Hydrometric Improvement Plan

November 2021

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Acknowledgment of Country

The Department of Planning, Industry and Environment acknowledges the Traditional Owners and Custodians of the land on which we live and work and pays respect to Elders past, present and future.

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Introduction

The NSW Government has reviewed its network of stream and storage gauges, and groundwater and water quality monitoring in the Murray Darling Basin. The primary purpose of the review was to ensure the network is fit for purpose. The current network is comprehensive, with over 500 sites. Most sites are located in the major regulated river catchments. The sites collect data on stream and storage flow and volume, groundwater level, water quality and meteorological information such as rainfall. The review found the stream gauging station, storage, water quality and rainfall monitoring network is effective given the need for prudence and efficiency in operation. The network is considered fit for purpose.

We have published our Surface Water Network Review and will soon publish our Groundwater Network Review. Under section 3.10 of the Murray-Darling Basin Compliance Compact (2018), NSW will publish a review of its water information requirements and a water information improvement program.

Although the network is fit for purpose, the review identified some potential improvements. The upgrade and operation of sites and equipment depends on extra funding and justifying the expected benefits against the additional cost.

We have now commenced work towards some upgrades, including ten new or upgraded gauging stations in the Northern Murray-Darling Basin (Tranche 1), and are preparing for an additional ten stations (Tranche 2).

We are seeking feedback from stakeholders and will incorporate groundwater sites before committing to further improvements and Tranche 2. We will update this document from time to time and will take into account any stakeholder input into each revised version.

Sites of interest

The review identified the following potential improvements for surface water sites:

- up to **65** potential new sites
- relocate or upgrade **83** sites
- downgrade **1** site
- close **0** sites.

The potential improvements have not had a detailed cost and benefit analysis and are dependent on funding. They will provide better information for operations and management.

Figure 1 and Table 1 present an initial 20 sites for possible installation or upgrade. These sites ranked highest during the review process. They will each fulfil many intents including:

- planning for our future resources and sharing water
- operating and actively managing the delivery and take of water
- compliance and enforcement
- public interest
- accounting for water use
- evaluating water in the landscape and its associated outcomes, including for environmental water.

Site upgrades are proposed for some locations to support this wider range of data purposes. Some existing sites were installed for only one purpose and can be accurate at low flows, but inaccurate across the flow range, or their accuracy is sufficient for their initial purpose, but insufficient for newer initiatives.

New installation sites or those for upgrade are grouped into one of the following primary data purposes:

- flow, level, or improved flow accuracy
- water quality with in-situ sensors or by discrete water sampling
- rainfall
- telemetered real time data.

The appendix tables list all surface water sites identified for installation or upgrade (Table 4, Table 5, Table 6, Table 7, Table 8).

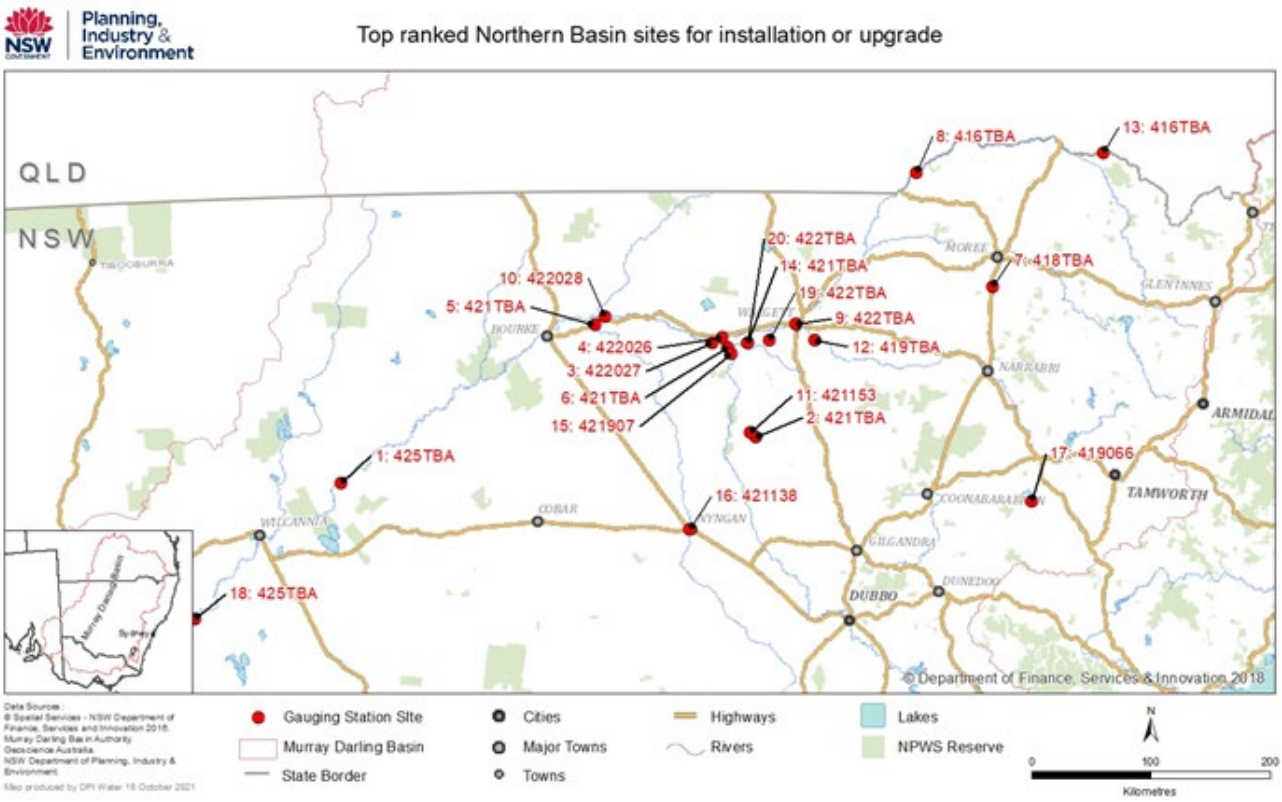

Figure 1 - Top ranked Northern Basin sites for installation or upgrade

Table 1 - Top ranked Northern Basin sites for installation or upgrade

No.	Site ID	Catchment	Site name	Install type	Data type	Ranking	Intent
1	425TBA	Darling	Darling River between Tilpa and Wilcannia	New	Flow	5.0	Connectivity, active management, accounting, water sharing, environmental water, compliance
2	421TBA	Macquarie	Marthaguy Ck at u/s Terrigal Ck	Upgrade	Flow (improve data quality)	5.0	Active management, accounting, water sharing, environmental water, compliance
3	422027	Culgoa	Barwon River at Geera	Upgrade	Flow (improve data range)	5.0	Connectivity, active management, accounting, water sharing, environmental water, compliance
4	422026	Culgoa	Barwon River at Boorooma	Upgrade	Flow (install velocity sensor)	5.0	Connectivity, operating, accounting, water sharing, environmental water, compliance
5	421TBA	Macquarie	Little Bogan u/s of Bourke	New	Flow	4.3	Connectivity, active management, accounting, water sharing, environmental water, compliance
6	421TBA	Macquarie	Macquarie d/s of Castlereagh junction	New	Flow	4.3	Connectivity, operating, accounting, water sharing, environmental water, compliance
7	418TBA	Gwydir	Gurley Creek	New	Flow	4.3	Operating, water sharing, environmental water

No.	Site ID	Catchment	Site name	Install type	Data type	Ranking	Intent
8	416TBA	Border Rivers	Macintyre river between Kanowona and Mungindi	New	Flow	4.3	Operating, water sharing, environmental water
9	422TBA	Culgoa	Barwon at Walgett Weir pool	New	Flow	4.3	Connectivity, operating, water sharing, environmental water
10	422028	Culgoa	Barwon River at Bemeery	Upgrade	Flow (install velocity sensor)	4.3	Connectivity, operating, water sharing
11	421153	Macquarie	Terrigal at u/s Marthaguy Ck	Upgrade	Level Flow (improve data quality)	4.0	Water sharing, environmental water
12	419TBA	Namoi	Namoi River between Goangra and Walgett	Replacement	Flow	3.7	Connectivity, water sharing, environmental water
13	416TBA	Border Rivers	Dumaresq River d/s of Mac Brook Junction	New	Flow	3.7	Water sharing, environmental water
14	421TBA	Macquarie	Macquarie River at Bindi Bridge (d/s Castlereagh confluence)	New	Level Flow	3.3	Operating, accounting, water sharing, compliance
15	421907	Macquarie	Macquarie River at Brewon	Upgrade	Upgrade temporary site to ongoing status	3.3	Operating, accounting, water sharing, compliance
16	421138	Macquarie	Bogan River at Nyngan	Upgrade	Flow (improve data quality)	3.3	Operating, accounting, water sharing, environmental water

No.	Site ID	Catchment	Site name	Install type	Data type	Ranking	Intent
17	419066	Namoi	Lake Goran at Hokey Pokey	Upgrade	Level (improve data quality)	3.3	Water sharing, environmental water
18	425TBA	Darling	Darling River u/s of Lake Wetherell	New	Flow	3.0	Connectivity, environmental water
19	422TBA	Culgoa	Wanourie Creek u/s of Castlereagh junction	New	Flow	3.0	Operating, accounting, water sharing, environmental water
20	422TBA	Culgoa	Womat Creek u/s of Castlereagh junction	New	Flow	3.0	Operating, accounting, water sharing, environmental water

Cost and funding

The Australian Government has provided funding to install up to **20** new sites over 3 years in the NSW Northern Murray Darling Basin under the Hydrometric Network and Remote Sensing (HNRS) program. Ongoing operation and maintenance costs are not covered by the Australian Government. The indicative capital and additional annual operating costs to install the 20 top ranked new or upgraded sites are $685,000 and $244,000 respectively. The indicative capital costs to install or upgrade the top ranked sites are presented in Table 2, with Table 3 showing the likely annual operating cost.

The capital cost assumes one year of operation to establish the site. The operating cost assumes a staggered installation of sites and operation until 2025.

The Appendix tables (Table 9, Table 10) list the indicative capital costs to install or upgrade all identified sites except groundwater sites.

Table 2 - Capital costs for top ranked sites in hydrometric network enhancement

Data type	Upgraded sites	Capital estimate	New sites	Capital estimate	Total estimate
Flow gauging stations	8	$150,000	11	$495,000	$645,000
Gauging stations for water quality (Time series physical-chemical parameters)	0	$0	0	$0	$0

Data type	Upgraded sites	Capital estimate	New sites	Capital estimate	Total estimate
Level sensors	1	$40,000	0	$0	$40,000
Telemetry	0	$0	Included in numbers above	0	$0
Total	**9**	**$190,000**	**11**	**$495,000**	**$685,000**

Table 3 - Operating costs for top ranked sites in hydrometric network enhancement

Installation type	Upgraded sites	Additional Operating estimate	New sites	Operating estimate	Total estimate
Flow gauging stations	8	$70,000	11	$165,000	$235,000
Gauging station for water quality (Time Series physical-chemical parameters)	0	$0	0	$0	$0
Level sensors	1	$9,000	0	0	$9,000
Telemetry	0	$0	Included in numbers above	Included in costs above	$0
Total	**9**	**$79,000**	**11**	**$165,000**	**$244,000**

Next steps

Sites will first be assessed for viability and the initial 5 sites will be installed by June 2022. The inclusion and ranking of groundwater sites, coupled with stakeholder feedback will dictate the installation of further sites.

Appendix

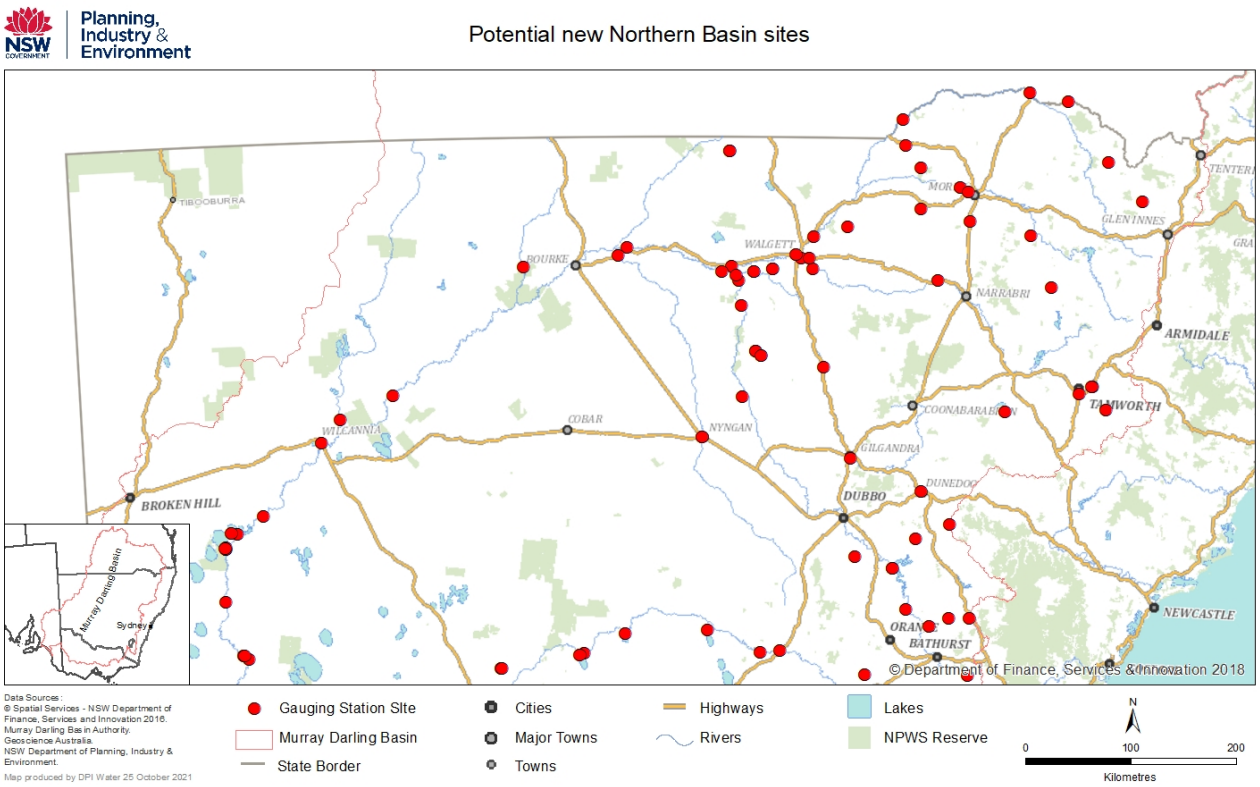

Figure 2 - Potential new Northern Basin sites

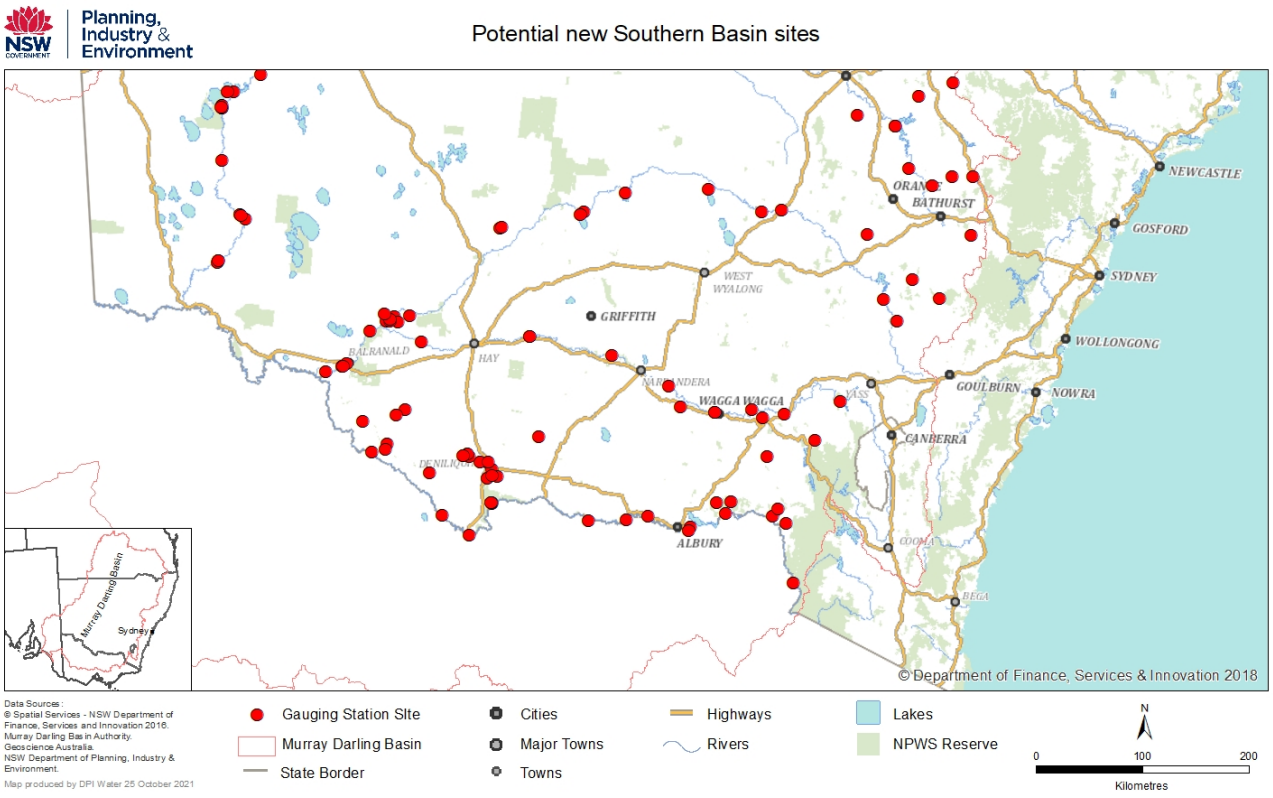

Figure 3 - Potential new Southern Basin sites

Table 4: New sites identified for flow

Site ID	Catchment	Site name	Request Flow
410087	Murrumbidgee	Bullenbung Creek at Above Old Man Creek	Flow
419114	Namoi	Cockburn River at D/S Kootingal Bridge Weir	Flow
422014	Culgoa	Bokhara River at Goodooga	Level Flow
422TBA	Culgoa	Barwon at Walgett Weir Pool	Flow
410TBA	Murrumbidgee	Billabong Creek Significantly D/S Of Darlot	Flow
410TBA	Murrumbidgee	Murrumbidgee Waldira	Flow
412TBA	Lachlan	Box Creek Offtake From Merrowie Creek	Flow, Temp
412TBA	Lachlan	Lake Forbes	New Level (Volume)
416TBA	Border Rivers	Dumaresq River D/S Of Mac Brook Junction	Flow
416TBA	Border Rivers	Macintyre River Between Kanowona And Mungindi	Flow
418TBA	Gwydir	Gil Creek Between Weemalah And Galloway	Flow
418TBA	Gwydir	Gurley Creek	Flow
419TBA	Namoi	Dungowan Creek at Thortons Road Bridge	Flow
419TBA	Namoi	Goonoo Goonoo Creek Upstream Of Calala Lane Road Bridge	Flow
419TBA	Namoi	Pian Creek Between Dempsys Bridge And Waminda	Flow
419TBA	Namoi	West Of Narrabri	Flow
420TBA	Castlereagh	Castlereagh Between Gilgandra And Gungulman Gauges.	Flow
420TBA	Castlereagh	Castlereagh River at Coonamble	Flow
421TBA	Macquarie	Little Bogan U/S Of Bourke	Flow
421TBA	Macquarie	Macquarie D/S Of Castlereagh Junction	Flow
421TBA	Macquarie	Macquarie River at Bindi Bridge (D/S Castlereagh Confluence)	Level Flow
421TBA	Macquarie	Macquarie U/S Of Bdong Dam Catchment	Flow

Site ID	Catchment	Site name	Request Flow
421TBA	Macquarie	Marthaguy Creek at U/S Confluence With Terrigal Creek	Flow
421TBA	Macquarie	Milmiland Creek at Carinda Road	Flow - reinstate site
422TBA	Culgoa	Wanourie Creek U/S Of Castlereagh Junction	Flow
422TBA	Culgoa	Womat Creek U/S Of Castlereagh Junction	Flow
424TBA	Paroo	Paroo River U/S Of Wilcannia	Flow
425TBA	Darling	Darling River Between Tilpa And Wilcannia	Flow
425TBA	Darling	Darling River U/S Of Lake Wetherell	Flow

Table 5: Sites identified for flow improvement

Site ID	Catchment	Site name	Request Flow
410143	Murrumbidgee	Murrumbidgee River at Eringoarrah	Flow
410155	Murrumbidgee	Tarcutta Creek at Belmore Bridge	Flow
412102	Lachlan	Lake Brewster Intake	Flow
412179	Lachlan	Lake Marool Outflow Channel	Flow improve quality
412180	Lachlan	Toopuntul Channel	Flow
412181	Lachlan	SW Floodplain Wetspot	Flow
412183	Lachlan	The Woodcutters	Flow
418049	Gwydir	Mallawa Creek at Regulator	Level Flow
418074	Gwydir	Gingham Channel at Teralba	Level Flow
418077	Gwydir	Gingham Channel at Waterhole	Level improve quality
419066	Namoi	Lake Goran at Hokey Pokey	Level
419091	Namoi	Namoi at Walgett	Flow - relocate site
421012	Macquarie	Macquarie River at Carinda (Bells Bridge)	Improved level and flow technology

Site ID	Catchment	Site name	Request Flow
421138	Macquarie	Bogan River at Nyngan	Flow
421138	Macquarie	Nyngan Lower Weir Pool	Level- move - extend orifice improvement
421153	Macquarie	Terrigal at U/S Marthaguy Ck	Level Flow - quality improvement
421153	Macquarie	Terrigal Creek at U/S Marthaguy Creek	Level Flow - relocate upstream
421907	Macquarie	Macquarie River at Brewon	Upgrade from project to ongoing status
422025	Culgoa	Barwon River at Tara	Relocate
422026	Culgoa	Barwon River at Boorooma	Velocity sensor
422027	Culgoa	Barwon River at Geera	Flow full Flow range
422028	Culgoa	Barwon River at Beemery	Velocity sensor
423008	Warrego	Warrego River at Boera Dam	Flow
419TBA	Namoi	Namoi River Between Goangra And Walgett	Flow
421TBA	Macquarie	Marthaguy Ck at U/S Terrigal Ck	Flow - quality issues improvement
421TBA	Macquarie	Tyreel And Mallowa Regulators	Flow - replace with another site - relocate?

Table 6: New sites identified for water quality and rainfall

Site ID	Catchment	Site name	Request water quality and rainfall
401003	Upper Murray	Tooma River at Warbrook	Level Flow Electrical Conductivity Water Temperature
409060	Murray	North Deniliquin Drain at Hay Rd.	Flow Electrical Conductivity Water Temperature
409067	Murray	Deniboota Canal Escape U/S Top Of Bridge Lashbrooks Rd.	Flow Electrical Conductivity Water Temperature

Site ID	Catchment	Site name	Request water quality and rainfall
421077	Macquarie	Macquarie River U/S Spillway Burrendong Dam	Level and flow for WQ sampling
4210123	Lachlan	Abercrombie River at Camping Area	Level and flow to support WQ programs
40910087	Murray	Murray River at Moama (Echuca)	Level, Flow Electrical Conductivity and Temperature
41000209	Murrumbidgee	Yanco Creek at Wiraki	Dissolved Oxygen
41000281	Murrumbidgee	Murrumbidgee River at Carrathool Bridge	Level flow Water Temperature Dissolved Oxygen
41010143	Murrumbidgee	Murrumbidge River at Waldaria	Level and flow to support WQ programs
41010395	Murrumbidgee	Murrumbidge River at Roach Road	Level and flow to support WQ programs
41010809	Murrumbidgee	Hillis Ck at Mundarlo	Level and flow to support WQ programs
41010890	Murrumbidgee	Adelong Ck at Bereena	Level and flow to support WQ programs
41010901	Murrumbidgee	Murrumbidgee River at Balranald Weir Storage	Level and flow to support WQ programs
41010904	Murrumbidgee	Murrumbidgee River at Berembed Weir - Storage Gauge	Level and flow to support WQ programs
41010924	Murrumbidgee	Goobarragandra River at Little River Road	Level and flow to support WQ programs
41610044	Border Rivers	Macintyre River at Salisbury Bridge (Boggabilla)	Level and flow to support WQ programs
41610079	Border Rivers	Severn River at Strathbogie Bridge (Inverell Road)	Level and flow to support WQ programs
41610152	Border Rivers	Gil Creek at Collarenebri Road Bridge	Level and flow to support WQ programs
41810006	Gwydir	Laura Creek at Upstream Bundara	Level and flow to support WQ programs
41810033	Gwydir	Myall Creek at Sheep Station Creek Road	Level and flow to support WQ programs
41810058	Gwydir	Horton River at Elcombe Road Bridge	Level and flow to support WQ programs
42110101	Macquarie	Macquarie River at Molong Rai Bridge	Level and flow to support WQ programs
42110170	Macquarie	Turon River at Bathurst Point	Level and flow to support WQ programs

Site ID	Catchment	Site name	Request water quality and rainfall
42110171	Macquarie	Fish River at Hazelgrove	Level and flow to support WQ programs
42399999	Benanee?	Sunraysia	Sampling site
401New	Upper Murray	Dogmas Hut Camping Area	Rain Gauge
401New	Upper Murray	Jergyle Mt Woomagarma National Park	Rain Gauge
401New	Upper Murray	Mt Welaregang	Rain Gauge
401New	Upper Murray	Oak Hill -Bogandyera Nature Reserve	Rain Gauge
401New	Upper Murray	Tailgauge On The Murray Arm Of Hume Around Mt Porcupine	Rain Gauge
401New	Upper Murray	Tin Mine Falls	Rain Gauge
410new	Murrumbidgee	Murrumbidgee at Balranald Weir Pool (~200M Upstream Of Weir Wall)	Thermistor chain
410new	Murrumbidgee	Murrumbidgee at Maude Weir Pool (~200M Upstream Of Weir Wall)	Thermistor chain
410new	Murrumbidgee	Murrumbidgee at Redbank Weir Pool (~200M Upstream Of Weir Wall)	Thermistor chain
412new	Lachlan	Box Creek Offtake From Merrowie Creek	Level Flow and Temperature
412new	Lachlan	Wallaroi/Wallamundry at Woolshed Weir	Level Flow and Dissolved Oxygen

Table 7: Sites identified for water quality and rainfall improvement

Site ID	Catchment	Site name	Request water quality (time series) and rainfall
409002	Murray	Murray River at Corowa	Upgrade to include rainfall
409006	Murray	Murray at Gulpa	Electrical Conductivity Water Temperature and Dissolved Oxygen
409008	Murray	Edward River at Offtake	Dissolved Oxygen
409014	Murray	Edward River at Moulamein	Upgrade to include rainfall
409019	Murray	Wakool River at Offtake Regulator	Dissolved Oxygen
409020	Murray	Yallakool Creek at Offtake	Dissolved Oxygen
409023	Murray	Edward River Downstream Of Stevens Weir	Dissolved Oxygen
409024	Murray	Colligen Creek at Below Regulator	Level Flow and Dissolved Oxygen

Site ID	Catchment	Site name	Request water quality (time series) and rainfall
409025	Murray	Murray River Downstream Yarrawonga Weir	Dissolved Oxygen
409029	Murray	Escape From Mulwala Canal at Edwards River	Dissolved Oxygen
409030	Murray	Gulpa Creek at Offtake	Dissolved Oxygen
409037	Murray	Murray River at Howlong	Upgrade to include rainfall
409047	Murray	Edward River at Toonalook	Dissolved Oxygen
409056	Murray	Tuppal Creek at Aratula Road	Dissolved Oxygen
409061	Murray	Wakool River at Coonamit Bridge	Dissolved Oxygen
409062	Murray	Wakool River at Gee Bridge (No.2)	Dissolved Oxygen
409075	Murray	Bullatale Creek at Upstream Of Edward River	Dissolved Oxygen
409098	Murray	Waddy Creek at Downstream Of Regulator.	Dissolved Oxygen
409107	Murray	Saint Helena Creek at Downstream Regulator	Dissolved Oxygen
409114	Murray	Kpf Offtake Downstream Of Regulator	Dissolved Oxygen
410130	Murrumbidgee	Murrumbidgee River at D/S Balranald Weir	Upgrade to include rainfall
412008	Lachlan	Lachlan - Lake Creek at Lake Cargelligo Outlet	Dissolved Oxygen
412027	Lachlan	Lachlan River at Reids Flat	Upgrade to include rainfall
412036	Lachlan	Lachlan - Lachlan River D/S Jemalong Weir	Water Temperature
412050	Lachlan	Crookwell River at Narrawa North	Upgrade to include rainfall
412056	Lachlan	Belubula River at The Needles	Upgrade to include rainfall
412066	Lachlan	Abercrombie River at Hadley No.2	Upgrade to include rainfall
412154	Lachlan	Cumbung Swamp at End Of System	Dissolved Oxygen
412177	Lachlan	Bunumbert Inflow	Dissolved Oxygen and Temperature
412194	Lachlan	Lachlan at 4 Mile	Dissolved Oxygen
421019	Macquarie	Cudgegong River at Yamble Bridge	Upgrade to include rainfall
421026	Macquarie	Turon River at Sofala	Upgrade to include rainfall
421176	Macquarie	Little River at Arthurville	Flow Electrical Conductivity Water Temperature

Site ID	Catchment	Site name	Request water quality (time series) and rainfall
421191	Macquarie	Macquarie River at Yarracoona	Upgrade to include rainfall
421904	Macquarie	Talbragar River at Dunedoo	Upgrade to include rainfall
425005	Darling	Lower Darling - Darling River at Pooncarie	Dissolved Oxygen
425007	Darling	Darling River at Burtundy	Upgrade to include rainfall
425008	Darling	Lower Darling - Darling River at Wilcannia Main Channel	Dissolved Oxygen
425012	Darling	Darling River at Menindee U/S Weir 32	Upgrade to include rainfall
425012	Darling	Lower Darling - Darling River at Menindee Upstream Weir 32	Dissolved Oxygen
425048	Darling	Darling River at Great Darling Anabranch Offtake	Upgrade to include rainfall
41010922	Murrumbidgee	Murrumbidgee River at Gogeldrie Weir - Storage Gauge	Level and flow to support WQ programs
401 DLH001	Upper Murray	Lake Hume at Heywoods	Relocate
401 DLH002	Upper Murray	Hume Dam Lake Hume Resort	Relocate

Table 8: Sites identified for telemetry

Site ID	Catchment	Site name	Request telemetry
410131	Murrumbidgee	Murrumbidgee River at Burrinjuck Dam - Storage Gauge	Telemetry
412108	Lachlan	Lake Brewster at Storage Gauge	Telemetry
424003	Paroo	Paroo River at Porters Crossing	Telemetry
425020	Darling	Darling River at Lakes Wetherell+ Tandure Total Storage	Telemetry
425021	Darling	Darling River at Lake Pamamaroo + Copi Hollow Total Storage	Telemetry
42510089	Darling	Darling River at Tulney	Telemetry
42510090	Darling	Darling River Upstream Weir 32	Telemetry
42510091	Darling	Darling River Upstream Menincourt	Telemetry

Site ID	Catchment	Site name	Request telemetry
42510092	Darling	Darling River Upstream Tulney	Telemetry
42510417	Darling	Darling River at Menincourt	Telemetry

Table 9: Capital costs for hydrometric network enhancement, except groundwater

Data type	Existing sites	Capital estimate	New sites	Capital estimate	Total estimate
Flow gauging stations	26	$650,000	29	$1,305,000	$1,955,000
Gauging stations for water quality (Time series physical-chemical parameters) Discrete WQ	29 2	$435,000 $2,000	29 1	$1,450,000 $5,000	$1,885,000 $7,000
Rain gauges (Real time)	15	$150,000	6	$120,000	$270,000
Level sensors	1	$40,000	0	0	$40,000
Telemetry	10	$50,000	Included in numbers above	0	$50,000
Total	**83**	**$1,327,000**	**65**	**$2,880,000**	**$4,207,000**

Table 10: Operating costs for hydrometric network enhancement, except groundwater

Installation type	Existing sites	Operating estimate	New sites	Operating estimate	Total estimate
Flow gauging stations	26	$130,000	29	$435,000	$565,000
Gauging station for water quality (Time Series physical-chemical parameters) Discrete WQ	29 2	$145,000 $10,000	29 1	$464,000 $5,000	$609,000 $15,000
Rain gauges (Real time)	15	$37,500	6	$54,000	$9,1500
Level sensors	1	$10,000	0	0	$10,000

Installation type	Existing sites	Operating estimate	New sites	Operating estimate	Total estimate
Telemetry	10	$2,000	Included in numbers above	Included in costs above	$2,000
Total	**83**	**$334,500**	**65**	**$958,000**	**$1,292,500**