Upper and Lower Namoi groundwater sources

2021 Groundwater level review

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Acknowledgment of Country

The Department of Planning 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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1.0 Analysis Summary

This report provides results of groundwater level analysis of the Upper and Lower Namoi Alluvial groundwater sources up to mid-2021. This report identifies areas of long-term declining water level trends and large seasonal drawdown in response to extraction and drought, and where further water level management may be required in the future.

A summary of the findings of this groundwater level analysis for the Lower Namoi Groundwater Source and Upper Namoi groundwater sources is listed in **Table 1.**

Table 1 Summary of groundwater level analysis

Groundwater Source	Comments
Lower Namoi	Trade Areas 2 and 3 are showing: ○ Over the last 5 years, multiple sites show pumping drawdown has exceeded 40% baseline total available drawdown. ○ Ongoing decline in recovered water levels, with multiple monitoring bores sites in these areas have the recovered water level greater than 25% of the baseline total available drawdown. ○ Change in recovered water levels over time is greater than 10 m at multiple monitoring bores Water level management maybe required to mitigate the declining trend.
Upper Namoi Zone 1	The water levels are within the acceptable levels however overall, the long-term water level trend in the downstream half of the water source is declining over time.
Upper Namoi Zone 2	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.
Upper Namoi Zone 3	An area south of Carroll shows the maximum drawdown is between 30 and 40% with one bore exceeding 40%. The recovered water levels at the majority of monitoring sites are within acceptable levels, however overall, the water levels are continuing to decline over time.
Upper Namoi Zone 4	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.
Upper Namoi Zone 5	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.
Upper Namoi Zone 6	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.
Upper Namoi Zone 7	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.

Groundwater Source	Comments
Upper Namoi Zone 8	Over the last 5 years the area east of Caroona shows, two sites where pumping drawdown has exceeded 40% baseline total available drawdown, multiple sites between 30 -40 %. Multiple monitoring sites east and north of Caroona show the recovered water level has exceeded 25% of the baseline total available drawdown some sites exceeding 30%. The greater area with the water recovered water level exceeds more than 20%. There is ongoing decline in recovered water levels across the whole of Zone 8, the most significant declining water level trend being east of Caroona. Water level management maybe required to mitigate the declining trend.
Upper Namoi Zone 9	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.
Upper Namoi Zone 10	Limited data.
Upper Namoi Zone 11	The water levels are within the acceptable levels however overall, the long-term water level trend is declining over time.
Upper Namoi Zone 12	Both the seasonal drawdown and recovered water level are within acceptable levels however there has been large overall long-term decline of greater than 10 m, with the shorter-term declining trend between 2 – 5 m. There has also been local concern over the falling trend for the last few years with both the water user's association and individual licence holder in the area contacting the Department expressing concern.

2.0 Introduction

The Upper and Lower Namoi groundwater sources are alluvial aquifer systems located in the Namoi River Catchment. There are 13 individual groundwater sources (**Figure 1 – page 2**) including the Lower Namoi Groundwater Source and the 12 individual groundwater sources in the Upper Namoi (identified as zones, that is Upper Namoi Zone 1 Groundwater Source to Upper Namoi Zone 12 Groundwater Source).

For detailed information of the hydrogeology and past long-term water level behaviour refer to the report 'Groundwater resource description report for the Namoi Alluvial groundwater sources' (https://www.industry.nsw.gov.au/water/plans-programs/water-resource-plans/drafts/namoi-alluvium/components).

2.1 Climate

The Namoi catchment has a temperate to sub-tropical climate with generally summer dominant rainfall with the heaviest rainfall occurring from October to February.

Cumulative deviation from mean rainfall (also known as rainfall residual mass) plots have been constructed using daily data sourced from the Scientific Information for Landowners (SILO) database. This graph plots the cumulative difference from the monthly average rainfall and provides a visual representation of the rainfall history in an area. A falling trend indicates a period of lower than average rainfall, a rising trend showing periods of above average rainfall. The residual mass graph of average monthly rainfall from 1968 for Gunnedah and Wee Waa is displayed in Figure 3. This period corresponds to the period of groundwater monitoring in the Namoi Alluvium which commenced in the late 1960's.

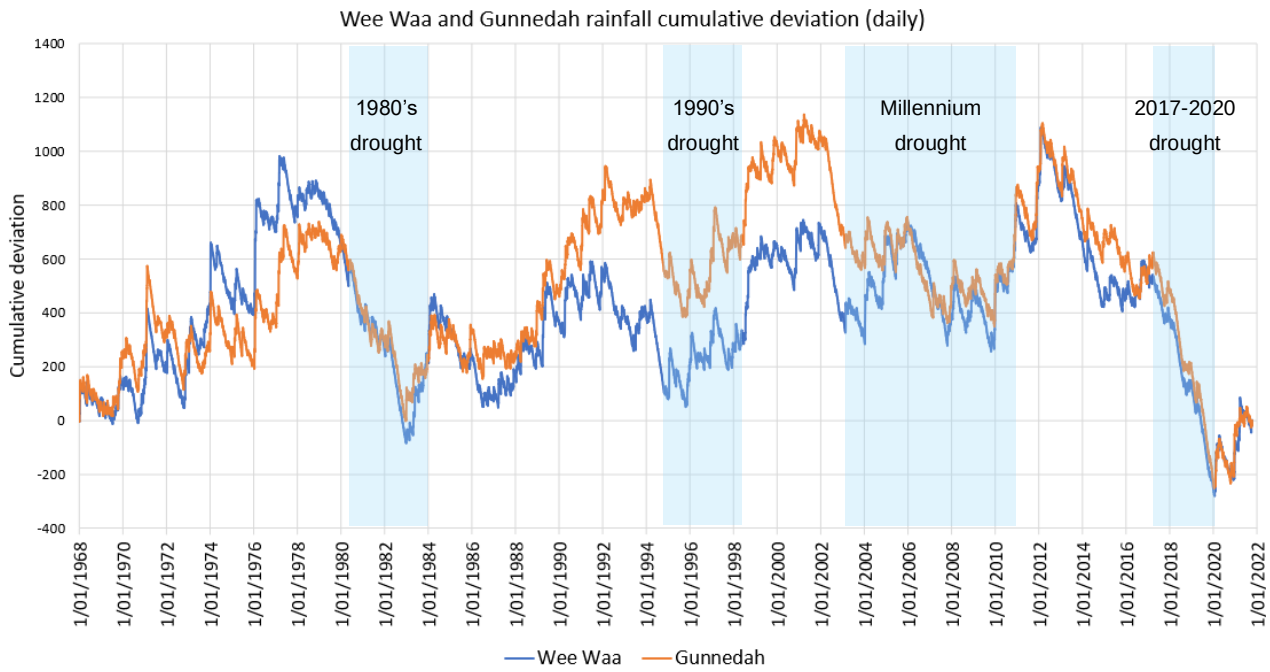


Figure 1 Cumulative deviation from mean rainfall

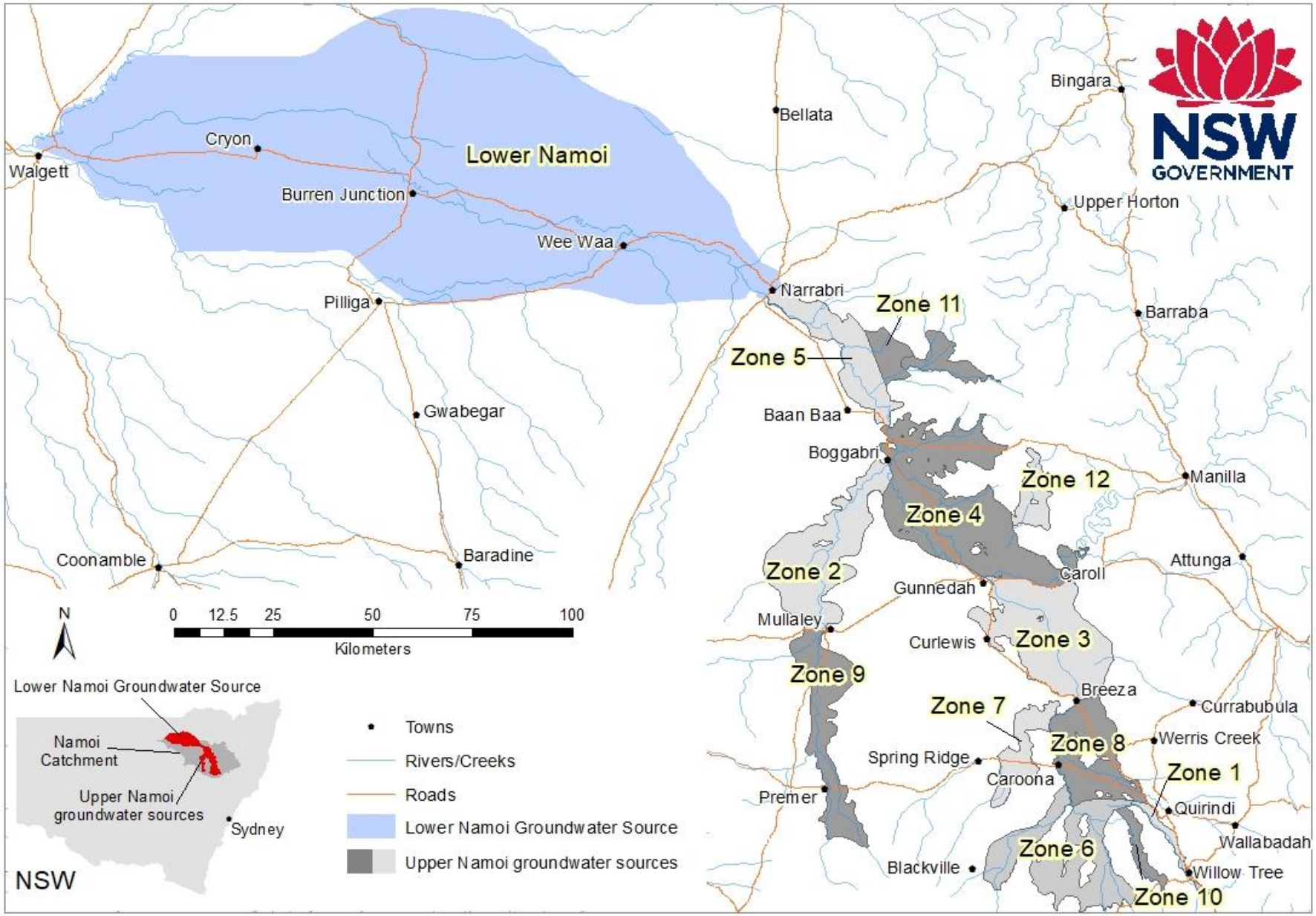


Figure 2 Location of the Upper and Lower Namoi groundwater sources

2.1 Bores

There are approximately 2,100 registered bores in the Lower Namoi Groundwater Source and 4000 registered bores across the Upper Namoi Alluvium. There is significant reliance on groundwater for irrigation (Table 2). The location of the bores is shown in Figures 3.

Table 2 Approximate number of registered bores by type

	Number of registered bores by type		
Groundwater Source	Basic Landholder Right (stock/domestic)	Production	Local Water Utility (town water supply)
Lower Namoi	1488	609	10
Upper Namoi Zone 1	81	50	4
Upper Namoi Zone 2	196	95	3
Upper Namoi Zone 3	444	181	2
Upper Namoi Zone 4	650	377	23
Upper Namoi Zone 5	433	188	
Upper Namoi Zone 6	207	58	
Upper Namoi Zone 7	43	52	
Upper Namoi Zone 8	225	174	1
Upper Namoi Zone 9	90	81	3
Upper Namoi Zone 10	38	14	
Upper Namoi Zone 11	185	43	
Upper Namoi Zone 12	68	34	

2.2 Accounts and extraction

Groundwater is managed to a long-term average annual extraction limit under the existing water sharing plan. The total allocated shares and extraction limit for each groundwater source is listed in **Table 3**.

Total extraction per year since the commencment of the water sharing plan (excluding basic rights) is shown in **Figure 4**. The distribution of extraction based on the 5 year average from 2016-17 to 2020-21 is shown in **Figure 5**.

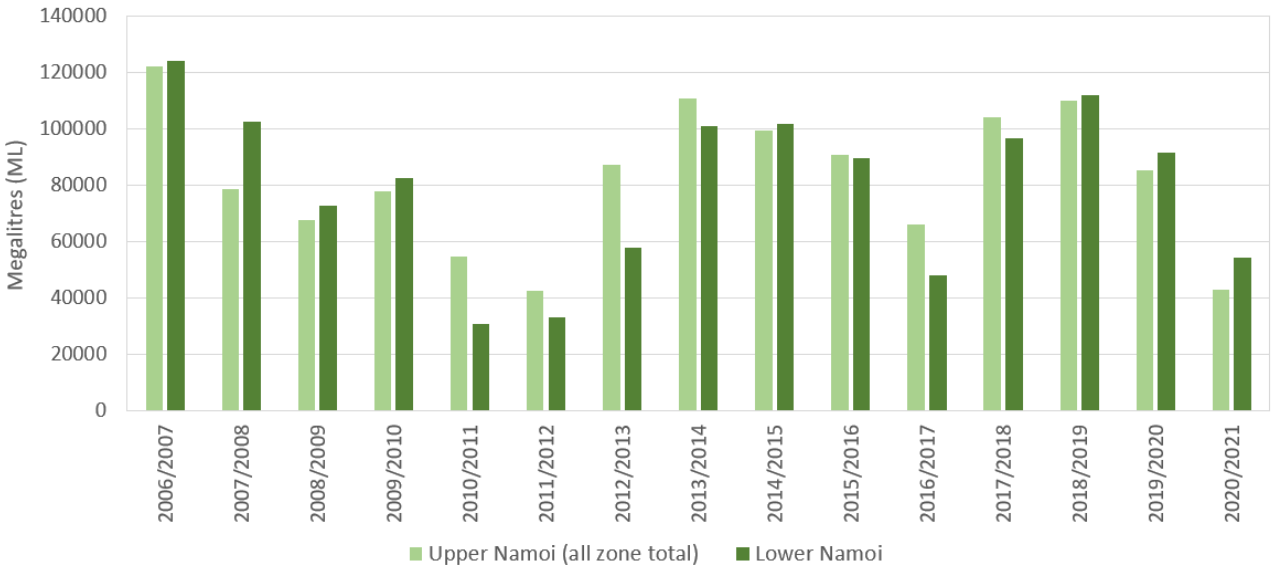


Figure 3 Annual metered usage for the Lower Namoi Groundwater Source and the Upper Namoi groundwater sources combined

Table 3 Extraction limit and shares by type

Groundwater Source	Long term average annual extraction limit (ML/year)	Volume allocated to Basic Rights (ML/year)	Aquifer Access Licence total shares	Local Water Utility Access Licence total shares
Lower Namoi	88,255	2,255	81,586	4,407
Upper Namoi Zone 1	2,127	27	384	1216
Upper Namoi Zone 2	7,327	127	7,141	59
Upper Namoi Zone 3	17,499	199	17,101	198
Upper Namoi Zone 4	26,121	421	21,032	4,660
Upper Namoi Zone 5	16,128	128	15,992	
Upper Namoi Zone 6	14,096	96	10,948	
Upper Namoi Zone 7	3,721	21	3,697	
Upper Namoi Zone 8	16,114	114	16,122	50
Upper Namoi Zone 9	11,441	41	11,245	97
Upper Namoi Zone 10	4,518	18	1,920	
Upper Namoi Zone 11	2,269	69	2,223	
Upper Namoi Zone 12	2,042	42	1,999	

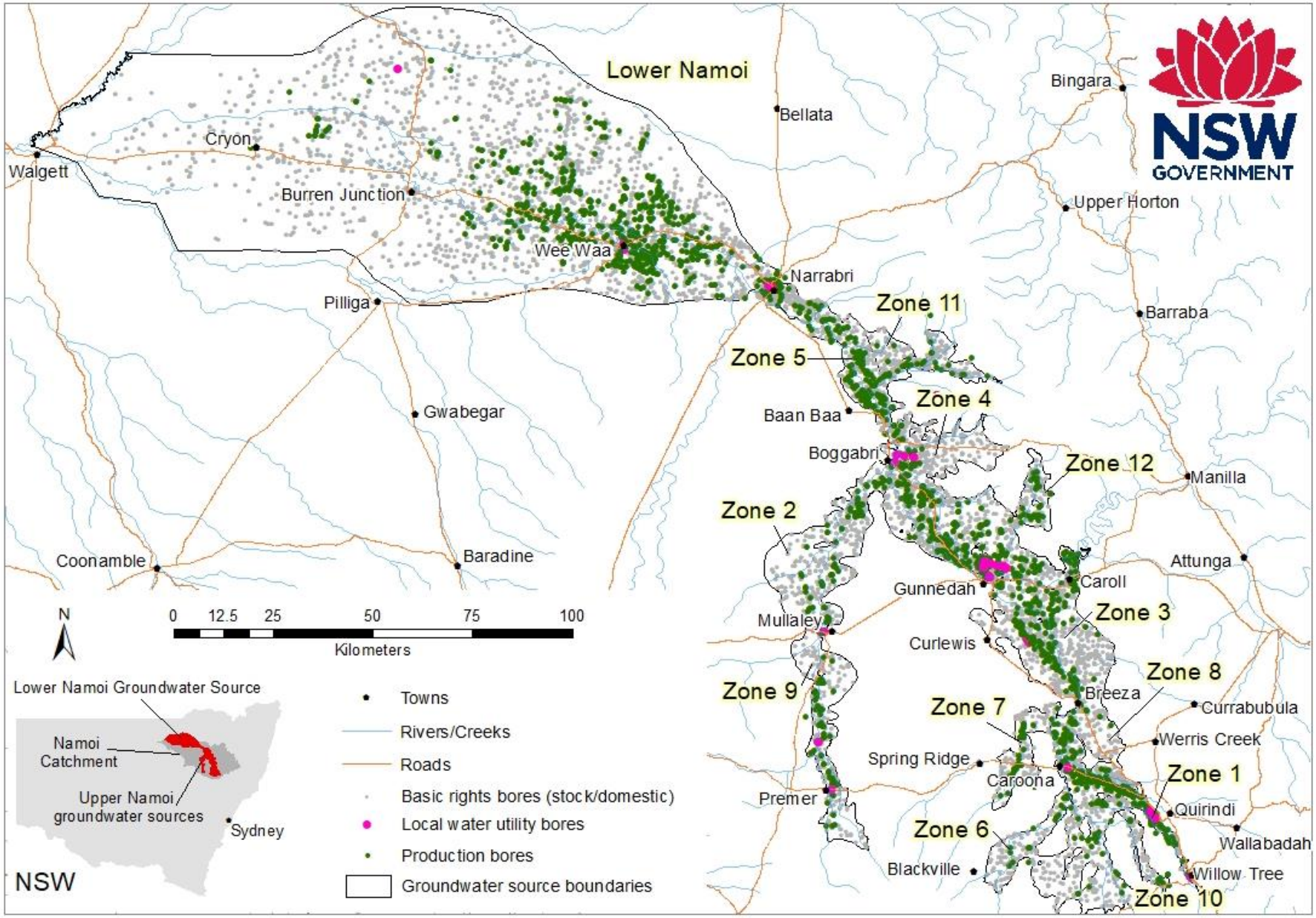


Figure 4 Bores in the Upper and Lower Namoi groundwater sources

2.3 Groundwater monitoring network

There are approximately 570 government groundwater monitoring sites across the Upper and Lower Namoi groundwater sources. The sites are shown in **Figure 6** and listed in **Table 4**.

At most monitoring sites there are two or more pipes monitoring different depths. Most of the bores are monitored manually and measurement taken generally every four to eight weeks. Data is also available for approximately 49 of the groundwater monitoring sites in real-time via telemetry, this data is available from the WaterNSW Realtime Data site:

https://realtimedata.waternsw.com.au/

Table 4 Approximate number of government monitoring bores

	Number of sites	Number of bores	Telemetered sites
Lower Namoi Groundwater Sources	243	580	24
Upper Namoi groundwater sources	330	640	25

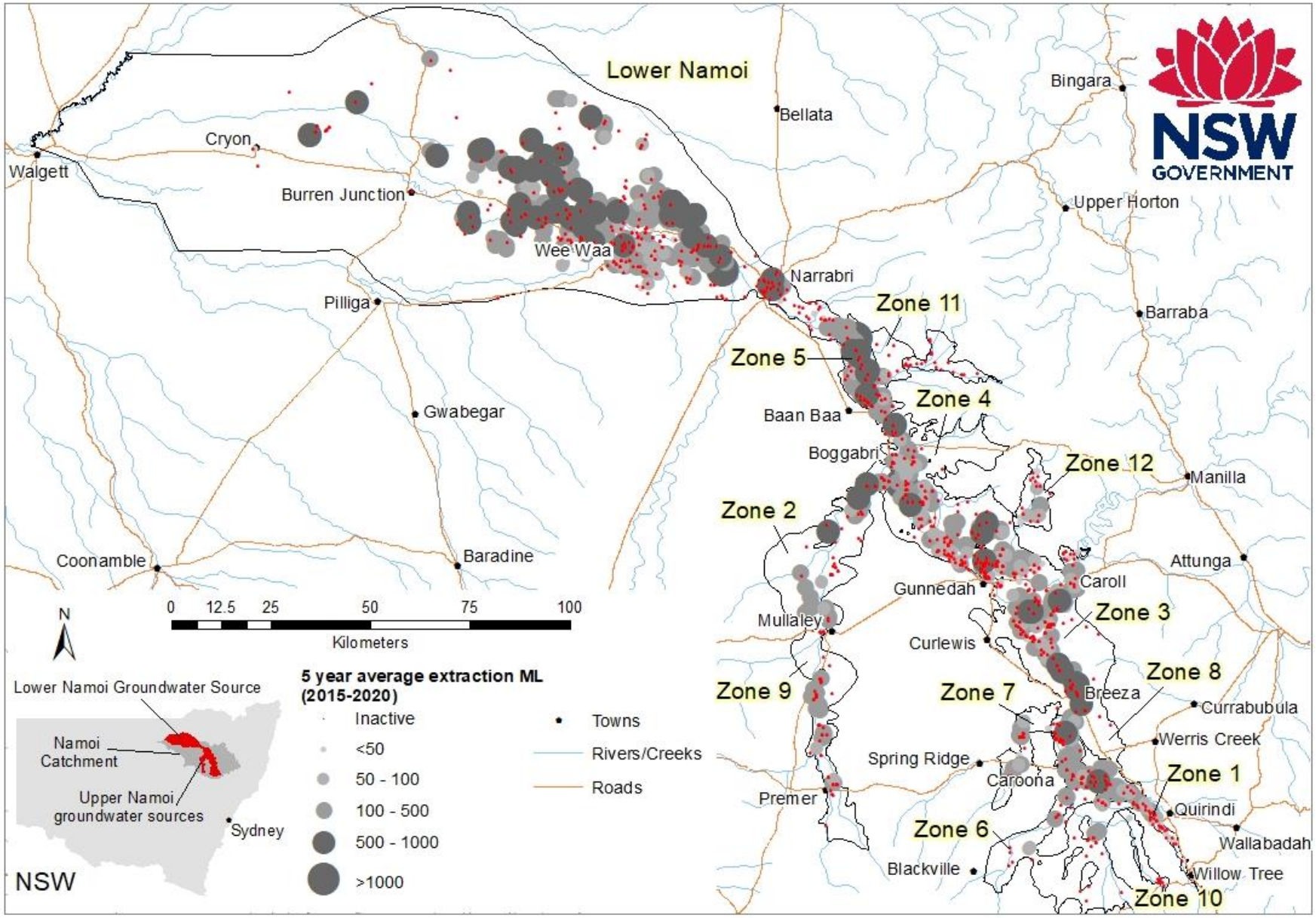


Figure 5 Distribution of extraction showing the average annual extraction over the five-year period from 2015-16 to 2020-21

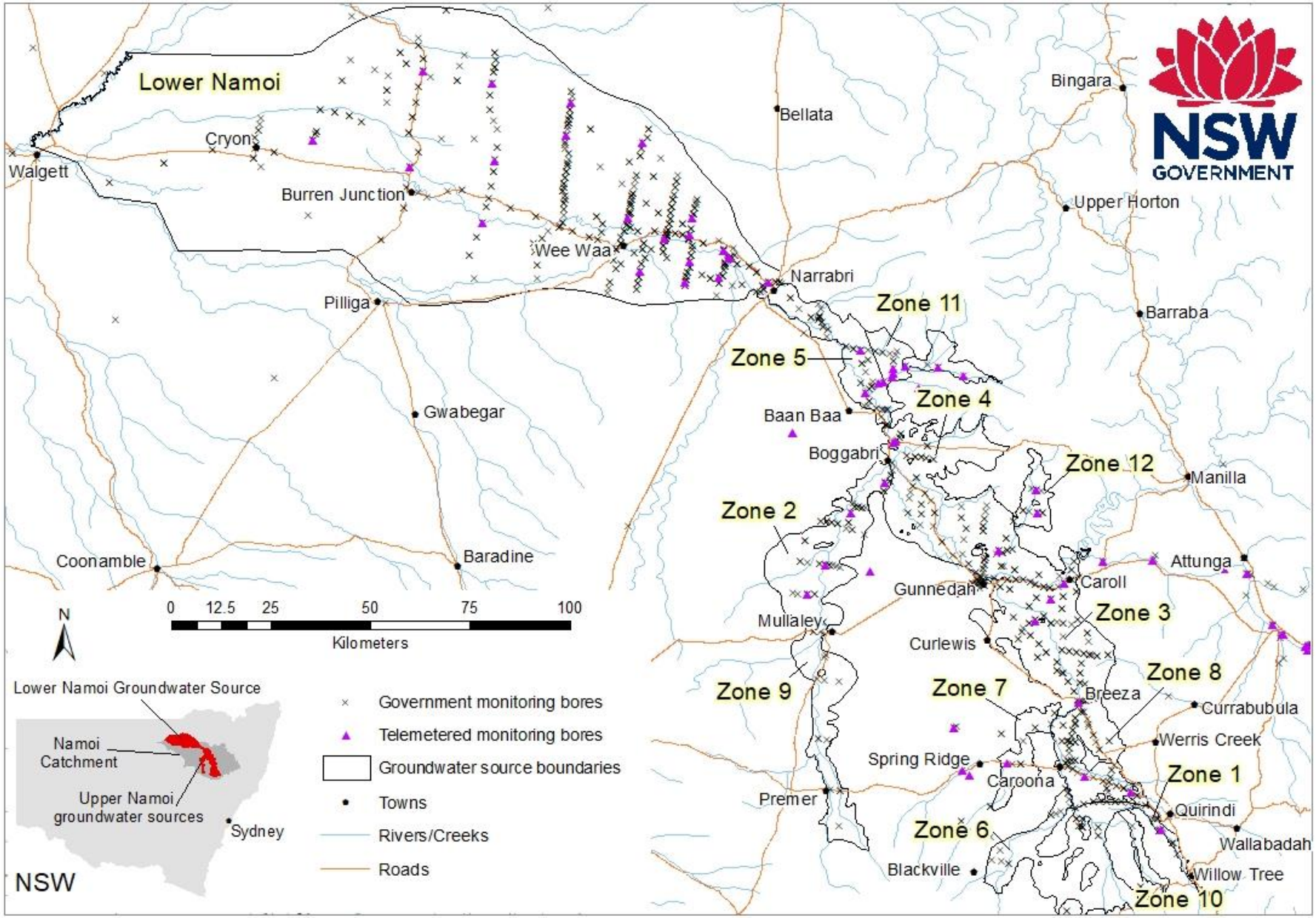


Figure 6 Location of monitoring sites

3.0 Groundwater level analysis

Pumping groundwater causes the water level in the aquifer to drawdown close to the pumping bore. When the pumping stops, the water level recovers (rises), these concepts are show in **Figure 7**. If there are multiple bores pumping, the area of drawdown around the individual bores can combine to form large broad areas of lower groundwater levels during the pumping season. The size and shape of the area affected by the drawdown depends on the volume being pumped, how transmissive the aquifer is and also the level of confinement of the aquifer (that is, how connected the aquifer is to the water table).

If groundwater levels do not fully recover before the start of the next pumping season and this continues for multiple seasons, there is an ongoing decline in the recovered groundwater levels from one season to the next. The depth of the pumping drawdowns will then drop deeper each successive irrigation season.

In large groundwater systems reliant on episodic recharge events to replenish the groundwater store, a decline in the seasonally recovered groundwater levels is an expected management outcome. However, if the seasonally recovered groundwater levels continue to decline after successive recharge events it is an indicator that the levels of pumping in that area of the water source may not be viable in the long term.

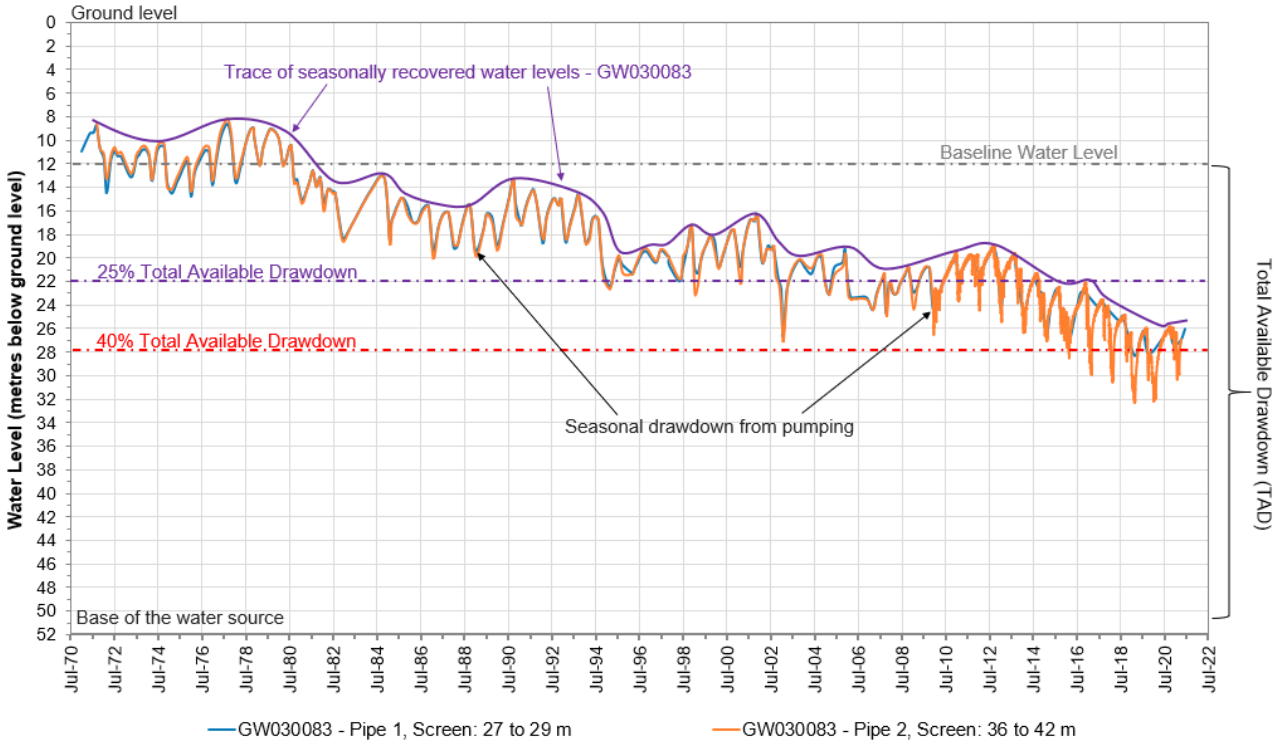


Figure 7 Hydrograph illustrating seasonal pumping drawdown and recovery and groundwater level criteria used to manage groundwater extraction impacts

To assess whether the monitored groundwater levels are fluctuating within these acceptable levels, a baseline is set for each area to reference the magnitude of the observed changes. Depending on the period of available data this baseline is generally set prior to widespread groundwater pumping in an area and is typically the median recovered water level prior to 1990.

The change in groundwater levels is expressed as a percentage of the total available drawdown (TAD) relative to the baseline water level. For the Namoi alluvial groundwater sources this is the height of the groundwater head above the base of the groundwater source as illustrated in **Figure 7**. The level of acceptable change in the groundwater level compared to the baseline

period is a percentage rather than an absolute value in recognition of the relative capacity of a groundwater system to buffer changes in groundwater levels.

For the Namoi alluvial groundwater sources the acceptable level of drawdown is set at 40% of the pre-development total available drawdown (**Figure 7)**.

The trigger for decline in the seasonally recovered water level is 25% of the baseline total available drawdown (**Figure 7**).

The relative change in recovered water level between years has also been reviewed to look at rate and magnitude of change over time. The change in recovered water level over the following two period were reviewed:

- Baseline water level to 2021 recovered water level (long term change)
- 2006 recovered water level (drought year) to 2021 recovered water level (change since the commencement of the water sharing plan)

3.1 Assessment of drawdown

The maximum drawdown over the last 5 years (2016 to 2021) has been calculated as a percentage of the baseline total available drawdown from water level data in the deeper aquifer from relevant monitoring bores. This information has been contoured and is displayed in **Figure 8** for the Lower Namoi Groundwater Source and **Figure 9** for the Upper Namoi groundwater sources.

There is an area in the Lower Namoi groundwater Source (**Figure 8**) north of Wee Waa, generally corresponding to Trade Areas 2 and 3, where the seasonal drawdown has exceeded 40%, and up to greater than 50%, of the baseline total available drawdown.

Drawdown across the majority of the Upper Namoi groundwater sources (**Figure 9**) has been less than 20% of the baseline total available drawdown with the exception of the area south west of Carroll (Upper Namoi Zone 3 Groundwater Source) and east of Caroona (Upper Namoi Zone 8 Groundwater Source), where the where the seasonal drawdown is greater than 30% and, in some areas, has exceeded 40%.

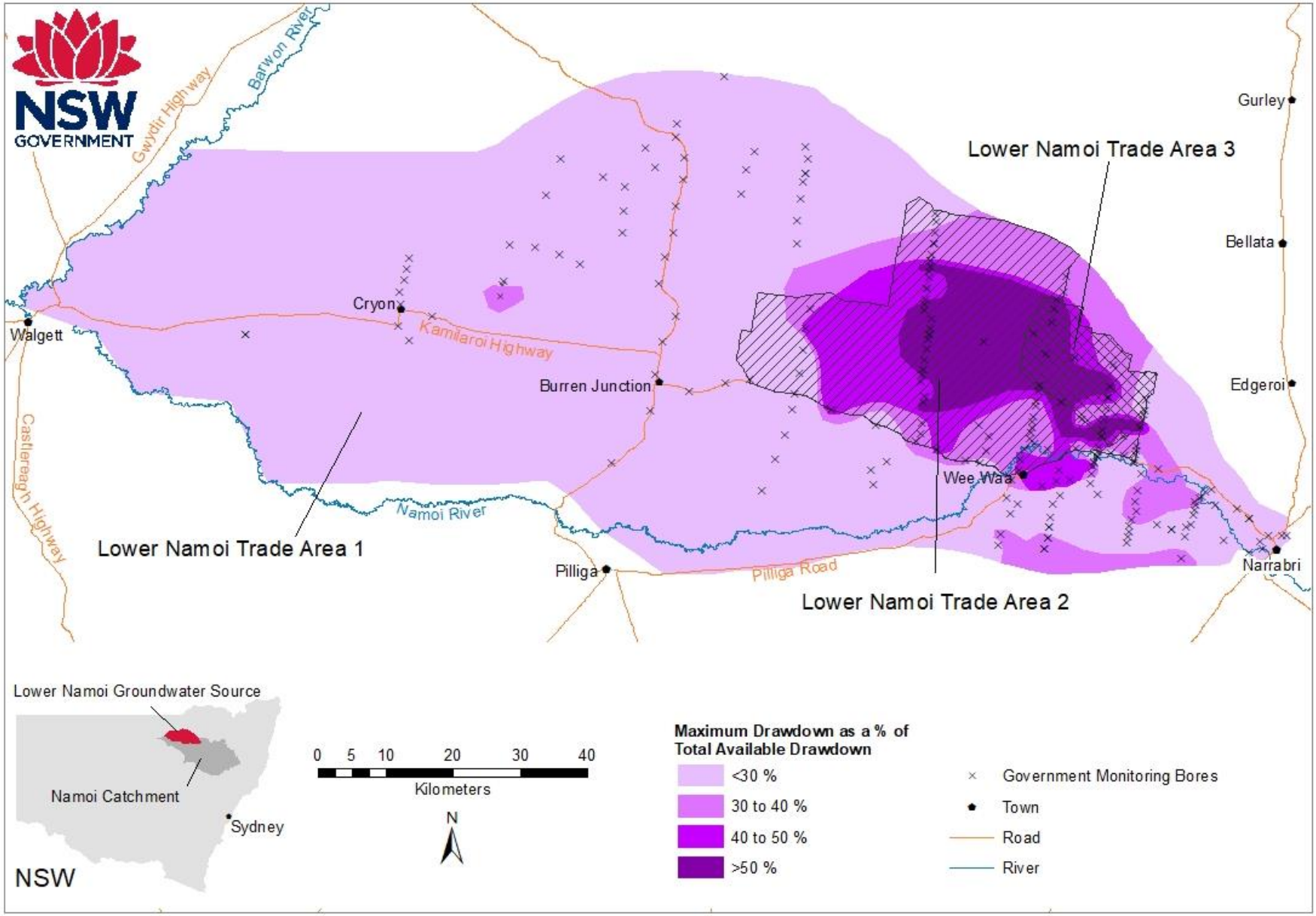


Figure 8 Lower Namoi Groundwater Source maximum pumping drawdown (2016 to 2021) as a percent of baseline total available drawdown

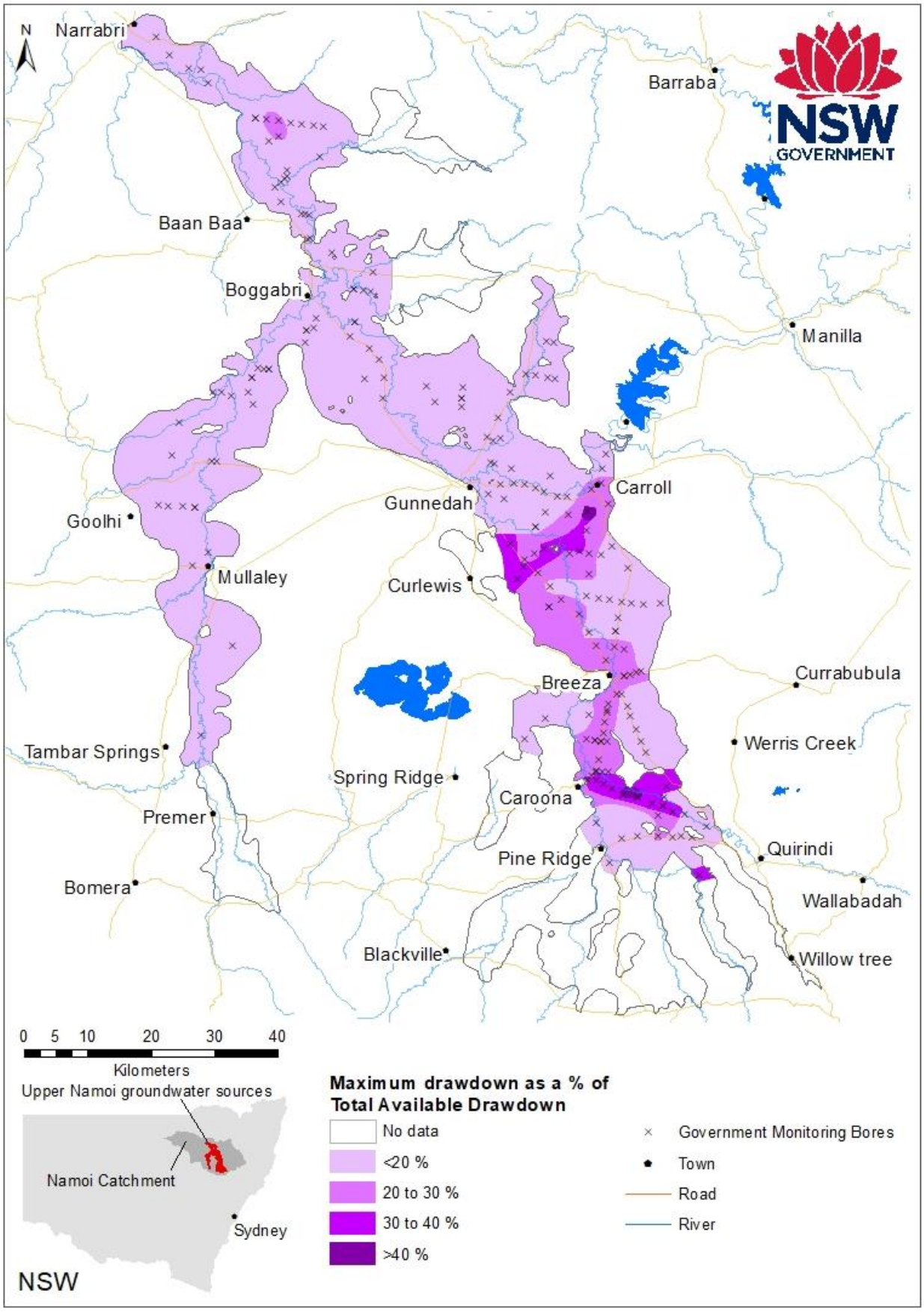


Figure 9 Upper Namoi groundwater sources maximum pumping drawdown (2016 to 2021) as a percent of baseline total available drawdown

3.2 Assessment of recovery

3.2.1 Change in the recovered water levels as a percent of baseline total available drawdown

The maximum recovered water level has been calculated as a percentage of the baseline total available drawdown for the deeper aquifer system from relevant monitoring bore data. The change in the recovered water levels are reported here for two years:

- 2019 recovered water level – corresponding to the recent drought
- 2021 recovered water level – as the most recent recovered water level (wetter conditions)

This information has been contoured and is displayed in **Figure 10A** and **10B** for the Lower Namoi Groundwater Source and **Figure 11A** and **11B** for the Upper Namoi groundwater sources.

Similar to the assessment of the maximum drawdown as a percent of baseline total available drawdown, the area in the Lower Namoi groundwater Source (**Figure 10A** and **10B**) north of Wee Waa, shows the recovered water level has declined by more than 25% of the baseline total available drawdown and in some areas by more than 30%.

The recovered water level across the majority of the Upper Namoi groundwater sources (**Figures 11A** and **11B**) has not declined by more than 15%. Again, the area east of Caroona in Upper Namoi Zone 8 Groundwater Source, the recovered water level has declined by more than 25% of the baseline total available drawdown. With the recovered water level in west of Manilla (Upper Namoi Zone 12) approaching 25% decline.

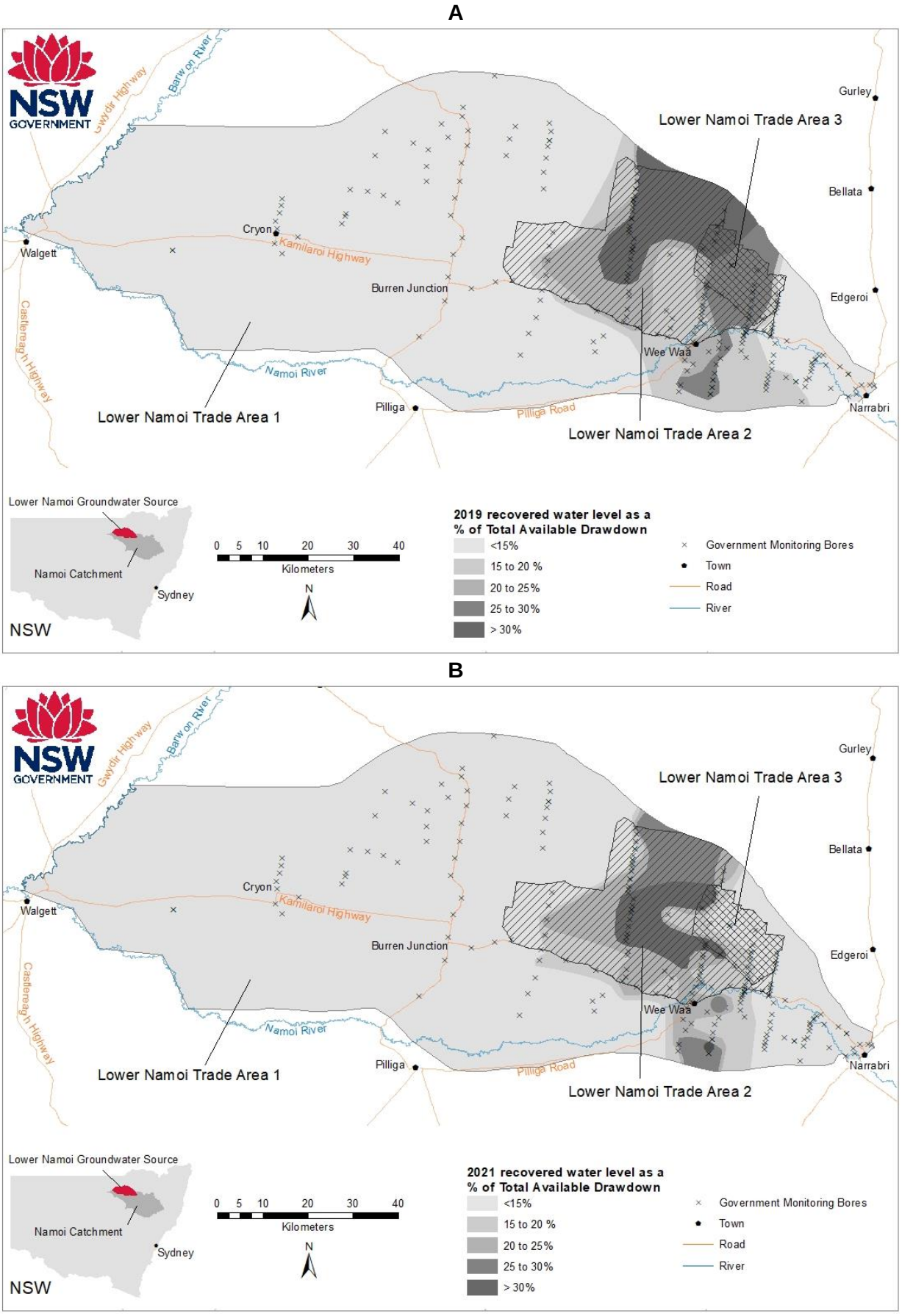


Figure 10 Lower Namoi Groundwater Source recovered water level as a percent of Total Available Drawdown for A. 2019 and B. 2021

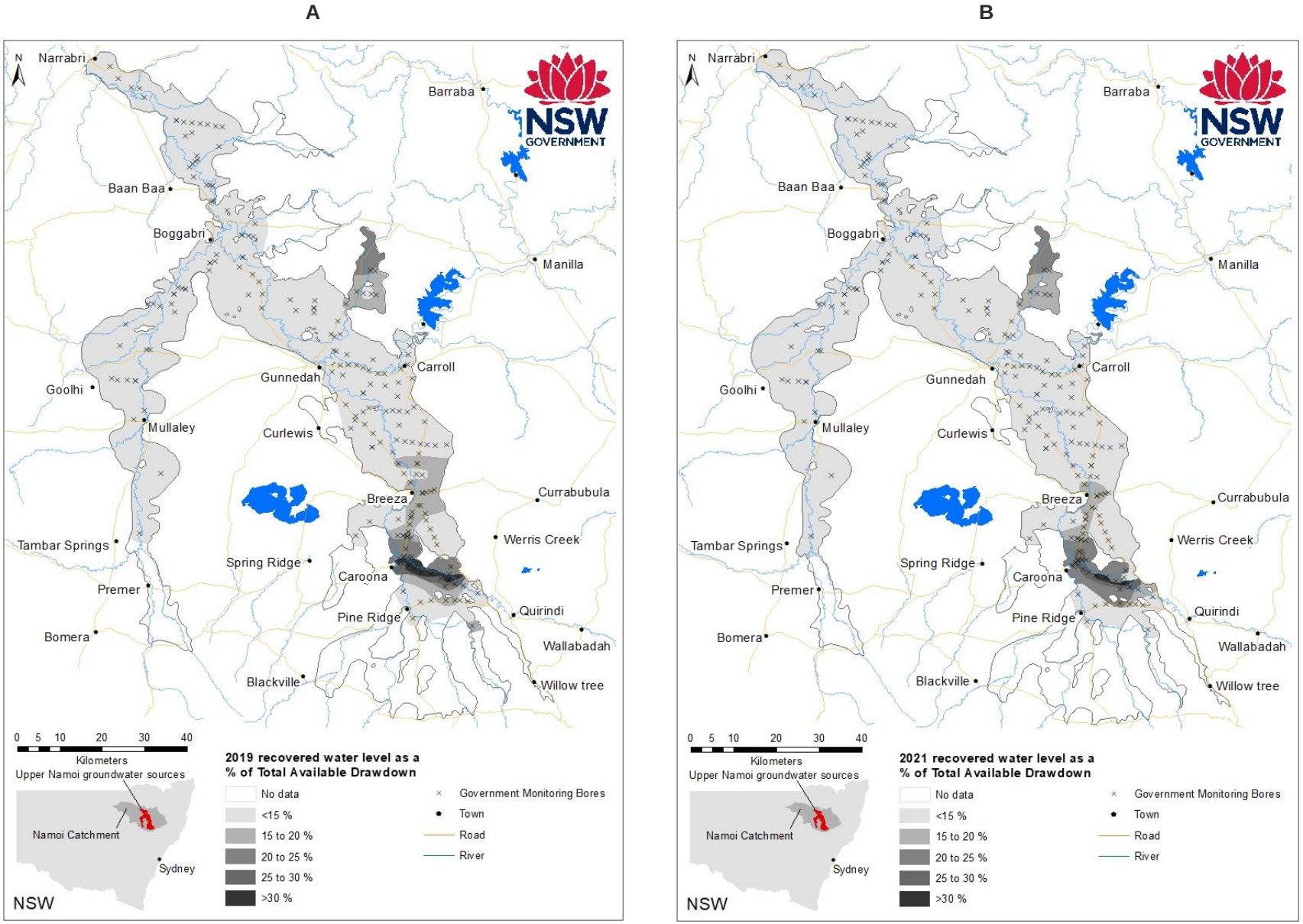


Figure 11 Upper Namoi groundwater sources recovered water level as a percent of Total Available Drawdown for A. 2019 and B. 2021

3.2.1 Change in the recovered water levels in metres

The change in depth of the recovered groundwater levels in the deeper part of the groundwater sources have been compared and contoured over the following two periods:

- Baseline water level to 2021 - long term change
- 2006 (drought year) to 2021 (wetter year) - change since commencement of the water sharing plan.

In the Upper Namoi (**Figure 12A**), the long-term change in recovered water level trend shows a much more significant decline in water levels with at least a 2 to 5m decline across most of the Upper Namoi. Declines up to 10 m north east of Gunnedah in Upper Namoi Zone 4 and Zone 12 groundwater source and near Breeza (Upper Namoi Zone 3 Groundwater Source and Upper Namoi Zone 8 Groundwater Source). The long-term change in recovered water level is greater than 10 m in Upper Namoi Zone 12 Groundwater Source as well as east of Caroona in the Upper Namoi Zone 8 Groundwater Source.

Similarly, in the Lower Namoi Groundwater Source the long-term change (**Figure 13A**) shows a large area where the water levels have declined by 5 to 10 m, with the area north of Wee Waa showing declines of greater than 10m.

The shorter-term comparison of recovered water level from 2006 to 2021 in the Upper Namoi (**Figure 12B**) comparing a drought year (2006) to a wet year (2021) shows areas where the water levels has improved; north of Breeza (Upper Namoi Zone 3 Groundwater Source) and near Mullaley and Boggabri in Upper Namoi Zone 2 Groundwater Source. The rest of the Upper Namoi shows mainly a 2 m decline in recovered water levels. With Upper Namoi Zone 12 Groundwater Source (north-east of Gunnedah) and the area near Caroona (Upper Namoi Zone 8 Groundwater Source) showing up to a 10 m decline.

The short-term trend in the Lower Namoi (**Figure 13B**) shows at least a 2 - 5 m decline across most of the area east of Burren Junction, the up to 10 m decline north of Wee Waa in Trade Area 2. The rate of change over time is listed in **Table 4**.

Table 5 Rate of decline in water levels in the deeper aquifer over time, ie since pre-development to 2021

Groundwater Source	Overall rate of decline in water level over time m/year
Lower Namoi	0.1 to 0.8
Upper Namoi Zone 1	-
Upper Namoi Zone 2	<0.2
Upper Namoi Zone 3	<0.3
Upper Namoi Zone 4	<0.2
Upper Namoi Zone 5	<0.2
Upper Namoi Zone 6	<0.3
Upper Namoi Zone 7	<0.1
Upper Namoi Zone 8	0.1 to 0.5
Upper Namoi Zone 9	<0.1
Upper Namoi Zone 10	-
Upper Namoi Zone 11	<0.1
Upper Namoi Zone 12	0.3 to 0.5

The rate of decline is greatest in the Lower Namoi, Upper Namoi Zone 8 and Upper Namoi Zone 12.

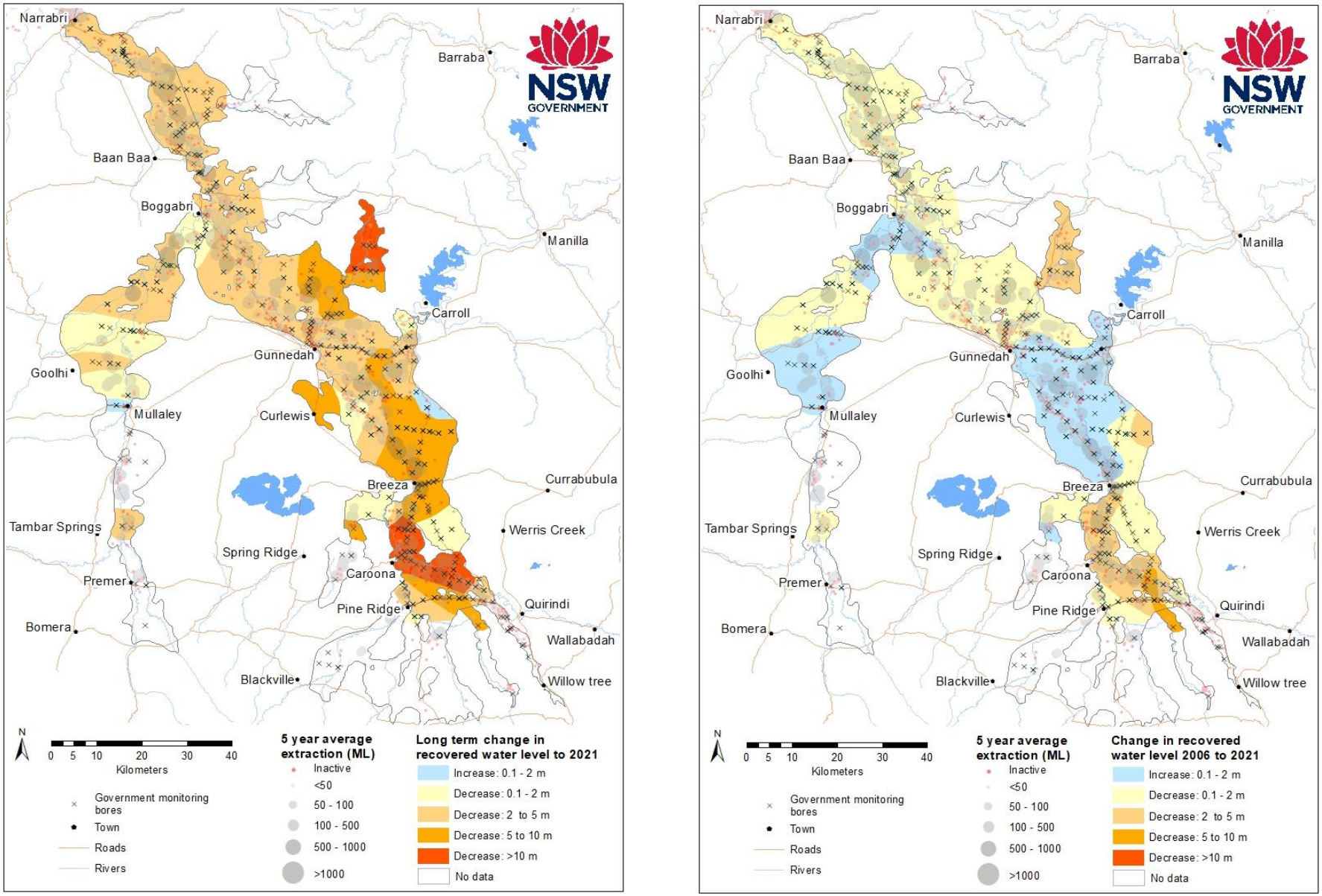
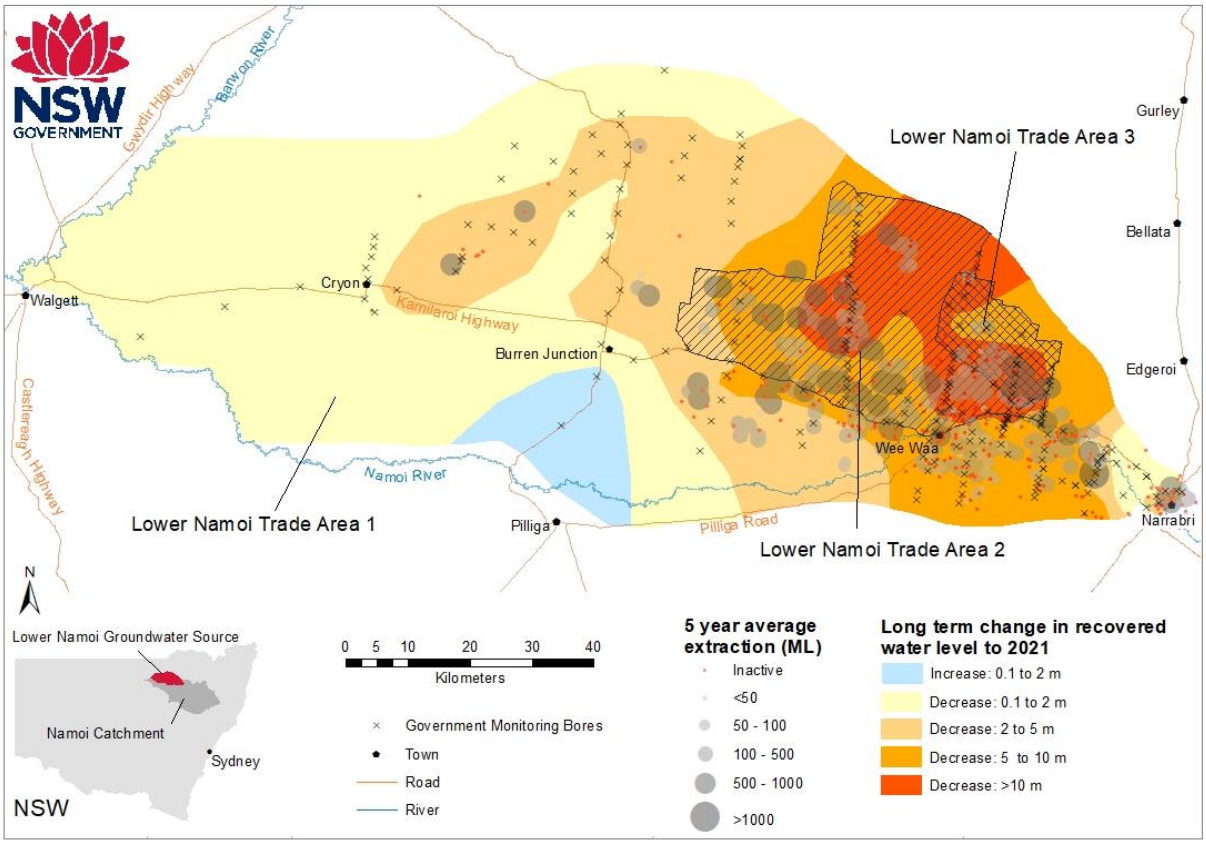


Figure 12 Upper Namoi groundwater source change in recovered water levels over two periods: A. Pre 1990 to 2021 and B. 2006 to 2021



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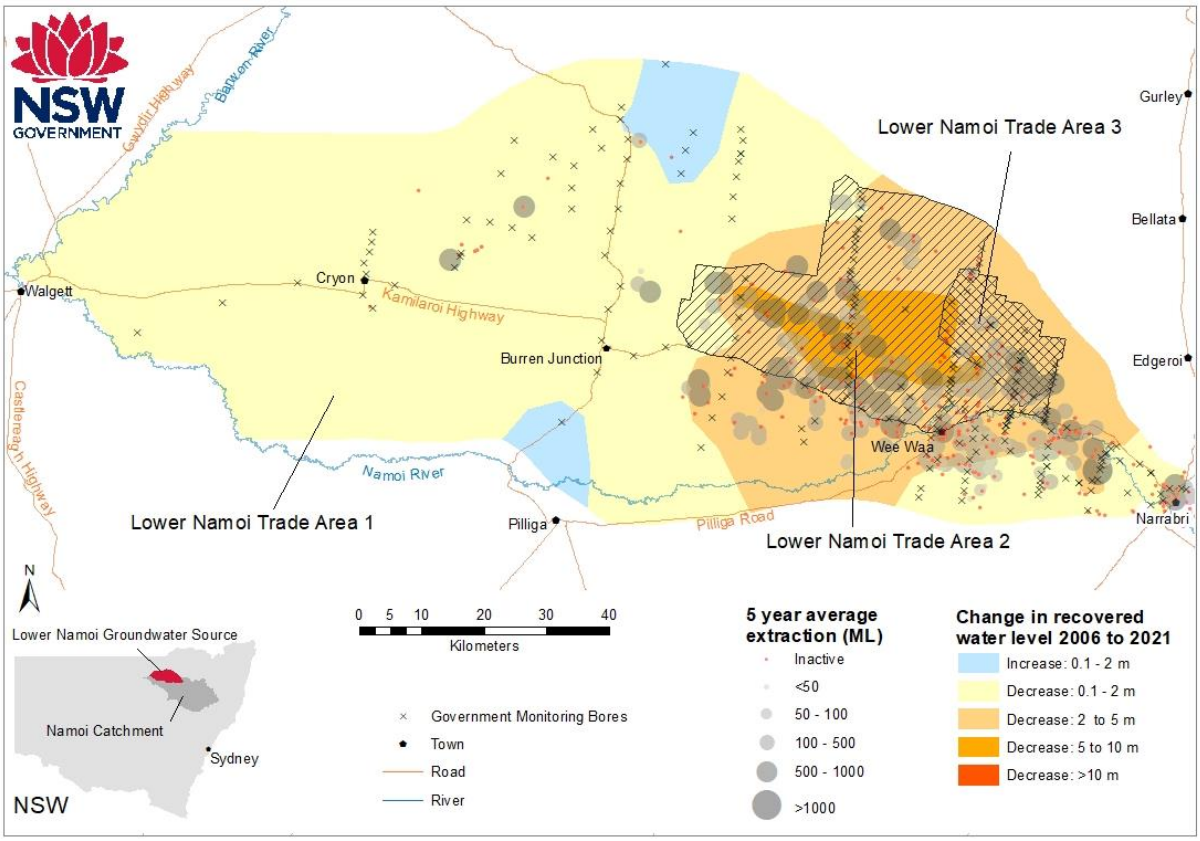


B

Figure 13 Lower Namoi Groundwater Source change in recovered water levels over two periods: A. Pre 1990 to 2021 and B. 2006 to 2021

4. Detailed analysis

Three areas of concern have been identified from the groundwater level analysis, these include:

- Lower Namoi Groundwater Source: Trade Areas 2 and 3
- Upper Namoi Zone 8 Groundwater Source
- Upper Namoi Zone 12 Groundwater Source

This chapter includes a more detailed review of groundwater level hydrographs and usage patterns in these areas. Additionally the groundwater numerical model for the Upper Namoi has been utilised to assess the ongoing decline in recovered water level in Upper Namoi Zone 8 and 12.

4.1 Numerical modelling

The Upper Namoi groundwater sources numerical model (Modflow USG-T), currently in the final stages of peer review (November 2021), has been used to run various usage scenarios in Zone 8 and 12.

A number of scenarios have been run based on the calibration data with and without the pumping included in the simulation.

The Lower Namoi numerical model was not available to run scenarios in time frame for this report however similar scenarios are proposed.

4.2 Upper Namoi Zone 8 Groundwater Source

4.2.1 Accounts and extraction

There are approximately 60 production bores in Upper Namoi Zone 8, 45 of which are consistently pumped. The volume held in the groundwater accounts is compared to extraction over the last 5 years as shown in **Figure 15**. The average extraction (last 5 years) is approximately 14,000 ML/year compared to the extraction limit of 16,114 ML/year. The maximum extraction in the last 5 year occurred in 2019/2020 at 20,300 ML, during the height of the recent drought.

71T Dealings (temporary trade) have also been reviewed over the last 5 years to determine if there are any areas where water is being concentrated. Only 5 licence holders have traded in water on a yearly basis over the last 5 years. Six licence holders have sold their water.

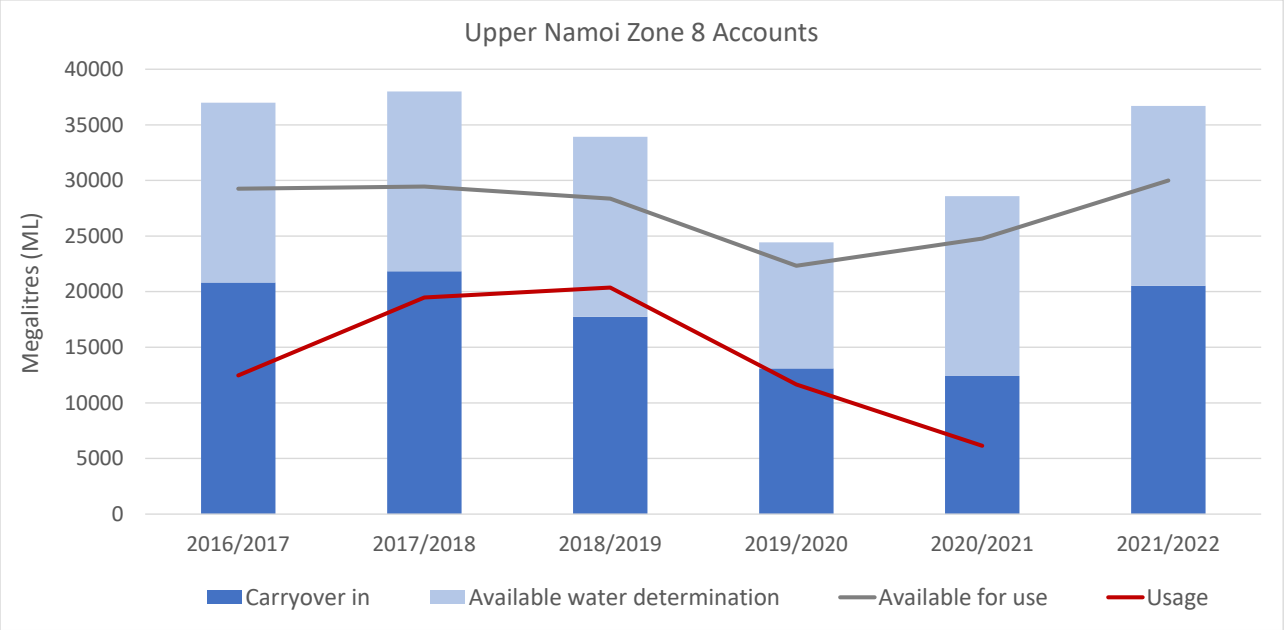


Figure 14 Upper Namoi Zone 8 Groundwater Source account and usage data 2016/17 to 2021/20

4.2.2 Hydrograph review

The long term seasonally recovered water levels have been declining since the 1980/90's across much of Upper Namoi Zone 8.

To evaluate the impact of long-term pumping in Zone 8, the Upper Namoi numerical model was used to compare the water level trends simulated under the historical pumping from 1996 to 2020 to what the model predicts would occur during the same period if there was no groundwater pumping.

These scenarios were compared to actual water level data from the government monitoring bores, the locations shown in **Figure 15**. The monitoring bores reviewed include GW030008 (**Figure 16**), GW030013 (**Figure 17**), GW030080 (**Figure 18**), GW030083 (**Figure 19**) and GW030063 (**Figure 20)** the locations highlighted are **Figure 15**.

The monitoring bore hydrographs (actual data and model simulated) for these sites are also shown with the measured water level data showing the baseline total available drawdown trigger for that site and a projection of the potential water level trend 10 years into the future.

4.2.3 Upper Namoi Zone 8 summary

The analysis highlighted the following:

- There is limited temporary trading (71T Dealings) occurring in the area.
- Extraction fluctuates depending on climate with average extraction overall less than the extraction limit. The water level continues to decline even during low usage years.
- Modelling scenario comparing no groundwater extraction with the calibration period indicates the declining trend is mainly driven by groundwater extraction as the water levels remain relatively stable over time without extraction.
- The projection of the seasonally recovered water level trend 10 years into the future shows that the water level could continue to decline to 40% of the baseline total available drawdown in the area east of Caroona.

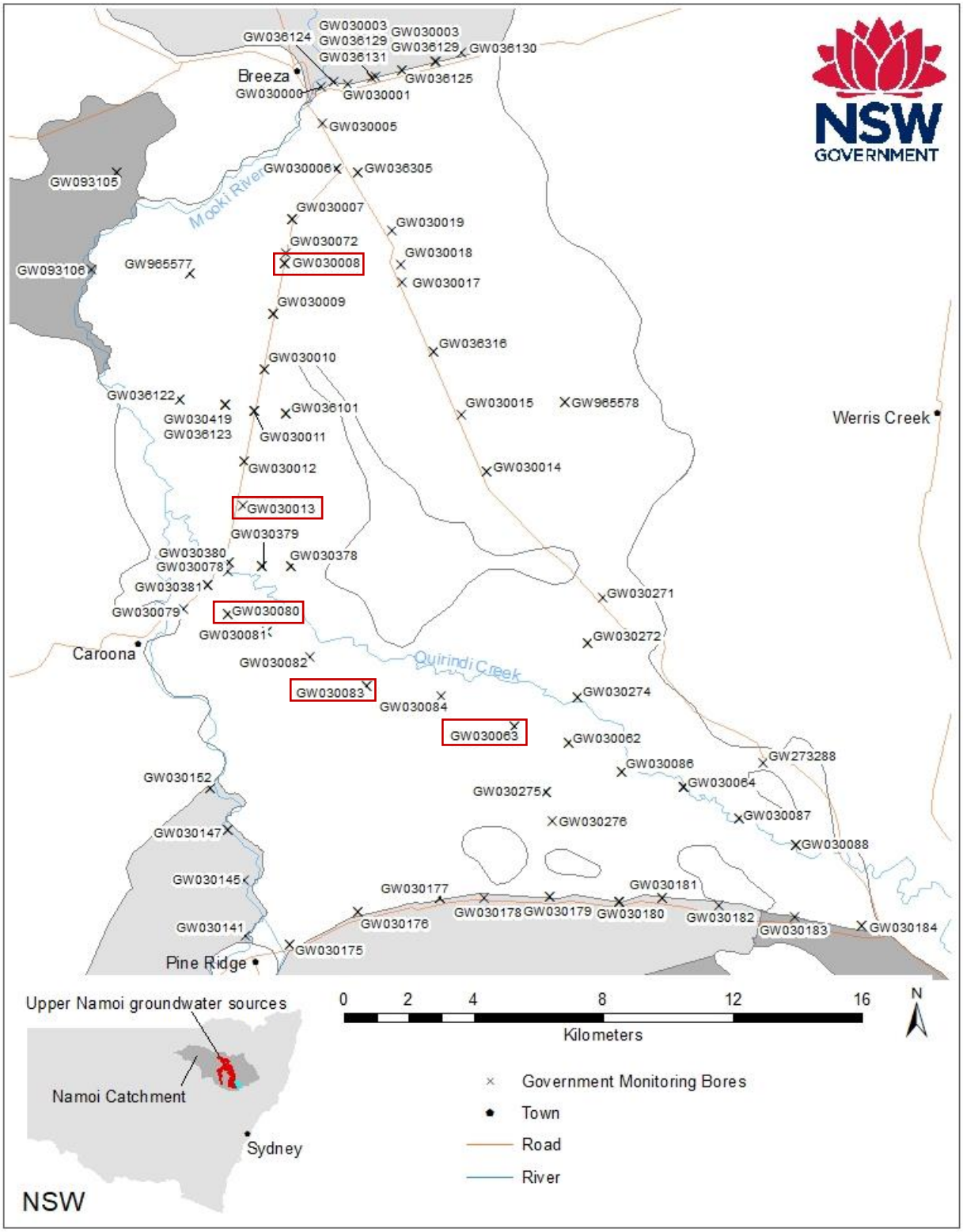


Figure 15 Upper Namoi Zone 8 location of reviewed monitoring bores

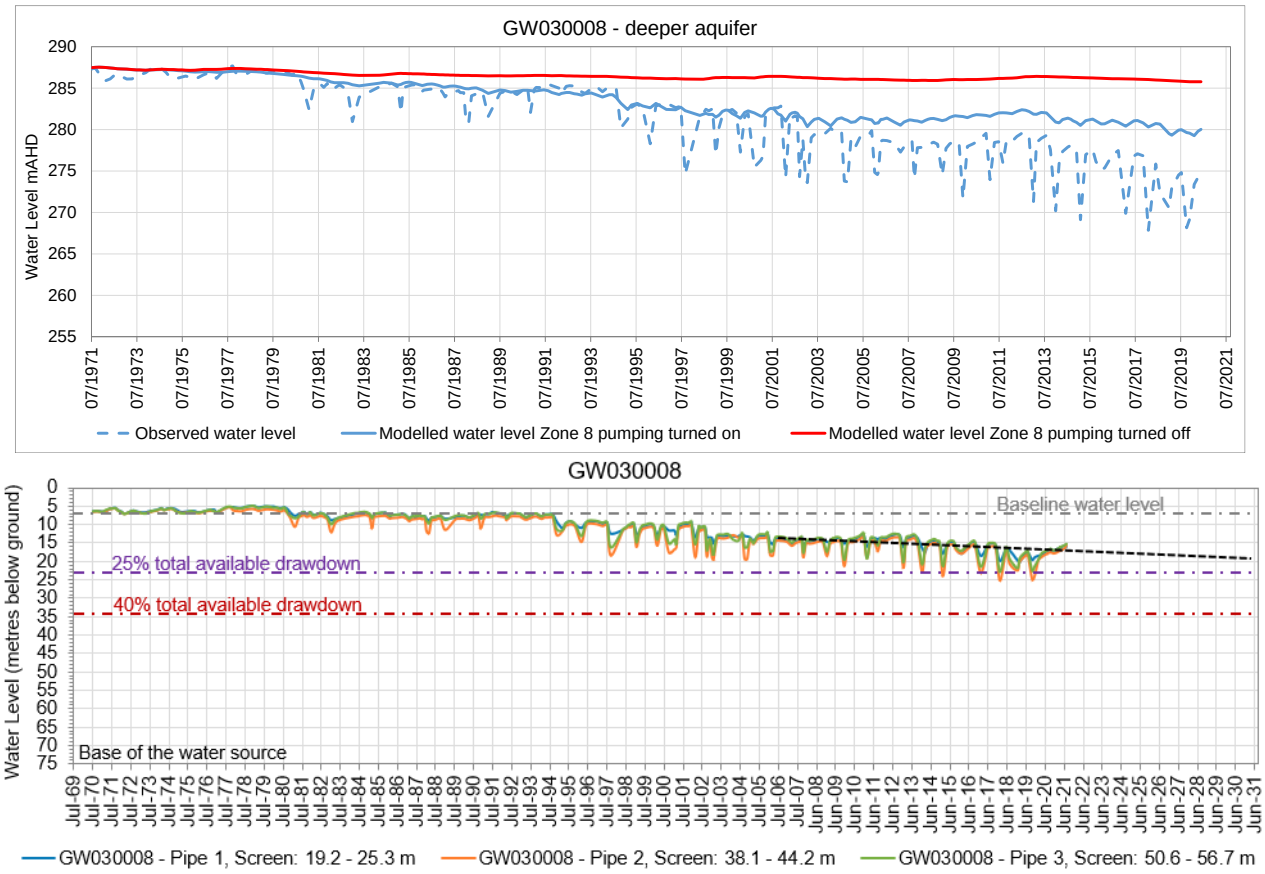


Figure 16 Monitoring bore GW030008: Top – modelled and observed water levels. Bottom: Observed water levels with trend projected ten year into the future.

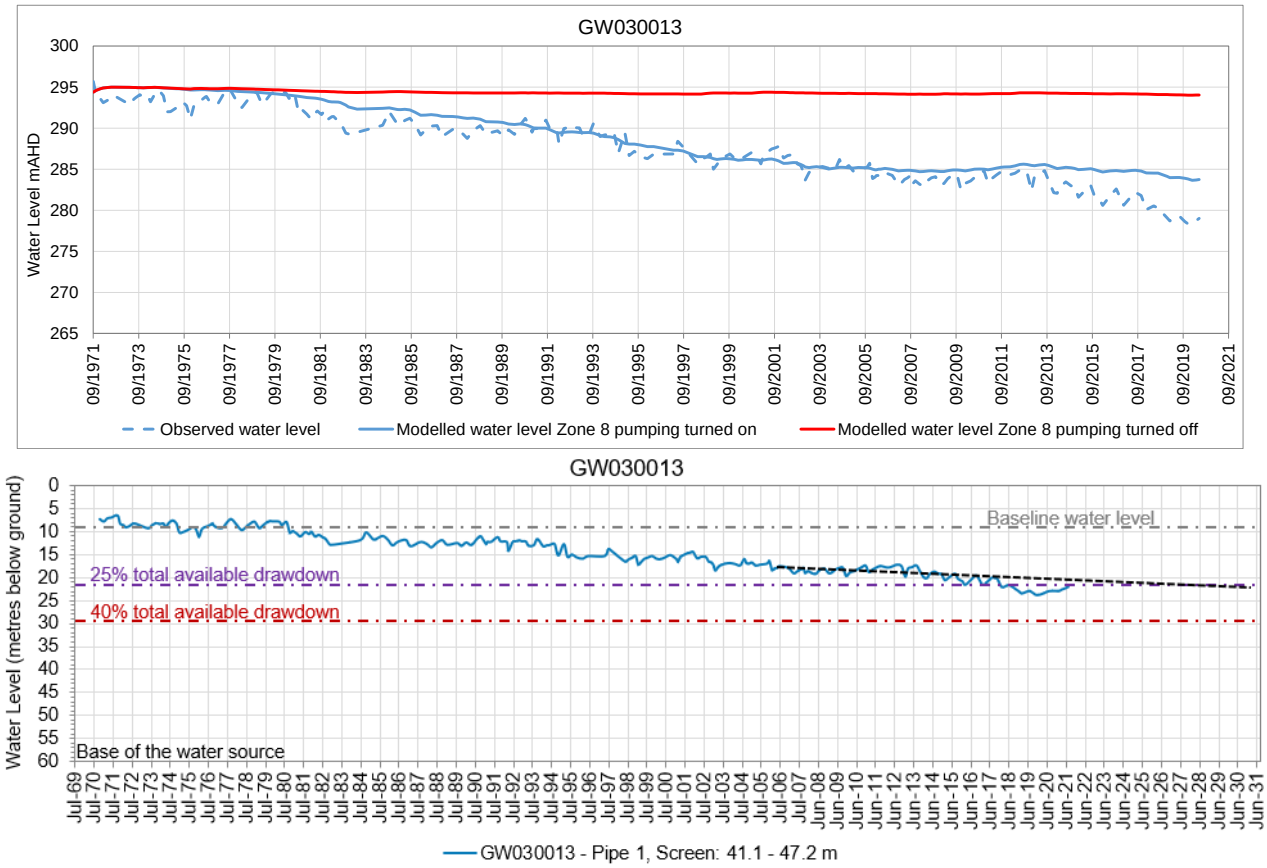


Figure 17 Monitoring bore GW030013 observed and simulated water levels

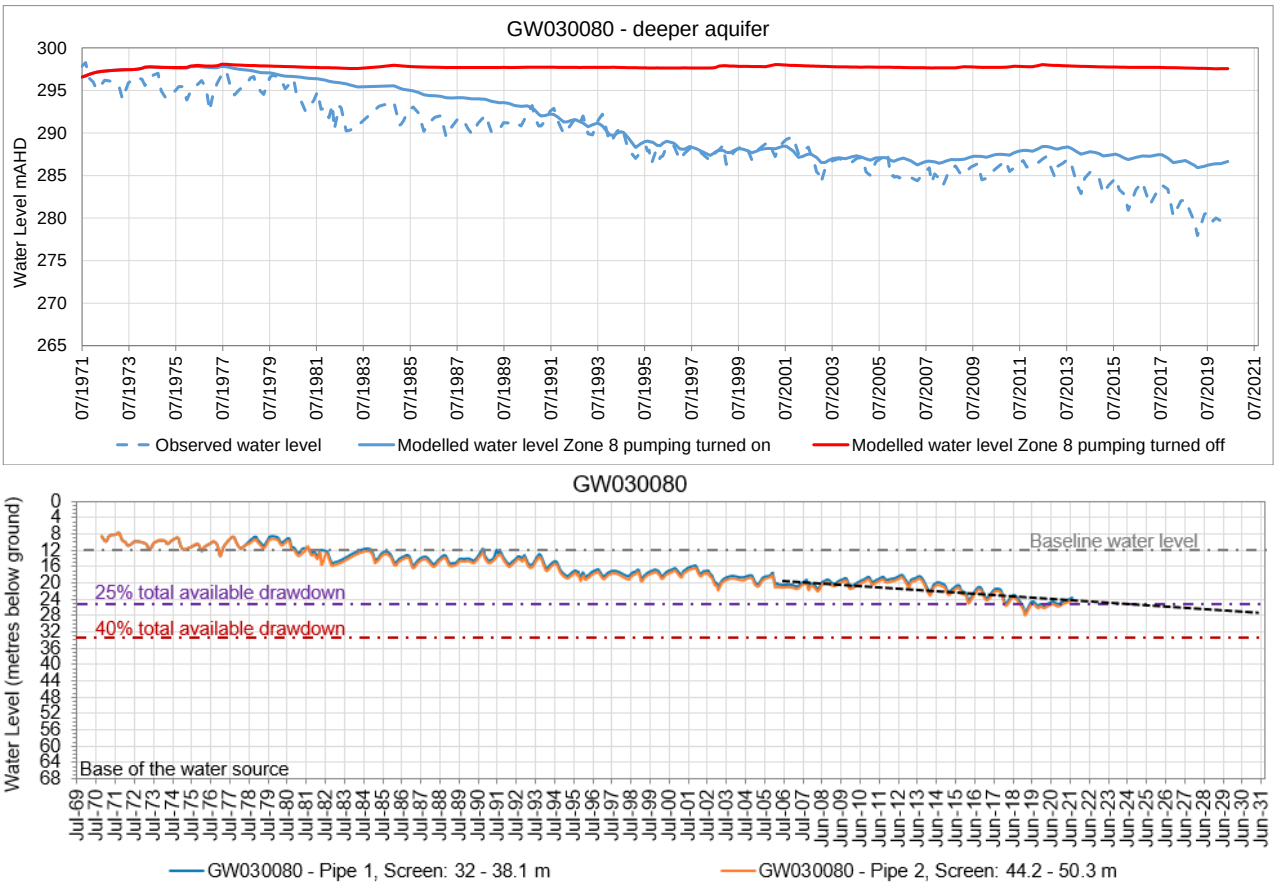


Figure 18 Monitoring bore GW030080 observed and simulated water levels

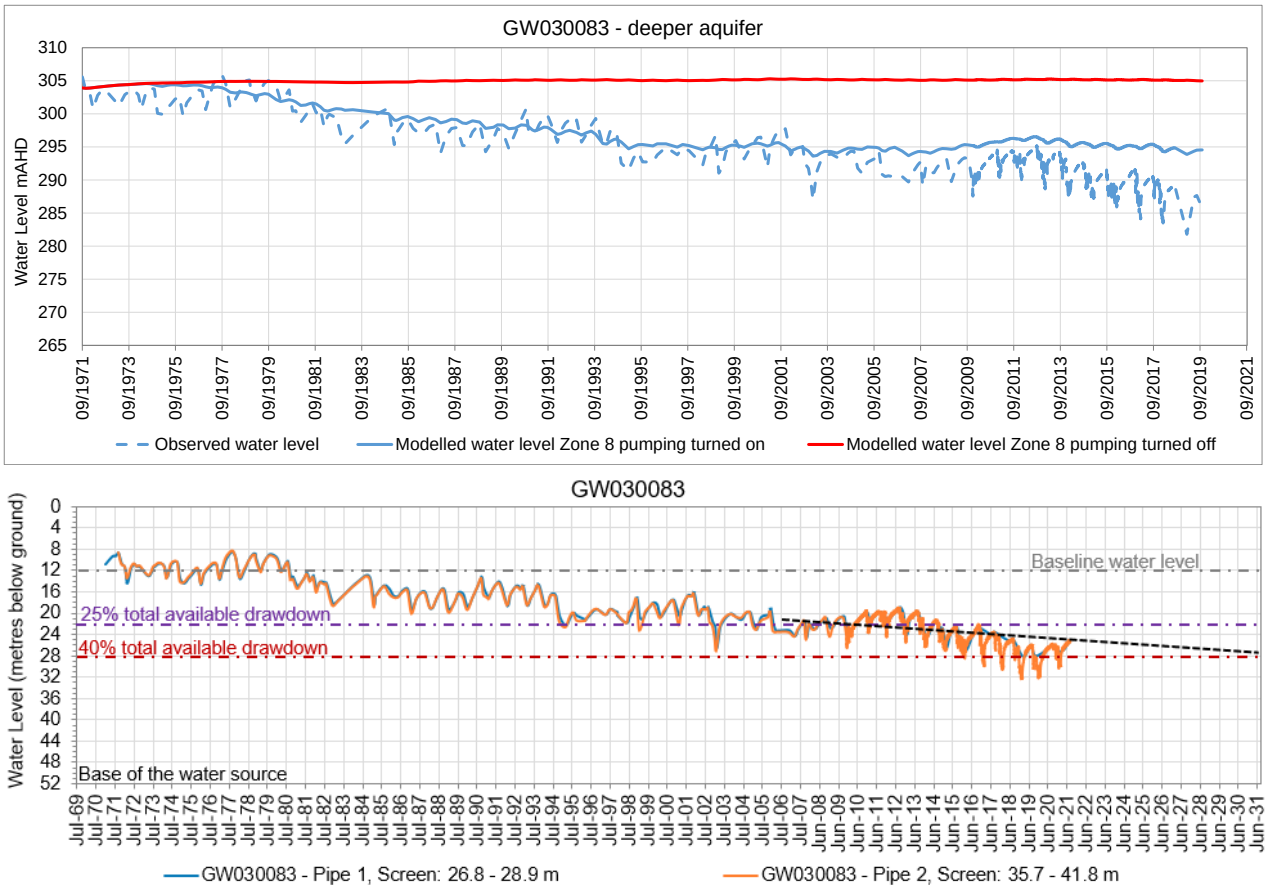
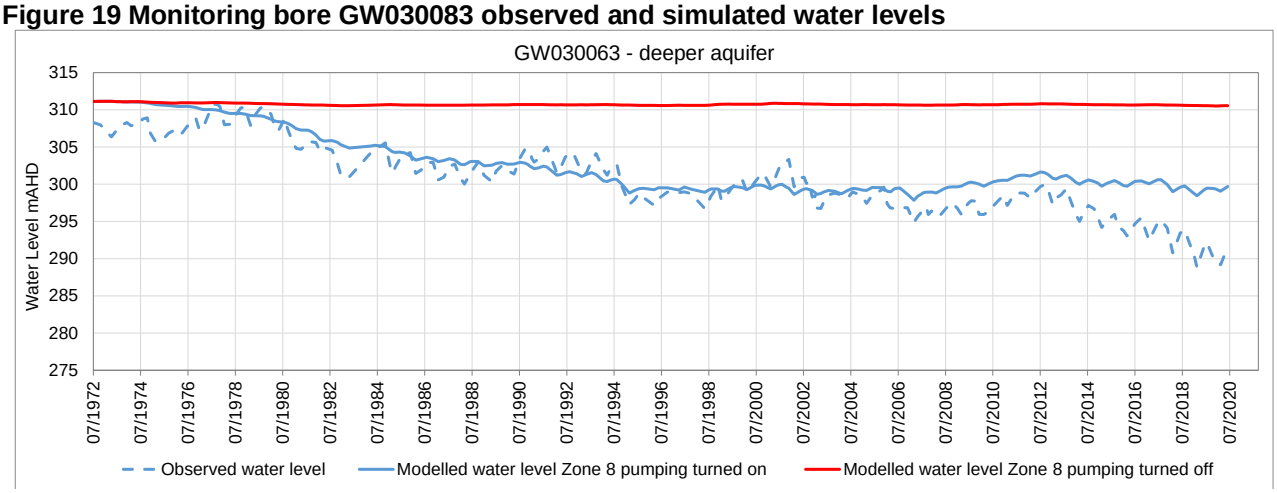


Figure 19 Monitoring bore GW030083 observed and simulated water levels



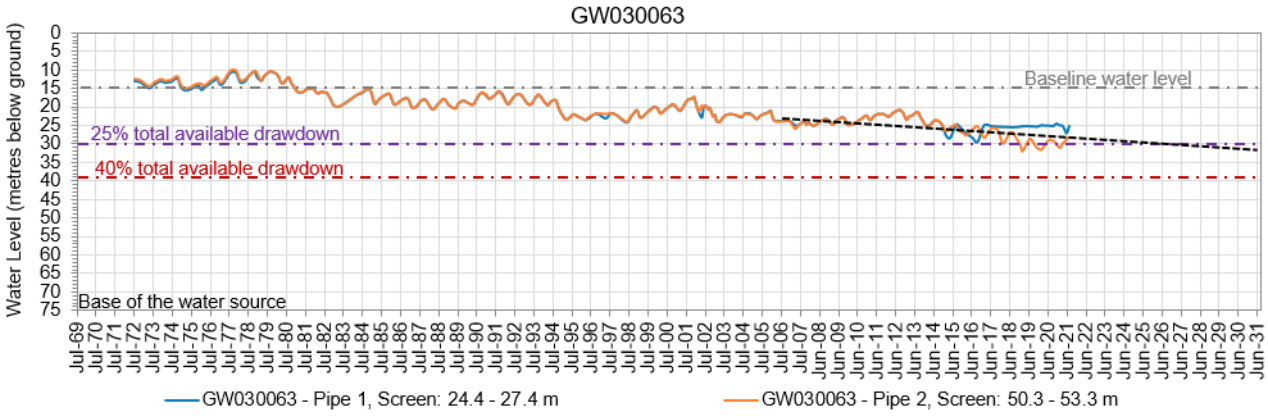


Figure 20 Monitoring bore GW030063 observed and simulated water levels

4.3 Upper Namoi Zone 12 Groundwater Source

4.3.1 Accounts and extraction

There are 20 production bores in Upper Namoi Zone 12, 9 of which are consistently pumped. The average extraction (last 5 years) is approximately 900 ML/year compared to the extraction limit of 2042 ML/year, that is, total extraction is less than have the extraction limit.

The account water compared to extraction over the last 5 years is shown in **Figure 21**.

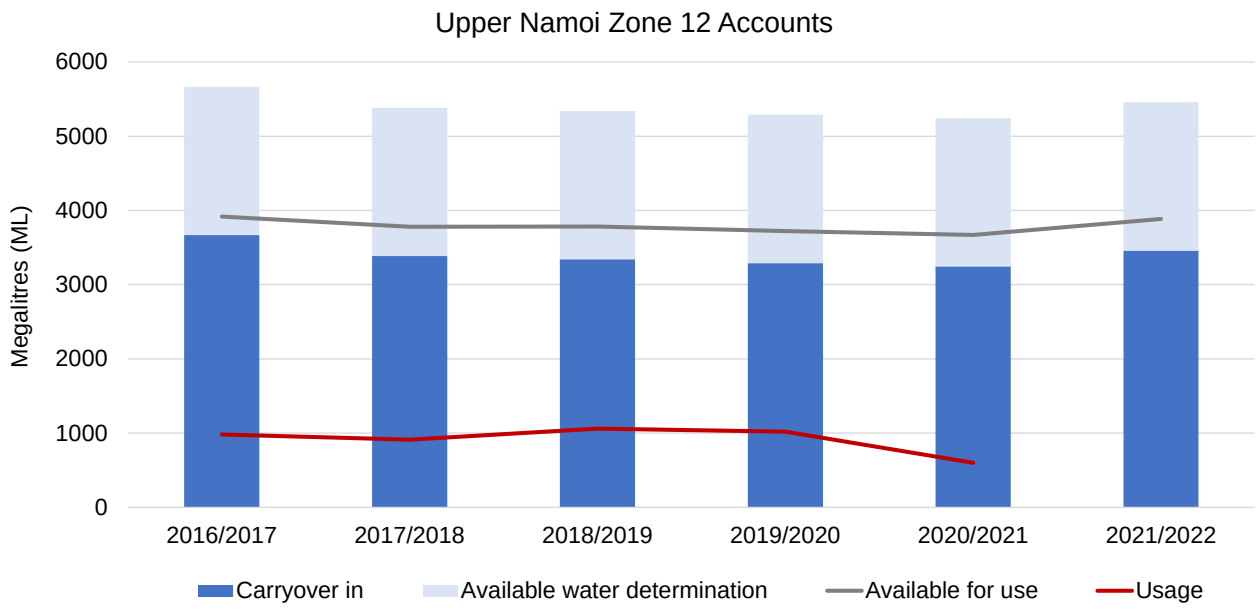


Figure 21 Upper Namoi Zone 12 Groundwater Source account and usage data 2016/17 to 2021/20

There is limited temporary trade (71T Dealings – assignment of allocation) within Zone 12, with one small trade occurring in the 2019/2020.

4.3.1 Hydrograph review

Users in Upper Namoi Zone 12 have raised concerns over the long-term declining water level trends in the areas since around 2019. NSW Department of Planning, Industry and Investment – Water have been investigating the water level trends over time and have recently used the numeric model to investigate the potential cause of the decline.

Three model scenarios were looked at:

- The calibrated water levels (all historic pumping turned on)
- The water levels with the groundwater pumping in the adjacent Upper Namoi Zone 4 turned off from 1996 to 2020
- The water levels with the groundwater pumping in Upper Namoi Zone 12 turned off from 1996 to 2020

These scenarios were compared to actual water level data from the government monitoring bores, the Location shown in **Figure 22**. The monitoring bores reviewed include GW036300 (**Figure 23**), GW036418 (**Figure 24**) and GW036383 (**Figure 25**), the locations highlighted are **Figure 22**.

The monitoring bore hydrographs (actual data and model simulated) for these sites are also shown with the measured water level data showing the baseline total available drawdown trigger for that site and a projection of the potential water level trend 10 years into the future.

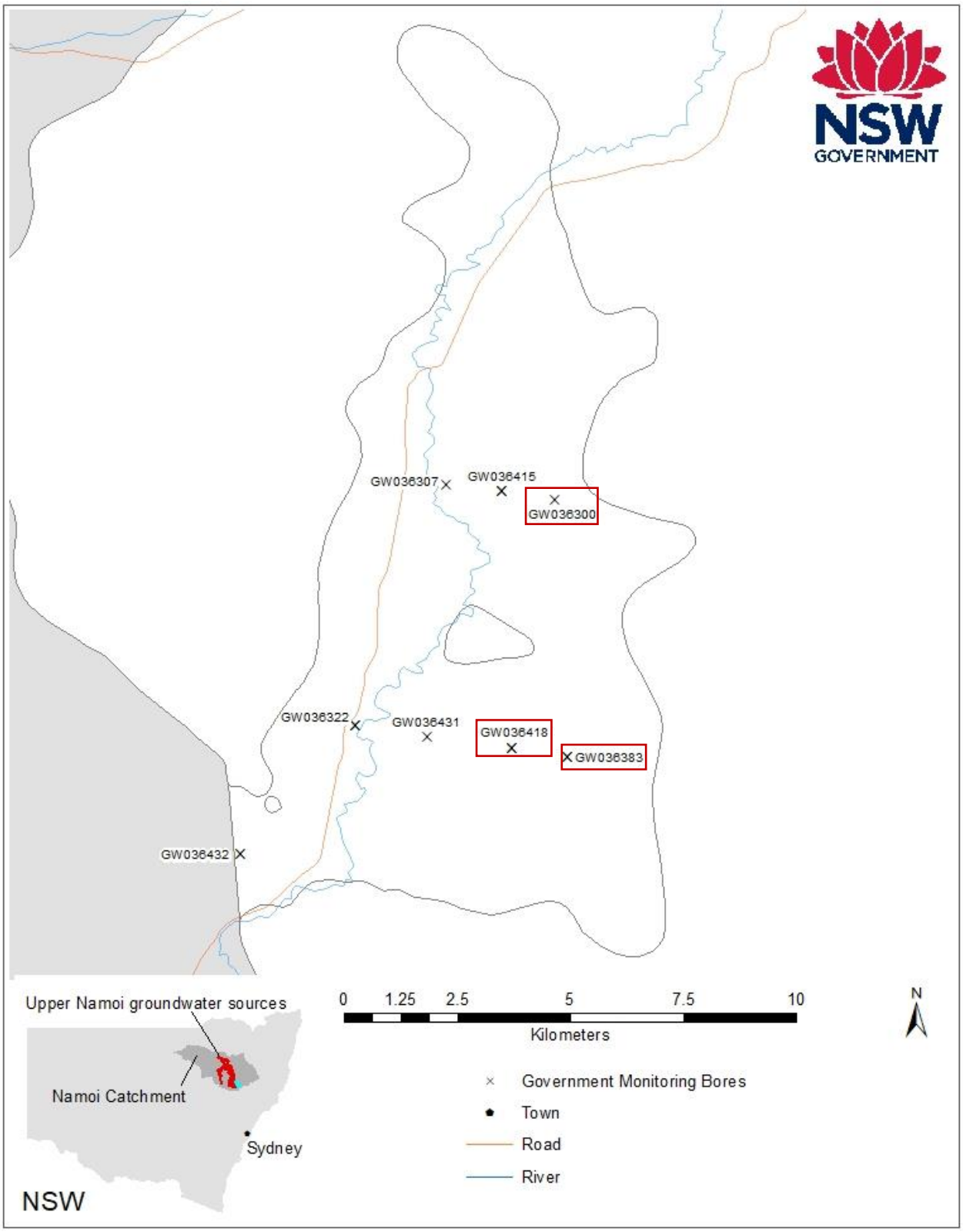


Figure 22 Upper Namoi Zone 12 location of reviewed monitoring bores

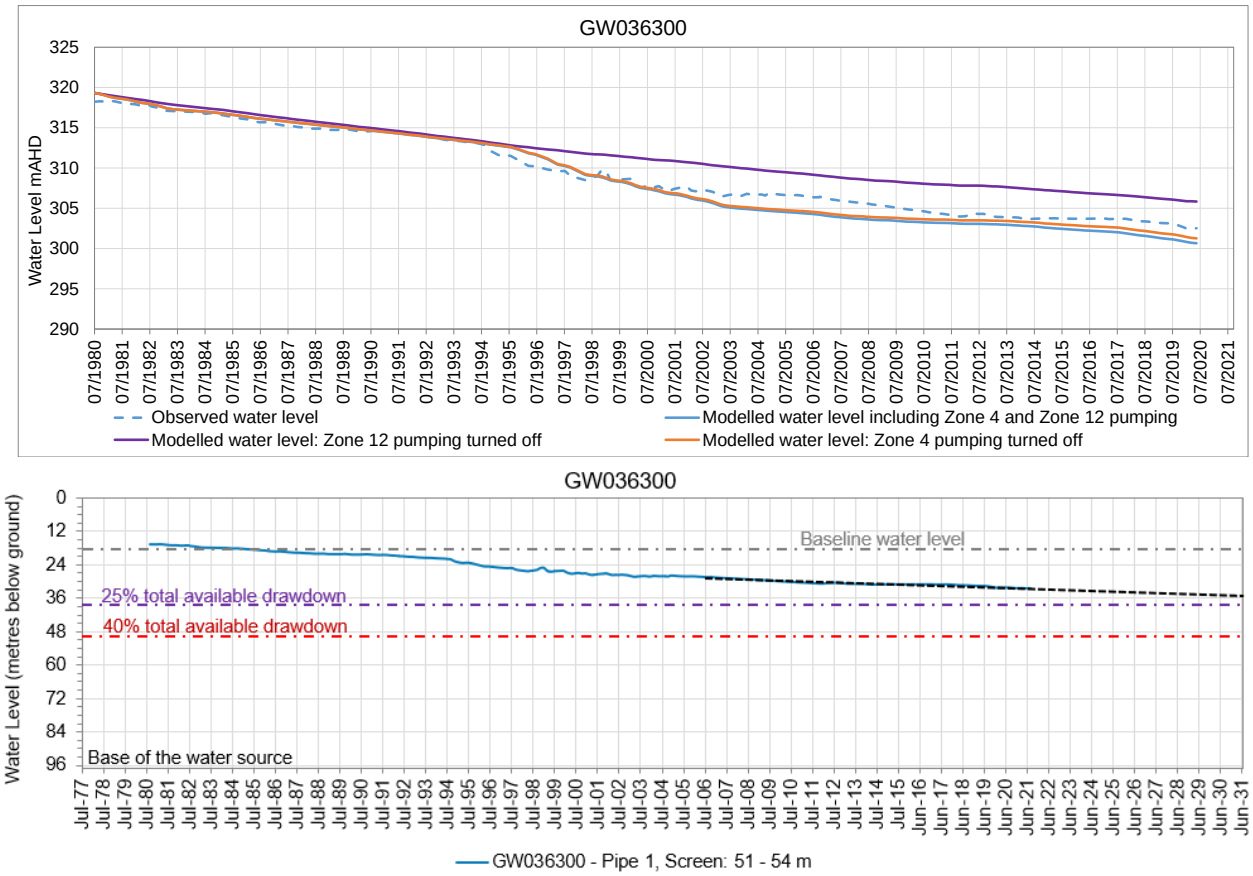


Figure 23 Monitoring bore site GW036300:Top – modelled and observed water levels. Bottom: Observed water levels with trend projected ten year into the future.

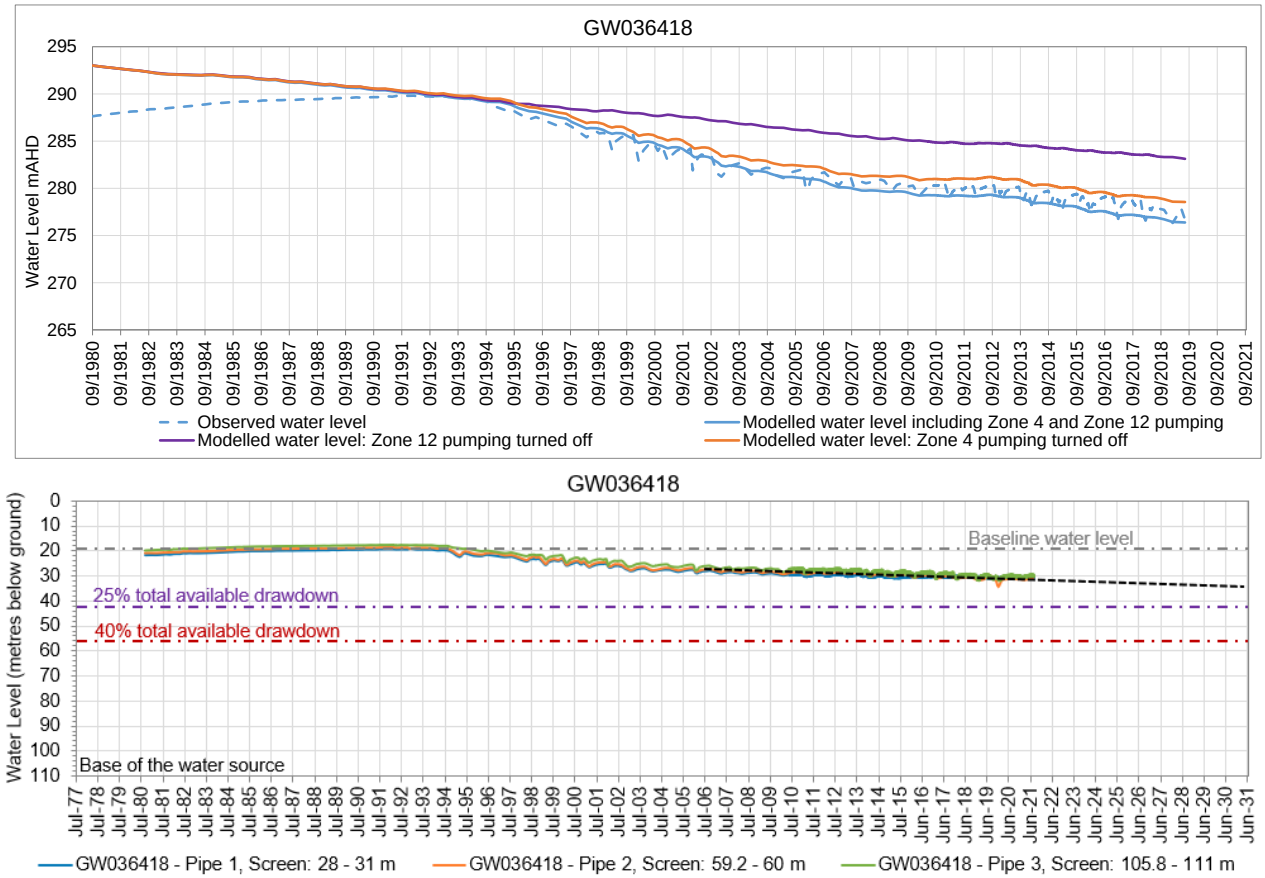
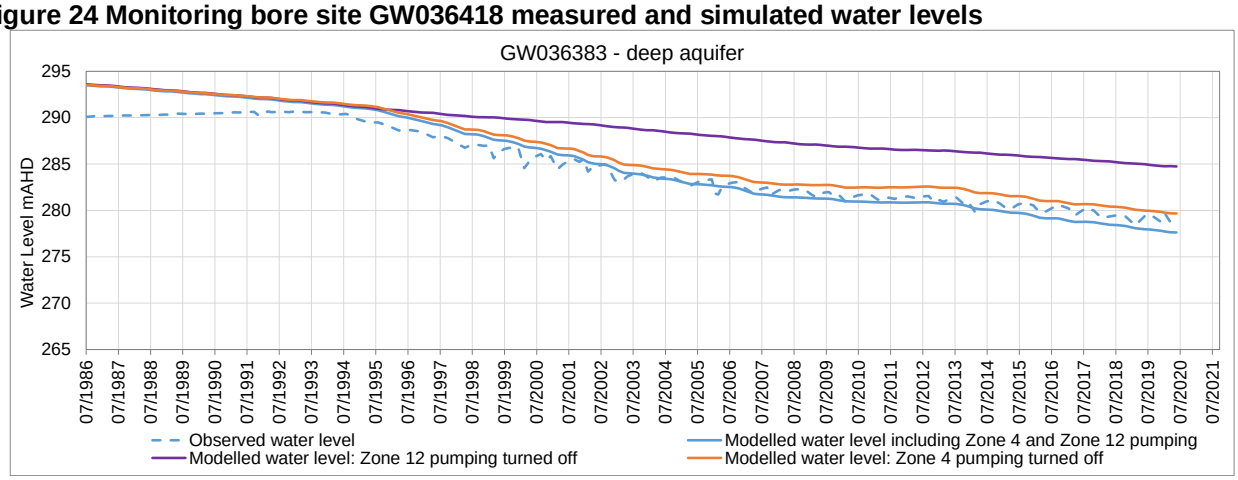


Figure 24 Monitoring bore site GW036418 measured and simulated water levels



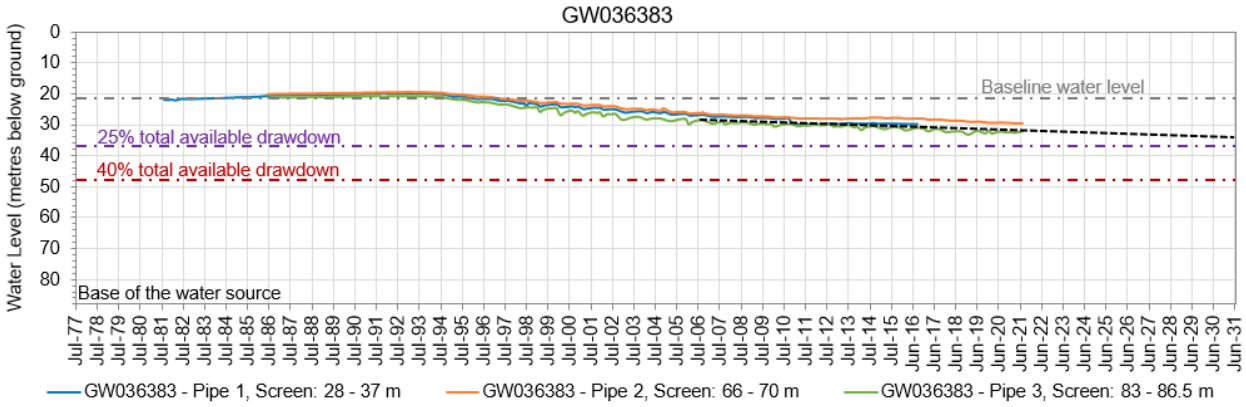


Figure 25 Monitoring bore site GW036383 measured and simulated water levels

3.3.3 Upper Namoi Zone 12 summary

The analysis highlighted the following:

- Extraction is well below the long-term average annual extraction limit.
- Modelling scenario comparing no groundwater extraction within the calibration period and with Zone 12 and Zone 4 pumping alternately turned off indicates the declining trend is mainly driven by groundwater extraction in Zone 12 in conjunction with climate.
- The projection of the seasonally recovered water level trend 10 years into the future shows that the water level may continue to decline however may not exceed the 25% baseline total available drawdown within the next 10 years.

4.4 Lower Namoi Groundwater Source: Trade Areas 2 and 3

4.4.1 Local area restrictions

In 2008, an area north of the Kamilaroi highway between Narrabri and Burren Junction in the Lower Namoi Groundwater Source was identified as an area of concern due to cumulative impacts from groundwater extractions on the aquifer. The identification of this area of concern lead to three trade management areas being established to assist in the management of permanent and temporary groundwater trades (Dealings), the location of the Trade Areas are shown in **Figure 26**.

These Trade Areas restrict where groundwater can be traded to and from within the Lower Namoi Groundwater Source, trade is allowed:

- between properties within the same Trade Area
- from Trade Area 3 into Trade Areas 1 and 2
- from Trade Area 2 into Trade Area 1

There is also an allowance for trading between contiguous properties run as a single farming unit.

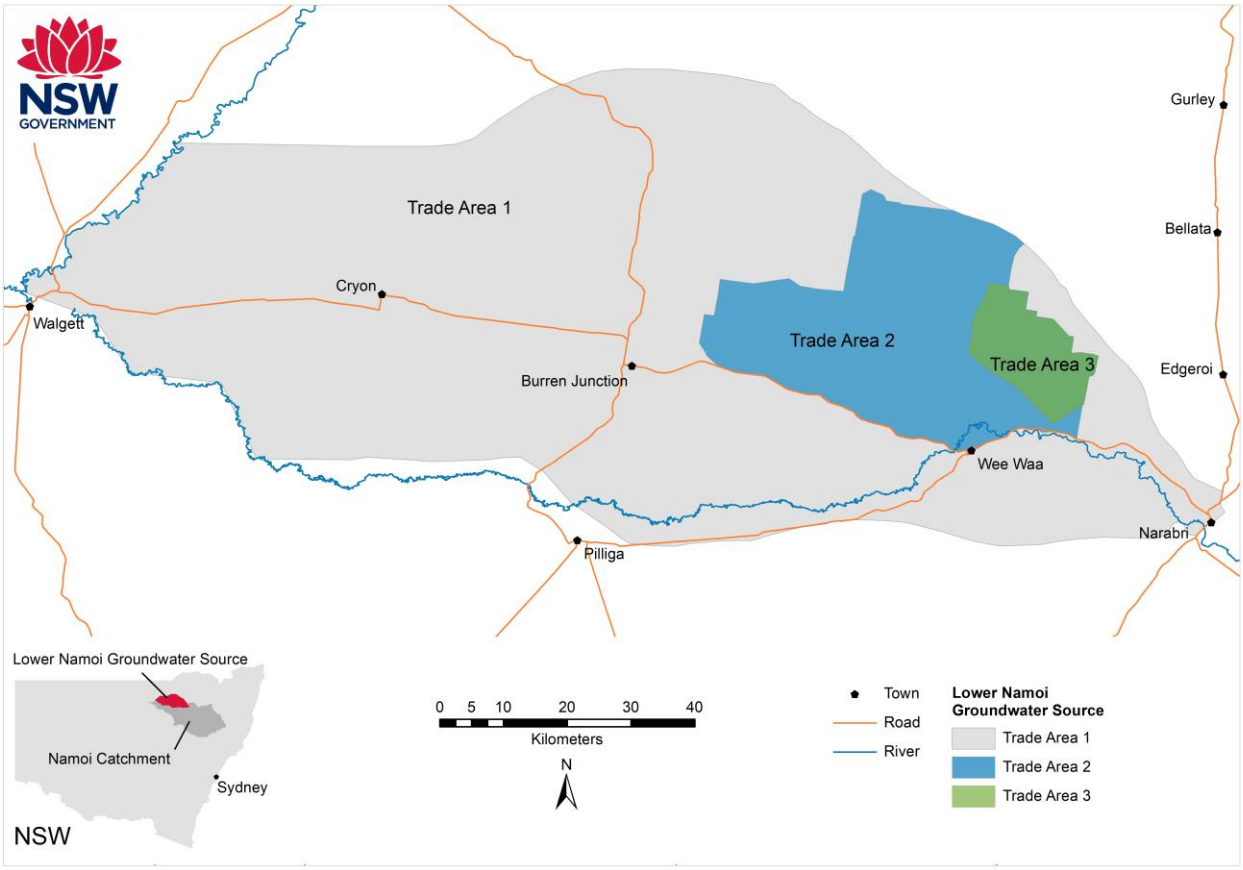


Figure 26 Trade management areas Lower Namoi Groundwater Source

4.4.2 Accounts and extraction

The account, trade and usage statistics are listed in Table 6 for the whole of the Lower Namoi Groundwater source as well as for Trade Area 2 and Trade Area 3 licences.

The account water compared to extraction over the last 5 years is graphed for the whole of the Lower Namoi (**Figure 27**), Trade Area 2 (**Figure 28**) and Trade Area 3 (**Figure 21)**.

Table 6 Account, trade and usage statistics (from 2015-16 to 2020-21)

	All Lower Namoi	Trade Area 2	Trade Area 3
Total Licences	230	65	15
Total shares	85,993	33,686	12,141
Volume in account 2020/2021	163,159	60,403	22,416
Volume available for extraction 2020/2021	143,103	56,365	20,569
Average Extraction (ML/year)	80,624	34,422	10,569
No. licences that use >100% of their share volume on average	96	54	3
No. licences who temporary trade IN	56	27	2
No. licences who temporary trade OUT	74	31	8
Average Volume traded (71T) ML	16,470	8,350	200
Average volume pumped from accounts that traded in (ML)	16,637	23,634	813

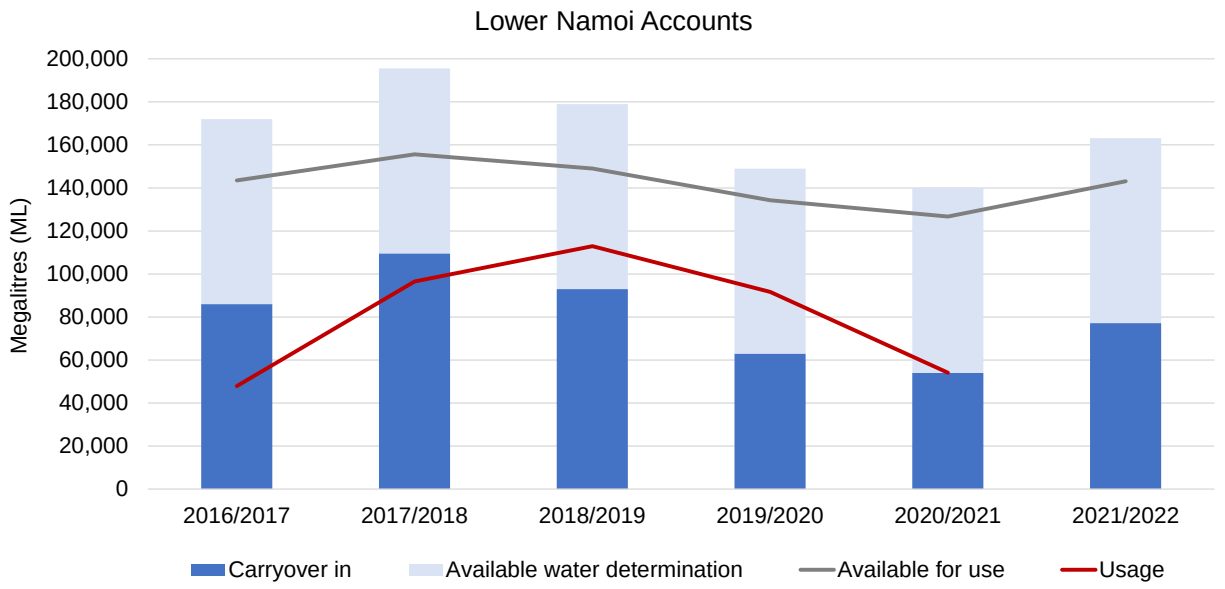


Figure 27 Whole of Lower Namoi Groundwater Source account and usage data 2016/17 to 2021/20

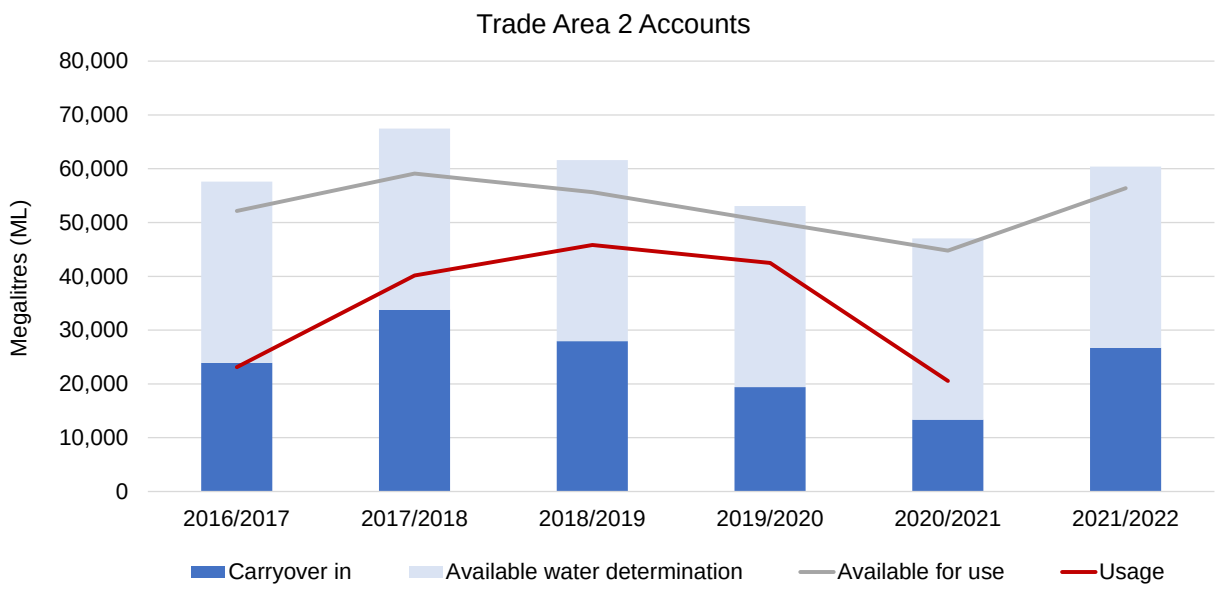


Figure 28 Lower Namoi Groundwater Source – Trade Area 2 account and usage data 2016/17 to 2021/20

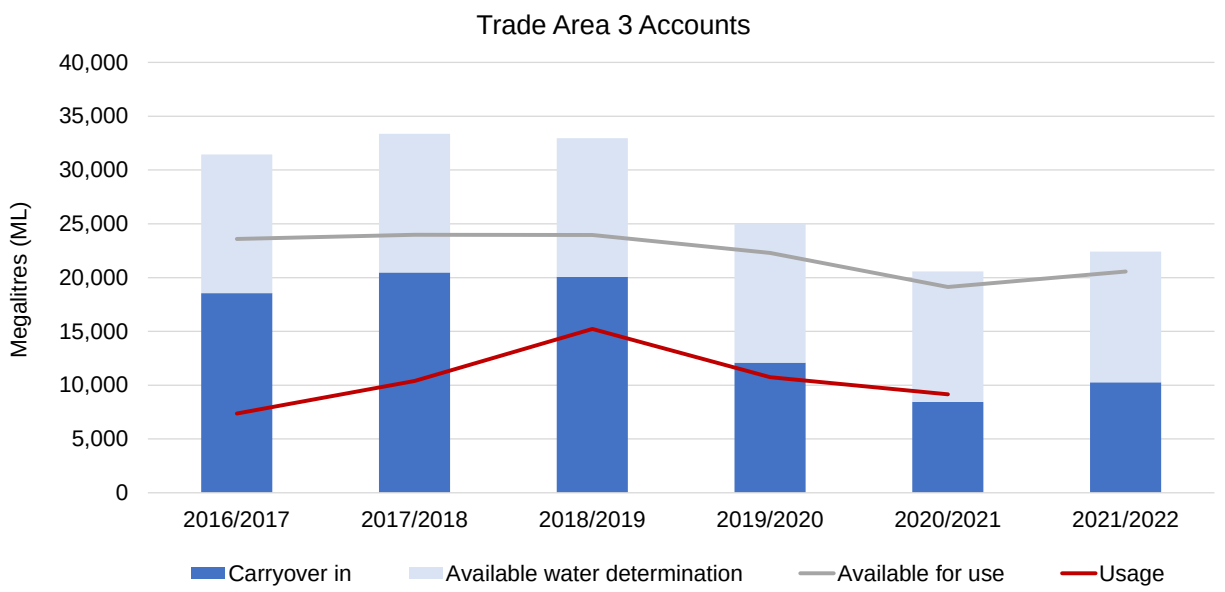


Figure 29 Lower Namoi Groundwater Source – Trade Area 3 account and usage data 2016/17 to 2021/20

4.4.3 Hydrograph review

The long term seasonally recovered water levels have been declining since the 1980/90's across much of the Lower Namoi Groundwater Source with the most significant decline around Trade Area 2. The seasonal drawdown in response to pumping has exceeded the impact threshold of 40% of the baseline total available drawdown in parts of Trade Area 2 and Trade Area 3

Hydrographs from six government monitoring bores (locations shown in **Figure 30)** across Trade Area 2 and Trade Area 3 have been reviewed he including sites: GW025326 (**Figure 31**), GW025049 (**Figure 32**), GW025055 (**Figure 33**), GW025144 (**Figure 34**), GW025148 (**Figure 36)** and GW025246 (Figure 37) the locations highlighted are **Figure 30**.

The monitoring bore hydrographs are shown with measured water level data showing the baseline total available drawdown trigger for that site and a projection of the potential water level trend 10 years into the future.

The monitoring bore hydrographs are shown with the baseline total available drawdown trigger for that site and a projection of the potential water level trend 10 years into the future.

4.2.3 Lower Namoi summary

The analysis highlighted the following:

- Average extraction exceeds the total allocated shares in Trade Area 2, this is compared to the Lower Namoi as a whole where average extraction over the last 5 years is less than the total shares allocated.
- Approximately 48% of the total number of trades (71T Dealings) that occur in the Lower Namoi are to licences in Trade Area 2.
- Approximately 50% of the total volume traded (71T Dealings) within the Lower Namoi are from Trade Area 2.
- Approximately 42% of the total usage in the Lower Namoi is from Trade Area 2.
- The majority of trading within Trade Area 3 is to licences outside of that trade area.
- Extraction fluctuates depending on climate with average extraction overall less than the extraction limit however the water level continues to decline over time even including wetter low usage years.

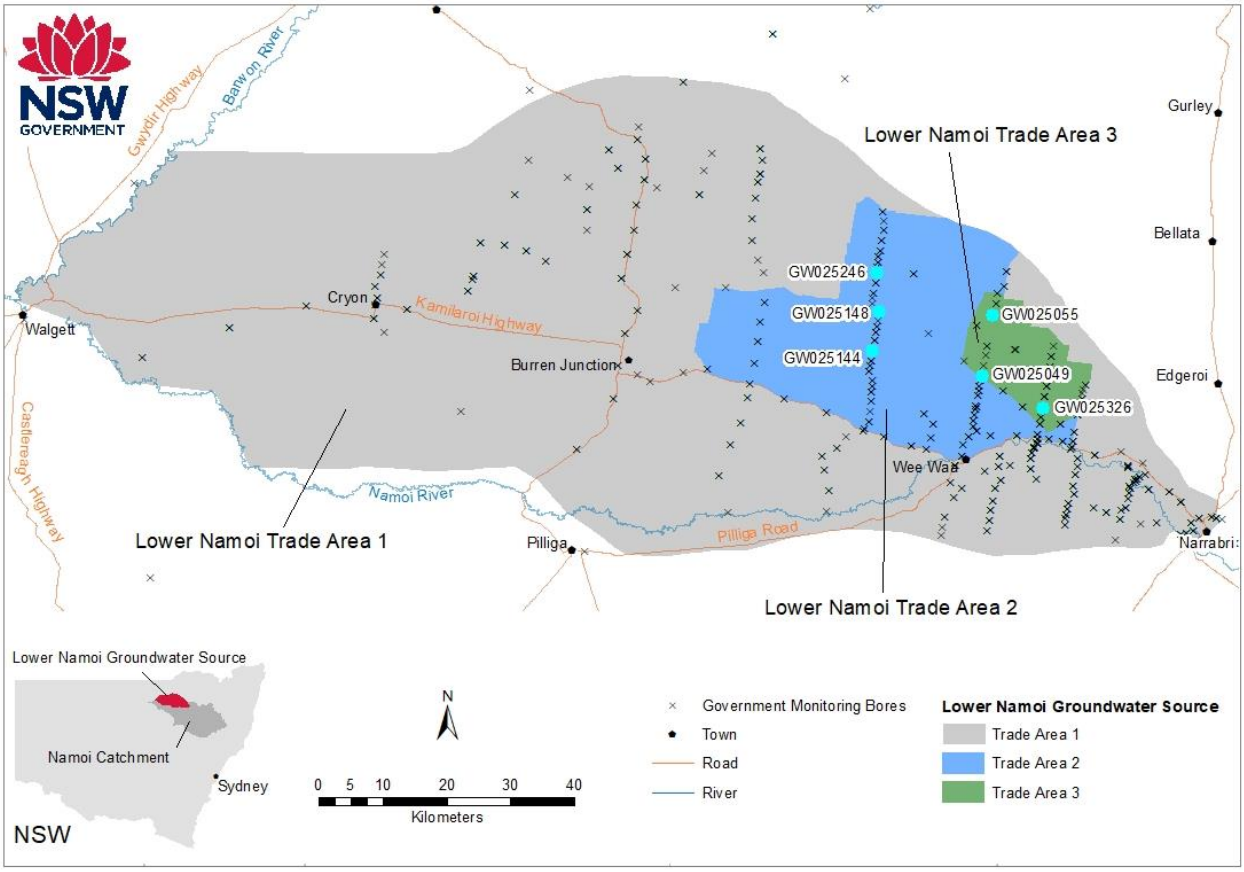


Figure 30 Lower Namoi Groundwater Source location map of reviewed monitoring bores

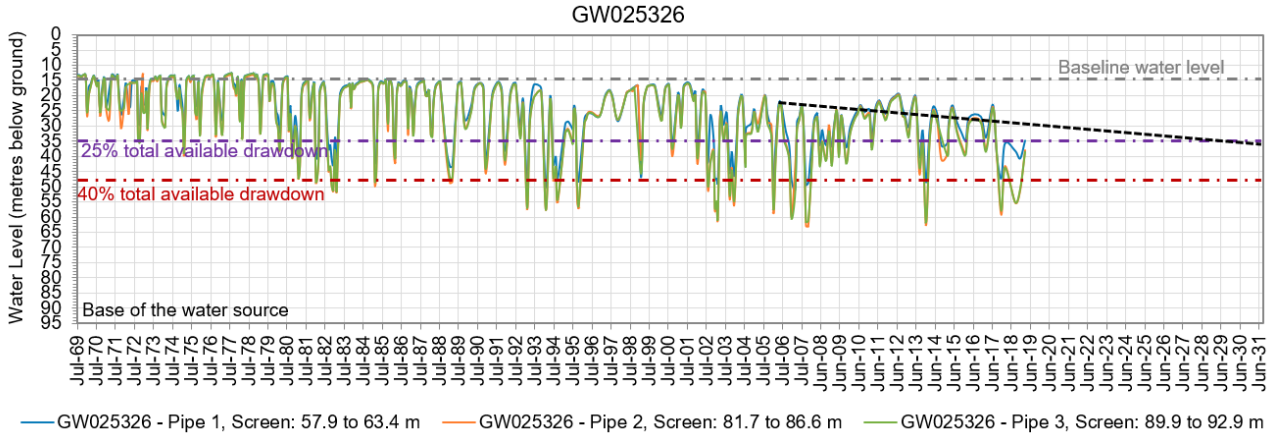


Figure 31 Hydrograph for monitoring bore site GW025326

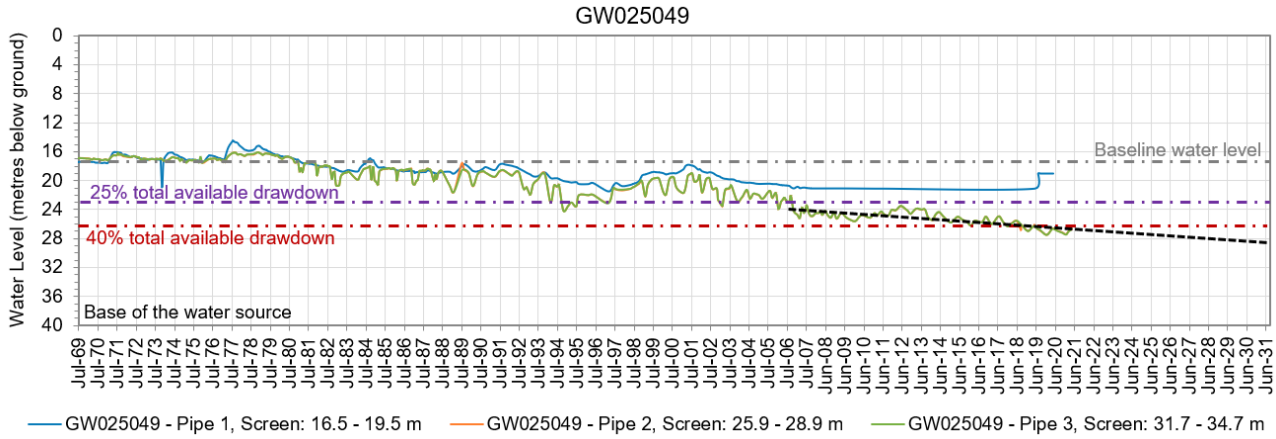


Figure 32 Hydrograph for monitoring bore site GW025049

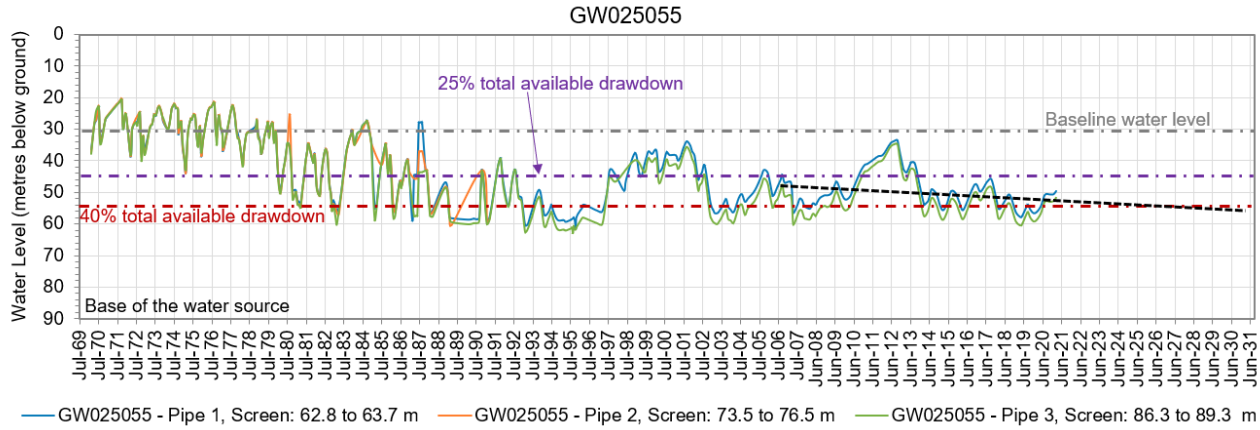


Figure 33 Hydrograph for monitoring bore site GW025055

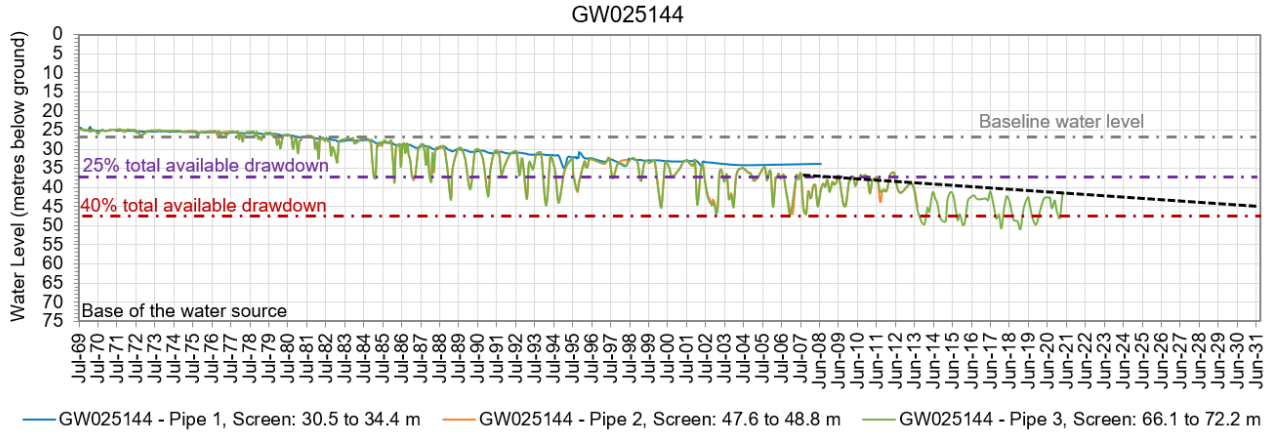


Figure 34 Hydrograph for monitoring bore site GW025144

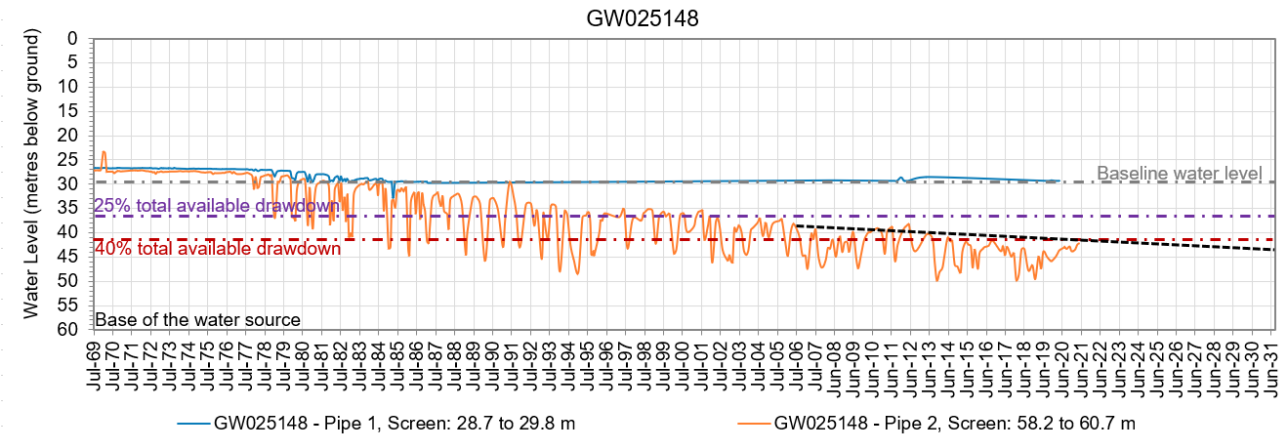


Figure 35 Hydrograph for monitoring bore site GW025148

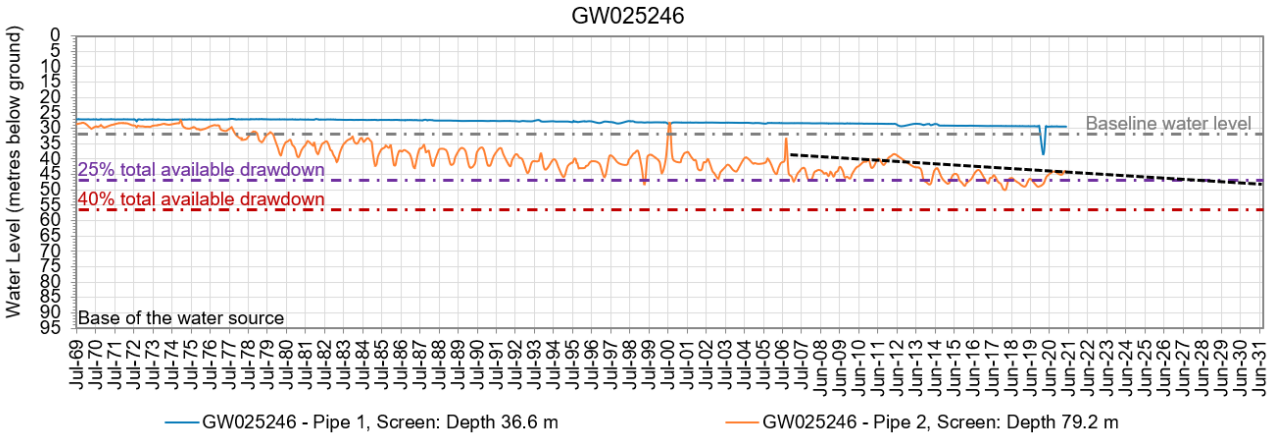


Figure 36 Hydrograph for monitoring bore site GW025246