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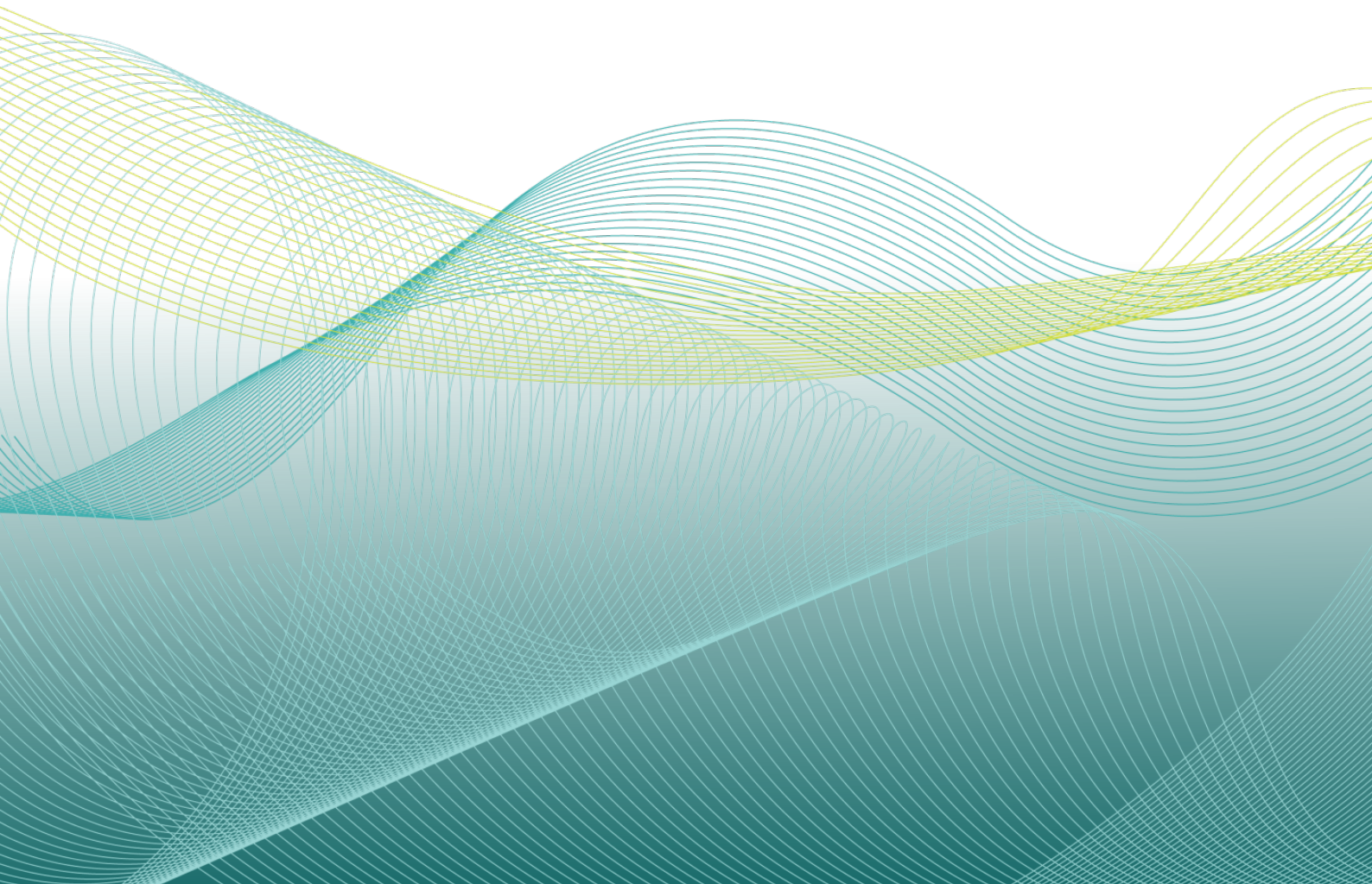
Gunnedah Shire Council Drought Management Plan

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Presented by Hunter H₂O

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Overview & Purpose

This 2017 revision of the Drought Management Plan has been prepared as a major update to the previous Plan, which was originally prepared in 2006. The Plan has been prepared based on a template that was prepared for the Namoi Water Alliance by Hunter H2O for the purpose of providing a consistent approach to drought management across the Namoi Region (Hunter H2O, 2015). The template was prepared following the adoption of a regional water restrictions policy (HWA, 2014) by Namoi Water Alliance member councils in late 2014.

The Drought Management Plan has been prepared in accordance with NSW Department of Primary Industries – Water (DPI Water) requirements as documented in their Best Practice Management of Water Supply and Sewerage Guidelines (DWE, 2007). With recent changes to best practice requirements, Drought Management can now be considered within Council’s Strategic Business Plan (SBP). However, Council considers it more practical to have a standalone Drought Management Plan that can be reviewed and updated as required, as updates may not necessarily line up with updates to SBPs (now required every 8 years).

The Plan outlines the various demand and supply side drought response actions that should be employed at various stages during an extended drought period. The Plan also outlines Council’s water restrictions policy and documents various backup supply sources and emergency supply options. The fundamental objective of preparing and adopting a Drought Management Plan is to minimise the risk of the community running out of water and ensuring there is always sufficient water available to satisfy the basic needs of the community.

DROUGHT MANAGEMENT PLAN - DOCUMENT CONTROL TABLE

Revision	Revision Date <i>(from when Revision Applies)</i>	Resolved by Council <i>(date of Council Meeting)</i>
<i>Draft Report (for public exhibition)</i>		
<i>Final Report</i>		
<i>Revision 1</i>		

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1 Introduction

This Drought Management Plan has been prepared by Gunnedah Shire Council (GSC) to ensure that a structured and transparent approach is taken for the management of drought impacts on Council's town water supply systems. The Plan outlines the various demand and supply side drought response actions that should be employed at various stages during an extended drought period. The Plan also outlines Council's water restrictions policy and documents various backup supply sources and emergency supply options.

The fundamental objective of preparing and adopting a Drought Management Plan is to minimise the risk of the community running out of water and ensuring there is always sufficient water available to satisfy the basic needs of the community. The Plan is only applicable to customers connected to the reticulated water supply systems operated by Council, which includes systems operated in the following towns:

- Gunnedah
- Curlewis
- Mullaley
- Tambar Springs

Management of water supply in NSW is administered by the *Water Management Act 2000*, *Water Act 1912* and *Local Government Act 1993*. Drought management planning is an essential component of the NSW Government's *Best Practice Management of Water Supply and Sewerage Guidelines* (DWE, 2007) for local water utilities (LWUs). This Drought Management Plan has been prepared in accordance with these guidelines and the associated Drought Management Check List.

This Plan contains the following sections:

Section 2 contains a description of the water supply systems that are covered by the Plan, including a brief review of previous drought experience.

Section 3 contains an overview of the operating environment for the Plan, including consideration of climatic conditions, water resources and potential downstream impacts.

Section 4 contains a discussion on pre-drought planning measures, including consideration of demand management measures, system operating rules, data collection and long-term supply strategies.

Section 5 contains the Drought Management Action Plans, which set out the actions to be taken during each drought response level, including the application of water restrictions.

Section 6 outlines the post-drought actions that should be undertaken, including regular review and updating of the Plan.

Section 7 contains the references to this report.

2 Water Supply Systems

This Drought Management Plan is applicable to the reticulated water supply systems that are owned and operated by Council, as listed in Table 2.1 below and shown in Figure 2.1.

Table 2.1 Summary of GSC Water Supply Systems

Water Supply System	Population Served *	Number of Connections **	Average Daily Consumption (ML/d) ***	Average Annual Consumption (ML/a) ***	Groundwater Allocation (ML/a)
Gunnedah	8,730	3,841	7.0	2,550	3,900
Curlewis	590	241	0.3	105	198
Mullaley	~75	29	0.05	19	59
Tambar Springs	~100	47	0.05	18	42

Notes: Data references - * Census Data (2011), ** Council connection data (2016), *** 3 Year Average (2013/14 – 2015/16)

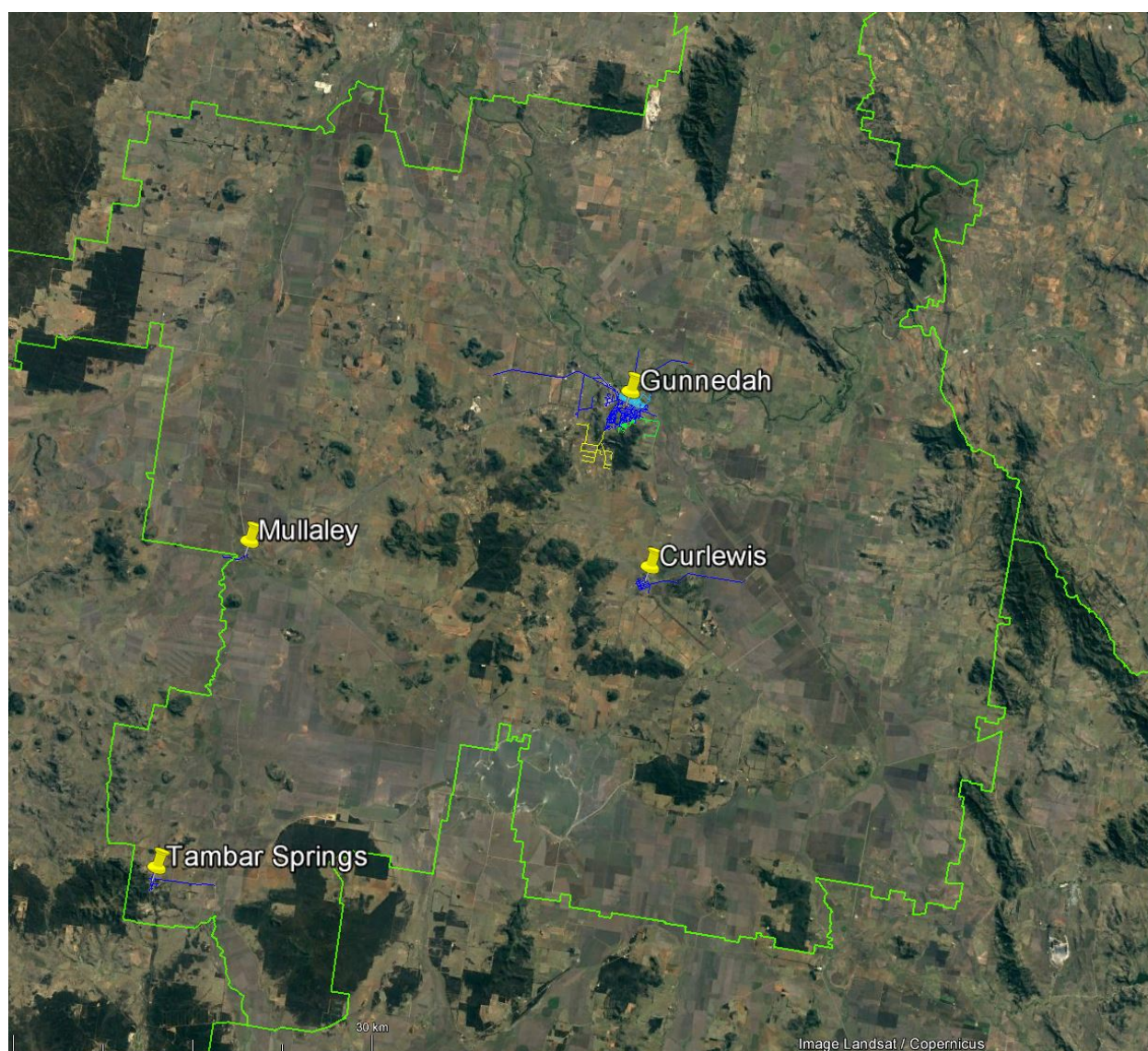


Figure 2.1 Locality Plan – GSC Water Supply Systems

2.1 System Overview

An overview of each water supply system is included on Table 2.2 below, including brief details on groundwater sources and bores. All systems source raw water from groundwater bores that are located within the Upper Namoi Groundwater Source (DIPNR, 2003) and raw water is subject to disinfection (chlorination) only, before transfer to reticulation reservoirs or directly into the water supply system.

Table 2.2 Overview of GSC Water Supply System Sources

Groundwater Source	No. of Bores	Details
GUNNEDAH WATER SUPPLY SYSTEM		
Upper Zone 4, Namoi Valley (Keepit Dam to Gin's Leap)	11	<ul style="list-style-type: none"> - 3 bores located off Old Tamworth Rd, south of Namoi River (bores 1 & 2 are still active & bore 10 has been decommissioned) - 4 bores located off Campbell Rd, north of Namoi River (3, 4, 5 & 6) - 3 bores located off Orange Grove Rd, north of Namoi River (7, 8 & 9) - 1 bore located off Wean Rd, north of Namoi River (11) - Bore pumping capacity ranges from 10 to 140 L/s - 5 storage reservoirs (17.9 ML) - 3,900 ML/a entitlement (WAL12605)
CURLEWIS WATER SUPPLY SYSTEM		
Upper Zone 3, Mooki Valley (Breeza to Gunnedah)	2	<ul style="list-style-type: none"> - 2 bores located off Curlewis Common Rd, west of Mooki River - Bore pumping capacity is around 17 L/s - 3 storage reservoirs (1.7 ML) - 198 ML/a entitlement (WAL12543)
MULLALEY WATER SUPPLY SYSTEM		
Upper Zone 2, Cox's Creek (Mullaley to Boggabri)	2	<ul style="list-style-type: none"> - 2 bores located off Oxley Highway, west of Cox's Creek - Bore pumping capacity is around 3 L/s - 1 small storage reservoir (0.19 ML) - 59 ML/a entitlement (WAL12513)
TAMBAR SPRINGS WATER SUPPLY SYSTEM		
Upper Zone 9, Cox's Creek (Upstream of Mullaley)	2	<ul style="list-style-type: none"> - 2 bores located off Smith Rd, west of Cox's Creek - Bore pumping capacity is around 5 L/s - 4 small storage reservoirs (0.17 ML) - 42 ML/a entitlement (WAL12958)

Further details on the water supply systems are included in Appendix B, including a discussion on system performance during previous droughts and any supply related problems.

3 Operating Environment

Drought Management Plans need to be tailored to adequately consider the prevailing operating environment conditions that are relevant to each individual water supply system. While there is a need to have some level of uniformity across the region for some drought response actions (e.g. specific rules associated with water restrictions), there is also a need to have tailored drought management strategies that are specific to the individual water supply system and the surrounding environment that it operates within (e.g. triggers for activating water restrictions).

This section provides a brief summary of the various operating environment factors that need to be considered in both the preparation and operation of the Drought Management Plan, including:

- Location & Climate
- Water Resources
- Additional Demands During Drought Periods
- Potential Downstream / Environmental Impacts

3.1 Location & Climate

GSC serves a population of over 12,000 people, over an area of around 5,000 km² on the Liverpool Plains, within the Namoi River catchment. In addition to the towns and villages that have reticulated water supply systems (Gunnedah, Curlewis, Mullaley and Tambar Springs) there are several other villages located within the local government area that do not have formal water supply systems, including Carroll, Breeza and Kelvin. The nearest towns to Gunnedah that are outside of the GSC area are Tamworth (around 80 km east), Quirindi (around 60 km south-east) and Narrabri (around 100 km north-west).

The Gunnedah Region experiences a dry sub-humid climate. Temperatures are warm to hot in summer with relatively low humidity, mild in autumn and spring and cool to mild in winter. Rainfall is generally lower over the autumn and winter months and highest in summer months due to a predominance of summer storms.

Median rainfall in Gunnedah is 623 mm per annum, average annual evaporation is 1752 mm per annum, and the mean maximum daily temperature is 26°C. Monthly climate statistics for Gunnedah are included in Table 3.1 below.

Table 3.1 Climate Statistics – Gunnedah Pool (Site No. 055023)

Climate Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Median Rainfall (mm)	55.3	50.2	33.6	30.8	31.5	37.8	32.8	34.8	34.0	50.8	52.8	62.4	622.9
10%ile Rainfall (mm)	14.5	10.7	4.0	1.4	3.4	10.6	7.1	6.2	6.2	12.2	12.5	16.3	378.0
Mean Daily Evap (mm)*	7.7	6.8	6.0	4.3	2.7	1.9	1.9	2.8	4.0	5.4	6.7	7.8	1752
Mean Max. Temp (°C)	34.0	32.9	30.7	26.4	21.3	17.6	16.9	18.9	22.8	26.7	30.3	32.9	26.0

Note: Mean Daily Evaporation was taken from Gunnedah Resource Centre (Site No. 055024)

It is widely accepted that future climate changes could impact water supply systems through changing frequency and duration of rainfall, as well as an increase in evaporation. While estimating the impacts associated with future climate change is very difficult and is an evolving science, recent studies have started to provide some indication of the potential climate impacts. However, modelling to-date has focused more on changes in average monthly or annual statistics and less on the duration and frequency of extreme events, which is more critical for drought management.

According to the Adapt NSW website (setup by the NSW Office of Environment and Heritage), average temperatures have been rising since the 1950s, with the rate of change increasing from about 0.1°C per decade during the 1950s to 1980s, to about 0.5°C per decade in the 1990s and 2000s. The decade from 2001 to 2010 was the hottest on record, while 2014 was the hottest year on record in NSW (OEH, 2016).

The Adapt NSW website includes climate projections for NSW as well as more specific catchment based projections. An extract from the *New England North West Climate Change Snapshot* (OEH, 2016) is included below:

Based on long-term (1910–2011) observations, temperatures have been noted to have been increasing since about 1970, with higher temperatures experienced in recent decades.

The New England and North West Region is projected to continue to warm during the near future (2020–2039) and far future (2060–2079), compared to recent years (1990–2009). The warming is projected to be on average about 0.7°C in the near future, increasing to about 2.2°C in the far future. The number of high temperature days is projected to increase, with fewer potential frost risk nights anticipated.

The warming trend projected for the region is large compared to natural variability in temperature and is of a similar order to the rate of warming projected for other regions of NSW.

The region currently experiences considerable rainfall variability across the region and from year-to-year and this variability is also reflected in the projections.

Currently, the biggest concern for local water utilities is the potential impact that climate change may have on rainfall patterns and volumes, and in turn how this will impact surface runoff and groundwater recharge rates. The latest estimates of hydrological climate change impacts are included in a recent report by the NSW Office of Environment and Heritage (OEH, 2015), which lists near future (2020 – 2039) and far future (2060 – 2079) estimates for rainfall, surface runoff and groundwater recharge for major river catchments across NSW. Hydrological climate change estimates for the Namoi River catchment are included in Table 3.2.

Table 3.2 Hydrological Climate Change Impacts – Namoi River (OEH, 2015)

Region	Percentage Change in Mean Annual:					
	Rainfall		Surface Runoff		Groundwater Recharge	
	Near Future	Far Future	Near Future	Far Future	Near Future	Far Future
Namoi River	+0.7%	+7.9%	+4.1%	+25.5%	-7.0%	+11.8%

The table reflects the level of uncertainty surrounding climate change, with rainfall predicted to increase slightly in the near future and then further increase in the far future. Surface runoff is predicted to increase slightly in the near future, but increase significantly (around 25%) in the far future. However,

groundwater recharge rates are predicted to fall in the near future, but then increase again in the far future.

While the table gives some indication of the potential changes in mean annual rainfall, streamflow and groundwater recharge rates, the potential impact on water resources (including groundwater systems) is more difficult to predict, as the future nature of rainfall patterns is unknown. Climate change models have been used to estimate changes in seasonal rainfall patterns; however, these models are not currently capable of predicting future extreme rainfall patterns, such as flooding and drought events. Therefore, predictions on the future impact on water resources are currently very limited, as they generally do not consider future climate variability, particularly climate extremes.

3.2 Water Resources

The GSC local government area is located within the Namoi River catchment in North West NSW. The Namoi River catchment drains an area of around 42,000 km² and is bounded by the Great Dividing Range in the east, the Liverpool and Warrumbungle Ranges in the south, and the Nandewar Ranges and Mt Kaputar to the North. Major tributaries of the Namoi River include Coxs Creek and the Mooki, Peel, Cockburn, Manilla, and Macdonald Rivers, all of which join the Namoi upstream of Boggabri.

There is an extensive groundwater system within the Namoi Valley and it is this groundwater system that all water supply systems serviced by GSC source their water from. The Upper Namoi Groundwater Source (see Figure 3.1 on page 8) includes 12 alluvium groundwater sub-zones located upstream (south-east) of Narrabri. Together with the Lower Namoi Groundwater Source (located downstream of Narrabri), these two major groundwater source areas are presently covered by the *Water Sharing Plan for the Upper and Lower Namoi Groundwater Sources (2003)*. The Water Sharing Plan originally commenced in late 2006 and is due for extension or replacement by July 2017.

The Upper Namoi Groundwater Source includes groundwater contained within unconsolidated alluvium aquifers associated with the Namoi River and its tributaries, including the Mooki River and Cox's Creek. The alluvial sediments are generally defined by two layers; the shallower Narrabri formation (up to 30 to 40 m) and the more productive deeper Gunnedah formation (40 to 100 m, up to 170 m at it deepest). These formations consist mainly of sand, gravel and clay and their thickness is largely controlled by the bedrock topography. The total area of alluvium is approximately 3,000 km² (NOW, 2012).

A key objective of the Water Sharing Plan was to reduce total extractions in the Upper Namoi Groundwater Source to 122 GL/a by 2016-17. Prior to the commencement of the plan, groundwater entitlements exceeded 300 GL. At the commencement of the plan, entitlements were reduced to 122 GL, with supplementary access licences provided temporarily to assist users progressively adjust to the reduced entitlement volumes. As of 2015-16, the share component of supplementary water has been reduced to zero. The plan includes long-term extraction limits for each groundwater zone based on estimated recharge rates, as well as rules for adjusting the maximum amount of water that may be made available if this limit is being exceeded.

The estimated average annual recharge to each groundwater zone, along with recent annual extractions and average extractions over the life of the Water Sharing Plan are shown in Table 3.3 below. The table shows that overall extractions in the Upper Namoi Groundwater Source have been below 122 GL in recent years and on average across the first nine years of the plan. However, extraction rates in some zones still exceed annual recharge estimates (extraction limits), including in some zones that GSC has local water utility water access licences – specifically Zone 2 (which includes Mullaley) and Zone 3 (which includes Curlewis).

Table 3.3 Upper Namoi Groundwater Source Extraction Limits versus Usage

Zone	Town Water Supply Entitlements (ML/a)	Extraction Limits / Recharge (ML/a)	Annual Groundwater Extractions (ML/a)			
			2014-15	2013-14	2012-13	Average Since WSP Commencement
1	Quirindi (1,150) Willow Tree (66)	2,100	888	1,225	1,312	1,311
2	Mullaley (59)	7,200	9,879	10,679	6,617	8,326
3	Curlewis (198)	17,300	22,565	22,985	15,586	15,802
4	Gunnedah (3,900) Boggabri (760)	25,700	16,789	26,662	23,329	20,627
5		16,000	14,160	20,781	19,614	15,712
6		14,000	2,242	1,558	1,338	1,223
7		3,700	2,063	1,855	1,429	1,343
8	Caroona (50)	16,000	15,726	19,455	15,123	13,234
9	Tambar Springs (42) Premer (55)	11,400	3,429	4,117	2,069	2,388
10		4,500	0	0	0	2
11		2,200	151	675	339	480
12		2,000	769	938	536	659
TOTAL	6,280	122,100	88,662	110,930	87,291	81,108

A review of historical groundwater levels in the vicinity of town water supply bores for Gunnedah, as monitored by DPI Water, shows there has been some decline in groundwater levels over the past 50 years, with monitoring bores near Gunnedah typically showing around a 5m decline in water levels (see Appendix C). However, the decline appears to have steadied over the last decade, most likely in part due to the introduction of the Water Sharing Plan which set diversion limits in line with estimated recharge rates.

The long-term extraction limits included in the current Water Sharing Plan are expected to be superseded by sustainable diversion limits (SDLs) in the next version of the plan to come into operation after July 2017. This is in accordance with the requirements of the Murray-Darling Basin Plan, which came into force in late 2012 (known as *Basin Plan 2012*). The *Basin Plan 2012* sets new long-term average SDLs that reflect an environmentally sustainable level of water use and requires the new SDLs to be in place by 2019. The currently proposed SDL for the Upper Namoi Groundwater Source (referred to as the Namoi Alluvium Water Resource Plan Area in the *Basin Plan 2012*) is 123.4 GL, which is only marginally higher than current extraction limit of 122.1 GL.

By 2019, the revised Water Sharing Plan for the Upper Namoi Groundwater Source will be incorporated into an overarching Namoi Alluvium Water Resource Plan, as required by the *Basin Plan 2012*. There are 22 groundwater Water Resource Plans in total to be developed across the Murray-Darling Basin.

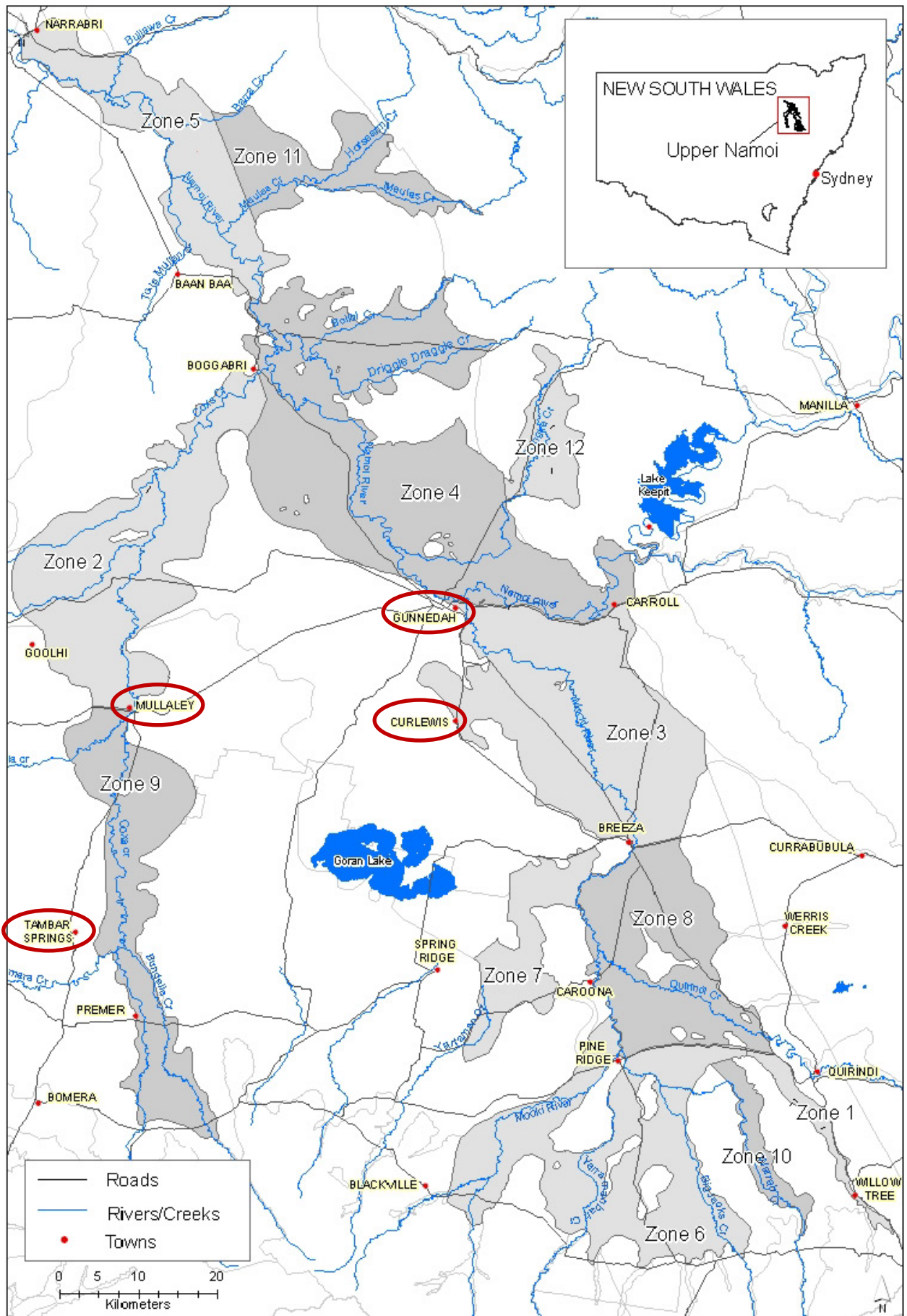


Figure 3.1 Upper Namoi Groundwater Source and Sub-Zones (NOW, 2012)

3.3 Additional Demands During Drought Periods

Villages that may seek water during drought periods are listed on Table 3.4 below, along with an estimate of the potential demands during drought periods based on water carting.

Table 3.4 Villages without Reticulated Town Water Supply

Village / Locality	Approximate Population	Potential Demand During Drought (kL/d)*
Carroll	150	12
Breeza	60	5
Kelvin	40	3

Note: * Based on 80 L/person/day for water carting (NOW, 2009)

3.4 Potential Downstream / Environmental Impacts

It is important that Council liaises with relevant government agencies and other large users (e.g. local irrigators) during drought periods to ensure that water resources are effectively managed at a whole of catchment level. Potential downstream impacts for each water supply system are included in the table below.

Table 3.5 Potential Downstream Impacts During Drought Periods

Water Supply System	Potential Downstream Impacts
Gunnedah	<ul style="list-style-type: none"> Groundwater extractions may have an impact on streamflows in the Namoi River during drought periods and also may impact other groundwater users; however, this is generally managed by the Water Sharing Plan process
Curlewis / Mullaley / Tambar Springs	<ul style="list-style-type: none"> Negligible impacts as relatively minor extractions are sourced from a large groundwater aquifer source

4 Pre-Drought Planning

While this Drought Management Plan focuses primarily on the response actions to be undertaken during a drought, the extent of the various impacts of drought (including economic, social and environmental impacts) will be driven in part by the effectiveness of a range of pre-drought planning and management activities.

This section provides a brief summary of the key activities that need to be in place at the beginning of any given drought period. The activities include:

- Implementation of demand management measures to ensure efficient management of water supply
- The adoption of appropriate system operating rules to ensure efficient operation of the system
- Regular data collection and system monitoring so that sufficient evidence is available in assessing the impacts of a drought
- The adoption of long term supply strategies to ensure that systems are capable of supplying future demands
- A funding strategy to assist in management of the costs associated with drought periods.

Each of these pre-drought planning activities is discussed further in the following sections.

4.1 Demand Management Program

Council revised its Demand Management Plan in conjunction with this revised Drought Management Plan. The revised Demand Management Plan includes a Demand Management Program that contains several water conservation initiatives, including an ongoing community awareness program, annual Council water audits, regulation and planning controls, and a Water Loss Management Program (including annual water loss assessments).

The Demand Management Program also includes permanent water conservation measures (see Table 4.1 below) that encourage common sense water use practices to always be adopted and reinforce other demand management measures by developing a culture of water efficiency. The rules are easy to understand and act as the default water conservation measures when drought response levels are not in action.

Table 4.1 Permanent Water Conservation Measures

Residential Gardens & Lawns Watering	<ul style="list-style-type: none">• Use of sprinklers, sprays, microsprays and fixed hoses is not allowed during the heat of the day• Trigger nozzles must be used on all hoses to help conserve water & avoid waste
Washing Down	<ul style="list-style-type: none">• No washdown of hard surfaces unless using a high pressure cleaner or water efficient nozzle
Swimming Pools & Spas	<ul style="list-style-type: none">• Pool covers to be used to reduce evaporation

4.2 System Operating Rules

Efficient operation of water supply systems is an important pre-emptive strategy for managing droughts. Due to the difficulty in predicting future drought conditions, it is important that groundwater levels are not drawn down excessively during non-drought periods as a result of inefficient operation of the system, as this would reduce the security of a supply system in the event of a drought and consequently worsen the impacts of drought.

System operating rules that are in place to ensure that groundwater levels are not drawn down excessively include:

- Regular monitoring of bore levels (with and without pumping)
- Regular draw down tests on bores to check performance and identify any operational issues
- Orange Grove Road bores (7, 8 & 9) are generally not utilised in winter due to higher pumping costs, which assists local groundwater level recovery during winter months.
- Council's two largest bores (8 & 9), both located within 500m of each other on Orange Grove Road, cannot be operated together due to downstream network constraints. This also assists with ensuring local groundwater levels are not drawn down excessively.

4.3 System Monitoring

Regular monitoring of water supply sources, extractions, production, consumption and climate is critical to understanding how well a water supply system is operating and whether there are any problems or potential future problems. Regular data collection becomes even more critical during drought periods as supply sources are stressed and the water supply situation can deteriorate quickly due to the drought condition.

Table 4.2 below includes a list of key monitoring sites and the minimum (or normal) data collection requirements.

Table 4.2 Minimum Monitoring Requirements (Normal Operation)

Monitoring Type	Data Type/s	Frequency of Monitoring	Responsibility
Groundwater Bores	- Groundwater levels - Groundwater extraction rates	6 monthly* Weekly*	GSC
Groundwater Monitoring Bores	- Groundwater levels	Every 2 months	DPI Water
Customers	- Consumption (metered)	Quarterly	GSC
Climate	- Rainfall - Evaporation	Daily	BOM

*Notes: * Council is upgrading the monitoring capabilities at all groundwater bore locations within Gunnedah, including connecting all sites to telemetry, which will provide real time data (bore levels and flows) from mid-2018.*

4.4 Long Term Supply Strategies

All water supply systems should be designed to cope with at least a repeat of the worst drought on record. Larger systems (>1,000 people) should be designed to cope with more severe drought conditions than the worst on record, on the basis that it is reasonably expected that we could face in the future a more severe drought than the worst on record.

All water supply systems operated by GSC are currently considered secure, with all systems operating normally during the severe drought conditions that were experienced across much of NSW in the mid-2000's. While all systems are generally considered secure based on historical performance, modelling of water supply system security under various combinations of future demands and future climate change scenarios has not been undertaken, therefore there is some uncertainty with future water supply security.

Prior to the next major revision of this Drought Management Plan, consideration should be given to assessing long-term town water supply security in association with DPI Water, with the aid of groundwater models that are capable of assessing water supply security for all users under various demand and climate change scenarios. Groundwater models would need to consider all groundwater users (including irrigators) and incorporate environmental water requirements (including water requirements for groundwater-dependant ecosystems (GDEs)).

4.5 Resource & Funding Strategy

The costs associated with managing drought can have a significant impact on Council's finances, due to a variety of factors, including:

- Reduced revenue due to water consumption reductions associated with enforcing restrictions, particularly in the mid to late stages of the drought. This would be partly offset by revenue from higher than average water consumption levels in the lead-up to the drought and in the early stages of the drought.
- Additional costs associated with Council activities, including running an ongoing community awareness campaign, increased frequency of supply and demand monitoring, liaison with government agencies and other stakeholders and policing of restrictions.
- Increased capital and operating expenditure associated with investigation, implementation and running of backup and emergency supply options.

Historically, budgeting for drought periods has not been a concern for GSC as water supply systems are very secure and generally continue to operate normally during these periods. However, in the future, GSC may need to consider budgeting for drought conditions if it is considered likely that water restrictions will need to be implemented and/or backup water supply options will need to be investigated and possibly implemented.

Any costs associated with managing droughts should be tracked and be available to report to Council, government regulators, DPI Water and the community (if required). These costs can then be used as a justification for further investment in long-term supply strategies and other drought management planning initiatives. If required, drought emergency funding may also be available through DPI Water to manage depleted supplies, investigate and implement emergency capital works or to cart water.

5 Drought Management Action Plans

Drought Management Actions Plans (DMAP) set out the actions to be taken during each drought response level. There are five drought response levels (Levels 1 to 5), with each level having a set of suggested actions to be undertaken during that phase of the drought, including an associated set of water restrictions.

5.1 Overview

The “All Systems” DMAP (see Table 5.2) outlines the common actions that should be undertaken by Council at various drought response levels, including:

- The application of water restrictions and associated enforcement and issuing of fines
- Community awareness campaign and liaison with non-residential large water users
- Monitoring of water supply sources and town water demands
- Liaison with authorities and local irrigators
- Development and/or review of backup / emergency supply options

Specific DMAPs (see Table 5.3) have also been prepared for each of the individual water supply systems, outlining additional specific actions to be undertaken in that system, generally related to the investigation and implementation of backup and emergency supply options. The DMAPs also nominate primary and secondary (or supplementary) supply sources for each of the drought response levels.

Drought Response Levels

A general description of the five drought response levels is provided below. More details on the various actions and water restrictions that are relevant to each level are included in Sections 5.2 and 5.3 below.

Level 1 (Low) – This is the first level of water restrictions and is more focused on general awareness, rather than trying to achieve significant reductions in usage. The key measure is to limit the hours that sprinklers can be used and generally, the impact on residences and their gardens would be relatively minor. Actions are mainly preparatory measures that activate the Drought Management Plan and its various components.

Level 2 (Moderate) – This level includes a ban on sprinklers and a time limit for drippers and hoses. The focus is on reducing usage back below typical levels for that time of year and the measures are likely to cause a moderate level of inconvenience to the community, without necessarily having significant impacts on most lawns and gardens. Key actions include setting up more regular liaison with key government stakeholders and preparing backup supply sources.

Level 3 (High) – This level includes banning all forms of outdoor watering other than buckets and will have a more significant impact on lawns and gardens and cause a fairly major inconvenience to most residences. The aim is to reduce usage well below typical levels while still allowing lawns and gardens to be maintained, albeit at a base level. Key actions include more focus on issuing warning and fines for violation of restrictions, stepping up the awareness campaign and notifying DPI Water of the intention to investigate and if necessary implement backup supply and/or emergency supply options.

Level 4 (Very High) – This severe level of water restrictions includes banning all outdoor watering (residential) in order to reduce usage to at or below winter levels and would have a major impact on lawns and gardens, including loss of lawns and gardens in many cases. The reestablishment of lawns and gardens after an extended period of severe restrictions would impose a relatively high cost on residences and therefore, the application of Level 4 restrictions or higher would only occur in very rare circumstances. Key actions include activating backup supply options, investigation / design emergency supply options, stepping up issuing of fines for violation of restrictions and recalling all Water Management Plans.

Level 5 (Emergency) – This extreme level of restrictions would involve an all-out campaign to reduce usage to absolute minimum levels by eliminating all non-essential usage and would have a major impact on nearly all residences and businesses. Residences may be asked to reduce shower times, limit washing machine loads and limit the use of evaporative coolers. Businesses may be asked to restrict water usage to only essential services, with the possible shutting down of non-essential, water dependent services. Key actions include implementing emergency response / supply options and an all-out community water reduction appeal.

Triggers & Water Consumption Targets

The DMAPs for each of the water supply systems include primary triggers for initiating each drought response level, as well as total system water consumption targets for those levels. Secondary triggers such as water quality incidents and failure to achieve water consumption targets are also suggested. Water consumption targets are average annual consumptions and should be adjusted for seasonal patterns (where appropriate). Note that once outdoor usage is banned (Levels 4 & 5), consumption targets become fixed daily targets due to the lack of influence from seasonal factors.

The basis for water consumption targets is shown on Table 5.1 below.

Table 5.1 Water Consumption Targets

Drought Response Level	Residential Consumption Target	Non-Residential Consumption Target	Total Consumption Target (70/30 split)
1 Low	95%	100%	95%
2 Moderate	85%	90%	90%
3 High	75%	85%	80%
4 Very High	65%	80%	70%
5 Emergency	50%	75%	60%

In considering the easing of water restrictions, Council will take into consideration water supply demand, projected demand, level and security of bulk water sources, catchment parameters, seasonal conditions, and seasonal outlook. The easing of water restrictions will generally not be implemented where it is likely that the revised restrictions will not be sustained for more than four weeks before tighter restrictions have to be re-imposed. Suggested triggers for easing restrictions are included in the DMAPs.

Drought Management Team

To assist in the undertaking of actions included in the DMAPs and to ensure the successful implementation of the greater Drought Management Plan, Council should assemble a Drought Management Team at the commencement of drought response level 1. The team should include representatives from key Council departments.

Communication

A key aspect in ensuring the successful implementation of the Drought Management Plan is the communication strategy. A community awareness campaign is vital for ensuring the community is made aware of actions that directly impact them, such as water restrictions and any associated fines and exemptions, and the activation of backup or emergency supply sources and any associated changes in water quality.

The community also needs to be given advice on how to minimise the impact of various water restrictions (including options for household recycling of water) and advice on saving water around the home in general. It is important that the community is kept up-to-date with the status of water supply sources (including river flows and dam storage volumes) and are given some idea of the consequences of not achieving target reductions in water consumption.

Liaison with key government agencies is another important component of the communication strategy. Key agencies include NSW Department of Primary Industries - Water (DPI Water), NSW Office of Environment and Heritage (OEH), NSW EPA, NSW Health, North West Local Land Services and WaterNSW. It is particularly important that the relevant agencies be informed when significant impacts on the community, the environment or other stakeholders are expected as a result of actions arising from implementation of the plan.

In most systems, liaison with local irrigators is also important, to ensure they are aware of any impacts they may be having on the town water supplies and conversely, to make sure they are aware of the potential impacts that Council's actions, arising from the implementation of the plan, may have on them.

Monitoring

Regular monitoring of groundwater bore levels (static and draw-down), water extractions and monitoring of actual water consumption compared to target are critical during drought periods. The data obtained from this monitoring provides important feedback on the effectiveness of the various drought response levels and will generally be the basis for moving between drought response levels. More frequent monitoring will generally be required as the drought progresses and the water supply situation deteriorates.

Emergency Supply Options

After each of the water supply system DMAPs, emergency supply sources (referred to in the action plans) are listed in order of preference. More details on these alternative sources are included in the Appendix D.

5.2 Action Plans

The Drought Management Action Plans (DMAPs) for “All Systems” is included in the table below, followed by more specific DMAPs for each individual water supply system.

Table 5.2 Drought Management Action Plan (All Systems)

Drought Response Level	Actions
<p style="text-align: center;">1 Low</p>	<ul style="list-style-type: none"> • Activation of Drought Management Plan • Implement Level 1 Water Restrictions • Establish a drought budget to track ongoing drought management costs • Establish a Drought Management Team to oversee the implementation of the Drought Management Plan • Review DMAP to ensure it is up-to-date, including a review of backup / emergency supply options • Prepare community awareness campaign (media advertising, internet) • Review major existing Water Restriction Exemptions and update where necessary • Initiate regular (2 monthly) liaison with key government agencies (DPI Water, WaterNSW) and local irrigators (where appropriate) • Weekly review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable)
<p style="text-align: center;">2 Moderate</p>	<ul style="list-style-type: none"> • Implement Level 2 Water Restrictions • Implement community awareness campaign • Consider issuing warnings and fines for violation of restrictions • Continue regular (2 monthly) liaison with key government agencies (DPI Water, WaterNSW) and local irrigators (where appropriate) • Weekly review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable) • Review all existing Water Restriction Exemptions and update where necessary
<p style="text-align: center;">3 High</p>	<ul style="list-style-type: none"> • Implement Level 3 Water Restrictions • More focus on the issuing of warnings and fines for violation of restrictions • Step-up community awareness campaign & meet with large non-residential users to discuss options for water reduction • Twice-weekly review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable) • Regular (monthly) liaison with key government agencies and local irrigators (where appropriate) • Notify DPI Water of intention to investigate backup / emergency supply options and seek drought assistance • Assess appropriateness of exemptions allowed under existing Water Restriction Exemptions
<p style="text-align: center;">4 Very High</p>	<ul style="list-style-type: none"> • Implement Level 4 Water Restrictions • Step-up the issuing of warnings and fines for violation of restrictions • Step-up community awareness campaign, including non-residential water reduction appeal • Daily review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable) • Regular (weekly) liaison with key government agencies and local irrigators (where appropriate) • Recall all Water Restriction Exemptions
<p style="text-align: center;">5 Emergency</p>	<ul style="list-style-type: none"> • Implement Level 5 Water Restrictions • Strict issuing of warnings and fines for violation of restrictions • All-out community water reduction appeal – minimum essential usage only • Regular (fortnightly) meetings with large water users to discuss ongoing water reduction options • Consider temporary closure of non-essential, high water dependant services • Daily review of groundwater bore levels, water extractions and monitoring of actual water consumption compared to target (monitor where applicable) • Regular (twice-weekly) liaison with key government agencies and local irrigators (where appropriate), including liaising with DPI Water re: emergency response options • Implementation of emergency response / supply options

Gunnedah Water Supply System

Table 5.3 Drought Management Action Plan (Gunnedah)

Drought Response Level	Primary Trigger* (% Total Available Groundwater Production Capacity)	Water Usage Target** (ML/d)	Additional Actions
1 Low	65%	6.6	
2 Moderate	55%	6.3	<ul style="list-style-type: none"> • Target 10% non-residential usage reduction
3 High	45%	5.6	<ul style="list-style-type: none"> • Target 15% non-residential usage reduction • Investigate emergency supply options
4 Very High	35%	4.9	<ul style="list-style-type: none"> • Target 20% non-residential usage reduction • Undertake design and seek approval to implement emergency supply options
5 Emergency	25%	4.2	<ul style="list-style-type: none"> • Target 25% non-residential usage reduction • Implement emergency supply options
Emergency Supply Options			
<ol style="list-style-type: none"> 1. <i>Additional Groundwater Bores</i> 2. <i>Pipeline to Keepit Dam</i> 3. <i>River Extraction from Namoi River</i> 			

Notes: * Secondary triggers include failure to achieve consumption targets & major water quality incidents

** Usage targets are average annual consumptions and should be adjusted for seasonal patterns

The primary trigger is based on the total available groundwater production capacity, which is expected to gradually reduce during periods of severe drought as groundwater levels are depleted. The maximum theoretical groundwater production capacity is around 30 ML/d, assuming all ten active bores are available and operate simultaneously. It should be noted that this is a theoretical total production capacity only, as all ten bores are unable to (and are not required to) operate simultaneously due to downstream network and pumping station constraints. Actual maximum production is effectively limited to around 20 ML/d, with the remaining production capacity of 10 ML/d being available as a backup if required).

Easing Restrictions

Restrictions will be eased when bore production capacity has improved by 10% above previous trigger level (i.e. drop back to Level 4 at 35%, drop back to Level 3 at 45%, drop back to Level 2 at 55%, drop back to Level 1 at 65% and drop back to PWCM at 75%).

Curlewis Water Supply System

Table 5.4 Drought Management Action Plan (Curlewis)

Drought Response Level	Primary Trigger*	Water Usage Target** (ML/d)	Additional Actions
1 Low	Bore pumps and reservoir unable to meet demands	0.27	
2 Moderate		0.26	
3 High		0.23	<ul style="list-style-type: none"> Investigate emergency supply options
4 Very High		0.20	<ul style="list-style-type: none"> Undertake design and seek approval to implement emergency supply options
5 Emergency		0.17	<ul style="list-style-type: none"> Implement emergency supply options
Emergency Supply Options			
<ol style="list-style-type: none"> Additional Groundwater Bores Water Carting from Gunnedah 			

Notes: * Secondary triggers include consideration of the drought response level for other water supply systems operated by GSC & major water quality incidents

** Usage targets are average annual consumptions and should be adjusted for seasonal patterns

Specific primary triggers have not been nominated for Curlewis. It is expected that primary triggers will be based on the ability of the system to supply the prevailing water supply demands. If demands start to exceed production capacity (due to high demand levels and/or reduced production capacity), the next drought response level (and associated water restrictions) should be triggered. In the case of both bores being unavailable (due to power outage or total failure of both bores), drought response level 5 (Emergency) would be implemented immediately.

Easing Restrictions

The Council decision for easing water restrictions at Curlewis will be based on water demands, bore levels (improving), catchment parameters, seasonal conditions and seasonal outlook.

Mullaley Water Supply System

Table 5.5 Drought Management Action Plan (Mullaley)

Drought Response Level	Primary Trigger*	Water Usage Target** (ML/d)	Additional Actions
1 Low	Bore pumps and reservoir unable to meet demands	0.049	
2 Moderate		0.047	
3 High		0.042	<ul style="list-style-type: none"> Investigate emergency supply options
4 Very High		0.036	<ul style="list-style-type: none"> Undertake design and seek approval to implement emergency supply options
5 Emergency		0.031	<ul style="list-style-type: none"> Implement emergency supply options
Emergency Supply Options			
<ol style="list-style-type: none"> Additional Groundwater Bores Water Carting from Gunnedah 			

Notes: * Secondary triggers include consideration of the drought response level for other water supply systems operated by GSC & major water quality incidents

** Usage targets are average annual consumptions and should be adjusted for seasonal patterns

Specific primary triggers have not been nominated for Mullaley. It is expected that primary triggers will be based on the ability of the system to supply the prevailing water supply demands. If demands start to exceed production capacity (due to high demand levels and/or reduced production capacity), the next drought response level (and associated water restrictions) should be triggered. In the case of both bores being unavailable (due to power outage or total failure of both bores), drought response level 5 (Emergency) would be implemented immediately.

Easing Restrictions

The Council decision for easing water restrictions at Mullaley will be based on water demands, bore levels (improving), catchment parameters, seasonal conditions and seasonal outlook.

Tambar Springs Water Supply System

Table 5.6 Drought Management Action Plan (Tambar Springs)

Drought Response Level	Primary Trigger*	Water Usage Target** (ML/d)	Additional Actions
1 Low	Bore pumps and reservoir unable to meet demands	0.047	
2 Moderate		0.044	
3 High		0.039	<ul style="list-style-type: none"> Investigate emergency supply options
4 Very High		0.035	<ul style="list-style-type: none"> Undertake design and seek approval to implement emergency supply options
5 Emergency		0.030	<ul style="list-style-type: none"> Implement emergency supply options
Emergency Supply Options			
<ol style="list-style-type: none"> Additional Groundwater Bores Water Carting from Gunnedah 			

Notes: * Secondary triggers include consideration of the drought response level for other water supply systems operated by GSC & major water quality incidents

** Usage targets are average annual consumptions and should be adjusted for seasonal patterns

Specific primary triggers have not been nominated for Tambar Springs. It is expected that primary triggers will be based on the ability of the system to supply the prevailing water supply demands. If demands start to exceed production capacity (due to high demand levels and/or reduced production capacity), the next drought response level (and associated water restrictions) should be triggered. In the case of both bores being unavailable (due to power outage or total failure of both bores), drought response level 5 (Emergency) would be implemented immediately.

Easing Restrictions

The Council decision for easing water restrictions at Tambar Springs will be based on water demands, bore levels (improving), catchment parameters, seasonal conditions and seasonal outlook.

5.3 Water Restrictions

Water restrictions corresponding to each Drought Response Level are summarised on the table below, with the full list of measures included in Appendix A. Water restrictions are generally based on a common set of measures adopted by the Councils associated with the Namoi Water Alliance. The adoption of a common set of water restrictions across the Namoi Region allows for a consistent and simplified communication process and reduces confusion in the community.

Table 5.7 Summary of Water Restrictions (Residential)

Category	1 Low	2 Moderate	3 High	4 Very High	5 Emergency
Residential Gardens & Lawns Watering	Fixed hoses & sprinklers banned, except between 6-7am & 6-7pm	Fixed hoses & sprinklers banned Hand held hoses restricted to 2hrs per day	Fixed hose, sprinklers & hand held hoses banned Buckets restricted to 2hrs per day	No watering at any time	No watering at any time
Washing Down (including vehicles)	Wash down hard / paved surfaces with high pressure hose only	Hoses restricted to 2hrs per day	No hoses Buckets restricted to 2hrs per day	No washing down at any time	No washing down at any time
Swimming Pools & Spas	Permit required for filling pools over 2,000L	Permit required for filling pools over 2,000L Top up via hoses only 2hrs per day	Permit required for filling pools over 2,000L Top up via hoses only 2hrs per day	Filling & topping up prohibited	Filling & topping up prohibited
Residential Consumption Target (% reduction)	5%	15%	25%	35%	50%

Refer to Appendix A for a detailed list of water restrictions.

Compliance with Water Restrictions

Periods of water restrictions and use of appliances in accordance with water restrictions in place will be policed by Council officers.

Under the Local Government Act 1993 the maximum penalty that may be applied for a breach of imposed water restrictions is \$2,200 for corporations and \$220 for individuals.

5.4 Emergency Response Measures

In the event of a severe water shortage which has resulted in primary and backup supply sources failing or approaching failure, emergency response measures will need to be implemented. These measures may include supply side measures (emergency supplies) and/or demand side measures (emergency demand management) and they would be implemented in association with Level 5 Emergency water restrictions. Both supply side and demand side emergency response measures are outlined further below.

Emergency Supplies

Key emergency supply options have been identified for each system and are listed in Drought Management Action Plans (Section 5.1), with further details in Appendix D. Emergency supply options include additional groundwater bores (all systems) and water carting (all systems except Gunnedah).

Emergency supply options generally need to be implemented very quickly and any pre-construction planning and design work should generally be undertaken prior to reaching the Level 5 drought response level to ensure the emergency supply source can be activated expeditiously.

For all towns / village systems, water carting would be the last resort emergency supply option and due to the high costs involved, would only be implemented if all other emergency response measures failed (see below).

Water Carting

Carting of water to towns and villages may be necessary to provide basic town water needs during an emergency – in the event that all other emergency supply measures have failed. It is anticipated that such arrangements would only be required for a short period in conjunction with water rationing to allow the local water source to recover. Water cartage is generally not considered a practical emergency supply options for larger towns (approximately 10,000 or more people) and therefore is not a viable option for Gunnedah.

It is anticipated that water carting to Curlewis, Mullaley and Tambar Springs could be achieved using a single truck (e.g. milk tanker). An estimate of the quantities of water that may need to be carted is included in the following section Table 5.8. Supplies would generally be sourced from Gunnedah.

Government assistance towards the cost of water cartage has historically been available from the NSW Government via DPI Water, but is subject to quantities and cartage arrangements being agreed with DPI Water. If the security of a town supply appears to be threatened, the regional staff of DPI Water can assist Council with undertaking an initial assessment of the system and advise on the best cartage arrangements; however, Council will be required to seek quotations from contractors for the carting. An application to the DPI Water should contain the following:

- A copy of a technical report prepared by Council/DPI Water following the initial assessment
- Details of any consideration given to, or steps taken towards, establishing an emergency supply from another source
- The location of the new source of water to be used, the method of cartage proposed, the number of loads and frequency
- The cost of purchase and transportation of water
- Copies of all correspondence with transport contractors on the subject of cartage

Guidelines for determining minimum supply requirements are contained in the DPI Water document *Drought Relief for Country Towns* (NOW, 2009).

Emergency Demand Management

In the event of severe water shortage, external residential water use would be stopped altogether by way of restrictions and indoor water use would need to be reduced through persuasive advertising and community education campaigns. Emergency response strategies should only be considered when all other options have been exhausted, and should be applied in conjunction with Level 5 water restrictions.

Once Level 5 water restrictions are introduced, Council will consider a range of actions for implementation, including the following emergency response measures:

- More frequent water meter reading to facilitate the imposition and monitoring of targets / allowances for residential water use. It is envisaged that a residential usage target of around 150 L/person/day (based on what has been achievable in other cities / towns during severe water restrictions) would initially be implemented and gradually reduced if necessary.
- The above measures would be implemented in conjunction with a major publicity campaign urging reductions in residential internal water use, with a focus on shorter showers, washing machines only being used for full loads and reduced operation of evaporative air conditioners.
- Investigation of properties that are consistently exceeding usage targets and not showing a significant reduction in water usage over time.

Rationing

In the event that Level 5 Water Restrictions do not sufficiently reduce system demands to sustainable levels (based on the prevailing drought conditions), water rationing will need to be considered. The key objective of rationing would be to reduce water consumption to minimum essential supply requirements only. For residential properties that normally have access to reticulated water, a minimum essential supply requirement of 100 L/p/day has been adopted. For non-residential properties, most businesses and industries would be required to reduce water consumption to minimum essential usage only and in some cases, non-essential businesses may be asked to temporarily cease operations until drought conditions improve.

An estimate of the essential supply requirements for the each water supply system is included in Table 5.8 below. While the estimates included in the table are considered useful for initial emergency planning purposes, more accurate assessments of minimum essential supply requirements should be undertaken as Council approaches drought response level 5 based on the prevailing climatic conditions, achievements to-date with reducing water consumption and a reassessment of essential businesses and industries.

Table 5.8 Minimum Essential Supply Requirements

Water Supply System	Population Served	Residential Essential Supply Requirement (L/p/day)	Residential Essential Supply Requirement (kL/d)	Non-Residential Essential Supply Requirement* (kL/d)	MINIMUM ESSENTIAL SUPPLY REQUIREMENT (kL/d)
Gunnedah	8,730	100	873	935	1,808
Curlewis	590	100	59	21	80

Mullaley	~75	100	8	11	19
Tambar Springs	~100	100	10	6	16

Notes: * Non-residential essential supply requirement assumed to be around 50% of average requirements

6 Post-Drought Actions

6.1 Post-Drought Evaluation & Revision

Once the drought has broken and water supply systems return to normal operating conditions, a review needs to be undertaken of the effectiveness of the Drought Management Plan. The post-drought evaluation should include:

- A review of both supply side and demand side actions, including their effectiveness and timing, should be undertaken for each system and documented.
- An assessment should be made of the impact of drought management actions (including water restrictions) on various stakeholders, including the community.
- An assessment of the impact of drought management actions on Council should also be undertaken.
- Community response to the imposition of various restrictions should be sought, including feedback on the effectiveness of the Community Awareness Campaign, how they managed the impacts of drought and any suggested changes / modifications to water restrictions.
- Feedback should also be sought from various government agencies and other stakeholders, including local irrigators.

Based on this review of the previous drought and any feedback received, the Drought Management Plan will need to be revised to include issues that were not previously considered and potentially modified to improve the future management of droughts.

6.2 Regular Review & Update of the Plan

In addition to evaluation and revision after each period of drought, regular reviews of the Drought Management Plan should be undertaken at least every 5 years. Plans should be updated with the latest information on water supply systems, including any augmentations that have occurred, changes to operating rules and up-to-date water consumption data and flow / level monitoring data for water sources. Plans should also be updated after any major changes / augmentations to water supply systems.

7 References

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Appendix A
Water Restrictions Policy

Appendix A –Water Restrictions Policy

CATEGORY	P Permanent	LEVEL 1 Low	LEVEL 2 Moderate	LEVEL 3 High	LEVEL 4 Very High	LEVEL 5 Emergency
RESIDENTIAL GARDENS & LAWN WATERING	Fixed Hoses & Sprinklers restricted except between 6-8am & 6-10pm during daylight saving time and 6-8am & 5-9pm during EST	Fixed Hoses & Sprinklers Banned except between 6-7am & 6-7pm	Fixed Hoses & Sprinklers Banned Hand held hoses restricted to 2hrs per day	Fixed Hoses & Sprinklers and hand held hoses banned Buckets restricted to 2 hrs per day	No watering at any time	No watering at any time
WASHING DOWN (including vehicles)	Wash down hard/paved surfaces with high pressure hose only	Wash down hard/paved surfaces with high pressure hose only	Hoses restricted to 2 hrs per day	No hoses. Buckets restricted to 2 hrs per day	No watering at any time	No watering at any time
SWIMMING POOLS & SPAS - PRIVATE	Use pool cover to reduce evaporation	Permit required for filling pools over 2000 litres	Permit required for filling pools over 2000 litres. Top up via hoses only 2 hrs per day	Permit required for filling pools over 2000 litres. Top up via hoses only 2 hrs per day	Filling and Topping up Prohibited	Filling and Topping up Prohibited
PUBLIC PARKS AND GARDENS	No Restriction	Fixed Hoses & Sprinklers Banned except for 6 hrs/day	Fixed Hoses & Sprinklers Banned except for 3 hrs/day	Fixed Hoses & Sprinklers Banned Hand held hoses only	Fixed Hoses & Sprinklers Banned Hand held hoses allowed 3hrs/day	No watering at any time
PUBLIC SPORTS GROUNDS AND	No Restriction	Main Parks to be watered at night	Limited watering only	Auto sprinklers 1hr max/line. Every second night Hand held hoses in other parks only.	Fixed Hoses & Sprinklers Banned Hand held hoses allowed 3hrs/day	No watering at any time
BOWLING/GOLF CLUBS	No Restriction	No Restriction	Fixed Hoses & Sprinklers Banned except for 2 hrs/day	Fixed Hoses & Sprinklers Banned except for 2 hrs every 2nd day	Fixed Hoses & Sprinklers Banned Hand held hoses allowed 1hr/day	No watering at any time
SCHOOLS AND HEALTH CARE PREMISES REQUIRING DAY STAFF FOR MAINTENANCE	No Restriction	Fixed Hoses & Sprinklers Banned except for 6 hrs/day	Fixed Hoses & Sprinklers Banned except for 3 hrs/day	Fixed Hoses & Sprinklers Banned Hand held hoses only	Fixed Hoses & Sprinklers Banned Hand held hoses allowed 3hrs/day	No watering at any time
NURSERIES ETC	No Restriction	No Restriction	Fixed Hoses & Sprinklers Banned except for 4hrs/day	Fixed Hoses & Sprinklers Banned except for 2 hrs/ day	Fixed Hoses & Sprinklers Banned. Hand held hoses allowed 2hr/day	Fixed Hoses, Sprinklers & Hand held hoses Banned Bucket Water Only
AUTO FLUSH TOILETS	No Restriction	No Restriction	On Timers Banned. On Demand okay	On Timers Banned. On Demand okay	On Timers Banned. On Demand okay	On Timers Banned. On Demand okay

Appendix A –Water Restrictions Policy

COMMERCIAL CAR WASH	No Restriction	No Restriction	No Restriction	Time Restricted by Negotiation	Time Restricted by Negotiation	Car wash closed
TRUCK WASH AT SALEYARDS	No Restriction	No Restriction	No Restriction	Time Restricted by Negotiation	Banned except as required by law	Closed
INDUSTRIAL USE (MAJOR)	No Restriction	No Restriction	No Restriction	Restricted by Negotiation	Restricted by Negotiation	Special Council Permission by Negotiation
WATER CARTAGE FROM STANDPIPE	No Restriction	No Restriction	No Restriction	Domestic Use Only	Domestic Use Only during working Hours	Domestic Use Only during working Hours
Residential consumption target (% reduction)t		5%	15%	25%	35%	50%

Appendix B

Water Supply Systems Details

Gunnedah Water Supply System

Gunnedah water supply system sources raw water from 11 groundwater bores, as shown on Figure B1 and in Table B1 below. Three bores are located off Old Tamworth Road (1, 2 & 10), four bores are located off Campbell Road (3, 4, 5 & 6), three bores are located off Orange Grove Rd (7, 8 & 9) and one bore is located off Wean Road. All bores are treated via disinfection with chlorine only.

Table B1 Groundwater Bore Details – Gunnedah

Bore No.	Location	Pump Capacity (L/s)	Bore Depth (m)	Typical Depth to Groundwater (m)	
				Static	Draw Down
1	Old Tamworth Rd	17	25.5	7 – 10	15 – 20
2	Old Tamworth Rd	15	25.0	8 – 15	15 – 20
3	Campbell Rd	18	39.3	10 – 13	14 – 18
4	Campbell Rd	18	31.0	10 – 14	15 – 17
5	Campbell Rd	17	22.5	10 – 14	14 – 17
6	Campbell Rd	50	41.5	10 – 14	18 – 27
7	Orange Grove Rd	38	73.0	8 – 14	22 – 33
8	Orange Grove Rd	142	133.5	12 – 20	20 – 35
9	Orange Grove Rd	108	132	12 – 20	30 – 40
10	Old Tamworth Rd	-	24.8	Decommissioned	
11	Wean Rd	27	21.5	9 – 13	13 – 15

A review of historical groundwater levels in the vicinity of town water supply bores for Gunnedah, as monitored by DPI Water, shows there has been some decline in groundwater levels over the past 50 years, with monitoring bores near Gunnedah typically showing around a 5m decline in water levels (see Appendix C). However, the decline appears to have steadied over the last decade, most likely in part due to the introduction of the Water Sharing Plan which set diversion limits in line with estimate recharge rates. The groundwater levels recorded by DPI Water in the monitoring bores generally compares well with groundwater levels recorded by GSC in town water bores.

Since the installation of the Orange Grove Rd bores in the mid 1990's, water restrictions have not been applied in Gunnedah as a result of drought conditions. Water restrictions have only been applied once for a short period in 2001, following a severe storm event that caused damage to power supplies.

Appendix B – Water Supply Systems Details

Gunnedah water supply system has five water reservoirs with a combined capacity of 17.9 ML:

- South Street Reservoir – 3.4 ML (TWL 300.9)
- Links Road Reservoir 1 – 2.3 ML (TWL 340.8)
- Links Road Reservoir 2 – 9.1 ML (TWL 340.8)
- Apex Reservoir – 1.1 ML (TWL 340.7)
- Gallen Reservoir – 2.0 ML (TWL 380.7)

There are four main water supply zones supplied by the water reservoirs:

- South Street Reservoir services the South Street Zone, which is the lowest pressure zone
- Links Rd Reservoirs and the Apex Reservoir service the Links / Apex Rd Zone, which is the middle pressure zone
- Gallen Reservoir services the Gallen High Zone, which is the highest pressure zone and is boosted from the Links / Apex Rd Zone
- The Wandobah Rd booster pumping station (13 L/s) services the Wandobah Rd Booster Zone, which is supplied from the Links / Apex Rd Zone

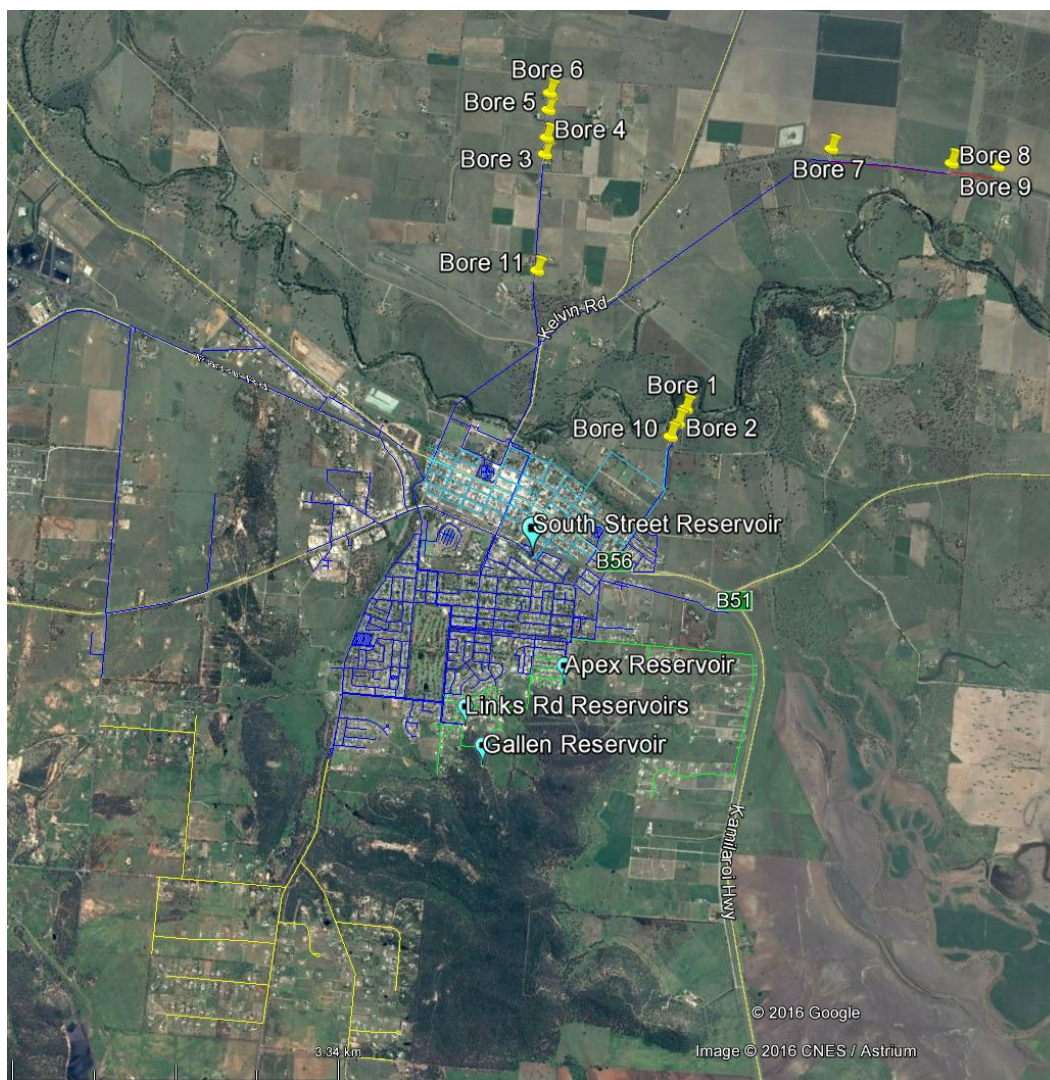


Figure B1 Gunnedah Water Supply System – Overview Plan

Curlewis Water Supply System

Appendix B – Water Supply Systems Details

Curlewis water supply system sources raw water from two groundwater bores, as shown on Figure B2 and in Table B2 below. The bores are located off Curlewis Common Road, to the east of the town and are treated via disinfection with chlorine only.

Table B2 Groundwater Bore Details – Curlewis

Bore No.	Location	Pump Capacity (L/s)	Bore Depth (m)	Typical Depth to Groundwater (m)	
				Static	Draw Down
1	Curlewis Common Rd	17	78	13 – 27	20 – 35
2	Curlewis Common Rd	17	60.1	13– 28	21 – 33

Both bores have shown a decline in groundwater levels during historical drought periods (particularly in 2006/07), with groundwater depths increasing to around 35 m. This is also reflected in the DPI Water monitoring bore GW036197, which is located around 1.3 km away and has daily data from 1977 (see Appendix C). The monitoring bore shows significant fluctuations in bore levels each year due to increased water usage during irrigation seasons. The monitoring bore also shows a general decline in bore levels between 1977 and the mid 2000's, followed by a rapid recovery in bore levels over the last 10 years.

Curlewis water supply system has three water reservoirs (combined capacity of 1.7 ML) that are co-located between the bores and the town and service a single supply zone:

- Curlewis 1 Reservoir – 0.19 ML (TWL 315.3)
- Curlewis 2 Reservoir – 0.19 ML (TWL 315.3)
- Curlewis 3 Reservoir – 1.30 ML (TWL 315.3)



Figure B2 Curlewis Water Supply System – Overview Plan

Mullaley Water Supply System

Appendix B – Water Supply Systems Details

Mullaley water supply system sources raw water from two groundwater bores, as shown on Figure B3 and in Table B3 below. The bores are located off the Oxley Highway, to the west of the town and are treated via disinfection with chlorine only. Historically, both bores have been reliable.

Table B3 Groundwater Bore Details – Mullaley

Bore No.	Location	Pump Capacity (L/s)	Bore Depth (m)	Typical Depth to Groundwater (m)	
				Static	Draw Down
1	Oxley Highway	3.8	23	5 – 10	10 – 15
2	Oxley Highway	2.8	23.7	5 – 10	10 – 15

Mullaley water supply system has one water reservoir that is located to the south of the town and services a single supply zone:

- Mullaley Reservoir – 0.19 ML



Figure B3 Mullaley Water Supply System – Overview Plan

Tambar Springs Water Supply System

The Tambar Springs water supply system sources raw water from two groundwater bores, as shown on Figure B4 and in Table B4 below. The bores are located off Smith Road, to the east of the town and are treated via disinfection with chlorine only. Historically, both bores have been reliable.

Table B4 Groundwater Bore Details – Tambar Springs

Bore No.	Location	Pump Capacity (L/s)	Bore Depth (m)	Typical Depth to Groundwater (m)	
				Static	Draw Down
1	Smith Rd	5	64	5 – 10	7 – 15
2	Smith Rd	5	62.8	5 – 10	7 – 15

Tambar Springs water supply system has four small water reservoirs with a combined capacity of 0.17 ML:

- Tambar Springs 1, 2 & 3 Reservoirs – 0.05 ML each
- Quarry Street Reservoir – 0.02 ML, which services a small high pressure zone

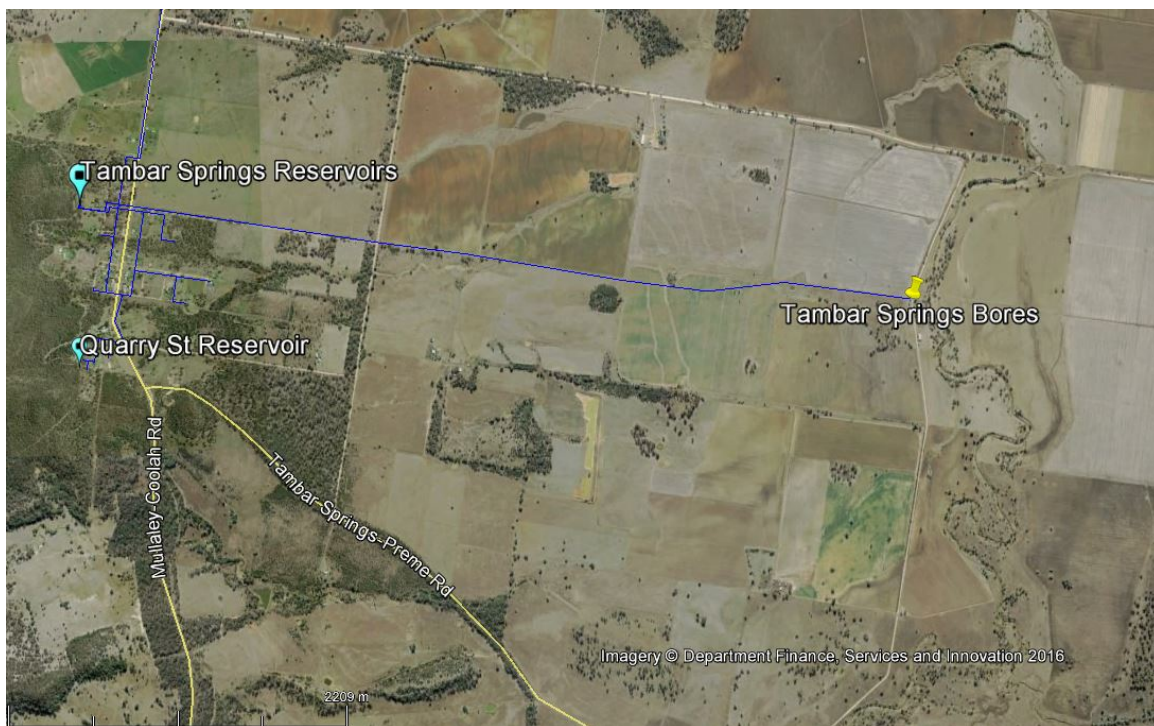


Figure B4 Tambar Springs Water Supply System – Overview Plan

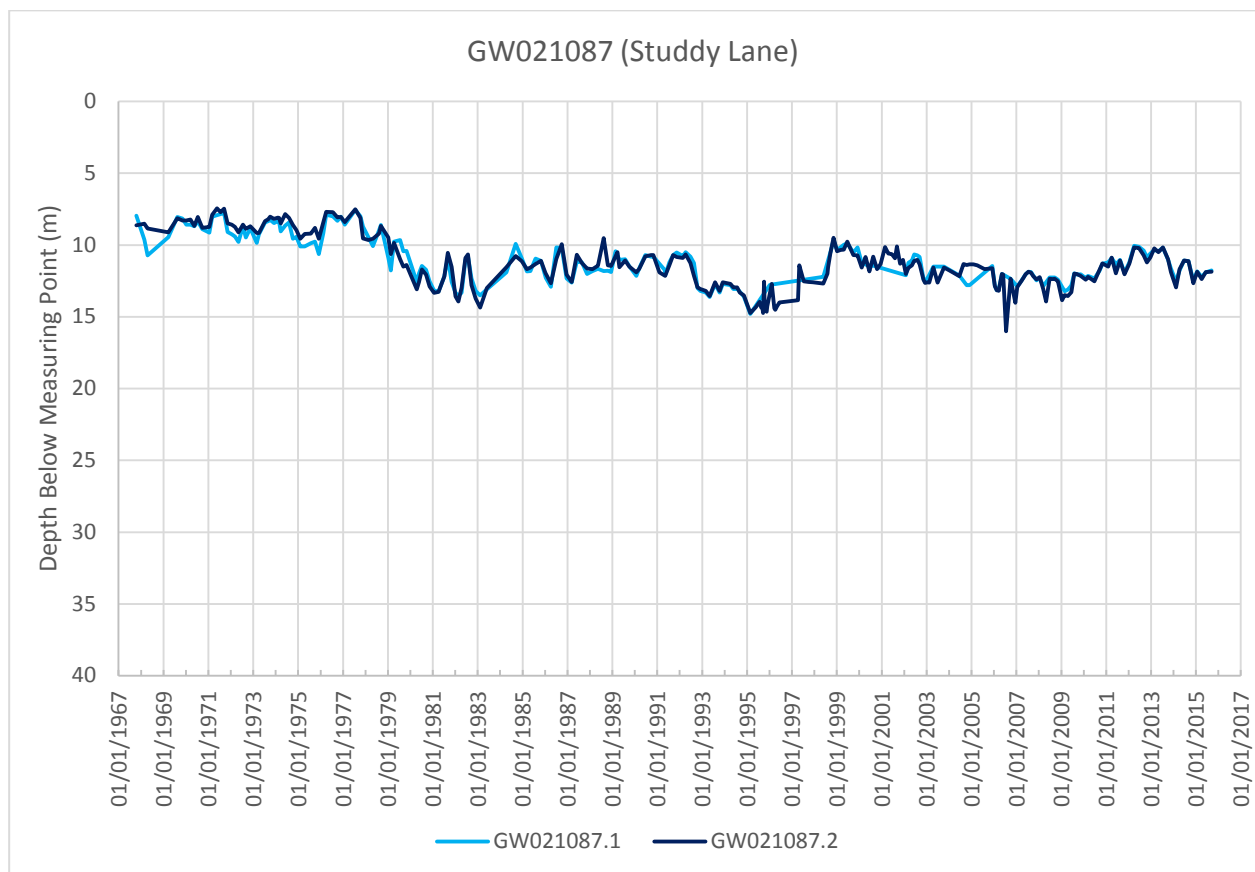
Appendix C

Historical Groundwater Levels

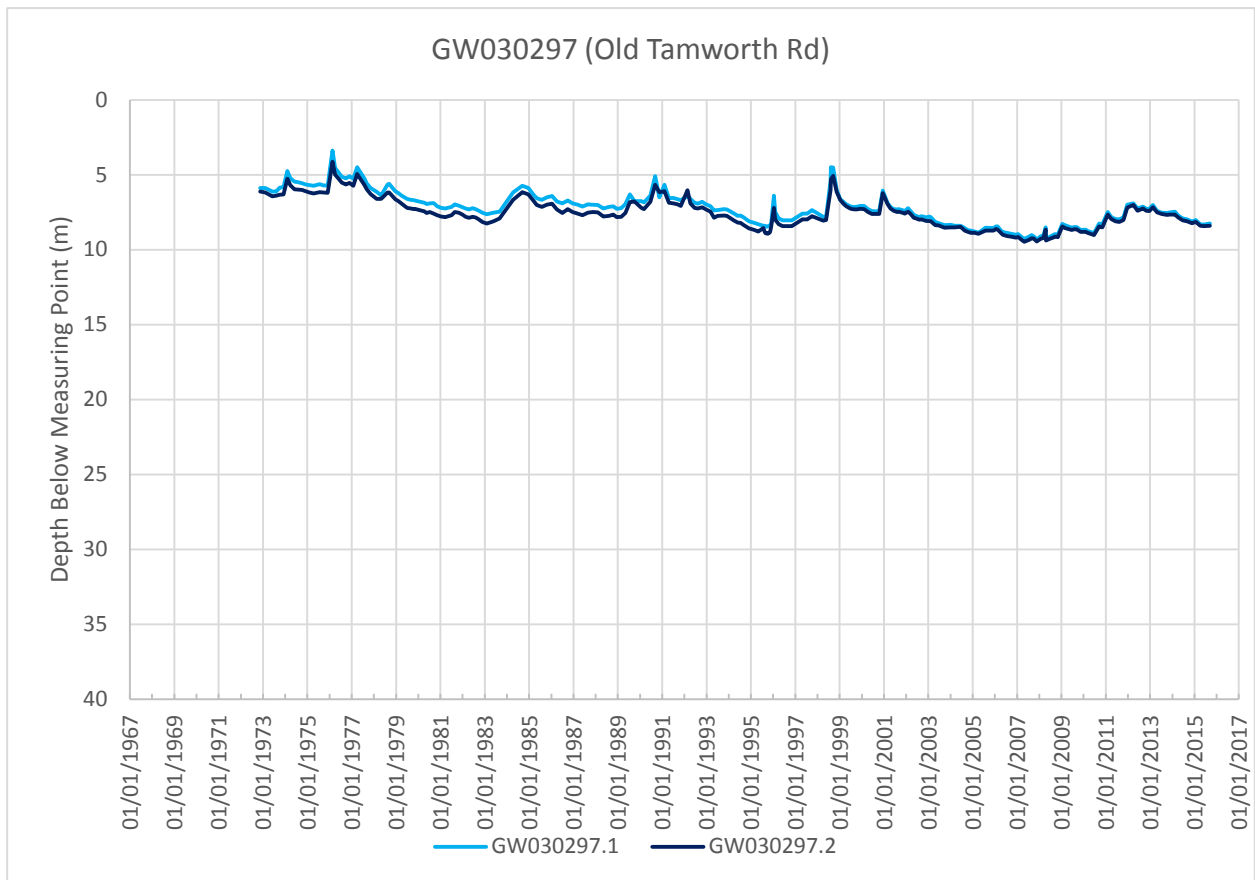
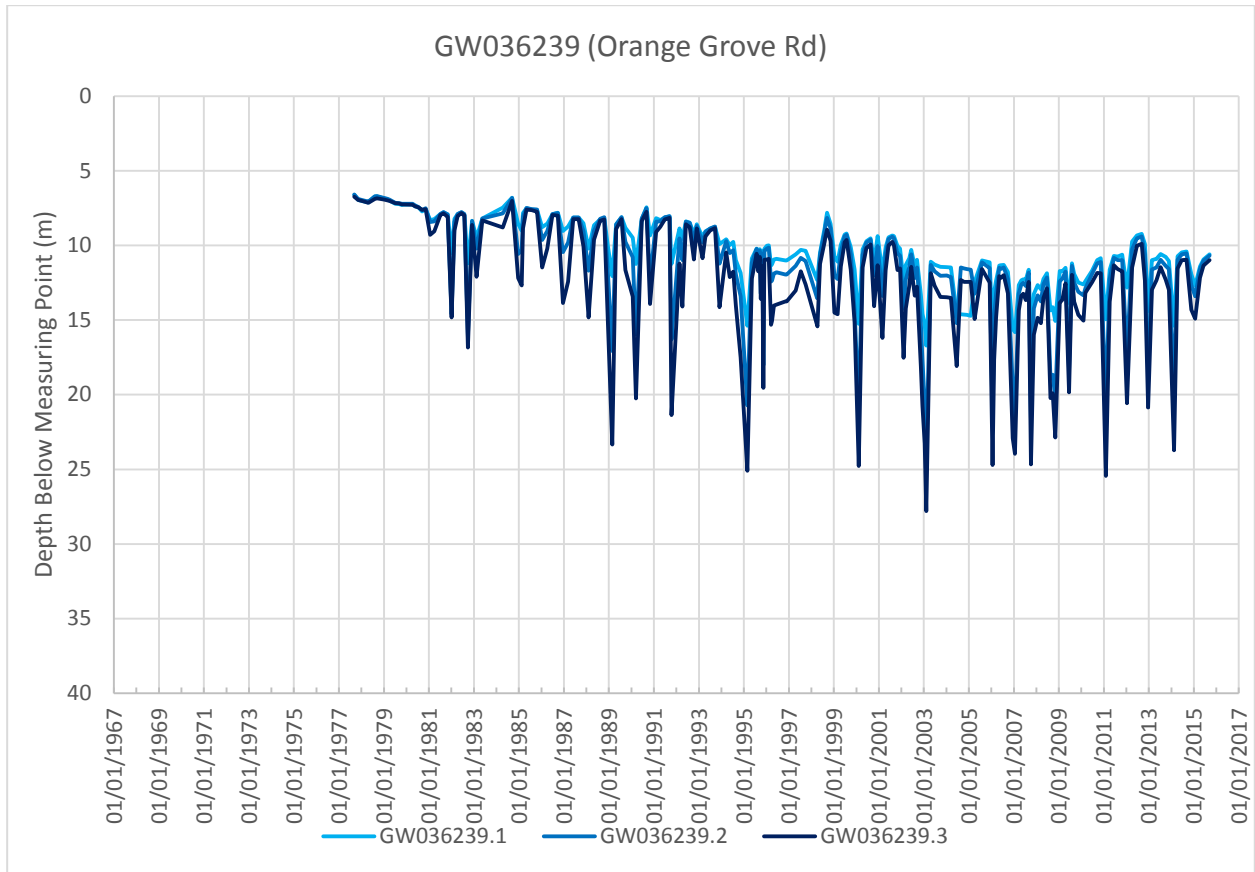
Appendix C – Historical Groundwater Levels

Historical groundwater levels (generally taken 5 – 6 times per year) as measured by DPI Water monitoring bores:

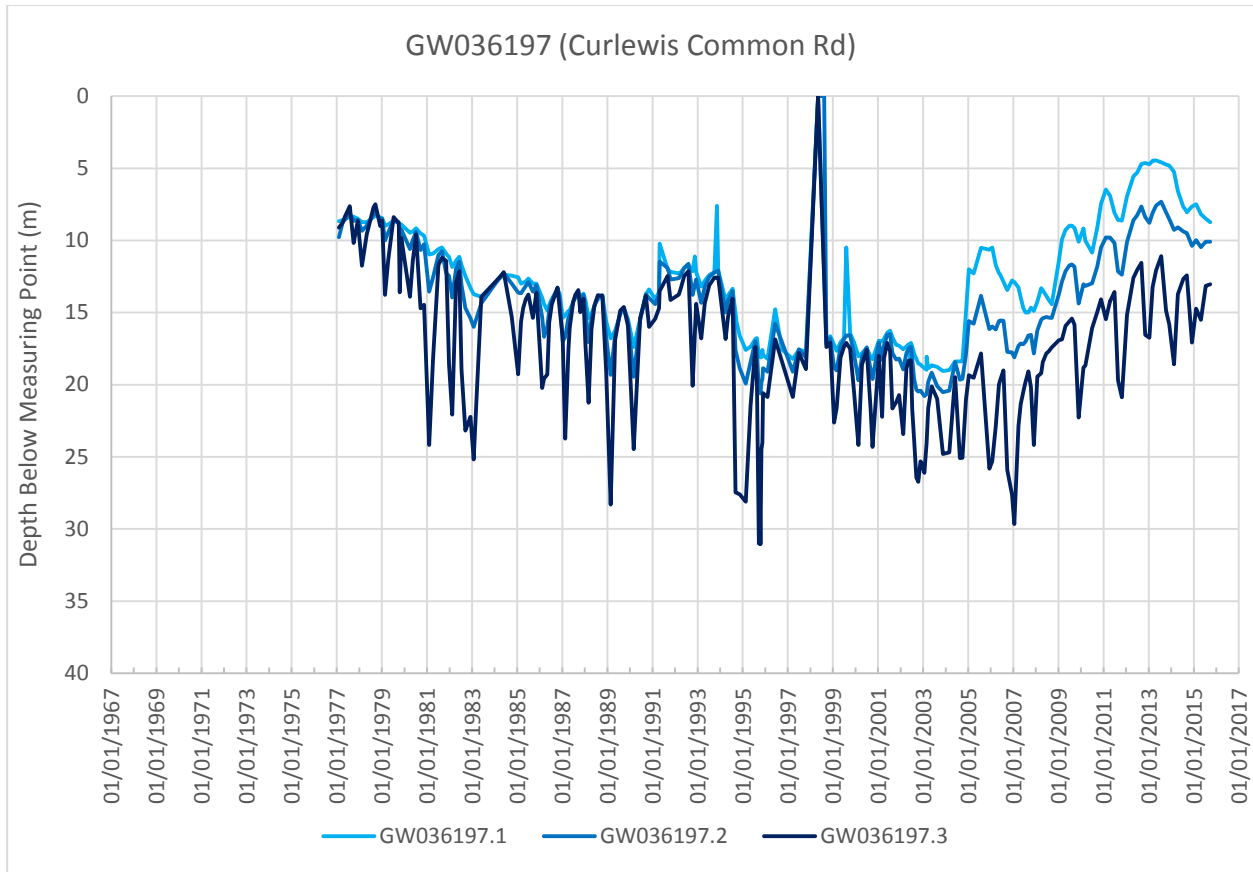
- GW021087 – monitoring bore located on Studdy Lane (Campbell Rd), within the general vicinity of Gunnedah town water bores 3, 4, 5 & 6.
- GW036239 – monitoring bore located on Orange Grove Lane, within the general vicinity of Gunnedah town water bores 7, 8 & 9.
- GW030297 – monitoring bore located on Old Tamworth Rd, around 1 km east of Gunnedah town water bores 1, 2 & 10.
- GW036197 – monitoring bore located at the eastern end of Curlewis Common Rd, around 1.3 km north-east of Curlewis town water bores 1 & 2.



Appendix C – Historical Groundwater Levels



Appendix C – Historical Groundwater Levels



Appendix D Emergency Supply Options

Emergency Supply Options

A summary of the emergency supply options that are available for each water supply system is included below.

Gunnedah

1. *Additional Groundwater Bores*

Additional groundwater bores could be investigated and tested if the existing bores were unavailable. Kelvin Road has been identified as a potential site for future groundwater investigations.

In the event of groundwater contamination affecting all existing bores, consideration should be given to investigating groundwater sites in adjacent groundwater systems / zones. Note that existing bores are located in the Upper Namoi Zone 4 groundwater source (which is generally located north of Gunnedah) and directly to the south and east of Gunnedah lies the Upper Namoi Zone 3 groundwater source.

2. *Pipeline to Keepit Dam (if sufficient water is available)*

The key alternative to sourcing emergency water supply from groundwater is to build a pipeline to Keepit Dam (around 30 km route from the dam to Bore 8). This option is dependent on the water available at the time within Keepit Dam and the upstream Split Rock Dam and whether that water could be put aside for emergency supply purposes. With a design and construction lead-time of at least 18 months, it is likely that other emergency supply options would need to be implemented during this period (see option 1 above).

- DN250 (40L/s) 30km pipeline from Keepit Dam to temporary WTP in vicinity of Bore 8 (possible Booster PS at Dam)
- Temporary package WTP to deliver treated water to existing DN500 trunkmain via existing Booster PS at Bore 8.

3. *River Extraction from Namoi River (if sufficient water is available)*

Alternative to building a pipeline to Keepit Dam is to release flows into the Namoi River and pump from a temporary weir close to Gunnedah. With this option, there is the potential for significant losses to underlying groundwater systems between the dam and Gunnedah.

- Temporary weir across Namoi River (in vicinity of Bore 7 & 8) and release from Keepit Dam and pump from weir river intake at weir to temporary WTP
- Temporary package WTP to deliver treated water to existing DN500 trunkmain via existing Booster PS at Bore 8.

Curlewis / Mullaley / Tambar Springs

1. *Additional Groundwater Bores*

Additional groundwater bores could be investigated and tested if the existing bores were unavailable.

2. *Water carting from Gunnedah*

In the event of a total water failure in these small towns, water could be carted from Gunnedah.

Appendix C – Historical Groundwater Levels