so increasing the system's efficiency, more automated regulators are required. These automated regulators will log water levels, which is information currently not recorded. This is important information for the Bureau if it is to better understand how MI distributes water to its 3,000 landholdings.

There are nine key sites that are of high priority to have accurate flow measurement devices installed. One of these sites also needs to be added to our SCADA system.

CATEGORY TWO: Upgrade of key water distribution and escape monitoring sites
COST: \$715,000

As above.

There are a further 19 sites that need to have accurate flow measurement devices installed, five of which also need to be added to our SCADA system.

CATEGORY TWO: Upgrade of key water distribution and escape monitoring sites
COST: \$255,000

As above.

There are a further seven sites that need to have accurate flow measurement devices installed, one of which also needs to be added to our SCADA system.

HUNTER WATER CORPORATION

CATEGORY TWO: Improved metering of recycled water use

COST: 50,000

Currently reporting of the volume of treated waste water that is recycled from Hunter Water facilities relies on a combination of metered data and estimated water use data. The purchase and installation of meters at priority locations will reduce the level of subjectivity associated with recycled water use reporting.

CATEGORY TWO: Installation of telemetered groundwater level monitoring instruments at strategic locations at Tomago and Anna Bay

COST: 120,000

Installation of telemetered groundwater level monitoring at strategic sites. This project would involve the installation of battery or solar operated telemetered groundwater data collection for 5 sites at Tomago and 1 site at Anna Bay. The benefit of this project is that Hunter Water Corporation would be able to continuously monitor groundwater level across the sandbed systems and thereby provide a daily (or finer) estimate of sandbeds storage. Currently Hunter Water manually reads 1 site at Tomago on a daily basis and the remaining 4 sites once per week. An accurate estimate of storage is thereby obtained once per week, and then daily variations through the week are inferred from daily variations at the single site. The downside of the current approach is that reported overall storage can jump up or down when the more accurate data comes in. The estimated cost of this project is around \$120,000.

CATEGORY TWO: Bathymetric survey of Chichester Dam

COST: 100,000

The estimated cost of this project is around \$100,000. The project would allow improved accuracy of dam storage estimates.

ROUS WATER

CATEGORY TWO: SCADA and Historical Database Upgrade

COST: 225,000

The existing Rous Water's telemetry system lives within a closed network and operates using legacy software that is incompatible with many external reporting systems. In order for Rous Water to be able to transfer data to the BOM in the required Water Data Transfer Format (WDTF) the existing telemetry system will need a SCADA upgrade and a WDTF compatible SCADA Historian will need to be installed.

In addition to meeting the reporting requirements for the Bureau of Meteorology this investment will provide for improved emergency management during flood by providing up-to-date dam level information to the SES and the public.

Data that Rous Water proposes to provide through this funding:

Rocky Creek Dam

- Dam level
- Water Quality Data
- Rainfall

Emigrant Creek Dam

- Dam level
- Water Quality Data
- Rainfall (gauge will need to be installed)

Wilsons River Pump Station (Howards Grass, near Lismore)

- Water Quality Data

CATEGORY TWO: Emigrant Creek Dam Inflow Monitoring

COST: 150,000

The installation of an inflow monitoring station at the Emigrant Creek Dam will be used for

- Improved management of the downstream environmental flows to Emigrant Creek, through controlled water releases from Emigrant Creek Dam.
- Improved emergency management during flood

LISMORE CITY COUNCIL

CATEGORY TWO **Update Telemetry and On Site Reporting**

COST: unknown

Lismore received M&E funding and installed 3 River gauges and 1 Rain gauge to assist with their Flood Telemetry System. There are still some areas not covered and the Council wants to install gauges in these areas. Council is also needing to upgrade degrading infrastructure to ensure collection and provision to the Bureau of timely and accurate flood data.

NORTHERN RIVERS CMA

CATEGORY TWO: Telemetry purchase for Ecohealth Program

COST: \$150,000

NRCMA is facing uncertainty regarding being able to provide long term assistance to LGA's for regional Aquatic Ecosystem Health Monitoring projects (Ecohealth) that are proposed to be repeated every 4 years in each catchment. The priority of the NRCMA with regard to water monitoring focuses on ecological assessment and includes interagency distribution of information gathered during these projects. Financial assistance is required to facilitate NRCMA and LGA's to undertake these projects to purchase, install and maintain water monitoring equipment ie. Hydrolab Quanta multiprobe meters and Doppler velocity meters. Other priorities are addressed in NRCMA project "Implementation of Ecohealth Program".

CATEGORY TWO: Implementation of Ecohealth Program

COST: \$200,000

NRCMA is facing uncertainty regarding being able to provide long term assistance to LGA's for regional Aquatic Ecosystem Health Monitoring projects (Ecohealth) that are proposed to be repeated every 4 years in each catchment. The priority of the NRCMA with regard to water monitoring focuses on ecological assessment and includes conducting water quantity and quality assessment at locations significant for ecological health, manage data collection and entry as well as writing of associated technical reports. Other priorities are addressed in NRCMA project "Telemetry Purchase for Ecohealth Program".

GOSFORD WYONG COUNCIL'S JOINT WATER AUTHORITY

CATEGORY TWO: Telemetry for Groundwater Monitoring Bores **COST: \$ 256,000**

To cope with increasing population growth and address objectives set by the new Gosford Wyong Council's Joint Water Authority and recently formed Central Coast Water Corporation, this project will install telemetry for 20 monitoring bores in Woy Woy (Gosford LGA) in the proximity of 12 production bores for city water supply. Additional telemetry in Woy Woy is preferred as where water is sourced from under the populated area. The project will also install 12 monitoring bores in Wyong LGA.

CATEGORY TWO: Mangrove Creek stream gauge and telemetry **COST: \$ 25,000**

This project will install a stream gauge to monitor releases from Mangrove Creek Dam to Weir and connecting to telemetry.

CATEGORY TWO: Installation of rain gauges **COST: \$ 50,000**

Installation of rain gauges at three sites: Bucketty (Mangrove Creek Dam Catchment), Kooree (Mangrove Creek Catchment), and Hay (Wyong River Catchment). A rainfall scoping study by MHL has recommended these gauges to improve the coverage of rainfall data in the Central Coast water supply catchment areas.

CATEGORY TWO: Establish weather stations **COST: \$ 100,000**

To assist with flood warning and water management, establish weather stations at Mardi Dam and Mooney Mooney Dam.

CATEGORY TWO: Water Data Transfer Format (WDTF) Schema Upgrade **COST: \$ 125,000**

This project will install a WDTF upgrade to meet changing Bureau data format requirements. Council has already contributed to an upgrade but is unable to fund further updates still required.

CATEGORY TWO: Continuous water quality monitoring at Wyong River and Ourimbah Creek Pump stations **COST: \$ 100,000**

This project will install monitoring equipment such as Yeokals to provide adequate monitoring data required by the Councils.

MIDWESTERN COUNCILS

CATEGORY TWO: Telemetry Upgrade

COST: \$ unknown

Council has nominated that it would accommodate NSW Office of Water's Electrical Conductivity Probes for ground water monitoring at our Glen Willow and Burrundulla Bore fields. Also Council would like to expand its monitoring program and install magflow meters and telemetry systems to collect daily water consumption data at Glen Willow, Burrundulla, Fletchers, Wait-a-While and Court St bore fields.

CATEGORY TWO: Improving Data Management

COST: \$ unknown

For consistency with NSW priorities, Council would like to have GPS systems at all Council owned bores.

APPENDIX TWO – WATER MONITORING STRATEGIC OBJECTIVES



Organization	Planning for the Future	Possible Future Projects
DPI - from M&E Benefits report Swimp 2011 and DPI Mini-Swimp 2010	<p>1. Across NSW I&I, the following have been listed as priorities for water monitoring and investment:</p> <ul style="list-style-type: none"> • acid sulphate soils in coastal catchments • understanding the effect of changes to landuse on interception • flow regimes and impact of landuse on fish populations • increased adoption of water-efficient practices • understanding and reducing the impact of mining on aquatic ecosystems • water management risks that threaten water dependant ecosystems and aquatic industries • development of water accounting and reporting standards including MER. <p>2. More specifically, Forests NSW has identified the following priorities:</p> <ul style="list-style-type: none"> • increased reliability of rainfall networks • increased reliability of in-situ water quality data • installation of telemetry. 	<p>NSW I&I is likely to consider project associated with:</p> <ul style="list-style-type: none"> • upgrades to its existing field instrumentation network including telemetry to provide real-time data • upscaling measurements to key areas by adding additional instrumentation <p>Forests NSW is likely to consider projects associated with:</p> <ul style="list-style-type: none"> • upgrades to its pluviometer and storage rain gauge network • telemetry to provide real-time data from gauging stations (possibly satellite and/or radio-modems in remote sites)
SCA - from M&E Benefits report Swimp 2011, and Mini Swimp 2010	<p>SCA anticipate appropriate funding from IPART for ongoing upkeep and upgrade of our hydrometric systems. However, for completeness the following information is a summary of information provided for the SWIMP by SCA in 2010 and 2011.</p> <p>Maintain and upgrade to existing infrastructure that has been enhanced by M&E funding. Focus on:</p> <ol style="list-style-type: none"> 1. System expansion 2. Asset management 3. Telemetry upgrades 4. Testing new ideas in evaporation measurement and calibration 5. Thermister chain replacement 	<p>SCA has an existing investment program, and the project relevant to water monitoring include:</p> <ul style="list-style-type: none"> • proposals to incorporate algal modelling into existing reservoir models • the ongoing Hydrometric Renewals program – this rolling program aims to replace aging assets, introduce new technology and standardisation across the system in order to maintain, and • • where appropriate, increase accuracy and reliability • review of the SCA's Communications Strategy, including telemetry • ongoing review of the SCA's SCADA strategy, including moving the telemetry and water monitoring data onto a common platform where appropriate • ongoing research into best practice for evaporation estimation methods • ongoing calibration of meters and hydrometric equipment • replacement of thermistor chains at strategic locations with state of the art systems and technology.

Organization	Planning for the Future	Possible Future Projects
OEH/MHL Mini-Swimp 2011	<p>The overall strategic objectives for the monitoring system are based upon the current drivers and current investment. Also the network vision is flexible enough to cater for the future, expected demands. Outlined below are the targeted objectives:</p> <ol style="list-style-type: none"> 1. Exceed 99 per cent data recovery for events and long-term datasets. 2. Provide all data in real-time, in a secure and accessible format 3. Quality code all data 4. Provide a monitoring system that: <ul style="list-style-type: none"> - is compliant and compatible with best practice with State and Commonwealth Water Authorities - is robust, responsive but flexible - is low powered - minimises OHS risks - optimises resource allocation via low maintenance - is discretely designed with minimal environmental impact - has sound data security, storage and access. 	<p>To achieve the strategic jurisdiction vision, the areas for highest priority investment are:</p> <ul style="list-style-type: none"> • complete the provision of real-time IP telemetry solutions • provide of real-time quality coding of data • migration of historical data to WDTF compatible databases.
OEH- from M&E Benefits report Swimp 2011	<p>The maintenance and upgrade of infrastructure associated with the current OEH Coastal Data Collection Network. The following areas would have a high priority for future investment:</p> <ol style="list-style-type: none"> 1. Telemetry upgrade 2. Database upgrades 3. Asset management 4. Datum Accuracy 5. OH&S 6. Data quality including real time quality assurance 7. Historical data rescue. 	<p>OEH would consider the following projects to have a high priority:</p> <ul style="list-style-type: none"> • upgrade the remaining hydrometric stations to include IP telemetry and development of a replacement system for the current B Bureau radio telemetry system • telemetry investigation to ensure redundancy for priority flood warning sites • further upgrades to the database and content management system • develop a Total Asset Management Strategy for the coastal and floodplain network to quantify funding requirements that will ensure assets are operated and maintained sustainably into the future, including asset replacement strategy related to the M&E funding • upgrade select gauging stations that do not currently met OH&S and risk management standards, and develop a gauging station of the future that would include no maintenance, minimum OH&S risk and self QA and calibration • undertake GPS heighting survey on gauging stations to meet specified horizontal datum accuracy, • improved real-time data quality assurance and quality coding, and • digital rescue of all historical data (including tidal gauging, water quality and level data).

Organization	Planning for the Future	Possible Future Projects
Sydney Water from M&E Benefits report Swimp 2011 and Mini SWIMP 2010	<p>Programs implemented by Sydney Water under the Bureau of Meteorology Modernisation and Extension program funding have provided significant benefits to hydrometric monitoring networks and improved water-related data and information delivery. Sydney Water aims to maintain and enhance the current hydrometric monitoring network to ensure the benefits are not lost. Sydney Water will focus on their entire monitoring network, but in particular:</p> <ol style="list-style-type: none"> 1. Data extraction 2. Data quality and data management 	<p>Priorities and strategies for improving Sydney Water's water information include:</p> <ul style="list-style-type: none"> • completion of data extraction and transfer routines to export information from Customer BI within the Enterprise Data Warehouse for reporting categories 7h through 7i • allocation of IT personnel to improve data integrity and work with the Bureau queries relating to data errors or data quality • develop and implement a data management application to manage data transfers between Sydney Water and the Bureau, allowing the tracking of all files sent and allow business users to <ul style="list-style-type: none"> - report on success and failures and manage re-sends and errors - review existing quality procedures and implement a quality management framework - evaluate historic water quality data to investigate opportunities to import pre-2008 data for reporting category 9.
State Water from M&E Benefits report Swimp 2011, and Mini Swimp 2010	<p>The harnessing of the investment in the following areas will result in improved understanding of water balance and the ability to deliver contemporary water accounting. Coupled with this will be improved reporting of water resource assessment and support for environmental sustainability.</p> <ol style="list-style-type: none"> 1. Automated data transfer to the Bureau 2. Improved Data Accuracy 3. New monitoring sites 4. Telemetry 5. Seasonally forecasting 6. Data management 	<p>The priorities and key aspects of the future investment relevant to the water delivery and monitoring program of State Water include:</p> <ul style="list-style-type: none"> • Upgrade instrumentation of weir level recording equipment, with improved accuracy in storage capacity tables • Software development to automate the transfer of TT figures to the Bureau • Installation of accurate measuring devices monitoring equipment, and confirm accuracy with NWI/Bureau standards • Identification and automation of isolated manual data management systems • Close gaps in current monitoring network • Improved forecasting of water demands and river 'losses' to make river operation more efficient – telemetry or other methods to improve demand capture and compliance monitoring • Flood operation – rainfall runoff predictive capacity, improve timing of storage pre-release against tributary flows • Seasonal forecasting – improve management of transfers between storages • Seasonal forecasting better management of environmental allocations <ul style="list-style-type: none"> – airspace operation of storages – More flexibility in access for water users • Consistent and efficient handling of information at times of floods and low flow conditions

Organization	Planning for the Future	Possible Future Projects
Bureau Mini-Swimp 2011	<ol style="list-style-type: none"> 1. Communications 2. Data security 3. New monitoring locations 	<ol style="list-style-type: none"> a) improved timeliness of data – funding for upgraded communications b) improved security of agency sites that provide FTP data feeds – funding for backup sites and other strategies that improve data security c) data gaps – funding for additional gauges.
Hunter Water Mini- Swimp 2011	<p>In no order of priority the future needs associated with longterm population growth for Hunter Water regarding water management and ensuring compliance under the Commonwealth Water Act (2007) relate to:</p> <ol style="list-style-type: none"> 1. WDTF 2. Telemetry 3. Improved linkages between HWC SCADA and Hydstra systems. 	<p>Priorities and strategies for improving HWC's water information include:</p> <ul style="list-style-type: none"> • Improved metering of recycled water use • Improved monitoring of groundwater reserves • Improved bathymetric information at Chichester Dam
Bega Valley Mini-Swimp 2010	<p>Bega Valley is in the initial phases of complying with requirements under the Water Act (2007), and developing systems to facilitate data delivery to the Bureau. Priorities for investment and planning in water monitoring for the Council include a focus on WDTF and systems development.</p>	<p>The first priority of Bega Valley Shire Council is to identify which commercially available data management system (or combination of) is most suited to Council's monitoring, data management and reporting requirements. The selection of a data management system that best suits Council's requirements will ensure funds are allocated effectively when purchasing such a system. It will also maximise the efficiency and reliability of data management and data transfer to organisations such as the Bureau of Meteorology.</p>
Wyong Shire Mini- Swimp 2011 and Gosford Shire Council Strategic Investment Plan 2012	<p>Wyong Shire works with Gosford City Council in monitoring and reporting on water. The priorities include:</p> <ol style="list-style-type: none"> 1. Improving Wyong river flow measurement for monitoring of environmental flows 2. Improving data management system by integrating the input from both councils 3. Improving meteorological information dataset by installing weather station and improving communication for the existing weather station 4. Improving rainfall gauge coverage for Wyong River and Mangrove Dam catchments. 	<p>The proposed projects for Wyong Shire and Gosford Shire Council's Joint Water Authority (and the recently formed Central Coast Water Corporation) are:</p> <ol style="list-style-type: none"> 1. Telemetry for Groundwater monitoring bores in both Gosford and Wyong LGA 2. Installing stream gauge to monitor releases from Mangrove Creek Dam to Weir and connecting to telemetry 3. Installation of 3 rain gauges (Bucketty, Kooree, and Hay). These sites have been recommended by MHL to improve coverage of rainfall data on the Central Coast. 4. Establish weather stations at Mardi Dam and Mooney Mooney Dam. 5. WDTF Schema Upgrade to meet changing Bureau data formats. 6. Continuous water quality monitoring at Wyong River and Ourimbah Creek Pump stations.

Organization	Planning for the Future	Possible Future Projects
Shoalhaven Mini-Swimp 2011	<p>Shoalhaven Council has identified information needs:</p> <ol style="list-style-type: none"> 1. Expand Council's network of rainfall and stream gauges in order to enable real-time flood data collection in catchments that currently have no historical records. This information is vital for future flood studies as well as the calibration of existing flood models. 2. Estuary and coastal lakes entrance management is an increasingly contentious issue in many of the city's catchments. Water level and rainfall data to inform Estuary and Coastal lakes entrance management. 3. Automation of data transfer to Bureau 4. Asset management. 5. Network expansion. 	<p>Shoalhaven Council has identified the following projects to meet strategic objectives:</p> <ol style="list-style-type: none"> 1. Filling of data gaps – funding for additional rain and stream gauges 2. Keeping the system up-to-date – funding for maintenance and upgrades of existing gauges 3. Training of staff and local SES volunteers in the use of Enviromon 4. Upgrading data transfer capabilities for water source data
Murrumbidgee Irrigation Mini-Swimp 2011	<p>From a water Information perspective it is Murrumbidgee Irrigation's vision that:</p> <ol style="list-style-type: none"> 1. Water information will be available to Irrigation and Customers Services staff on a near real-time basis, using the Internet and SCADA to ensure our system is run at the highest level of efficiency. 2. We operate beyond licence compliance by implementing a risk-based water quality monitoring program, which includes risk mitigation strategies such as the capacity to prevent discharge of contaminated water to the river 3. We are able to provide important water information, including historic data, to the Bureau 4. We are able to participate in the process of developing the Pilot National Water Account. 	<p>Murrumbidgee Irrigation has identified the following projects as priorities between 2012-2017</p> <ol style="list-style-type: none"> 1. Flow measurement and remote communication upgrade of River Drain and End Of System sites. 2. Upgrade of key water distribution and escape monitoring sites 3. Upgrade of key water distribution and escape monitoring sites 4. Upgrade of key water distribution and escape monitoring sites - why is this repeated twice? 5. Application to send data from SCADA Historian to Bureau in WDTF - the lack of this application is making it impossible to provide data for a number of categories.
Cabonne Shire Council Mini-Swimp 2011	<p>Cabonne Shire Council has strategic plans in place with regard to :</p> <ol style="list-style-type: none"> 1. Dam Safety 2. Telemetry 	<p>Cabonne Shire Council has noted that Improvement is needed in the following areas:</p> <ol style="list-style-type: none"> 1. Remote monitoring system should be installed at Molong Creek Dam for the purpose of providing dam safety information (seepage flows and piezometer readings) on at least a three times a week basis as required by the NSW Dam Safety Committee and the NSW Office of Water 2. Telemetry monitored rainfall recording systems providing real-time rainfall readings at Molong Creek and Borenore Creek Dams are needed for closer monitoring of that parameter, particularly for flood warning purposes

Organization	Planning for the Future	Possible Future Projects
Port Macquarie Hastings Council Mini- Swimp 2011	Strategic water monitoring planning for Port Macquarie Hastings Council is not currently required. Council has completed the SCADA upgrade & software development commitment and is now transferring all required water data using WDTF protocols. Any future planning will focus on data rescue and historic data retrieval.	Possible future projects for the Council focus on skill development and application of the new historical database to utilise it to its full potential.
Murray CMA 2010	The Murray CMA works towards improving the condition of aquatic habitats and contributing to environmental water management. The CMA is currently working with key stakeholders to identify specific water information requirements in the Edward-Wakool System to support environmental flow management and risk management. Implementation of recommendations will be a priority.	To meet a shortfall in existing monitoring the Murray CMA, with funding partners, have established a Community Stream Sampling project. Funding expired in June 2010. The CMA is exploring alternative options to resource and maintain this program to enable continuity of monitoring that meets the regional needs.
Mid Coast Water 2010	MCW have identified that existing SCADA system requires some improvements to enable more efficient and timely data transfer into MCW information management system. Reporting of the historical data (more than 5 years old) requires extensive resources to collate information kept at various locations and databases in different format.	Priority projects for improving MCWs water information system: 1. Improve SCADA system capability to export data for the reporting purposes 2. Collate historical information from various databases/spreadsheets into WDTF
Clarence Valley Council Mini-Swimp 2011	Clarence Vally Council has stated that they have no information system. Creating a data management system would enable more efficient data transfer and enquiries.	Council's highest priority for investment in water information is to implement a system that will contain water information for water and sewage, be easily queried and automatically and electronically provide data to the Bureau of Meteorology. Clarence Valley Council will need to identify which commercially available data management system (or combination of) is most suited to Council's monitoring, data management and reporting requirements. The selection of a data management system that best suits Council's requirements will ensure funds are allocated effectively when purchasing such a system. It will also maximise the efficiency and reliability of data management and data transfer to organisations such as the Bureau of Meteorology.

Organization	Planning for the Future	Possible Future Projects
Rous Water - Strategic Investment Plan 2012	<p>Rous Water has identified the need to upgrade the onsite telemetry and reporting systems to enable access for internal and external users.</p>	<p>Rous Water needs to upgrade telemetry and water monitoring systems and to install a Historian database to enable data access for internal users and for export to external sources such as the Bureau and emergency management services such as the SES.</p> <p>Water monitoring data at Rous Water sites that could be provided with the necessary funding includes;</p> <p>Rocky Creek Dam</p> <ul style="list-style-type: none"> • Provide up-to-date dam level information to the Bureau and/or Rous Water website. • Rainfall data export to Bureau <p>Emigrant Creek Dam</p> <ul style="list-style-type: none"> • provide up-to-date dam level information to the Bureau and/or Rous Water website. • Construct an Inflow monitoring monitoring station with data export to Bureau • Install an automatic Rain Gauge to provide rainfall data to Bureau <p>Wilsons River Pump Station</p> <ul style="list-style-type: none"> • turbidity monitoring data
Northern Rivers CMA- Strategic Investment Plan 2012	<p>NRCMA is facing uncertainty regarding being able to provide long term assistance to LGA's for regional Aquatic Ecosystem Health Monitoring projects (Ecohealth) that are proposed to be repeated every 4 years in each catchment. The priority of the NRCMA with regard to water monitoring focuses on ecological assesment and includes interagency distribution of information gathered during these projects. Financial assistance is required to facilitate NRCMA and LGA's to undertake these projects to purchase, install and mainting water monitoring equipment ie.Hydrolab Quanta multiprobe meters and Doppler velocity meters as well as conduct water quantity and quality assessment at locations significant for ecological health, manage data collection and entry as well as writing of associated technical reports. The NRCMA are also keen to see all LGA water quality data collected via Ecohealth made freely available to the Bureau in WDTF . The Bureau's MEP funded WQ data base was found to be unsatisfactory and could not address NRCMA needs and as such we have decided to store our WQ data in Ozcoast database for the foreseeable future untill these issues are resolved.</p>	<p>Projects for the NRCMA focus on:</p> <ul style="list-style-type: none"> • Increased funding to extend and improve catchment based monitoring under the ecohealth program • Provision of financial support to improve data collection and management including improving pathways for data sharing and storage of water quality data between agencies. • Provision of financial support for LGA's to purchase, install and maintain water monitoring equipment ie.Hydrolab Quanta multiprobe meters and Doppler Velocity meters.

