GOLDER
MEMBER OF WSP

REPORT

Hay Local Government Area - Vulnerability Assessment Report

Supporting Hay Shire Council's UPSS Inspection and Monitoring Plan

Submitted to:

Hay Shire Council
134 Lachlan Street
Hay NSW 2711

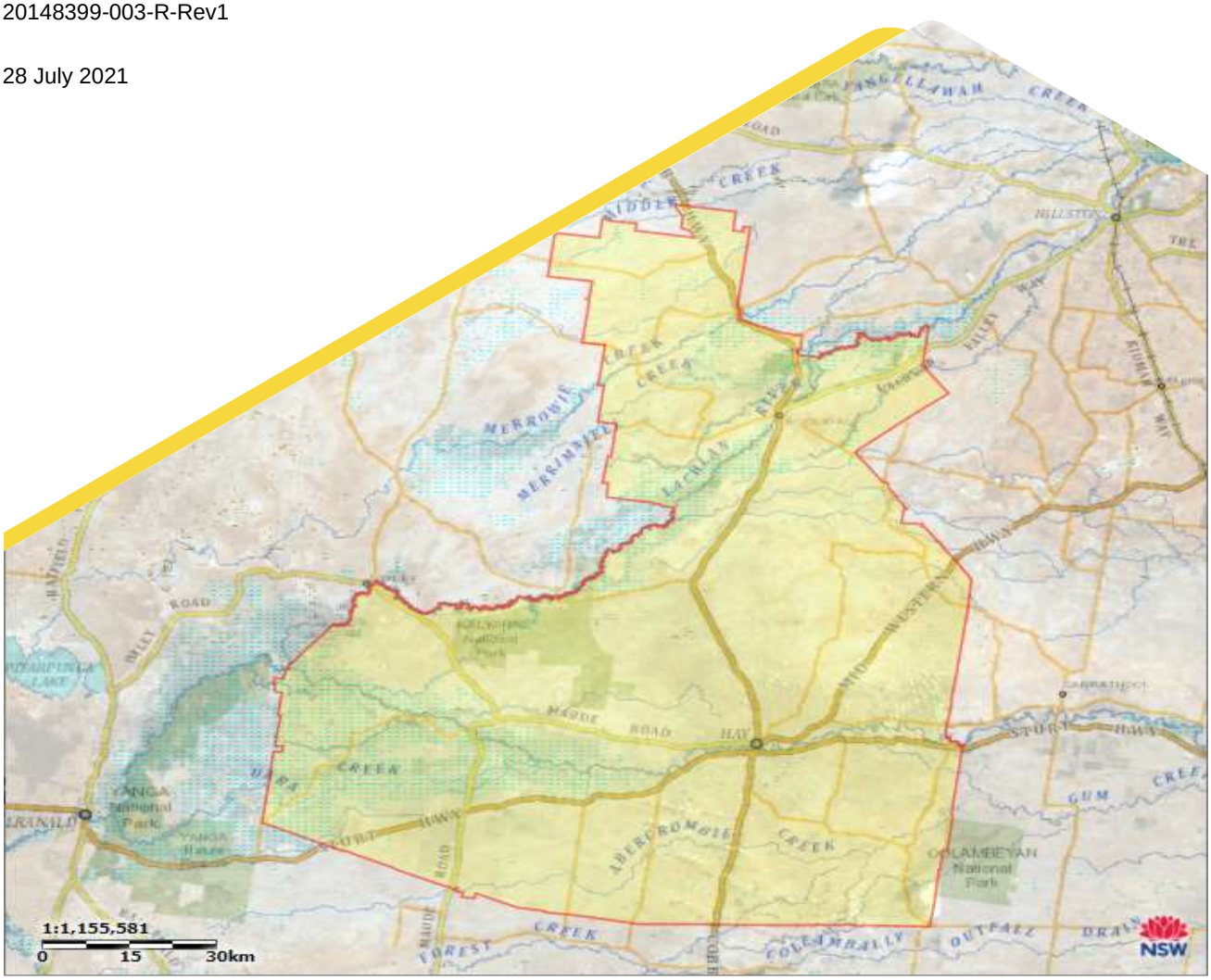
Submitted by:

Golder Associates Pty Ltd
Level 8, 40 Mount Street, North Sydney, New South Wales 2060, Australia

+61 2 9478 3900

20148399-003-R-Rev1

28 July 2021



Distribution List

Jasmine Gregory - Hay Shire Council

Roger McGrath - Hay Shire Council

Jack Terblanche - Hay Shire Council

David Webb - General Manager, Hay Shire Council

Matthew Dudley - RAMJO & REROC CRCB Program

Jacqui Vyner - RAMJO & REROC CRCB Program

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 ABOUT THIS REPORT

This vulnerability assessment report aims to provide information about the environmental and environmental health conditions likely to be encountered in the Hay Shire Council (Council) Local Government Area (LGA). These conditions are useful for Council when considering the potential harm that a leak from an Underground Petroleum Storage System (UPSS) may present to sensitive receptors (environmental and human health). This report serves as a reference guide to assist Council when considering the high-level environmental conditions and settings around operational UPSS Sites. This will assist Council to implement a risk-based approach when carrying out their responsibility for under the *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019* (*UPSS Regulation 2019*).

1.1 How to use this report

This report serves as a reference guide providing desktop information and references from region-wide resources. These regional resources are used to score potential risks for known active UPSS Sites in the LGA. These scores are recorded by Council when they develop their UPSS – Investigation and Monitoring Plan (UPSS-IMP) and utilise the rankings for the UPSS Sites. This risk ranking process is an ongoing process and should continually be updated, utilising site-specific information such as, information gained during onsite UPSS Site inspections, reference to environmental assessment reports, additional UPSS Site improvement works and consideration of changes and updates to local government and source information.

1.2 Maintenance of this report

The information presented in this report is accurate at the time of reporting. The data and information will require maintenance and to be reviewed on a regular basis to ensure any risk management decisions are informed by accurate and up to date information.

2.0 ENVIRONMENTAL CONDITIONS – UPSS

2.1 Local soil types

Based on the information below, sites in the Hay LGA are likely to consist of predominantly **clay** as a surface soil, however, areas of the LGA are also likely to consist of **sandy clays** and/or **sand/gravel** layers. The sand/gravel layers are likely preferential pathways for contaminated groundwater – any contaminated land assessment would require a site-specific assessment to confirm the on-site soil and geological conditions.

Surface soil likely to be encountered in the following towns are:

- **Hay:** Clay
  - *South Hay* (in close proximity to the Murrumbidgee River) was shown to have a soil profile of predominantly grey dermosols (noted as silty **clay**) and alluvial soils. The floodplain profile was noted to be slowly permeable, with poor drainage and high erosion rates, although no salting was evident.
  - *North Hay* was noted to have a soil profile of predominantly self-mulching brown vertosols (silty **clays**)**.** The soil profile was noted to be slowly permeable, with poor drainage and moderate erosion rates, although no salting was evident.
- **Maude:** Clay
  - Maude was noted to have a soil profile of predominantly epipdeal grey vertosols (**clays**) (in close proximity to the Murrumbidgee River). The soil profile was noted to be slowly permeable, with poor drainage and no erosion nor salting evident. Brown sodosols (sandy **clays**) were noted near the Hay Weir.

- **Booligal:** Clay
  - Booligal (in close proximity to the Lachlan River) was noted to have a soil profile of predominantly massive grey vertosols and grey **clays**. The soil profile was noted to be very slowly permeable, with very poor drainage and moderate erosion rates, although no salting was evident.

These soil types were determined from soil profiles sourced from the eSPADE v2.1 (nsw.gov.au)[1] mapping tool, which provides soil profiles from previous investigations and can be used to consider other town centres or areas where a UPSS is identified.

Soils in the area are predominantly vertosols (central), tenosols (alluvial) (southern) and some sections of rudosols to the north west and chromosols in the north, northeast and southeast. This generalised soil information was provided by the MinView mapping tool[2] and adding the Soils -> Australia Soils Classification and outcrop areas layer.

2.2 Regional and local geology

Regional and local geology is important when considering the potential fate and transport of a contaminated groundwater plume following a leak from a UPSS site.

The regional geology in the Hay LGA is dominated by predominantly a surface geology of alluvial floodplain deposits (Cenozoic sedimentary), an alluvial channel (following the meandering Murrumbidgee River) in the southern part of Hay and small pockets of a claypan and lacustrine deposit (Quaternary sedimentary) as well as small pockets of the Lachlan Orogen Ordovician shale (marine deposited) overlying Silurian-Devonian felsic volcanic rocks and granites (characteristic of the Hay-Booligal Zone). The MinView mapping tool (Regional NSW - Mining, Exploration and Geoscience)[3] can be used to determine the surface geology and various geological formations (although it is noted that this tool does not provide any additional supporting information on the geology).

The geological formations in the area can be sourced from the 1:250 000 map provided by Geoscience Australia, link[4].

Further geological information may be sourced from the DIGS Geological Survey of NSW Search[5] (noting the need for a GIS platform on your computer to download and view)

2.3 Acidic soil conditions

There was no acid sulfate soil risk information provided or associated with the Hay LEP.

The likelihood of acidic soil conditions in the Hay LGA is low, but the presence or acid sulfate soils cannot be ruled out particularly for sites within the proximity of creeks and rivers.

The eSPADE v2.1 (nsw.gov.au)[1] mapping tool shows the soil was predominantly clays with the following pH ranges:

- Booligal: 5.0 – 6.5, **low** level of acidic soil.
- North Hay: 5.5 - 6.0, **low** level of acidic soil.

[1] https://www.environment.nsw.gov.au/eSpade2WebApp
[2] https://minview.geoscience.nsw.gov.au/
[3] https://minview.geoscience.nsw.gov.au/#/?lon=144.8459&lat=-34.50766&z=16&bm=bm1&l=ge611:n:100,ge610:n:100,ge69:n:100,ge68:n:100,ge67:n:100,ge66:n:100,ge65:n:100,ge64:n:100,ge63:n:100,ge62:n:100,ge61:n:100,ge612:y:100,wa2:n:100,hi1:n:25,wa1:n:100,wa3:n:100,ut1:n:50,ad0:y:100,so1:n:0,so8:n:100,so9:n:100
[4] https://resourcesandgeoscience.nsw.gov.au/miners-and-explorers/geoscience-information/products-and-data/maps/geological-maps.
[5] https://search.geoscience.nsw.gov.au/product/372

- South Hay - 5.0 - 6.0, **low** level of acidic soil.
- Maude 7.5 - 9.0, slightly alkaline soil, **not acidic** soil.

Typically, the field pH of acid sulfate soil tends to be less than or equal to a pH of 4, however, field pH is a qualitative method that cannot be substituted for laboratory analysis for the identification of acid sulfate soils (ASS). It is noted that pH values between 4 and 5.5 are 'acid and may be the results of some previous or limited oxidations sulfides but is not confirmatory of actual ASS': Acid Sulfate Manual (nsw.gov.au)[6]

2.4 Groundwater conditions

2.4.1 Local groundwater conditions

The local groundwater conditions are unlikely to have an influence on UPSS infrastructure across the Hay LGA due to deep and very deep groundwater aquifers. Site specific information is required to verify the site-specific conditions.

Assessment of site-specific groundwater conditions are the best reference for understanding the following parameters. These should be found in either an UPSS Site's initial groundwater well installation report, ongoing groundwater monitoring event reports, or in the UPSS Site's Fuel System Operation Plan (FSOP).

The groundwater conditions of interest are:

- Depth to the groundwater table (to consider the influence of groundwater in UPSS infrastructure).
- Groundwater flow direction.
- Gradient of the groundwater table.

If a UPSS site does not have groundwater monitoring wells (minimum of 3 required) as part of their Leak Detection System, then regional groundwater information may be useful as a first step in understanding the likely conditions on the UPSS site. Groundwater information from other sites may also be utilised however, the reliability of the information is potentially low unless it is current, and the construction details of the well are also available.

2.4.2 Regional groundwater conditions

The depth to groundwater in the townships listed below have been gained from the publicly available information presented by Water NSW on their website (link[7]). This may be misleading in terms of potential influence or impact a shallow perched groundwater system may have on the degradation of UPSS infrastructure. The Water NSW information is often biased towards deep potable aquifers (as it appears to be in this case). The Water NSW information also does not usually include shallow perched or localised groundwater systems; and the local groundwater conditions of a site should always be used to assess the potential risks to UPSS Site infrastructure, and from petroleum hydrocarbon contaminated groundwater.

However, in the absence of any other site-specific information this information may be a useful starting point so long as the user of the data is aware if the information typically relates to very deep artesian aquifers.

There are also private registered groundwater wells in the Hay LGA presented on the Water NSW website. Not all private groundwater bores are registered by Water NSW The following information has been sourced from the closest groundwater well locations to Hay, Maude and Booligal.

[6] https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/epa/Acid-sulfate-Manual-1998.ashx

[7] https://realtimedata.waternsw.com.au/

Hay: The regional groundwater noted in the records of the closest groundwater well (GWMA002) to the east of Hay (near Carrathool). The depth was generally 36 – 38 metres below ground level (61 - 67 metres AHD). The groundwater flow direction appeared to be to the west at a moderate gradient. Figure 1 shows the current information available for groundwater bore GWMA002. Figure 2 shows the groundwater level at GWMA002 since January 2021 to May 2021 with the groundwater level becoming shallower since March, potentially due to recharge from rain. Figure 3 shows the locations of groundwater bores near South Hay. Figure 4 shows the standing water level for two of these local bores at approximately 11 metres below ground surface (mbgs). This groundwater depth is consistent with that obtained from 2 UPSS Sites in South Hay.

Figure 1: Regional groundwater information - Hay region

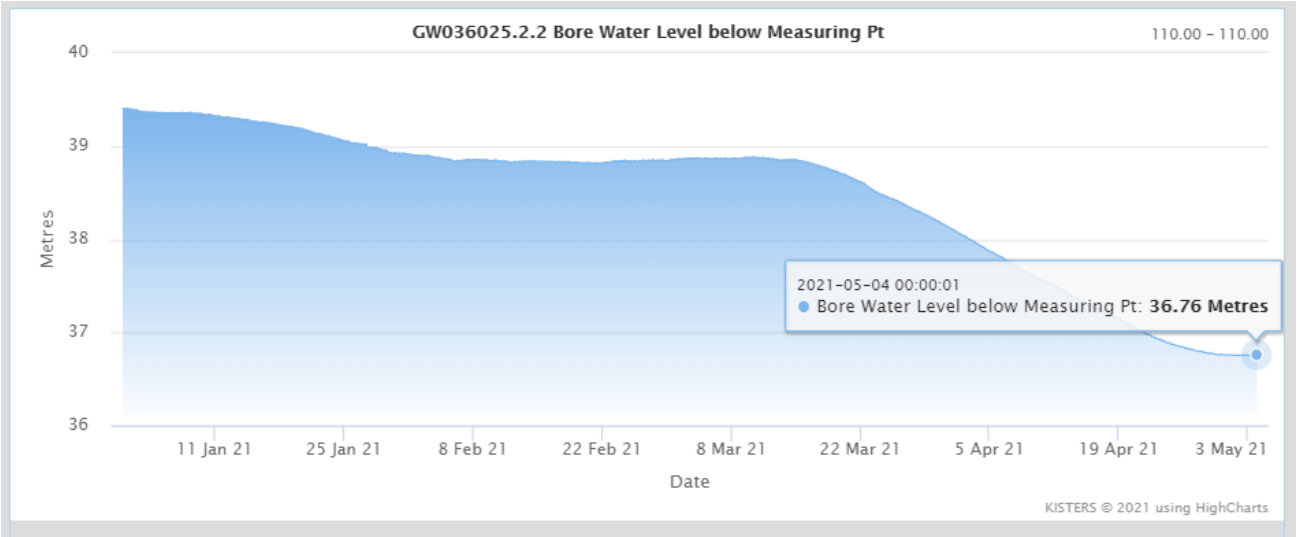


Figure 2: Regional groundwater fluctuation 2021 – South Hay

Figure 3: South Hay local groundwater bore locations

Figure 4: South Hay local groundwater standing groundwater level (meters below ground surface) (GW084036, GW084035)

Maude: No regional groundwater information was available near Maude.

Figure 5 shows groundwater bores south of Maude, across the Murrumbidgee River at 8.2 mbgs, noting that this information is from 1989, hence is of a low reliability to current conditions.

Figure 5: Maude standing groundwater level (mbgs) (GW036797)

Booligal: The regional groundwater information from Water NSW shows that the closest groundwater well is to the northeast of Booligal (GWMA012) near Gunbar. As shown in Figure 6 the latest groundwater level recorded was 27.5 metres below ground level (73.96 mAHD). Figure 7 shows that the groundwater level has been quite stable since 2010 however major fluctuations have been observed since monitoring began. Figure 8 shows some local groundwater bores to the south of the town which are used for stock and domestic

(human consumption potential) purposes. Figure 9 shows the differing values for groundwater depth at locations in this vicinity at 28 mbgs (GW703915) and 16 mbgs closer to the Lachlan River (GM704561).

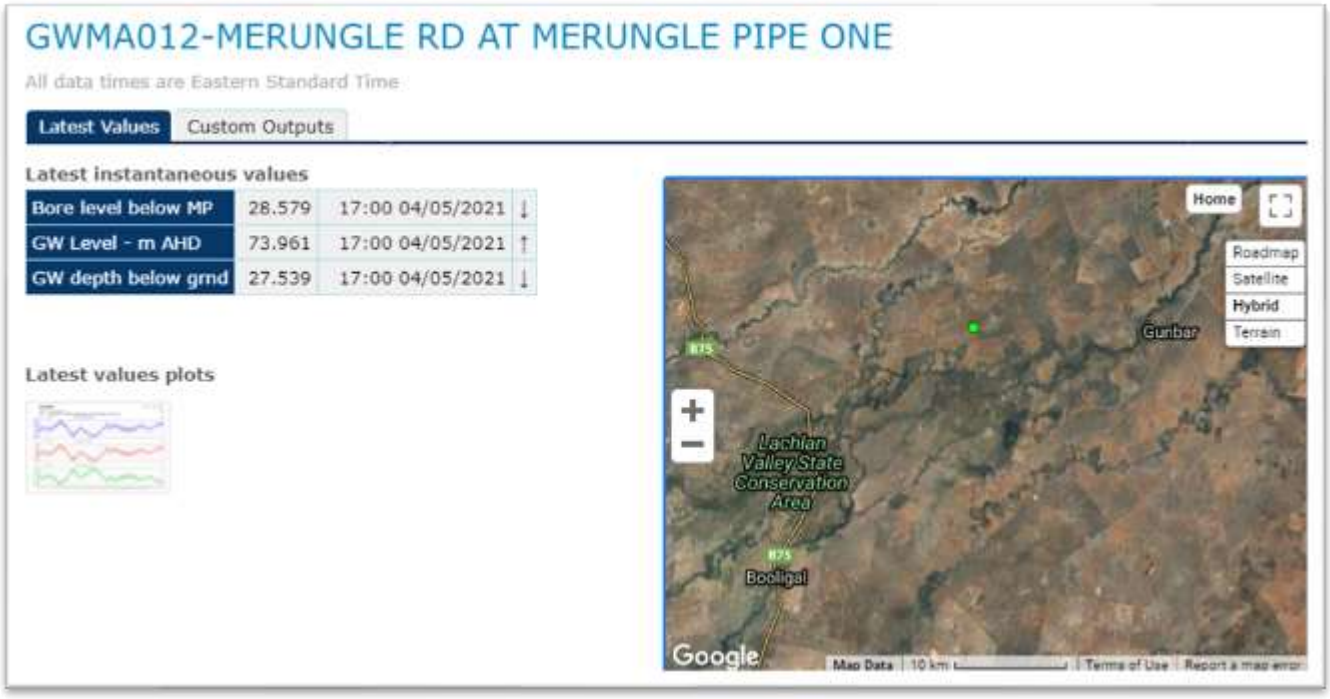


Figure 6: Current groundwater depth for GWMA012

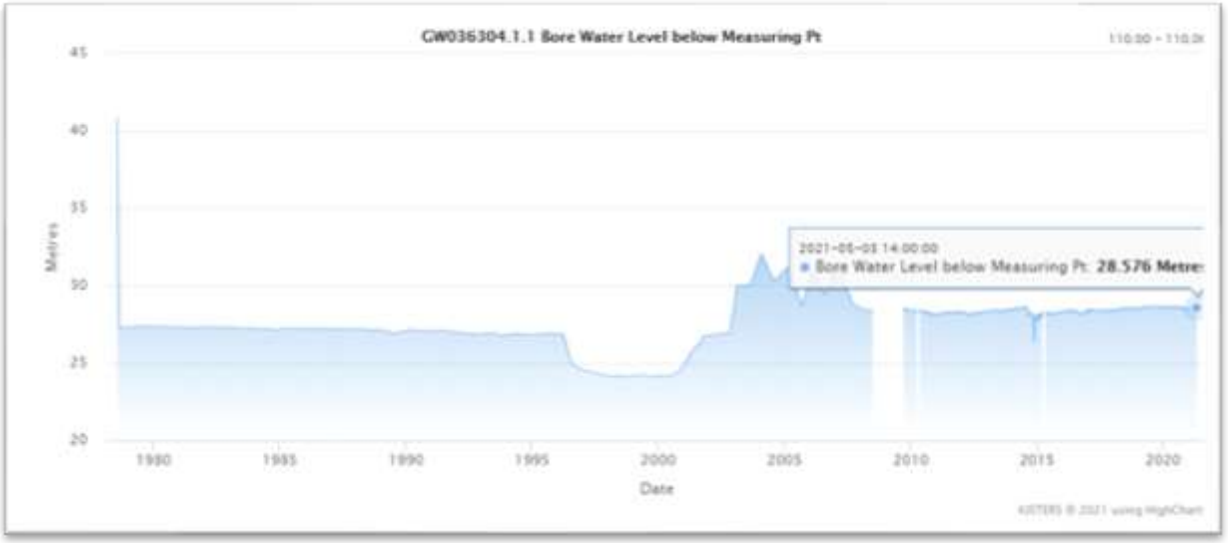


Figure 7: Booligal regional groundwater depth

Figure 8: Booligal - Local groundwater information

Figure 9: Booligal - local groundwater depths

The information obtained in this section was from the Water NSW Real-time water data website. link[8]

2.5 Topography

Hay: The city of Hay appears to be relatively **flat**, with an elevation generally ranging between 89 – 92 metres AHD. The city has a maximum elevation of 110 metres AHD at the area surrounding the Murrumbidgee River to the southeast of the Hay township.

Maude: The township of Maude appears to be relatively **flat** with an elevation generally ranging between 77 – 83 metres AHD, with an increase in gradient to the south. There is an area to the south of the Maude township in close proximity to the Murrumbidgee River which appears to slightly increase in elevation, with a maximum elevation of 91 metres AHD. The elevation subsequently decreases in elevation to the south of the Murrumbidgee River.

Booligal: The township of Booligal appears to be relatively **flat** with an elevation generally ranging between 91 – 96 metres AHD, with the maximum elevation in close proximity to the Booligal Weir.

For the townships of Hay, Maude and Booligal, the majority of the township areas are relatively flat, which would generally indicate a ***'low'*** ranking in regards to the impact upon groundwater conditions and influence on the likelihood of environmental conditions and a UPSS leak occurring.

[8] https://realtimedata.waternsw.com.au/

For more site-specific detail on the UPSS Sites in the Hay LGA the following sources may be useful.

Topographical maps can be sourced from the NSW Spatial Services or displayed over a mapping tool using the Six Maps E-Topo tool. Link: Link[9]. The catalogue of maps can be found at this Link[10].

Topographical maps for Hay, Maude and Booligal are referred to as:
Hay '7828-N' and Illilawa '7829-S' for Hay;
Maude '7729-S'; and
Booligal '7830-S.

Elevation data can also be sourced from Google Earth.

3.0 VULNERABILITY TO VAPOUR INTRUSION

The following information can be used to estimate the potential for vapour intrusion risk from a leaking UPSS in the Hay LGA. Site specific information should be used where available. When not available the settings and conservative conditions below should be used as the default setting.

3.1 Zoning – Vapour Intrusion

The Hay LEP[11] zoning includes land uses which are sensitive when considering the 3 different risk pathways, Vapour intrusion, Drinking Water contamination and Ecological degradation.

Appendix A includes a list of the zones with the land uses arranged and considered against the major risk pathways.

The following Figure 10, Figure 11 and Figure 12 were provided by Council for consideration of the risk to sensitive land zoning 150m radius around the UPSS sites in Hay town centre.

As detailed, all of the UPSS Sites have RU5 'Village' zoned areas which allow sensitive land use with development consent. These sensitive land uses include centre-based childcare facilities; community facilities; dwelling houses; recreation areas; recreation facilities (indoor); recreation facilities (outdoor); respite day care centers; places of public worship and schools.

- **Hay** - The vapour intrusion risk scoring for the Hay UPSS Sites for the land zoning ranking is the highest score for both neighbouring residential sites and residential land settings and zones within 150m of the site boundary. This is due to the presence of residential land settings which neighbour all of the UPSS Sites.

[9] https://maps.six.nsw.gov.au/etopo.html
[10] https://www.spatial.nsw.gov.au/__data/assets/pdf_file/0003/217938/SS_TopoMapCatalogue.pdf
[11] https://www.legislation.nsw.gov.au/view/whole/html/inforce/current/epi-2011-0642#sec.2.1

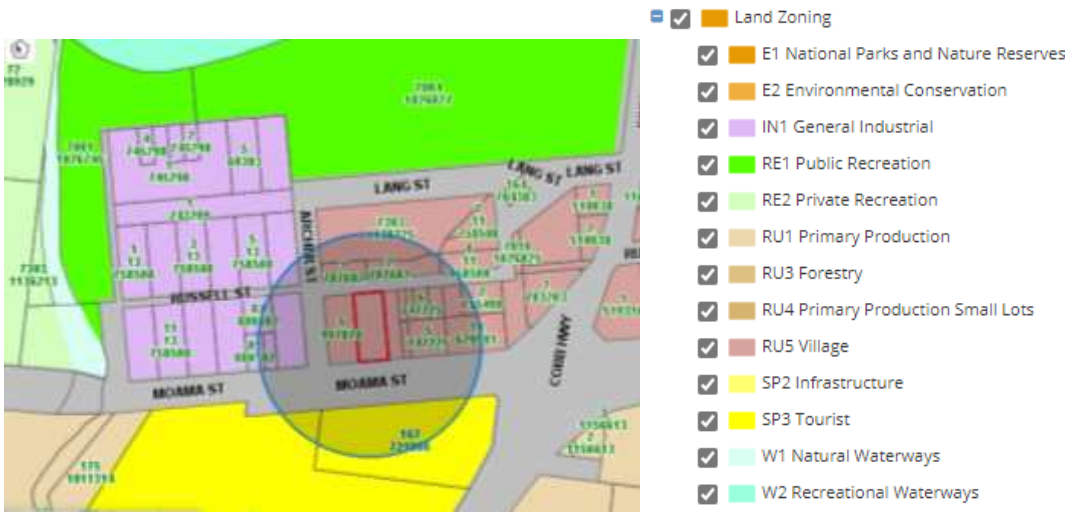


Figure 10: 150m radius from Caltex – Includes Zones: Village, Tourist, General Industrial

Figure 11: 150m radius from Shell – Includes zones: Village and Tourist

Figure 12: 150m radius from 58 Lachlan Street (Atlas Fuels) – Includes zones: Village and Public Recreation

- **Maude and Booligal** – have not been considered in detail with respect to zoning as they do not currently have active UPSS sites. Both towns have residential zones adjacent or nearby the legacy UPSS Sites.

3.2 Groundwater – Vapour Intrusion

3.2.1 Groundwater depth and soil type

Section 2.4 summarises information regarding local and regional groundwater conditions.

Section 2.2 summarises information regarding local soil types likely to be encountered in the town centres.

Note: The relevance and ranking of groundwater depth when considering the consequences of vapour intrusion are different from those when considering the potential impact of groundwater on UPSS infrastructure.

Hay: The depth to groundwater in the closest wells to South Hay were generally 11 mbgs, noting this is not site-specific information. This would indicate that the likely groundwater conditions at Hay is *'Deep'* in regard to the potential vapour intrusion consequence.

Note: The local soil type in Hay is most likely clay. Hence, the vapour intrusion risk to residential neighbours from a contaminated groundwater plume would likely be low – however, further site-specific information is required to inform this ranking prior to forming any decision. This information would include groundwater flow direction, gradient, and the speed at which a groundwater plume may move.

Maude: The depth to groundwater in the closest wells to Maude was approximately 8 mbgs, noting this is not site-specific information and is of low reliability. This would indicate that the likely groundwater conditions at Maude are *'Medium'* in regard to the potential vapour intrusion consequence.

Note: The local soil type at Maude, is most likely clay. Hence, the vapour intrusion risk to residential neighbours or sensitive human receptors (if any) from a contaminated groundwater plume would likely be low – however, further site-specific information is required to inform this assessment. This information would include groundwater flow direction, gradient, and the speed at which a groundwater plume may move.

Booligal: The shallowest depth to groundwater in the closest wells to Booligal was generally 16 metres below ground level. This would indicate that the likely groundwater conditions at Booligal are *'deep'* in regard to the potential vapour intrusion consequence.

The local soil type at Booligal, is most likely clay. Hence, the vapour intrusion risk to residential neighbours or sensitive human receptors (if any) from a contaminated groundwater plume would likely be low – however, further site-specific information is required to inform this assessment. This information would include groundwater flow direction, gradient, and the speed at which a groundwater plume may move.

3.3 Sensitive Points of Interest – Vapour Intrusion

One of the essential elements of a conceptual site model (as per the EPA guidelines) is to identify the list of sensitive receptors or sensitive 'points of interest (POI)' and their proximity to the UPSS site, as these sensitive POIs which might be affected by any known or potential sources of contaminations. Figures 13 to 15 and the NSW SEED[12] portal contains some POI and the UPSS sites which can be reviewed for proximity and sensitivity.

Further examples of web tools that can assist in locating sensitive POIs include:

- Childcare centres: Link[13]
- Parks: Link[14]
- Schools: Link[15]
- Health Services (including hospitals, aged care): Link[16]

- **South Hay:** Figure 13 shows that the UPSS Sites are isolated from these Points of Interest, which are all greater than 150m away from the site boundary.

Figure 13: Points of Interest - South Hay

[12] https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
[13] http://childcarensw.com.au/
[14] https://maps.six.nsw.gov.au/etopo.html
[15] https://schoolfinder.education.nsw.gov.au/
[16] https://www.parking.health.nsw.gov.au/

- **North Hay** – Figure 14 shows that there are sensitive Points of Interest surrounding the UPSS site. These include recreational areas such as Stuart Park, Lions Park and Hay Skatepark.

Figure 14: North Hay - Points of Interest

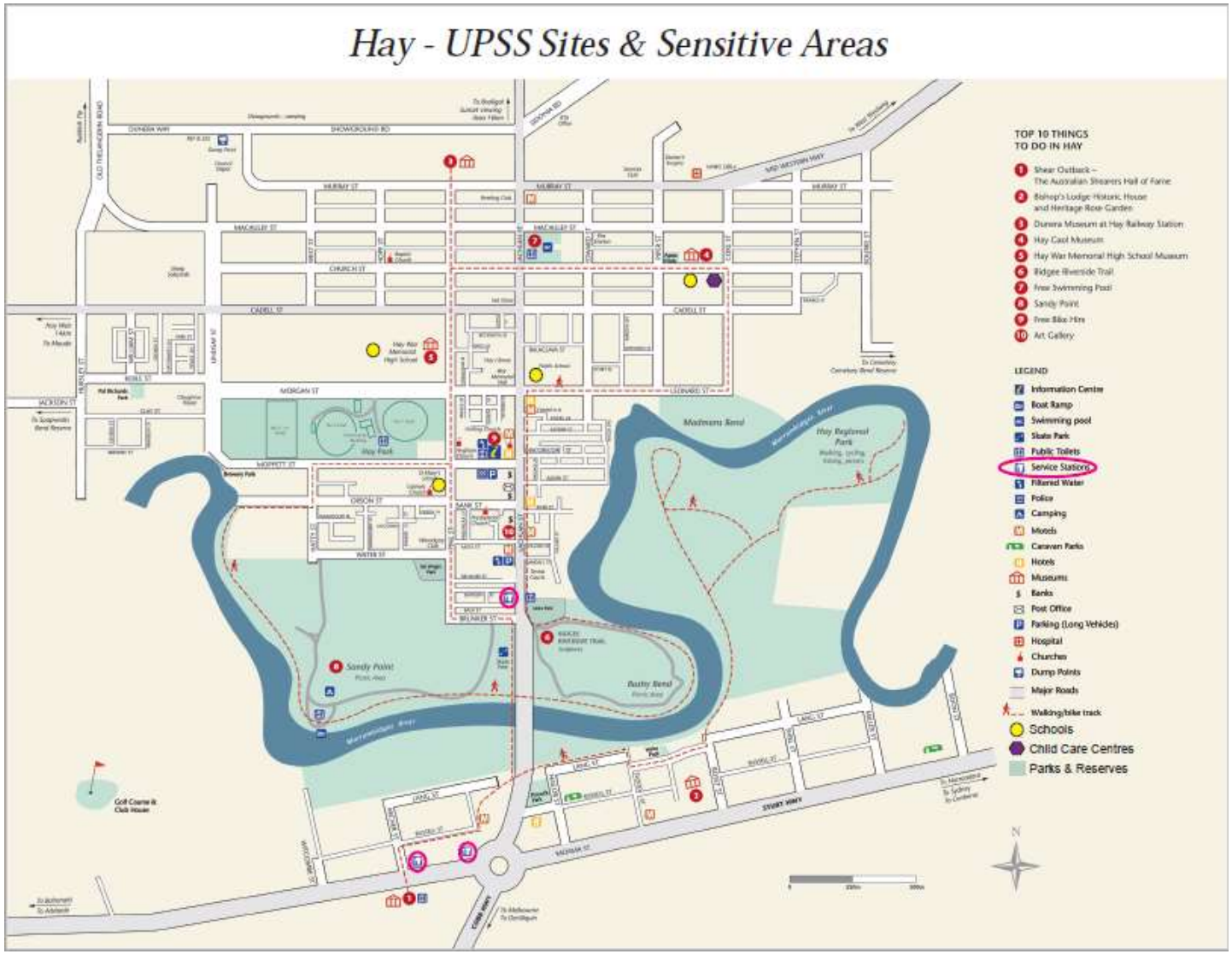


Figure 15: Hay township - Schools, Childcare centres, Health Services and Parks

4.0 VULNERABILITY TO DRINKING WATER CONTAMINATION

A reticulated drinking water supply is provided by Council for the town of Hay. The extent and management of the drinking water supply is detailed in the report, Risk-Based Drinking Water Management System (Hay Shire Council) (V2.1 December 2015) Appendix B. Information from this report is utilised in the following sections of this report. A map of the extent of the reticulated water supply is presented in Figure 16.

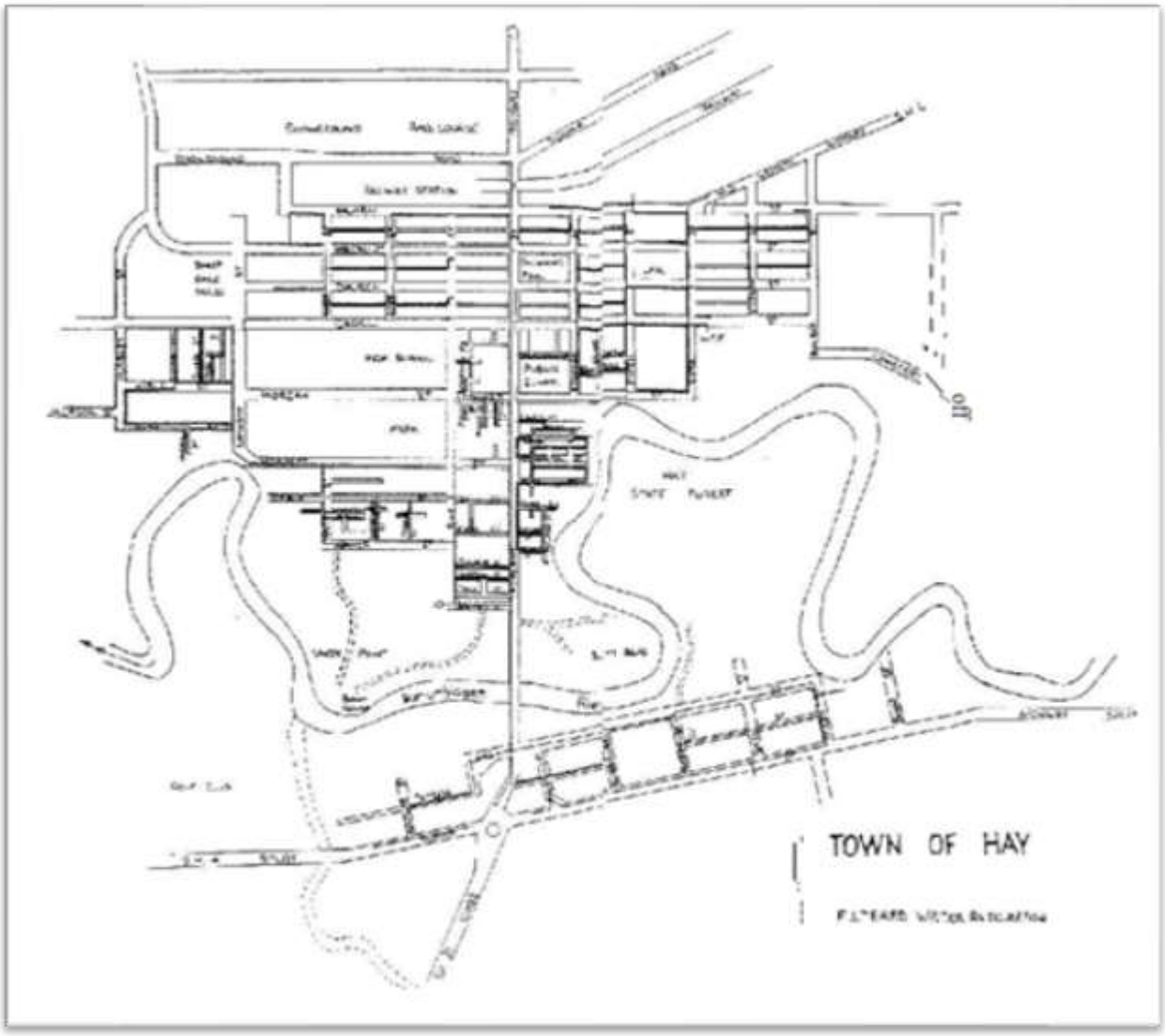


Figure 16: Areas of reticulated water supply in Hay

4.1 Drinking Water - River source water

- **Hay:** Source water is drawn from the Murrumbidgee River for both potable and non-potable water supply systems. The offtake for the potable supply is located at the Leonard Street Pump Station (Figure 17).

Figure 17: Murrumbidgee River off-take (Leonard Street Pump Station)

Figure 18: Water Supply Offtakes on the Murrumbidgee River (Source: Six Maps)

The known operational UPSS Sites in the town of Hay are all downstream of the source water offtakes (Figure 18). Hence, any impact on the river from contaminated groundwater seepage associated with the UPSS Sites is unlikely to enter the source water supplies.

- **Maude and Booligal:** The Risk-Based Drinking Water Management System (from Hay Shire Council) (V2.1 December 2015) Appendix B states (page 13) that '*towns of Maude and Booligal are not*

connected to the reticulated water supply. These towns are supplied by rainwater and/or privately owned groundwater bores.'

4.2 Drinking water catchments

The Catchment for the Murrumbidgee River upstream of both the Leonard Street and Murray Street Pump Stations is relevant as a potential area of contamination if a large surface spill were to impact the catchment. This is not relevant to this study which is focused on leaking UPSS Sites. The nearest known operational UPSS Site upstream of the Hay Drinking Water river offtake is at Darlington Point which is over 110 km away. Dilution, dispersion, volatilisation and degradation of petroleum hydrocarbons associated with a potential UPSS contamination event, if it were to impact the river, would be unlikely to have an impact on the Hay Drinking Water supply.

The Hay Weir is located approximately 25 downstream of the town of Hay (Figure 19). Its purpose is to capture and regulate river water flows for local agricultural (irrigation) and industrial uses and potentially domestic use further downstream. The waters of the Weir are also an important local recreational fishing area. Hence, there is the potential for an impact to the waters, and aquatic biota (fish) which are utilised downstream from Hay, and at the Hay weir. Further information regarding the locations of water extraction locations and the use of water is not considered a priority for this assessment, however it is worth Council being aware of the uses that may be occurring downstream from the town in the event of a contamination incident.

Figure 19: The location of the Hay Weir on the Murrumbidgee River, downstream from Hay

4.3 Groundwater aquifers

The hydrogeology of the area can be sourced from the Murray Basin Hydrogeology Map Series, Hay (link[17]), Booligal (link[18]), NSW from Geoscience Australia (Commonwealth of Australia). These maps provide

[17] https://d28rz98at9flks.cloudfront.net/16750/16750_Hay.jpg

[18] https://d28rz98at9flks.cloudfront.net/16654/16654_Booligal.pdf

information on the aquifers in the area, including depth to water table and aquifer quality (salinity). productivity and thickness.

- **Hay:** The map indicates (Figure 20) that the aquifer in the Hay area is predominantly unproductive with variable yields, which are predominantly low. Salinity is also variable (between 1500 mg/L and >3000 mg/L), however is likely above the Australian Drinking Water Guideline of 180 mg/L for sodium and 500 mg/L for total dissolved solids (TDS) and in the undrinkable (without treatment) range of > 1000 mg/L. The Hay LGA was noted to have a water table depth range of approximately 12 to 21 metres below ground level.

HYDROGEOLOGICAL CHARACTERISTICS

SALINITY /YIELD SHALLOW AQUIFER	MAP AREA (SEE FIG. 8)	AQUIFER	DEPTH TO WATERTABLE (M)	AQUIFER THICKNESS (M)	APPROXIMATE STORATIVITY	APPROXIMATE HYDRAULIC CONDUCTIVITY (M/D)	COMMENTS
4,1 / 5,1	HAY	TQs	12–21	20–50	.01–.05	1–10	Relatively unproductive with available yields generally less than 5 l/s. Slightly higher yields may be obtainable in localised areas. Salinity is mainly in the range 1500 – 3000 mg/l but exceeds 3000 mg/l in the north.
3,4 / 4,3		Tpc		20–50	.0001	20–40	This area marks the western extent of the main part of the Calivil Fm. and water salinity is in the range 1000 – 3000 mg/l. Yields above 50 l/s can be obtained only in the eastern part of the area.
2,4 / 5,4		Ter		200–250	.0001	50–100	Salinity in the southern part is less than 1500 mg/l and less than 1000 mg/l in a large proportion. Salinity increases to the north with a small area near the sheet margin having water exceeding 3000 mg/L. Yields over 50 l/s are commonly available.

Figure 20: Hydrological Characteristics of the aquifers in the vicinity of Hay

- **Maude:** The map indicates (Figure 21) that the aquifer in the Maude area is shallow (4 to 14 mbgs) in places and can produce water that is of potable salinity and sufficient in quantity for use as a local water supply.

HYDROGEOLOGICAL CHARACTERISTICS

SALINITY /YIELD SHALLOW AQUIFER	MAP AREA (SEE FIG. 8)	AQUIFER	DEPTH TO WATERTABLE (M)	AQUIFER THICKNESS (M)	APPROXIMATE STORATIVITY	APPROXIMATE HYDRAULIC CONDUCTIVITY (M/D)	COMMENTS
2,2	MAUDE	TQs	4–14	40–50	.01	1–5	Salinity is less than 1000 mg/l and there are indications (not shown on map) of some water with less than 500mg/l. The water table is shallow and mounded and it is clear that it is an area of local recharge at a rate sufficient to overcome the upward flow from the regional groundwater discharge conditions

Figure 21: Hydrological Characteristics of the aquifers in the vicinity of Maude

- **Booligal:** The map indicates (Figure 22) that the aquifer in the Booligal area in the vicinity of the Lachlan River, with which Booligal is associated, can produce water that is of potable salinity and is an important recharge (groundwater storage) area for the Lachlan River system. The aquifer in the area of Booligal is shallow to very deep (5 to 30 mbgs).

SALINITY/ YIELD	MAP AREA (see Fig. 7)	AQUIFER	DEPTH TO WATERTABLE (m)	AQUIFER THICKNESS (m)	STORATIVITY	HYDRAULIC CONDUCTIVITY (m/d)	COMMENTS
2,1 / 5,2	Lachlan	TQs	5–30	40–50	0.01	1–5	Main recharge area associated with Lachlan River system
2,4 / 6,2		Tpc		50–80	0.0001	50–100	Recharge from Lachlan River, especially in NE part
2,4 / 7,4		Ter		130–300	0.0001	50–100	Main deposits of initial Lachlan drainage system. Important irrigation source in NE part where salinity is low

Figure 22: Hydrological Characteristics of the aquifers in the vicinity of Booligal

4.3.1 Bore water use

Council reticulated water supplies are not provided to townships such as Maude or Booligal.

There is a possibility that groundwater sourced in these areas may be used for human consumption. Available information on the registered bores is:

- **Maude:** The two groundwater bores identified in Section 2.4.2 are a monitoring bore (GW036797) and a Groundwater exploration bore (GW036845). The Water NSW Work Summary information (Figure 23) indicates that neither are used for domestic purposes: GW36845 is Groundwater Exploration bore and GW036797 is a monitoring bore.

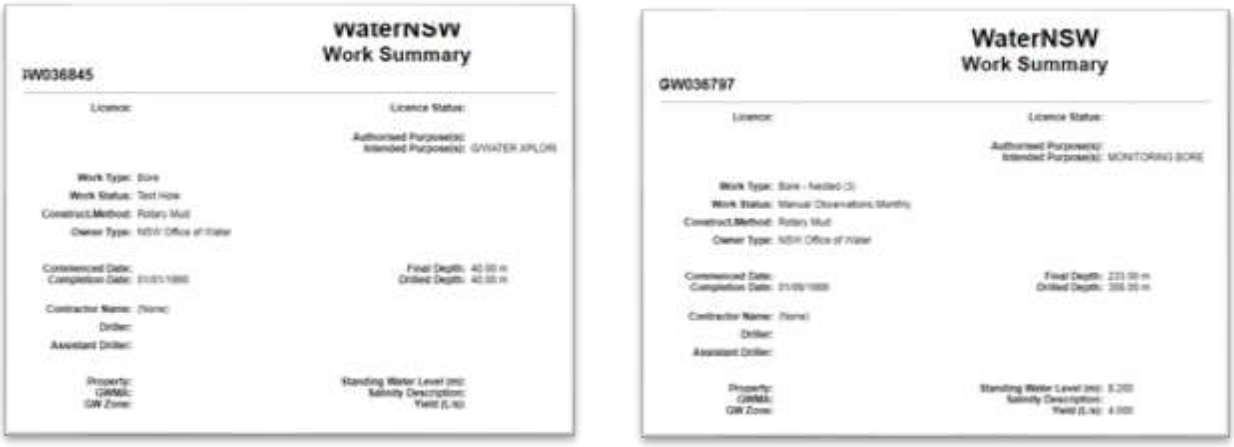


Figure 23: Water NSW Work Summaries for groundwater bores located near Maude

- **Booligal:**

A groundwater well in Booligal GW703908 is recorded as a “test bore, town-water supply.”

There are potentially 2 legacy service stations in Booligal. The purpose and functioning of the bore and any function it serves for town water should be clarified with the local water utility or internally within Council.

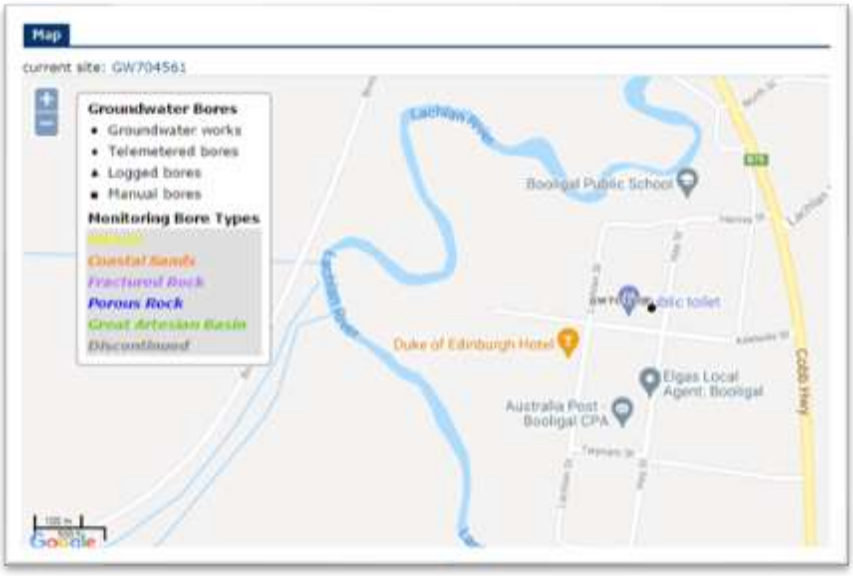
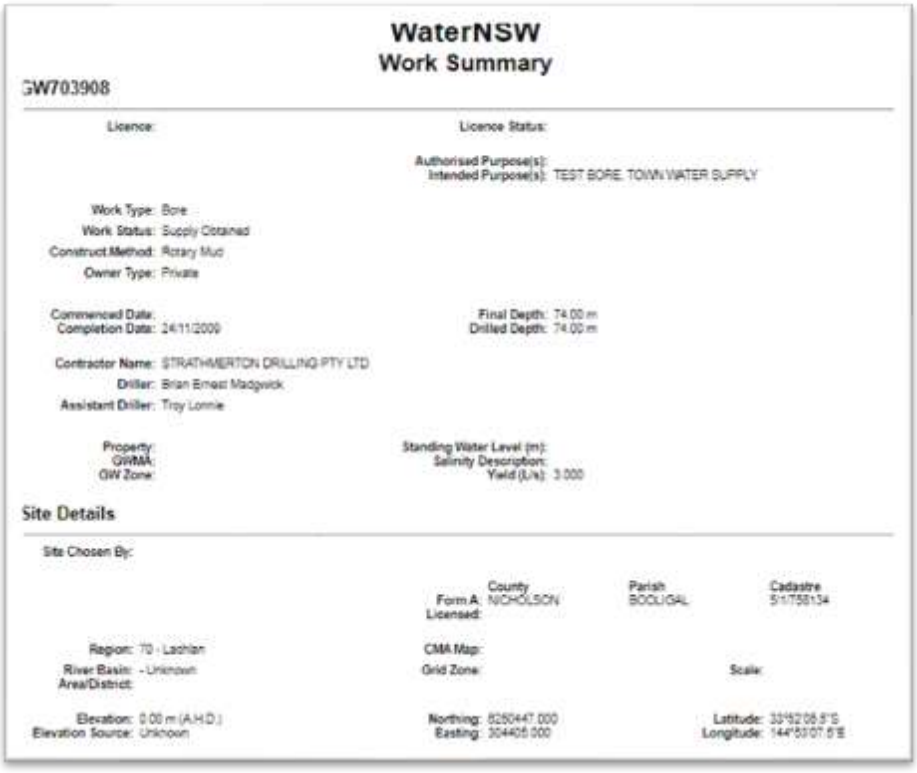


Figure 24: Groundwater bore locations - Booligal



WaterNSW
Work Summary

GW703908

Licence:
Licence Status:
Authorised Purpose(s):
Intended Purpose(s): TEST BORE. TOWN WATER SUPPLY
Work Type: Bore
Work Status: Supply Obtained
Construct.Method: Rotary Mud
Owner Type: Private
Commenced Date:
Completion Date: 24/11/2009
Final Depth: 74.00 m
Drilled Depth: 74.00 m
Contractor Name: STRATHMERTON DRILLING PTY LTD
Driller: Brian Ernest Madgwick
Assistant Driller: Troy Lonnie
Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s): 3.000

Site Details

Site Chosen By:
Form A Licensed:
County: NICHOLSON
Parish: BOOLIGAL
Cadastre: 5//758134
Region: 70 - Lachlan
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:
Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6250447.000
Easting: 304405.000
Latitude: 33°52'06.5"S
Longitude: 144°53'07.5"E

Figure 25: Water NSW Work Summary for a bore located near Booligal

4.3.2 Private water suppliers

Private Water suppliers in the Hay LGA have not been identified.

The Local Public Health Unit – Murrumbidgee - LINK[19] may be able to assist via direct contact to identify private water suppliers. If you suspect there may be a contamination issue and a private water supply may be impacted liaison with the local public health unit is recommended.

MLHD-Publichealth@health.nsw.gov.au, 1300 066 055

Caravan parks and campgrounds are recognised (by NSW Health) as locations with a higher likelihood to have a private water supply. The State Environmental Planning Policy No 21-Caravan Parks - Anzlic_Dataset - SEED (nsw.gov.au) applies across all Council areas. As such Council should utilise their planning and assessment information and team to understand if these sites are likely, licensed, approved (or prohibited) to provide a private water supply.

[19] https://www.mlhd.health.nsw.gov.au/our-services/environmental-health

5.0 VULNERABILITY TO ECOLOGICAL DEGRADATION

Ecological receptors are all vulnerable to degradation from petroleum hydrocarbon contamination.

Areas which are particularly sensitive or are protected and or highly values are:

- Surface water bodies
- National parks
- Environmentally protected areas (zone)
- Wetlands
- UPSS sensitive zones

The following sections identify areas in the Hay LGA that are potentially sensitive and vulnerable to degradation if they are impacted by contamination.

5.1 Zoning - Environment

The Hay LEP[20] zoning includes land uses which are sensitive when considering the 3 different risk pathways, including **Ecological degradation**.

Appendix A includes a list of the zones that are relevant are to ecological protection and would be prone to degradation from petroleum contamination. In summary, these are:

- **SP3** Tourist – (Ecotourism is noted)
- **E1** National Parks and Nature Reserves
- **E2** Environmental Conservation
- **W1** Natural Waterways
- **W2** Recreational Waterways

The Zoning diagrams

- **Hay**: Figure 10, Figure 11and Figure 12 detail that the UPSS Site in North Hay is within the proximity of land zoned RE1 Public Recreation. The zoning aims to protect and enhance the natural environment and allows for environmental facilities with consent and environmental protection works without consent.
- **Maude and Booligal** – have not been considered further with respect to zoning as they do not currently have active UPSS Sites.

5.2 UPSS Sensitive Zones

UPSS sensitive zones are shown on the Council map – LINK[21], Appendix C.

The main zone UPSS sensitive zone in the Hay LGA are the areas directly surrounding the Murrumbidgee River and Lachlan River. These are the potential receiving waters for uncontrolled stormwater forecourt run-off from UPSS Sites.

The stormwater systems of each individual UPSS Site should be considered to determine any risk to the local rivers or waterways from uncontrolled stormwater runoff from UPSS Sites.

[20] https://www.legislation.nsw.gov.au/view/whole/html/inforce/current/epi-2011-0642#sec.2.1
[21] https://www.epa.nsw.gov.au/-/media/epa/corporate-site/resources/clm/lgas/hay.pdf?la=en&hash=91C129B997112DBE5A3D3D96710760A4B7466ADC

5.3 Surface Water

- **Hay and Maude**: The major nearby surface water receptor is identified as the Murrumbidgee River, a tributary of the Murray River, located to the south of the towns of both Hay and Maude. The Murrumbidgee River flows in a westerly direction connecting with the Lachlan River near Oxley (between Hay and Balranald).
- **Booligal:** The surface water receptor identified is the Lachlan River to the immediate west of Booligal.

5.4 Groundwater Dependent Ecosystems

Groundwater dependent ecosystem information can be sourced using the link: Link[22].

- **Hay:** The mapping tool shows the town of Hay with a high probability of GDEs around the Murrumbidgee River, an abundance of non-native vegetation in the city of Hay and low probability GDE in the greater surrounding area to the north, west and south of the town of Hay.

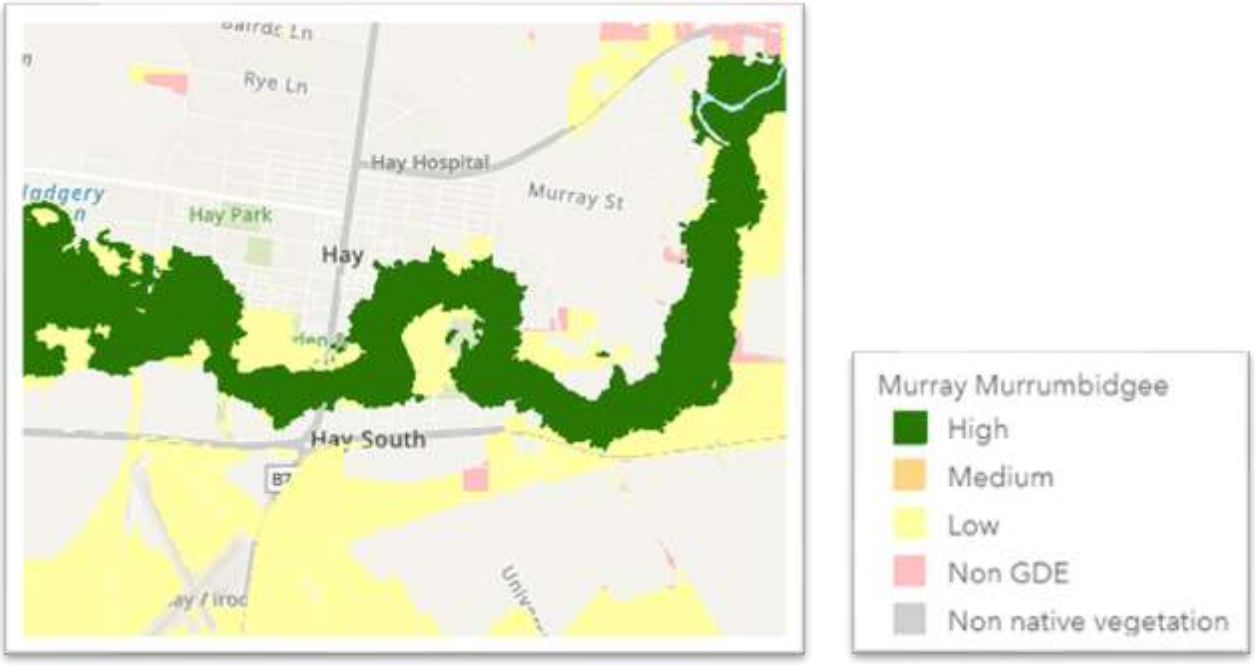


Figure 26: Hay - Groundwater dependent ecosystems

[22] https://spatial-portal.industry.nsw.gov.au/portal/home/item.html?id=a3a671e8825c47238d6808239ce53d9f

- **Maude**: The mapping tool shows the town of Maude with a high probability of GDEs around the Murrumbidgee River, some non-GDE areas associated with the town areas and low probability GDE in the greater surrounding area to the north, south of the town of Maude.

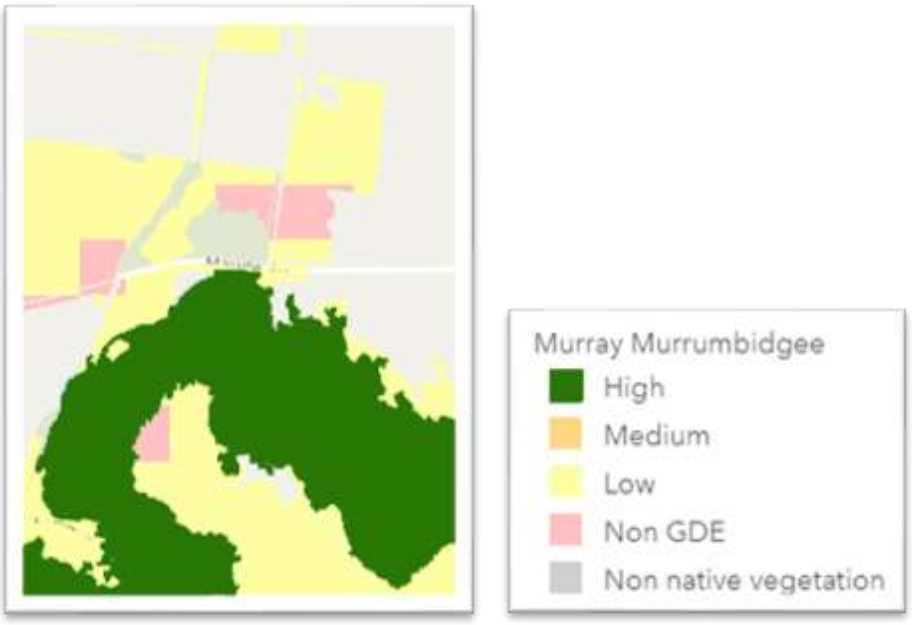


Figure 27: Maude - Groundwater dependent ecosystems

- **Booligal -** The mapping tool shows the town of Booligal with a high probability of GDEs around the Lachlan River, with non-GDE and non-native vegetation areas in the greater surrounding area to the east and west sides of the town of Booligal and the Lachlan River.

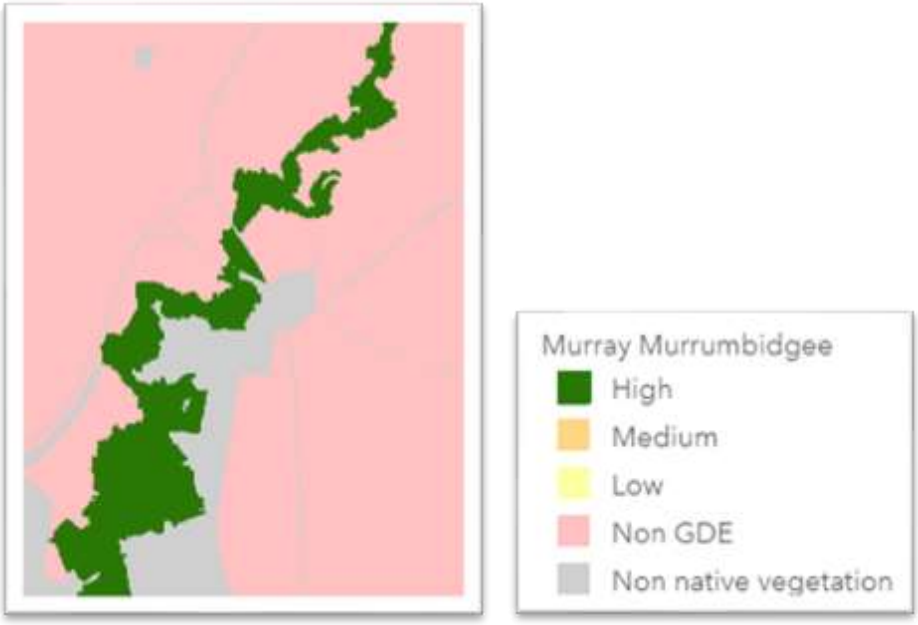


Figure 28: Booligal - Groundwater dependent ecosystems

5.5 National Parks, State Forest

National Parks can be confirmed using the NSW National Parks website: Link[23].

National Parks in the Hay LGA include the Lachlan Valley National Park and Kalyarr National Park, none of which are in close proximity to the town centres where there are known operational UPSS Sites.

5.6 Wetlands

The Hay Council LEP includes maps of Wetlands (Link[24]) for which the objective of the LEP is to "*ensure that the wetlands are preserved and protected from the impacts of development.*"

- The Hay (Figure 29), Maude (Figure 30) and Booligal (Figure 31) areas all show wetland areas which would potentially be impacted from uncontrolled stormwater discharges from UPSS Sites, as discussed above in Section 5.2.

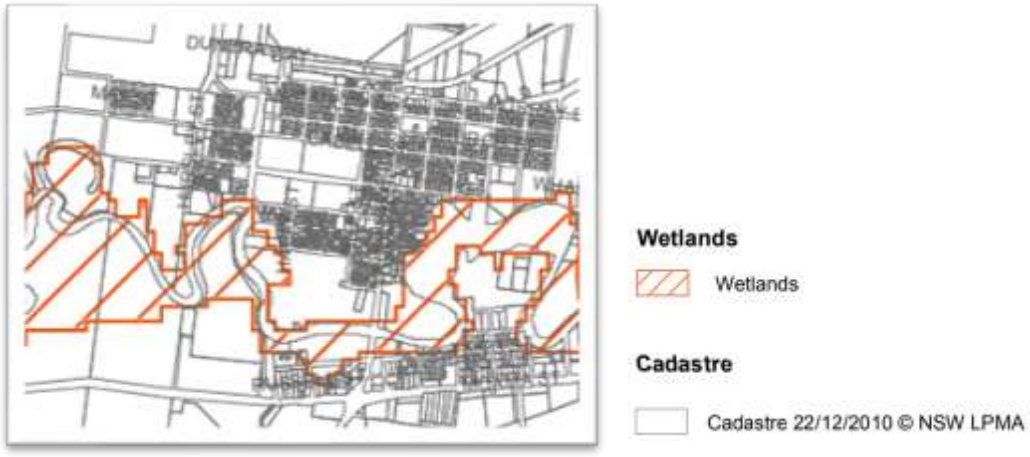


Figure 29: Hay – areas identified as wetland areas for preservation and protection

[23] https://www.nationalparks.nsw.gov.au/nsw-state-map

[24] https://www.legislation.nsw.gov.au/view/html/inforce/current/epi-2011-0642/maps#NRW

Figure 30: Maude - areas identified as wetland areas for preservation and protection

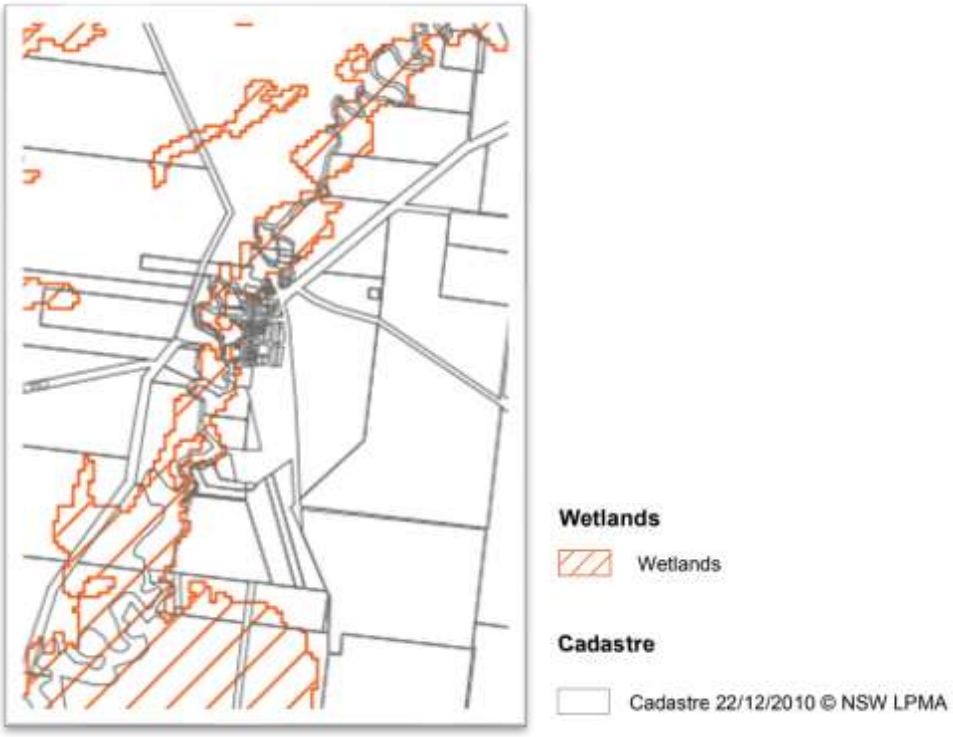


Figure 31: Booligal - areas identified as wetland areas for preservation and protection

6.0 CONCLUSION

The information gathered and presented above is a snapshot of the local environmental conditions which can be used to determine potential risks to environmental assets (e.g. source drinking water, residential land, protected natural environments) and areas of environmental vulnerability (national parks and parkland).

The information is accurate at the time of reporting, however, is prone to change as the resources from which the information is drawn is updated, re-evaluated or studied in greater detail. Hence, this report should only be used as a general guide when seeking to understand the vulnerability of the local and surrounding environment regarding contamination from a UPSS Site.

7.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled - “Important Information Relating to this Report”, which is included in Appendix D of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

Signature Page

Golder Associates Pty Ltd

Matthew James
Principal Environmental Scientist

Shane Doyle
Principal Environmental Scientist

MJ/SD/cl

A.B.N. 64 006 107 857

Golder and the G logo are trademarks of Golder Associates Corporation

https://golderassociates.sharepoint.com/sites/131368/project files/5 technical work/adequacy reviews/hay/vulnerability assessment report/20148399-003-r-rev1.docx

APPENDIX A

Council LEP Table

LAND USE ZONING

Information sourced from the Hay Local Environment Plan 2011.

Table 1: Sensitive land use zoning categories

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
Zone RU1 Primary Production					
Objectives of zone ■ To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. ■ To encourage diversity in primary industry enterprises and systems appropriate for the area. ■ To minimise the fragmentation and alienation of resource lands. ■ To minimise conflict between land uses within this zone and land uses within adjoining zones.					
Permitted without consent	Home-based child care; Home occupations	Water reticulation systems	Environmental protection works		Extensive agriculture; Roads
Permitted with consent	Bed and breakfast accommodation; Cellar door premises; Community facilities; Correctional centres; Dual occupancies (attached); Dwelling houses; Farm stay accommodation; Home businesses; Home industries; Home occupations (sex services); Information and education facilities; Recreation areas; Recreation facilities (major); Recreation facilities	Water supply systems	Eco-tourist facilities; Environmental facilities	Air transport facilities; Airstrips; Boat sheds; Depots; Extractive industries; Jetties; Farm buildings; Open cut mining; Landscaping material supplies; Intensive plant agriculture;	Animal boarding or training establishments; Aquaculture; Boat launching ramps; Building identification signs; Business identification signs; Cemeteries; Forestry; Freight transport facilities; Helipads; Industrial training facilities; Intensive livestock agriculture; Plant nurseries; Roadside stalls; Rural industries

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
	(outdoor); Rural workers' dwellings; Veterinary hospitals; Water recreation structures.				
Zone RU3 Forestry					
Objectives of zone ■ To enable development for forestry purposes. ■ To enable other development that is compatible with forestry land uses.					
Permitted without consent					
Permitted with consent					Aquaculture; Roads
Zone RU4 Primary Production Small Lots					
Objectives of zone ■ To enable sustainable primary industry and other compatible land uses. ■ To encourage and promote diversity and employment opportunities in relation to primary industry enterprises, particularly those that require smaller lots or that are more intensive in nature. ■ To minimise conflict between land uses within this zone and land uses within adjoining zones.					
Permitted without consent	Home-based child care; Home occupations	Water reticulation systems	Environmental protection works		Extensive agriculture; Roads
Permitted with consent	Animal boarding or training establishments; Bed and	Water supply systems	Environmental facilities	Air transport facilities; Airstrips;	Aquaculture; Boat launching ramps; Building identification signs; Business

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
	breakfast accommodation; Cellar door premises; Community facilities; Dwelling houses; Home businesses; Home industries; Home occupations (sex services); Information and education facilities; Farm stay accommodation; Recreation areas; Veterinary hospitals; Water recreation structures			Boat sheds; Depots; Freight transport facilities; Helipads; Jetties; Landscaping material supplies; Open cut mining;	identification signs; Extractive industries; Farm buildings Industrial training facilities; Intensive plant agriculture; Plant nurseries; Roadside stalls; Rural industries; Waste or resource management facilities
Zone RU5 Village					
Objectives of zone ■ To provide for a range of land uses, services and facilities that are **associated with a rural village**. ■ To ensure that development in village areas is **compatible with the environmental capability of the land**, particularly in terms of the capacity of that land to accommodate on-site effluent disposal. ■ To retain and facilitate expansion and redevelopment of the existing central business district of the Hay urban area and to further strengthen the **core retail functions of this area**. ■ **To encourage appropriate business development at the intersection of Cobb, Mid-Western and Sturt Highways that services the needs of the travelling public**. ■ To encourage appropriate tourist development within the Hay urban area.					
Permitted without consent	Home-based child care	Water reticulation systems	Environmental protection works		Home occupations; Roads

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
Permitted with consent	Centre-based child care facilities; Community facilities; Dwelling houses; Home industries; Recreation areas; Recreation facilities (indoor); Recreation facilities (outdoor); Respite day care centres; Places of public worship; Schools			Liquid fuel depots; Neighbourhood shops	High technology industries; Oyster aquaculture; Tank-based aquaculture
Zone IN1 General Industrial					
Objectives of zone ■ To provide a wide range of industrial and warehouse land uses. ■ To encourage employment opportunities. ■ To minimise any adverse effect of industry on other land uses. ■ To support and protect industrial land for industrial uses. ■ To encourage the establishment of new industry on land which is well separated from residential areas, has good road access and can be economically serviced. ■ To enable other land uses that provide facilities or services to meet the day to day needs of workers in the zone and its vicinity.					
Permitted without consent		Water reticulation systems	Environmental protection works		Roads
Permitted with consent	Animal boarding or training establishments; Community facilities; Correctional centres; Places of public worship; Sex	Water supply systems	Environmental facilities	Boat sheds; Depots; Freight transport facilities; Helipads; Heliports; Highway	Boat building and repair facilities; Boat launching ramps; Car parks; Crematoria; Extractive industries; Funeral homes; Garden centres; General industries;

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
	services premises; Veterinary hospitals			service centres; Jetties; Landscaping material supplies; Neighbourhood shops; Rural supplies; Service stations; Transport depots; Truck depots; Vehicle body repair workshops; Vehicle repair stations; Warehouse or distribution centres	Hardware and building supplies; Industries; Industrial retail outlets; Industrial training facilities; Kiosks; Light industries; Mortuaries; Oyster aquaculture; Research stations; Restricted premises; Rural industries; Signage; Storage premises; Take away food and drink premises; Tank-based aquaculture; Timber yards; Wholesale supplies
Zone SP2 Infrastructure					
Objectives of zone ■ To provide for infrastructure and related uses. ■ To prevent development that is not compatible with or that may detract from the provision of infrastructure.					
Permitted with consent					Aquaculture; The purpose shown on the Land Zoning Map, including any development that is ordinarily incidental or ancillary to development for that purpose; Roads

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
Zone SP3 Tourist					
Objectives of zone ■ To provide for a variety of tourist-oriented development and related uses.					
Permitted without consent		Water reticulation systems	Environmental protection works		Roads
Permitted with consent	Amusement centres; Community facilities; Information and education facilities; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor); Tourist and visitor accommodation;	Camping grounds; Caravan parks; Water supply systems	Eco-tourist facilities; Environmental facilities	Helipads; Highway service centres; Neighbourhood shops; Passenger transport facilities;	Aquaculture; Emergency services facilities; Entertainment facilities; Food and drink premises; Function centres; Kiosks; Registered clubs; Restricted premises; Signage; Water recycling facilities
Zone RE1 Public Recreation					
Objectives of zone ■ To enable land to be used for public open space or recreational purposes. ■ To provide a range of recreational settings and activities and compatible land uses. ■ To protect and enhance the natural environment for recreational purposes.					

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
Permitted without consent		Water reticulation systems	Environmental protection works		
Permitted with consent	Community facilities; Information and education facilities; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor);	Camping grounds; Water recreation structures; Water storage facilities	Environmental facilities	Boat sheds; Heliports Jetties	Aquaculture; Boat launching ramps; Building identification signs; Business identification signs; Kiosks; Roads; Water recycling facilities
Zone RE2 Private Recreation					
Objectives of zone ■ To enable land to be used for private open space or recreational purposes. ■ To provide a range of recreational settings and activities and compatible land uses. ■ To protect and enhance the natural environment for recreational purposes.					
Permitted without consent		Water reticulation systems	Environmental protection works		
Permitted with consent	Amusement centres; Backpackers' accommodation; Community facilities; Hotel or motel accommodation; Information and education	Camping grounds; Water recreation structures;	Environmental facilities;	Airstrips; Boat sheds; Charter and tourism boating facilities; Helipads; Jetties; Marinas;	Aquaculture; Boat launching ramps; Emergency services facilities; Entertainment facilities; Food and drink premises; Function centres; Kiosks;

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
	facilities; Recreation areas; Recreation facilities (indoor); Recreation facilities (major); Recreation facilities (outdoor); Serviced apartments; Tourist and visitor accommodation;	Water supply systems			Registered clubs; Roads; Research stations; Signage; Water recycling facilities
Zone E1 National Parks and Nature Reserves					
Objectives of zone ■ To enable the management and appropriate use of land that is reserved under the *National Parks and Wildlife Act 1974* or that is acquired under Part 11 of that Act. ■ To enable uses authorised under the *National Parks and Wildlife Act 1974*. ■ To identify land that is to be reserved under the *National Parks and Wildlife Act 1974* and to protect the environmental significance of that land.					
Permitted without consent	There are instances of residential dwellings on NPWS estate.	Uses authorised under the *National Parks and Wildlife Act 1974* (These include drinking water catchments)		NPWS may have UPSS	
Zone E2 Environmental Conservation					
Objectives of zone ■ To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values. ■ To prevent development that could destroy, damage or otherwise have an adverse effect on those values. ■ To ensure that existing and future development is not intensified on land subject to a significant risk of flooding.					

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
Permitted without consent		Water reticulation systems			
Permitted with consent		Camping grounds; Water treatment facilities	Boat launching ramps; Environmental facilities; Environmental protection works;	Boat sheds; Jetties; **Prohibited:** Service stations	Extensive agriculture; Oyster aquaculture Roads; Water recycling facilities
Zone W1 Natural Waterways					
Objectives of zone ■ To protect the ecological and scenic values of natural waterways. ■ To prevent development that would have an adverse effect on the natural values of waterways in this zone. ■ To provide for sustainable fishing industries and recreational fishing.					
Permitted with consent	Recreation areas; Information and education facilities; Water recreation structures	Water supply systems	Environmental facilities; Environmental protection works;	Boat sheds; Jetties; **Prohibited:** Service stations	Aquaculture Boat launching ramps; Building identification signs; Business identification signs; Emergency services facilities; Moorings; Research stations; Roads
Zone W2 Recreational Waterways					

Zone	Vapour Intrusion	Drinking Water	Environmental	UPSS (potential)	Other
Objectives of zone ■ To protect the ecological, scenic and recreation values of recreational waterways. ■ To allow for water-based recreation and related uses. ■ To provide for sustainable fishing industries and recreational fishing.					
Permitted with consent	Information and education facilities; Recreation areas; Recreation facilities (outdoor); Water recreation structure	Water supply systems	Environmental facilities; Environmental protection works	Boat launching ramps; Boat sheds; Charter and tourism boating facilities; Marinas	Aquaculture; Building identification signs; Business identification signs; Emergency services facilities; Jetties; Kiosks; Mooring pens; Moorings; Roads

APPENDIX B

Risk-Based Drinking Water Management System V2.1 - December 2015

Hay Shire Council

Risk-Based Drinking Water Management System

Version 1.1
1 December, 2015

Adopted: .....
(Allen Dwyer), General Manager
7 December, 2015

Review Date: December 2016 (or on system change)

Document Owner: Infrastructure Manager

Document Information

Information	Details
Document version	Version 1.1
Date issued	1 July 2014
Document controller	
Key document authors	S. Loder, City Water Technology A Davison, Risk Edge Pty Ltd
Document history	Version 0.1 – Draft issued for review
	Version 1.1 – Revised by K Cunningham 1 July 2014 Version 2.1 – Revised by W Moore 1 December 2015, Adopted by General Manager (A. Dwyer) 7 December 2015
Filename	NHS627-14-A Hay DWMS

This Drinking Water Management System document was compiled for Hay Shire Council by project consultants:

City Water Technology Pty Ltd

ABN 92 052 448 094

26 / 924 Pacific Highway, Gordon, NSW 2072, Australia

T: +61 2 9498 1444 F: +61 2 9498 1666

W: www.citywater.com.au

E: contact@citywater.com.au

in conjunction with

Risk Edge™ Pty Ltd

ABN 43 143 242 399

3 Monash Avenue, East Killara NSW 2071

T: +61 4011 049 544

W: www.riskedge.com.au

E: contact@riskedge.com.au

Contents

Introduction

Purpose

The Public Health Act 2010 (NSW) ('the Act') has been passed by Parliament and came into effect on 1 September 2012. The Act requires drinking water suppliers to establish, and adhere to, a 'quality assurance program' (QAP) that complies with the Public Health Regulation 2012 (NSW) ('the Regulation'). The Regulation requires water suppliers to implement a QAP consistent with the Framework for Management of Drinking Water Quality in the Australian Drinking Water Guidelines (2011). The QAP will be referred to as a Drinking Water Management System (DWMS) and water utilities in NSW will be required to have them in place by 1 September 2014.

As stated in the Australian Drinking Water Guidelines (NHMRC/NRMMC, 2011):

> "The most effective means of assuring drinking water quality and the protection of public health is through adoption of a preventive management approach that encompasses all steps in water production from catchment to consumer."

The NSW Government has encompassed this philosophy within the recent legislation. The Act includes the following requirement:

> Section 25 Quality assurance programs
>
> (1) A supplier of drinking water must establish, and adhere to, a quality assurance program that complies with the requirements prescribed by the regulations.

The Regulation states the following:

Part 5 Safety measures for drinking water

Clause 34 Quality assurance programs

(1) For the purposes of section 25 (1) of the Act, a quality assurance program must address the elements of the Framework for Management of Drinking Water Quality (as set out in the Australian Drinking Water Guidelines published by the National Health and Medical Research Council) that are relevant to the operations of the supplier of drinking water concerned.

(2) A supplier of drinking water must provide the Director-General with a copy of its most recent quality assurance program.

(3) The Director-General may arrange for the review of a quality assurance program of a supplier of drinking water at any time.

In developing a management system, water suppliers should undertake a risk assessment from catchment to consumer and develop critical control points to ensure that unsafe water is not released into the distribution systems and that treated water it is protected from contamination during distribution.

This document forms Hay Shire Council's response to the development of a DWMS and is based on the 12 Elements, 32 Components and 76 Actions of the Framework.

This DWMS is supported by a range of procedures, registers, data management systems, flow diagrams, etc., which are all referenced at the appropriate points in this document.

Overview of the Framework

The Australian Drinking Water Guidelines (ADWG) (NHMRC/NRMMC, 2011) set out a holistic approach to drinking water management including understanding where sources of contamination may arise and how contamination may find its way to the consumer. The approach is termed the Framework for Management of Drinking Water Quality (the Framework; Figure 1).

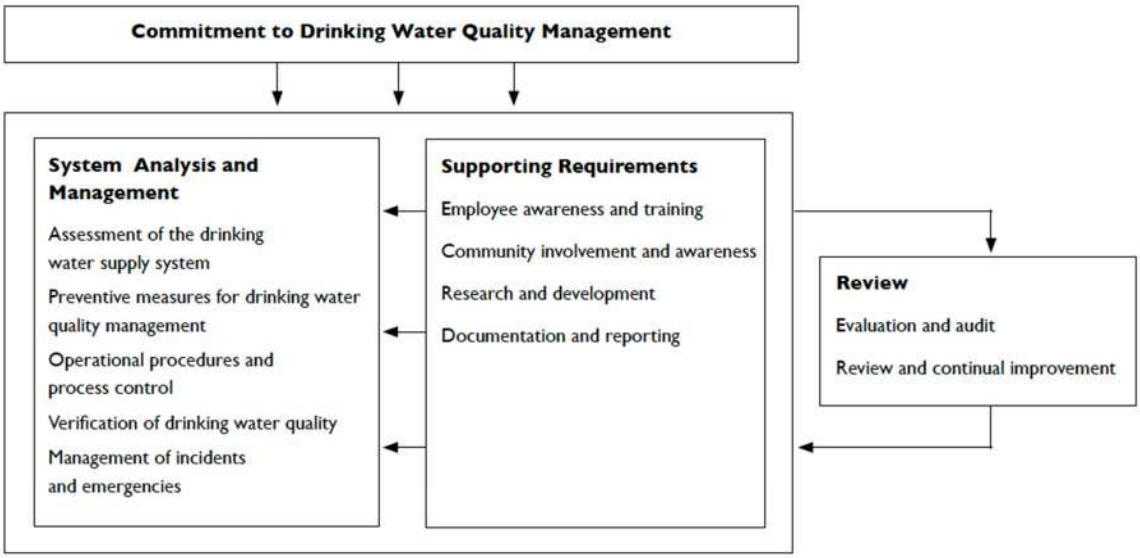


Figure 1: Framework for Management of Drinking Water Quality (NHMRC/NRMMC 2011)

ADWG (2011) sets out six guiding principles for drinking water management as follows:

- The greatest risks to consumers of drinking water are pathogenic microorganisms. Protection of water sources and treatment are of paramount importance and must never be compromised.
- The drinking water system must have, and continuously maintain, robust multiple barriers appropriate to the level of potential contamination facing the raw water supply.
- Any sudden or extreme change in water quality, flow or environmental conditions (e.g. extreme rainfall or flooding) should arouse suspicion that drinking water might become contaminated.
- System operators must be able to respond quickly and effectively to adverse monitoring signals.
- System operators must maintain a personal sense of responsibility and dedication to providing consumers with safe water, and should never ignore a consumer complaint about water quality.
- Ensuring drinking water safety and quality requires the application of a considered risk management approach.

Scope

This DWMS applies to the operation and maintenance of the Hay drinking water supply system. The Hay non-potable water supply system is not covered by this DWMS.

Document Structure

The following chapters show how Hay Shire Council (HSC) addresses each of the Framework elements. Where opportunities for improved compliance have been noted, these are detailed in the Improvement Plan in Appendix C. The DWMS is also supported by a number of policies, procedures, registers and other documents, which are referenced at appropriate points in this document.

Document Control

This DWMS document is owned by the Infrastructure Manager and approved by the General Manager. The Infrastructure Manager is responsible for ensuring that the DWMS is reviewed annually and on system change.

Records Management

DWMS records are created and maintained in order to provide evidence of conformance to requirements. Records shall be managed in accordance with HSC's Records Management Policy.

DWMS Responsibilities and Authorities

HSC employees are encouraged to participate in decisions that affect their jobs and areas of responsibility. This fosters a sense of ownership for decisions and their consequences. The main responsibilities and authorities related to the DWMS are listed below.

Council, please carefully reviewthe responsibilities and authorities set out below and amend as required to reflect actual management of the water supply. Council might also wish to consider including these responsibilities and authorities within Position Descriptions instead.

All Managers and Employees

All managers and employees involved in the supply of drinking water are responsible for:

- Understanding, implementing, maintaining and continuously improving the DWMS.
- Being aware of:
    - Commitment as contained in Appendix F to DWMS;
    - Characteristics of the water supply system and preventive strategies in place throughout the system;
    - Regulatory and legislative requirements;
    - Roles and responsibilities of employees and departments;
    - How their actions can impact on water quality and public health.

Councillors

Councillors will be responsible to review and approve the Drinking Water QualityPolicy. They also should be aware of the DWMS and the regulatory and legislative requirements surrounding it.

GeneralManager

The General Manager is responsible for:

- supporting and promoting the Drinking Water Quality Policy and the establishment and continual improvement of a DWMS;
- maintaining oversight of the effectiveness of the DWMS;
- evaluating the need for change;
- acting as media spokesperson in line with the conditions of employment contract.

The General Manager is authorised to:

- make water quality decisions outside the authority of managers;
- approve identified drinking water quality improvement initiatives (or improvement plan) submitted outside of budget requests.

Infrastructure Manager

The Infrastructure Manager is responsible for:

- supporting and promoting the Drinking Water Quality Policy and the implementation and continual improvement of the DWMS within the Technical Services Department;
- maintaining oversight of the effectiveness of the DWMS, particularly from an operations perspective;
- evaluating the need for change;
- management review of the DWMS and in particular:
    - reviewing reports from audits, drinking water quality performance and previous management review;
    - considering concerns of consumers, regulatory and other stakeholders and appropriate responses where warranted;
    - evaluating the suitability of the Drinking Water Quality Policy, objectives and preventive strategies in relation to changing internal and external conditions;
    - implementing mechanisms and communication procedures to increase employees' awareness of and participation in drinking water quality management;
    - maintenance of preventive measures as identified in the water quality risk assessment;
    - implementation of operational procedures, process control and verification of drinking water quality;
    - management of incidents and emergencies;
    - implementing processes and communication procedures to increase employees' awareness of and participation in drinking water quality management;
    - implementing processes to identify and act on drinking water quality improvements, including communication and monitoring of effectiveness of improvements.

Senior Engineering Assistant

The Senior Engineering Assistant is responsible for:

- development, maintenance and continual improvement of adequate DWMS processes and documentation including procedures, work instructions and forms;
- ensuring that employees and contractors of the Technical Services Department, maintain the appropriate experience and qualifications;

Engineering Assistant (Building)

The Engineering Assistant (Building) Officer is responsible for:

- minor maintenance of the Hay WTP;

Water and Sewer Manager

The Water and Sewer Manager in conjunction with Operators is responsiblefor:

- development, maintenance and continual improvement of adequate DWMS processes and documentation including procedures, work instructions and forms;
- managing key functions including:
  - proactive work planning and prioritisation (developing prioritised work packages);
  - timely maintenance and repair of mechanical and electrical equipment throughout the water supply chain;
  - delivering asset maintenance plans;
  - conducting condition assessments;
  - coordinating the allocation, prioritisation and procurement of internal and external resources;
  - interpreting and responding to reactive work requests.
- operation and minor maintenance of the Hay WTP;
- operation and maintenance of laboratory functions to meet operational and reporting needs;
- primary response to incidents.

Element 1 - Commitment to Drinking Water Quality Management

1.1. Drinking Water Quality Policy

.A. Formulate a drinking water quality policy, endorsed by senior executives, to be implemented throughout the organisation.

.A. Ensure that the policy is visible and is communicated, understood and implemented by employees.

The vision statement presented in HSC's Management Plan (2011-2014) is as follows:

- "Maintain Hay Shire's strong, safe community, whilst striving to continuously improve."

The key (relevant) Strategic Objective identified in HSC's Strategic Business Plan (SBP) for Water Supply & Sewerage Services (2009/10) is as follows:

- "To provide supplies of both filtered and raw water in sufficient quantity to meet the realistic demands of the town area and of a quality that conforms to current public health standards."

Further to this, Council's aim for the water supply is as follows:

- "Council's aim is to supply clean, safe and secure water to the people of Hay in a way which meets their needs, in an efficient, cost effective manner which maximises the potential benefits of the resource and satisfies the needs of the natural ecosystem in an ecologically sustainable way and, where appropriate, to investigate supplies to areas outside the Town boundaries."

The 2012-2016 Delivery Plan states the following relevant 'community strategies':

- "Provide a clean and safe water supply";
- "Manage waterways and the environment in a way to minimize risks to the community"; and
- "Within available resources ensure all assets and infrastructure are effectively maintained to industry and community standards."

HSC is committed to the provision of safe drinking water and articulated this commitment on 23rd September, 2014 by adopting the following policy:

- Water Supply – Drinking Water Quality Plan

1.2 Regulatory and Formal Requirements

- .A. Identify and document all relevant regulatory and formal requirements.
- .A. Ensure responsibilities are understood and communicated to employees.
- .A. Review requirements periodically to reflect any changes.

HSC's SBP for Water Supply & Sewerage Services (2009/10) includes a Legislative Framework section which lists legislation relevant to water supply and sewerage services. According to the NSW Water and Sewerage Strategic Business Planning Guidelines 2011 (NSW Office of Water), SBPs should be prepared every 4 years, at which point the regulatory and formal requirements can be reviewed.

However, the current SBP pre-dates a number of important Acts and Regulations, and does not include non-legislative requirements such as Standards, Codes and Guidelines, nor does it include formal requirements such as contracts. Actions relating to this component are captured in the Improvement Plan (Appendix C).

HSC has formally agreed to communicate regulatory and formal requirements on an annual basis to the relevant staff.

1.3 Engaging Stakeholders

- .A. Identify all stakeholders who could affect, or be affected by, decisions or activities of the drinking water supplier.
- .A. Develop appropriate mechanisms and documentation for stakeholder commitment and involvement.
- .A. Regularly update the list of relevant agencies.

Through the SBP for Water Supply (2009/10), HSC has identified the following stakeholders involved in its activities:

- Property Owners/Ratepayers;
- Residents/Families;
- Pensioners;
- Commercial and industrial customers;
- Irrigators;
- Downstream water users;
- Environmental groups;
- Tourists;
- Councillors;
- Council Employees;
- Government Agencies (Department of Local Government[1], Department of Energy Climate Change and Water[2], Department of Health[3]);

[1] Now Division of Local Government (part of the Department of Premier and Cabinet).
[2] Now Office of Environment and Heritage (part of the Department of Premier and Cabinet)
[3] Now Ministry of Health

- Murrumbidgee Catchment Management Authority.

In HSC's Management Plan (2011-2014) and Strategic Business Plan for Water Supply (2009/10) a commitment to consult with stakeholders is articulated as follows:

- "Responsiveness: We will consult with our community and other stakeholders and be guided by their wishes. We will deliver on our promises."

Other drinking water specific stakeholder engagement is undertaken through internal and external reporting including:

- To Councillors (via Ordinary Council meetings);
- HSC Management Plan;
- HSC Annual Report;
- Via State of the Environment reporting;
- Liaison with government agencies as required;
- Workshops and meetings to involve Council employees;
- 'Shire Snippets' Council newsletter.

Actions relating to development of a drinking water specific Stakeholder Register and communication methods are captured in the Improvement Plan (Appendix C).

For the purposes of this first version of the DWMS, the list of stakeholders within the SBP and the list of participants in the Risk Workshop were used to compile the first draft of stakeholders for this system (Table 1).

Table 1: Preliminary Stakeholder Register

Stakeholder	Current Contact	Current Contact Details
Drinking water consumers		
Commercial and industrial customers		
Irrigators		
Downstream water users		
Environmental groups		
Tourists		
Councillors		
Council Employees		
NSW Ministry of Health (Water Unit)	Uzma Bashir, Senior Project Officer	02 9391 9762 buzma@doh.health.nsw.gov.au
NSW Ministry of Health (Public Health Unit)	Kevin Prior, Environmental Health Officer	02 6933 9128 0429 076 135 kevin.prior@gsahs.health.nsw.gov.au
Department of Primary Industries	Bernie Barnes, Inspector	0429 604 409 Bernie.Barnes@water.nsw.gov.au

Department of Premier and Cabinet (Division of Local Government)		
Department of Premier and Cabinet (Office of Environment and Heritage)		
Murrumbidgee Catchment Management Authority		
Police	Emergency	000
	Police – Hay Police Station	02 6993 1100
Fire Brigade	Emergency	000
Rural Fire Service	Bush Fire Information	1800 NSW RFS (1800 679 737)
	Hay Rural Fire District	02 6993 4213
State Emergency Service	General	132 500
	Murrumbidgee Region	02 6932 9199

Element 2 - Assessment of the Drinking Water Supply System

2.1 Water Supply System Analysis

- A. Assemble a team with appropriate knowledge and expertise.
- A. Construct a flow diagram of the water supply system from catchment to consumer.
- A. Assemble pertinent information and document key characteristics of the water supply system to be considered.

2.1.1 Water Quality Team

The team shown in Table 2 was chosen to participate in the Risk Workshop (5-6 September 2012), and represent the system assessment team.

Table 2: Risk Assessment Team

Organisation	Role
Hay Shire Council	Infrastructure Manager
	Senior Engineering Assistant
	Water Treatment Plant Operator
NSW Ministry of Health	Water Unit Representative
	Public Health Unit Environmental Health Officer
NSW DPI Water	Inspector
DWMS development consultants	Workshop Facilitator
	Workshop Capture and DWMS Development

The ongoing water quality team consists of:

- Infrastructure Manager;
- Senior Engineering Assistant;
- Water Treatment Plant Operator;

This core team is supported by NSW Ministry of Health and NSW Office of Water (NOW) as well as independent consultants when required.

To improve compliance with this component of the Framework, an action has been captured within the Improvement Plan to develop a clear team details' table to show current positions and responsibilities for drinking water quality.

2.1.2 Water Supply System - Overview

Conceptual flow diagrams were developed in Microsoft PowerPoint for the risk assessment workshop (5-6 September 2012) and are reviewed and kept current as part of this process.

Hay is served by both a potable water system and a raw water system as detailed within the Risk Workshop Summary Paper. A flow diagram for the potable water supply systems is shown in Figure 2 and for the non-potable water supply systems is shown in Figure 3. The purpose of these diagrams is to show key inputs, steps and flow direction.

Responsibility for maintaining currency of the conceptual system flow diagrams has been captured within the Improvement Plan (Appendix C).

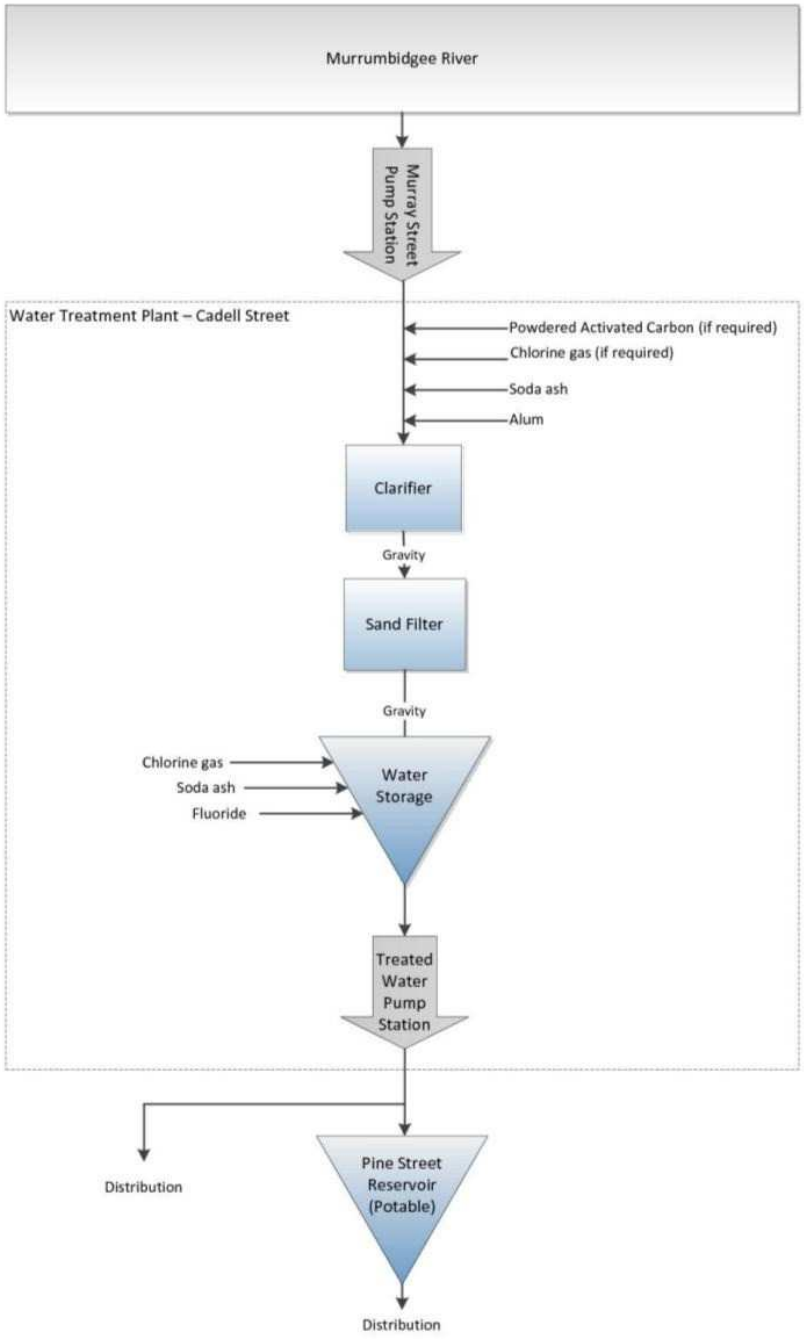


Figure 2: Conceptual Process Flow Diagram of the Potable Water Supply System (Source: HSC)

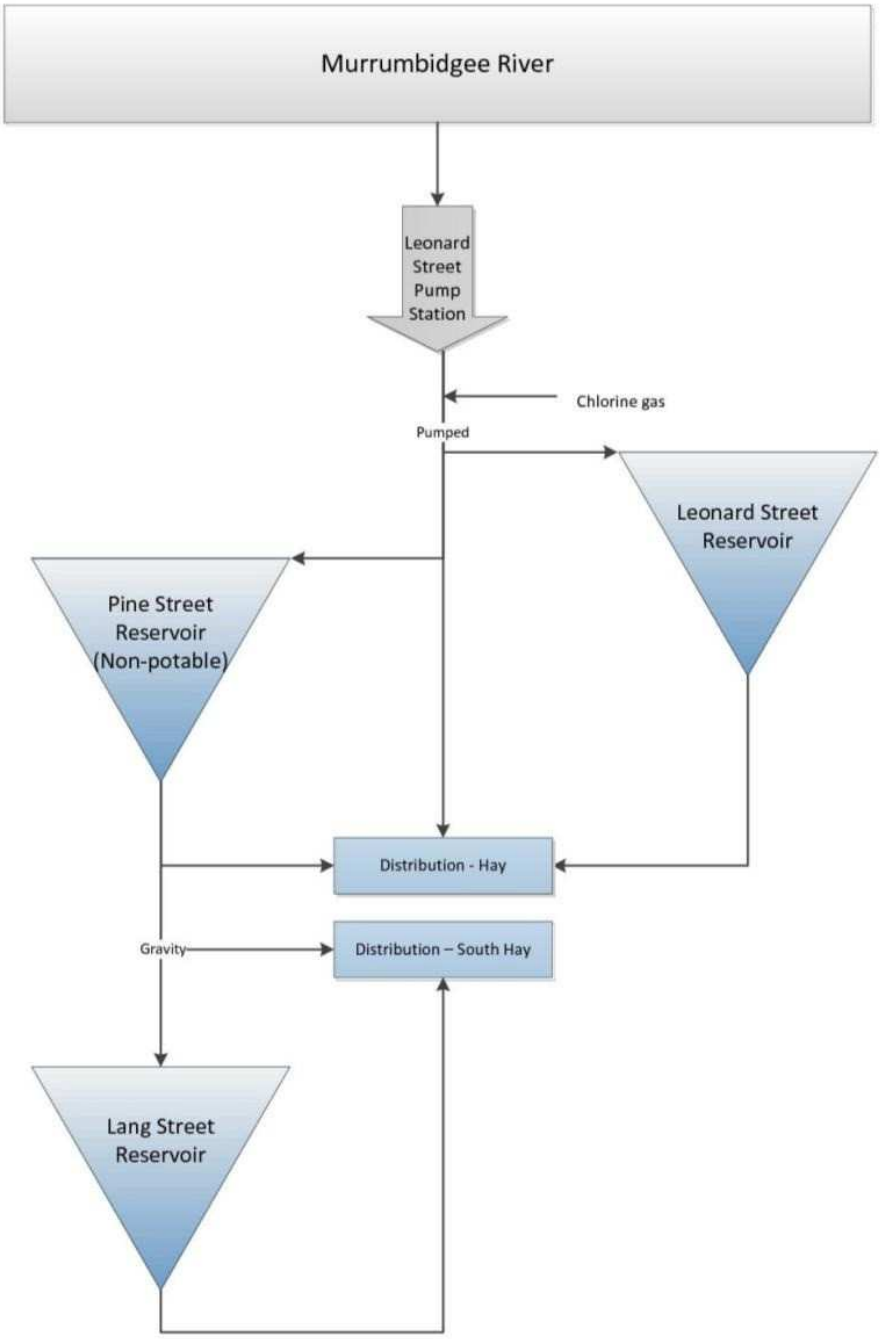


Figure 3: Conceptual Process Flow Diagram of the Raw Water Supply System (Source: HSC)

An overview of HSC's water supply systems is provided in Table 3.

Table 3: Water Supply System – Overview Description

SYSTEM COMPONENT	DESCRIPTION
Population Supplied	2,800 [4]
Water Source	Murrumbidgee River (managed by State Water)
Water Storage	None
Water Treatment	Raw water from Murrumbidgee River is treated at the Hay Water Treatment Plant (WTP) as follows: • Powdered Activated Carbon (PAC) for removal of taste and odour and algal toxins (as required) • Pre-coagulation chlorination for oxidation (if required, but rarely used) • Pre-coagulation soda ash for pH correction (if required but rarely used) • Alum for coagulation • Flocculation • Clarification • Filtration • Chlorination (chlorine gas) for disinfection • Post-filtration soda ash for pH correction and stabilisation • Fluoridation A raw, non-potable, water supply is also provided for external residential use only and this is chlorinated (using chlorine gas) prior to distribution.
Storage After Treatment	Treated Water Supply Clear Water Tank at the WTP site and then distribution reservoir at Pine Street. Raw Water Supply Distribution reservoirs at Leonard Street, Pine Street[5] and Lang Street.
Distribution of Product	Via pressurised pipes, pumps and tanks: • 2 km Transfer + Trunk Mains • 47 km Reticulation Mains (total for raw and treated water supplies) • 3 Pumping Stations (6 per 100 km of main)[6]
Any Special Controls Required	Quality of chemicals, materials etc. used in the production and delivery of the product. Manual verification sampling of water from the distribution network. Backflow prevention and trade waste management. Operation and maintenance of all infrastructure to prevent recontamination.

[4] NSW Health Drinking Water Database Supply System Information Report
[5] Noting that there is a non-potable and a potable reservoir at the Pine Street location.
[6] NSW Office of Water (2012) 2010-11 NSW Benchmarking Report

There is currently no register of rainwater tanks (a potential backflow issue) that are installed in the Hay Shire Local Government Area (LGA).

HSC holds an Environment Protection Licence (EPL) No. 3237 for its Hay WTP premises for discharge of Miscellaneous Licensed Discharge to Waters (at any time) for up to 200 kL per day filter backwash water with a Total Suspended Solids concentration of up 100 mg/L[7].

HSC has not yet undertaken an Integrated Water Cycle Management (IWCM) evaluation of its system.

HSC does not currently have a trade waste program in place.

Actions relating to water supply system analysis are captured in the Improvement Plan (Appendix C).

2.2 Assessment of Water Quality Data

- .A. Assemble historical data from source waters, treatment plants and finished water supplied to consumers (over time and following specific events).
- .A. List and examine exceedances.
- .A. Assess data using tools such as control charts and trends analysis to identify trends and potential problems.

HSC undertakes drinking water monitoring under the NSW Health Drinking Water Monitoring Program. Analyses are stored within the NSW Health Drinking Water Database, which allows summaries of data to be generated. HSC also undertakes operational monitoring, such as grab samples and jar tests, the results of which are recorded at the plant on log sheets.

The Hay LGA is covered by the Murrumbidgee Regional Algal Coordinating Committee (RACC) which coordinates a weekly blue-green algae report during the algae alert season (November to March)[8]. During this period, additional algal water quality assessments are also performed by the Hay WTP operator by boiling a sample of the raw water and performing an odour assessment.

Telemetry (SCADA) is used to monitor and log data from instruments.

HSC undertakes State of the Environment reporting, which includes water quality components.

In the past, water quality details have not been included in the Management Plan.

Water quality data from the NSW Health Drinking Water Database were analysed for the Risk Assessment Workshop (5-6 September 2012), results of which are recorded in the Risk Workshop Summary Paper (Appendix A).

---

[7] NSW EPA (2003) Section 58(5) POEO Act 1997 Variation of Licence 3237. Available online: www.environment.nsw.gov.au/prpoeoapp/ViewPOEONotice.aspx?DOCID=-1&SYSUID=1&LICID=3237. Accessed 23 October 2012.

[8] NSW Office of Water (2012) Murrumbidgee Regional Algal Coordinating Committee. Available online: http://www.water.nsw.gov.au/Water-management/Water-quality/Algal-information/Murrumbidgee-Regional-Algal-Coordinating-Committee-/murrumbidgee-racc/default.aspx. Accessed 23 October 2012.

Actions relating to assessment of water quality data are captured in the Improvement Plan (Appendix C).

2.3 Hazard Identification and Risk Assessment

- A. Define the approach and methodology to be used for hazard identification and risk assessment.
- A. Identify and document hazards, sources and hazardous events for each component of the water supply system.
- A. Estimate the level of risk for each identified hazard or hazardous event.
- A. Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty.
- A. Determine significant risks and document priorities for risk management.
- A. Periodically review and update the hazardidentification and risk assessment to incorporate any changes.

The Risk Assessment Workshop Summary Paper (September 2012, Appendix A) includes documentation of:

- The risk assessment methodology adopted; and
- The Risk Register (also kept separately within an Excel spreadsheet to allow for ease of currency maintenance)

Actions for maintaining the currency of the Risk Register are captured in the Improvement Plan (Appendix C).

Element 3 - Preventive Measures for Drinking Water Quality Management

3.1 Preventive Measures and Multiple Barriers

- .A. Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk.
- .A. Evaluate alternative or additional preventive measures where improvement is required.
- .A. Document the preventive measures and strategies into a plan addressing each significant risk.

HSC's existing preventive measures were identified and assessed during the Risk Workshop and have been documented within the Risk Register alongside the significant risks they address. Gaps identified during the workshop were recorded as actions within the Risk Register and subsequently transcribed to the Improvement Plan (Appendix C).

HSC uses codes and standards to underpin its DWMS including, but not limited to:

- New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 http://www.health.nsw.gov.au/resources/aboutus/legal/pdf/code_of_practice.pdf;
- Current version of the Plumbing Code of Australia (which references AS/NZS 3500);
- AS/NZS 2927 The storage and handling of liquefied chlorine gas;
- Water Services Association of Australia (WSAA) codes.

HSC maintains a register of on-site sewage management systems and evaluates site (soil) conditions and any potential contamination issues before approving installation of new systems[9].

3.2 Critical Control Points

- .A. Assess preventive measures from catchment to consumer to identify critical control points.
- .A. Establish mechanisms for operational control.
- .A. Document the critical control points, critical limits and target criteria.

Key risks were reviewed during the Risk Workshop and critical control points (CCPs) identified. For a point to satisfy the requirements of a CCP it must:

- Control hazards that represent a significant risk and require elimination or reduction to assure supply of safe drinking water;
- Have a parameter (may be a surrogate of the hazard being controlled) that can be measured in a timely manner for the hazardous event; and

[9] http://www.hay.nsw.gov.au/CouncilServices/WaterSewer/tabid/124/Default.aspx

- Be able to have a correction applied in a timely manner in response to a deviation in the process.

CCP's for the water supply system were identified at the Risk Workshop held on 5-6 September 2012 and are documented in Appendix B.

Element 4 - Operational Procedures and Process Control

4.1 Operational Procedures

.A. Identify procedures required for processes and activities from catchment to consumer.

.A. Document all procedures and compile into an operations manual.

HSC has the following manuals and procedures:

- New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 http://www.health.nsw.gov.au/resources/aboutus/legal/pdf/code_of_practice.pdf
- NSW Water Directorate's Manuals
    - Operations and Maintenance Manual for Water Supply Service Reservoirs – June 2002 - Revised June 2010
    - Backflow and Cross Connection Prevention Guidelines
    - Blue-Green Algae Management Protocols
    - O&M Manual for Water Reticulation – September 2001 – Revised October 2003
- Safe Work Method Statements for the following tasks
    - Chlorine cylinder replacement
    - Water meter readings
    - Water pump well maintenance
    - Water main emergency repairs
    - Powdered Activated Carbon batching
    - Sodium Fluoride batching

Actions to increase compliance with this component are noted in the Improvement Plan (Appendix C).

4.2 Operational Monitoring

.A. Develop monitoring protocols for operational performance of the water supply system, including the selection of operational parameters and criteria, and the routine analysis of results.

.A. Document monitoring protocols into an operational monitoring plan.

HSC has the following guidance and forms in place for operational monitoring:

- New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 http://www.health.nsw.gov.au/resources/aboutus/legal/pdf/code_of_practice.pdf (Form 4)
- Jar Testing Results form (Public Works Department template)
- WTP log sheets for the following characteristics:
    - Raw water:
        - pH
        - Turbidity
        - Colour
        - Temperature

Clarified water:
- pH
- Turbidity
- Colour

- Filtered water:
  - pH
  - Turbidity
  - Colour
- Treated water:
  - pH
  - Turbidity
  - Colour
  - Free Chlorine Residual
  - Fluoride

- SCADA
- Standard operating procedures for the following sampling and monitoring.
  - Chlorine residual testing and microbiological and chemistry sampling - DAL sampling guide. http://www.health.nsw.gov.au/publichealth/environment/water/drinkwater_nsw.asp

Actions to increase compliance with this component are noted in the Improvement Plan (Appendix C).

4.3 Corrective Action

.A.	Establish and document procedures for corrective action to control excursions in operational parameters.
.A.	Establish rapid communication systems to deal with unexpected events.

HSC has a number of corrective actions associated with CCPs, which are summarised in Appendix A.

HSC also relies on guidance documents from external parties for appropriate corrective actions, such as the NSW Health Drinking Water Monitoring Program Handbook, the Code of Practice for the Fluoridation of Public Water Supplies and NSW Health Response Protocols. These are publically available via the NSW Health website.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

4.4 Equipment Capability and Maintenance

.A.	Ensure that equipment performs adequately and provides sufficient flexibility and process control.
.A.	Establish a program for regular inspection and maintenance of all equipment, including monitoring equipment.

HSC has the following laboratory instruments in place:

- Bench flocculator

- Turbidimeter 2100A Hach
- Colorimeter 2000 TK/100
- pH meter Lovibond
- Chlorine residual meter Hach DR100
- Iron test kit Hach 1465-00
- Laboratory balance Ohaus 760W
- Platform scales Mercury Weighing & Control Systems 211-DA

In addition, the following online water quality monitoring instruments are installed and connected to telemetry:

- Turbidimeter (ABB 4600) on outlet from Clear Water Tank
- Free chlorine residual meter (Wallace and Tiernan) on outlet from Clear Water Tank
- pH meter (ABB AX400) on outlet from Clear Water Tank

All meters/probes are calibrated regularly by the operators using the manufacturers' instructions. Servicing of measuring apparatus is through an annual instrumentation service contract.

HSC also relies on guidance documents from external parties including The New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 which contains guidance on how to deal with equipment capability and maintenance.

HSC prepares Asset Management Plans, which evaluate the condition of its assets and inform maintenance and capital works programs for those assets.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

4.5 Materials and Chemicals

.A.	Ensure that only approved materials and chemicals are used.
.A.	Establish documented procedures for evaluating chemicals, materials and suppliers.

HSC orders chemicals as required. Chemicals used at Hay WTP are:

- Chlorine Gas supplied by Orica;
- Alum supplied by Omega Chemicals;
- Soda Ash supplied by Redox;
- Powdered Activated Carbon (PAC) supplied by Redox; and
- Sodium Fluoride supplied by Prominent Fluid Controls.

Chemicals are supplied with a certificate of compliance which is filed by the operator. The operator confirms the specific gravity of liquid alum on delivery but does not perform further checks of other chemicals.

HSC has a Procurement Policy in place although water quality issues are not specifically mentioned. HSC purchases from reputable suppliers and specifies that materials and chemicals used in the water supply must be suitable for use with potable water.

HSC also relies on standards and guidance documents from external parties for appropriate selection and use of materials and chemicals, these include:

- Guidance on chemical quality contained within the New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011.
- Guidance on acceptable levels and calculation of contaminants in chemicals used in drinking water production contained within Chapter 8 of the Australian Drinking Water Guidelines (NHMRC/NRMMC, 2011).
- List of approved materials and products contained within AS/NZS 4020 Testing of products for use in contact with drinking water.
- List of approved materials and products contained within AS/NZS 3500 Plumbing and drainage set.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 5 - Verification of Drinking Water Quality

5.1 Drinking Water Quality Monitoring

.A.	Determine the characteristics to be monitored in the distribution system and in water as supplied to the consumer.
.A.	Establish and document a sampling plan for each characteristic, including the location and frequency of sampling.
.A.	Ensure monitoring data is representative and reliable.

HSC participates in the NSW Health Drinking Water Monitoring Program.

HSC takes microbiological samples weekly and chemical twice-yearly from various points in the reticulation system. Measurements of free chlorine in the reticulation system are undertaken more frequently as part of HSC's operational monitoring.

HSC undertakes twice-yearly testing for disinfection by-products and pesticides.

All samples are sent to Sydney to NSW Health's NATA accredited laboratory and both NSW Health and HSC are provided with results from the analyses. HSC does not have specific formal protocols in place with external laboratories in the event of non-compliant results. However, under the NSW Health Drinking Water Monitoring Program, local water utilities are notified of results that exceed a guideline value.

HSC also relies on standards and guidance documents from external parties including:

- The New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 which contains guidance on monitoring.
- Disinfection of Drinking Water Information Sheet 1 in the Australian Drinking Water Guidelines (NHMRC/NRMMC, 2011) which includes information on disinfection residual maintenance and monitoring.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

5.2 Consumer Satisfaction

.A.	Establish a consumer complaint and response program, including appropriate training of employees

HSC's customer service staff receive customer requests by telephone, email, mail, in person and via the Council website. Call receivers are trained to take and log the requests but are not specifically trained in water quality issues. HSC uses the 'Authority' Customer Request Management (CRM) system for logging and tracking consumer requests. Through Authority, actions are forwarded to the responsible officer, are monitored while still open and stored once closed out.

Actions to increase compliance with this component are noted in the Improvement Plan (Appendix C).

5.3 Short Term Evaluation of Results

.A.	Establish procedures for the daily review of drinking water quality monitoring data and consumer satisfaction.
.A.	Develop reporting mechanisms internally, and externally, where required.

Water quality data are recorded in the NSW Drinking Water Database and can be accessed by HSC on demand.

Operational data are recorded daily at the WTP. Analysis of results is performed by the Water Sewer Operator.

A SCADA system used for monitoring the WTP and distribution system is checked by the operators. Critical alarms automatically dial-out to the duty officer, parameters monitored include:

- Dosing pump duties;
- Clear Water Tank and Pine Street Reservoir levels; and
- Pump station operation (running, off and fault status).

As per Section 5.2 above, records of consumer requests can be accessed via HSC's Authority CRM system for analysis.

HSC also relies on standards and guidance documents from external parties including the New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 which contains guidance on evaluation.

It is acknowledged that water quality data recorded in the NSW Drinking Water Database should also be reviewed on a regular basis (e.g. monthly) and following the submission of each sample.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

5.4 Corrective Action

.A.	Establish and document procedures for corrective action in response to non-conformance or consumer feedback.
.A.	Establish rapid communication systems to deal with unexpected events.

As per Section 5.2 above, follow-up of consumer requests and complaints is tracked using HSC's Authority CRM system.

When a 'dirty water' complaint is received, HSC responds by flushing the affected area of the reticulation.

HSC also relies on guidance documents from external parties including the NSW Health Drinking Water Monitoring Program response protocols.

For this first draft, HSC commits to a timely response to adverse sampling results or other events e.g. dirty water, and/or public complaints including appropriate investigation, and corrective actions and notification/discussion with the Public Health Unit (PHU).

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 6..-..Management of Incidents and Emergencies

6.1 Communication

.A.	Define communication protocols with the involvement of relevant agencies and prepare a contact list of key people, agencies and businesses.
.A.	Develop a public and media communications strategy

HSC currently does not have an emergency contacts list or formalised communication protocols in place for drinking water quality.

In the past, State Water notified HSC and NOW prior to releases from Tom Bullen storage (allowing three days' to prepare for a change in raw water quality) however this no longer occurs.

HSC is a member of the Murrumbidgee RACC which coordinates a weekly blue-green algae report during the algae season (November to March).

HSC often learns of other Murrumbidgee River incidents through NOW and/or NSW Ministry of Health who have contact with upstream Councils.

The Mayor and General Manager are HSC's official spokespeople on all Council matters but the General Manager may nominate other staff to act as spokesperson on specific matters (such as water quality). Individual officers within HSC create a media release on HSC's media template, which is then reviewed, edited and formatted by the Executive Assistant and approved by the General Manager prior to release.

Information within the NSW Health Drinking Water Monitoring Program booklet is used by operators and other Council officers.

HSC also relies on standards and guidance documents from external parties including the New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011 which contains guidance on incidents and emergencies.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

6.2 Incident and Emergency Response Protocols

.A.	Define potential incidents and emergencies and document procedures and response plans with the involvement of relevant agencies
.A.	Train employees and regularly test emergency response plans
.A.	Investigate any incidents or emergencies and revise protocols as necessary

HSC staff use daily log sheets and the WTP diary to record water quality incidents. At the start of their shift the WTP operator checks the WTP diary for any notices and then records events throughout the day as required.

In the event of an incident or an emergency, the operator will contact the Infrastructure Manager in the first instance and will involve NOW and/or the PHU to seek advice and/or report water quality issues as required. HSC currently does not have formal Emergency Response Procedure(s) in place for drinking water quality.

HSC also relies on standards and guidance documents from external parties including the NSW Health Response Protocols, New South Wales Code of Practice for Fluoridation of Public Water Supplies 2011, Murrumbidgee Regional Algal Contingency Plan and NSW Water Directorate's Blue Green Algae Management Protocols which contain guidance on incidents and emergencies.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 7 -Employee Awareness and Training

7.1 Employee Awareness and Involvement

.A.	Develop mechanisms and communication procedures to increase employee awareness of and participation in drinking water quality management

HSC is a member of Riverina and Murray Regional Organisation of Councils (RAMROC) which represents the interests of 18 member councils in the Murray, Murrumbidgee, Lower Murray-Darling and Lachlan Valley catchment areas. RAMROC meets quarterly to discuss and resolve various issues of regional significance and common concern but water quality issues are not always considered at these meetings.

HSC is a member of the Local Government Water Directorate. HSC staff members are encouraged to utilise technical information, networking events and other services provided by the Water Directorate.

Operators also use the Water Industry Operators' Association website for updates.

HSC makes a commitment, as part of this DWMS, to increase employee awareness of the potential risks to the public from poor water quality or a contamination event.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

7.2 Employee Training

.A.	Ensure that employees, including contractors, maintain the appropriate experience and qualifications
.A.	Identify training needs and ensure resources are available to support training programs
.A.	Document training and maintain records of all employee training

HSC operators attend conferences and workshops. Examples of training include the following:

- Work Health and Safety Induction
- Dangerous Goods Handling/Hazardous Substances competencies as part of Certificate II in Transport and Logistics
- Operator Competency in Operation of Water Treatment Works (NOW)
- Operator Competency in Operation of Chemical Dosing Systems for Water Treatment Works (NOW)
- Chlorine operator training
- Confined space training

Records of training are maintained for the operators and required skills and currencies are documented within a training plan. An annual training currency review is performed at the time of the performance review. The Senior Operator is responsible for reviewing the performance of the WTP operators. The Infrastructure Manager is responsible for reviewing the performance of the Senior Operator.

HSC understands the need to keep staff aware of emerging issues and for the opportunity for staff to attend relevant training on a regular basis.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 8 - Community Involvement and Awareness

8.1 Community Consultation

.A. Assess requirements for effective community involvement.

.A. Develop a comprehensive strategy for community consultation.

HSC involves the community in drinking water planning and strategy through public access to Ordinary Meetings of Council held monthly.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

8.2 Communication

.A. Develop an active two-way communication program to inform consumers and promote awareness of drinking water quality issues.

HSC communicates with the community in several ways including:

- Local media including radio station '2Hay FM'
- Fortnightly 'Shire Snippets' Council newsletter
- Website
- State of the Environment Reporting

HSC maintains signs at parks to advise the community where non-potable water is supplied. However, HSC does not regularly remind residents whose properties are connected to the non-potable supply. NSW Health has prepared a Draft Guidance to Water Utilities on Declaration of Non-potable Water Supplies which lists a number of ways to keep all potential consumers informed of the status of the water supply.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 9 - Research and Development

9.1 Investigative Studies and Research Monitoring

- .A. Establish programs to increase understanding of the water supply system.
- .A. Use information to improve management of the water supply system.

HSC can access investigative monitoring programs through the NSW Health Drinking Water Monitoring Program if required.

An inspector from NOW visits Hay several times per year and performs external inspections of the water supply system. The inspector identifies areas for improvement and reports to the Infrastructure Manager. HSC implements corrective actions in response to the issues identified during these inspections. The effectiveness of the corrective actions is evaluated by the NOW inspector on their return visit. Issues identified during inspections by NSW Ministry of Health are dealt with in the same way.

HSC receives the NSW Health Public Health Bulletin and is a member of the Local Government Water Directorate through which projects can be undertaken collectively and information disseminated to members.

HSC commits to establishing a process for the regular review and analysis of water quality trends.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

9.2 Validation of Processes

- .A. Validate processes and procedures to ensure that they are effective at controlling hazards.
- .A. Revalidate processes periodically or when variations in conditions occur.

Validation of processes and procedures was undertaken as part of the risk assessment process undertaken as part of the development of this DWMS.

HSC will be revalidating processes through the CCP process initiated through the development of this DWMS.

HSC operators perform jar testing regularly to ensure that treatment regime at Hay WTP is appropriate for current raw water conditions in the river.

HSC will need to review system changes such as the future possible extension of the potable water reticulation network.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

9.3 Design of Equipment

.A.	Validate the selection and design of new equipment and infrastructure to ensure continuing reliability.

HSC has recently installed upgraded PAC and fluoride systems at Hay WTP. These systems were completed as Design and Construct contracts and approval was granted by NOW in accordance with section 60 of the Local Government Act 1993 prior to construction.

If HSC is to go ahead with extension of the potable water reticulation network (or other water infrastructure works), it will need to check the water quality impacts of the design and location of the pipeline(s) before the infrastructure is built (via section 60 approval).

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 10 - Documentation and Record Keeping

10.1 Management of Documentation and Records

- A. Document information pertinent to all aspects of drinking water quality management.
- A. Develop a document control system to ensure current versions are in use.
- A. Establish a records management system and ensure that employees are trained to fill out records.
- A. Periodically review documentation and revise as necessary.

HSC has a records management policy in place.

HSC contributes to the annual performance data collection and reporting required by the NOW.

HSC uses TRIM, an electronic document and records management system, to control and store documents and written correspondence, including those pertinent to water quality. There is no formalised procedure for filing/naming of files.

HSC currently does not have a Laboratory Information Management System (LIMS) in place but uses a system of hard-copy log sheets for data recording. The hard-copy log sheets are filed in binders at Hay WTP.

The NSW Health Drinking Water Database is used as a records management system for HSC's water quality results that are collected as a part of that program.

As per Section 5.2 above, records of consumer requests are stored in HSC's Authority CRM system.

As per Section 6.2 above, water quality incidents are recorded in the WTP diary and on the operator log sheets.

HSC's website is also used as a vehicle for the storage and communication of information.

HSC will commit to reviewing the NSW Health website for the most recent documents and protocols on information management.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

10.2 Reporting

- A. Establish procedures for effective internal and external reporting.
- A. Produce an annual report to be made available to consumers, regulatory authorities and stakeholders.

HSC contributes to the annual performance data collection and reporting required by the NOW.

Reports on water quality can be generated through the NSW Drinking Water Database.

Other internal and external reporting includes:

- To Councillors (via Ordinary Council meetings);

- HSC Management Plan;
- HSC Annual Report;
- Via State of the Environment reporting;
- Liaison with government agencies as required;
- Workshops and meetings to involve Council employees;
- 'Shire Snippets' Council newsletter.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 11 - Evaluation and Audit

11.1 Long Term Evaluation of Results

- .A. Collect and evaluate long-term data to assess performance and identify problems.
- .A. Document and report results.

Long term trending of data was carried out for the risk assessment workshop 5-6 September 2012 and is captured within the Risk Assessment Workshop Summary Paper from that workshop.

HSC will use the NSW Drinking Water Database for long-term evaluation of distribution water quality results. HSC will review performance of CCPs, water quality data and levels of service against its Strategic Business Plan, ADWG, NSW Water Supply and Sewerage Performance Monitoring reports and other regulatory requirements prior to annual review of the Improvement Plan (Appendix C), the annual budgeting process and the strategic planning process.

The Annual Report includes information regarding water infrastructure including condition and proposed expenditure. The Annual Report does not usually contain information on water quality however some water quality information was included in the 2008/09 Annual Report.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

11.2 Audit of Drinking Water Quality Management

- .A. Establish processes for internal and external audits.
- .A. Document and communicate audit results.

The NSW Health Drinking Water Database is used to document water quality results and was interrogated as part of the preparation for the risk assessment workshop on 5-6 September 2012.

Informal inspections of the system are carried out by operators but there is currently no program of formal internal audits in place.

External inspections of the system are carried out by NOW inspectors several times per year. The inspector's findings are used to help direct works.

The internal and external audit frequency will be determined in consultation with the PHU. For external audit, HSC will engage an independent auditor approved by the PHU.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

Element 12 - Review and Continual Improvement

12.1 Review by Senior Executive

- .A. Senior executive review of the effectiveness of the management system.
- .A. Evaluate the need for change.

The Annual Report includes information regarding water infrastructure including condition and proposed expenditure. The Annual Report does not usually contain information on water quality however some water quality information was included in the 2008/09 Annual Report.

Reviews of the Council systems and actions for improvement are captured and targeted for action within the Management Plan (2011-2014).

This DWMS and its implementation will be reviewed regularly (at least annually) to ensure that it maintains currency with the water supply and its management practices.

Actions to improve compliance with this element are captured in the Improvement Plan (Appendix C).

12.2 Drinking Water Quality Management Improvement Plan

- .A. Develop a drinking water quality management improvement plan.
- .A. Ensure that the plan is communicated and implemented, and that improvements are monitored for effectiveness.

Actions to improve risk management in the water supply system were identified in the risk and CCP workshops of 5-6 September 2012. All actions are captured within Appendix C.

A prioritisation plan, including the assignation of responsibilities, will be developed for implementation of the actions.

References

ADWG (2011) NHMRC/NRMMC (National Health and Medical Research Council/ Natural Resource Management Ministerial Council) Australian Drinking Water Guidelines (ADWG) National Water Quality Management Strategy. ISBN Online: 1864965118.

Hay Shire Council, 2012. Septic Tanks, Available online: http://www.hay.nsw.gov.au/CouncilServices/WaterSewer/tabid/124/Default.aspx. Accessed 23 October 2012

Hay Shire Council, 2009. Strategic Business Plan for Water Supply (provided by Ashwan Datt, Hay Shire Council).

NSW Health Drinking Water Database. Online: www.drinkingwaterdb.nsw.gov.au. Accessed 9 August 2012.

NSW Office of Water, 2012. Murrumbidgee Regional Algal Coordinating Committee. Available online: http://www.water.nsw.gov.au/Water-management/Water-quality/Algal-information/Murrumbidgee-Regional-Algal-Coordinating-Committee-/murrumbidgee-racc/default.aspx. Accessed 23 October 2012.

NSW Office of Water, 2012. NSW Water Supply and Sewerage Benchmarking Report 2010-11. NSW Office of Water Online.

NSW EPA, 2003. Section 58(5) POEO Act 1997 Variation of Licence 3237. Available online: www.environment.nsw.gov.au/prpoeoapp/ViewPOEONotice.aspx?DOCID=-1&SYSUID=1&LICID=3237. Accessed 23 October 2012.

Appendix A Risk Assessment Summary Paper

Risk Assessment Summary Paper

for Hay Shire Council

18 December 2012

Risk Assessment Summary Paper

for Hay Shire Council

18 December 2012

City Water Technology Pty Ltd

ABN 92 052 448 094

26 / 924 Pacific Highway, Gordon, NSW 2072, Australia

T: +61 2 9498 1444 F: +61 2 9498 1666

W: www.citywater.com.au E: contact@citywater.com.au

in conjunction with

Risk Edge Pty Ltd

ABN 43 143 242 399

3 Monash Avenue, East Killara NSW 2071

T: +61 4011 049 544

W: www.riskedge.com.au E: contact@riskedge.com.au

DOCUMENT ISSUE RECORD

Issue Date	Revision	Issue	Issued To	Prepared By	Approved By
14/09/2012	A	First release	Hay Shire Council NSW Health NSW Office of Water	S Loder, A Davison	S. Loder
18/12/2012	0	Final	Hay Shire Council NSW Health	S Loder	S Loder

Executive Summary

Workshop Background

The Public Health Act 2010 (NSW) has been passed by Parliament and came into effect on 1 September 2012. The Act requires drinking water suppliers to establish, and adhere to, a 'quality assurance program' (QAP) that complies with the Public Health Regulation 2012 (NSW) ('the Regulation'). The Regulation requires water suppliers to implement a QAP consistent with the Framework for Management of Drinking Water Quality in the Australian Drinking Water Guidelines (2011). The QAP will be referred to as a Drinking Water Management System (DWMS) and water utilities in NSW will be required to have them in place by 1 September 2014.

In developing a management system, water suppliers should undertake a risk assessment from catchment to consumer and develop critical control points (both items being the focus of this workshop) to ensure that unsafe water is not released into the distribution systems and that treated water is protected from contamination during distribution.

Workshop Objective

The objectives of the workshop were to:

- Understand the system from catchment to tap from a water quality perspective;
- Understand and prioritise (assess) the events, hazards and risks to drinking water consumers;
- Identify the control measures in place for addressing the identified events, hazards and risks;
- Identify any additional controls or actions which may be required to improve the risk management of the scheme; and
- Identify critical control points for the scheme.

Workshop Outline

The workshop agenda is summarised as follows:

- Describe the methodology to be used in the workshop;
- Present what was known about water quality risks relating to the source;
- Capture knowledge on Hay Shire's water supply system in an integrated fashion;
- Capture participant consensus on risks and appropriate controls; and
- Identify critical control points for the scheme.

Risk Summary

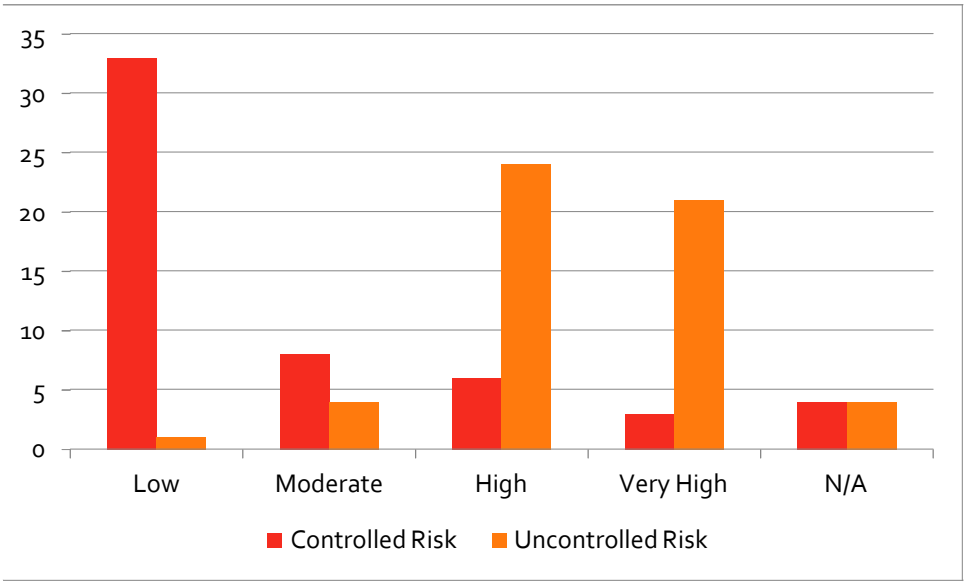
A total of 57 hazardous events were identified for the Hay Shire Council (HSC) system with 'uncontrolled' or 'maximum' risks (without controls in place) and 'controlled' or 'residual' risks (with controls in place) as summarised in the tables below. Refer to Section 5 for definition of risks. A total of 29 actions were identified to address the risks.

Uncontrolled Risk Summary - No. of risks by location in water supply system

Svstem Components	Low	Moderate	High	Verv High	Uncertain	Not Applicable	Grand Total
Catchment	1	3	1	2			8
Adsorption				1			1
Pre-dose pH correction	2		2				2
Coagulation	5		5				5
Clarification				1			1
Filtration				4			4
Disinfection (chlorine gas)	1		1	3			4
Post Dosing (stabilisation)	1		1				1
Fluoridation		1					2
Clearwater Tank	1	1	1				2
Pine St Reservoir	2		2	1	1		4
Distribution	2	3	2	3		2	10
Whole of System	4		4	7			12
Non-Potable Water				1			1
TOTAL	19	4	8	2	22	2	57

Controlled Risk Summary - No. of risks by location in water supply system

System Components	Low	Moderate	High	Very High	Uncertain	Not Applicable	Grand Total
Catchment	2	3	1				8
Adsorption							1
Pre-dose pH correction			2				2
Coagulation			5				5
Clarification							1
Filtration							4
Disinfection (chlorine gas)			1				4
Post Dosing (stabilisation)			1				1
Fluoridation	1	1					2
Clearwater Tank		1	1				2
Pine St Reservoir			2		1		4
Distribution		3	2			2	10
Non-Potable Water				1			1
Whole of System	1		4				12
TOTAL	42	6	5	1	1	2	57



Comparison of Controlled and Uncontrolled Risks

CCP Summary

The following CCPs were identified for the HSC water supply system:

- Coagulation;
- Clarification;
- Filtration;
- Primary Disinfection;
- Fluoridation; and
- Distribution Reservoirs.

Contents

1 Introduction

The Australian Drinking Water Guidelines (ADWG) (NHMRC/NRMMC, 2011) set out a holistic approach to drinking water management including understanding where sources of contamination may arise and how contamination may find its way to the consumer. The approach is termed the Framework for Management of Drinking Water Quality (the Framework).

A significant component of the Framework is understanding and managing the risks to drinking water and forms the basis of this workshop.

The workshop details are provided in Appendix A.

2 Water Quality Risk Assessment – A Background

2.1 ADWG Risk Assessment Components

Element 2 of the Framework provides the following information for undertaking a risk assessment on a water supply system (the section where the specific information is addressed in this paper is shown in brackets):

Water supply system analysis:

- Assemble a team with appropriate knowledge and expertise (Appendix A).
- Construct a flow diagram of the water supply system from catchment to consumer (Section 0).
- Assemble pertinent information and document key characteristics of the water supply to be considered (Sections 3 & 4).

Assessment of water quality data:

- Assemble historical data from source waters, treatment plants and finished water supplied to consumers (Section 4 and Appendix B).
- List and examine excursions (Section 4 and Appendix B).
- Assess data using tools such as control charts and trend analysis to identify trends and potential problems (Appendix B).

Hazard identification and risk assessment:

- Define the approach and methodology to be used for hazard identification and risk assessment (Section 5);
- Identify and document hazards, sources and hazardous events for each component of the water supply system (Workshop Activity – output being the Risk Register);
- Estimate the level of risk for each identified hazard or hazardous event (Workshop Activity – output being the Risk Register);
- Evaluate the major sources of uncertainty associated with each hazard and hazardous event and consider actions to reduce uncertainty (Workshop Activity – output being the Risk Register); and
- Determine significant risks and document priorities for risk management (Workshop Activity – output being the Risk Register).

2.2 ADWG CCP Components

Element 3 of the ADWG Framework covers assessment of preventive measures, multiple barriers and critical control points.

Preventive measures and multiple barriers:

- Identify existing preventive measures from catchment to consumer for each significant hazard or hazardous event and estimate the residual risk (Workshop Activity – output being the Risk Register).
- Evaluate alternative or additional preventive measures where improvement is required (Workshop Activity – output being the Risk Register).
- Document the preventive measures and strategies into a plan addressing each significant risk (Workshop Activity – output being the Risk Register).

Critical Control Points (Section 6):

- Assess preventive measures from catchment to consumer to identify critical control points.
- Establish mechanisms for operational control (Post Workshop).
- Document the critical control points, critical limits and target criteria (Workshop Activity – output being the identified CCPs in Section 6).

3 System Description

An overview of HSC's water supply system is provided in Table 3-1, and in further detail in the following sections.

Table 3-1: Water Supply System – Overview Description

SYSTEM COMPONENT	DESCRIPTION
Population Supplied	2,800[1]
Water Source	Murrumbidgee River (managed by State Water)
Water Storage	None
Water Treatment	Raw water from Murrumbidgee River is treated at the Hay Water Treatment Plant (WTP) as follows: • Powdered Activated Carbon (PAC) for removal of taste and odour and algal toxins (as required) • Pre-coagulation chlorination for oxidation (if required, but rarely used) • Pre-coagulation soda ash for pH correction • Alum for coagulation • Flocculation • Clarification • Filtration • Chlorination (chlorine gas) for disinfection • Post-filtration soda ash for pH correction and stabilisation • Fluoridation A raw, non-potable, water supply is also provided for external residential use only and this is chlorinated (using chlorine gas) prior to distribution.
Storage After Treatment	Treated Water Supply Clear Water Tank at the WTP site and then distribution reservoir at Pine Street. Raw Water Supply Distribution reservoirs at Leonard Street, Pine Street[2] and Lang Street.
Distribution of Product	Via pressurised pipes, pumps and tanks: • 2 km Transfer + Trunk Mains • 47 km Reticulation Mains (total for raw and treated water supplies) • 3 Pumping Stations (6 per 100 km of Main)[3]
Any Special Controls Required	Quality of chemicals, materials etc used in the production and delivery of the product. Manual verification sampling of water from the distribution network. Backflow prevention and trade waste management. Operation and maintenance of all infrastructure to prevent recontamination.

[1] NSW Health Drinking Water Database Supply System Information Report
[2] Noting that there is a non-potable and a potable reservoir at the Pine Street location.
[3] NSW Office of Water (2012) 2010-11 NSW Benchmarking Report

3.1 Water Sources

Water for Hay is drawn directly from the Murrumbidgee River (see Figure 3-2). There are two dedicated river off-takes for the Hay water supply (as marked in Figure 3-1). River water is drawn by the Murray Street pumps for transfer to Hay Water Treatment Plant (WTP) for treatment. Water is also drawn by the Leonard Street pumps for chlorination and distribution as non-potable water, for external domestic use only.

Figure 3-1: River Off-takes for Hay's potable and non-potable water supply systems (Source: Google Maps)

Figure 3-2: Murrumbidgee River Intake (Leonard Street Pump Station)

The Murrumbidgee River is one of the larger rivers of the Murray Darling Basin in south-eastern Australia, having a catchment of approximately 84,000 km². Being such a large catchment, the climatic conditions and land uses are quite diverse. The landscape ranges from mountainous country in the east to broad semi-arid plains in the west. Rainfall is mostly winter dominant.

The Hay Irrigation Area on the Murrumbidgee River is regarded as the 'cradle of irrigation' and a range of crops are grown throughout the region. The area is regarded as one of the best wool growing areas in Australia. In recent years, Hay has also become a significant rice producer.

The Murrumbidgee River rises in the Snowy Mountains and flows generally westward to its confluence with the Murray River. Water quality monitoring downstream of Burrinjuck dam indicates that the Murrumbidgee River has relatively low (but potentially increasing) salinity, medium levels of turbidity and high total phosphorus levels[4]. Rainfall events and periods of high river flows are often associated with inputs of nutrients into the river. High nutrient levels (particularly combined with warmer waters, thermal stratification and long residence times) can result in increased incidence of algal blooms. The section of the Murrumbidgee River at Hay (as marked in Figure 3-3) is considered to have a medium to high potential for blue-green algal (cyanobacterial) blooms. Raw water drawn from Murrumbidgee River is also characterised by low alkalinity.

[4] Murray-Darling Basin Commission (2004)

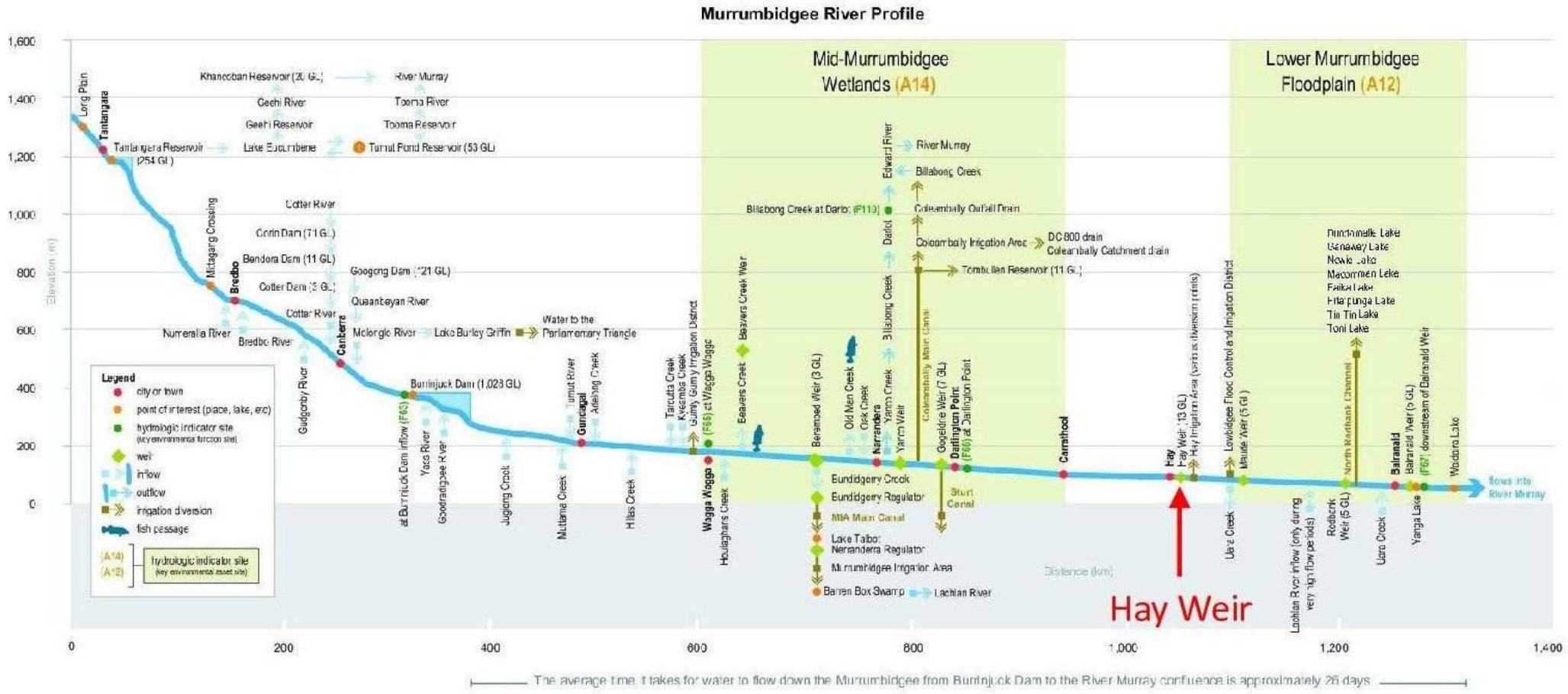


Figure 3-3: Murrumbidgee River Profile (Source: Murray-Darling Basin Commission (2011) Murrumbidgee River Profile. MDBA Online)

3.2 Treatment

Hay Shire Council (HSC) owns and operates the Hay Water Treatment Plant (WTP). This is a conventional treatment plant, which was built in 1988 and has a capacity of 2.1 ML/day. The treatment process train steps are listed above in Table 3-1.

HSC also owns and operates a separate chlorination facility at Leonard Street which is used to disinfect the raw water supply prior to distribution.

Figure 3-4: Sedimentation Tank at Hay WTP

3.3 Distribution

Figure 3-5: Pine St Reservoir (Potable)

Hay's overall (raw and treated) water supply distribution system comprises 2 km of transfer and trunk mains and 47 km of reticulation mains. Reticulation diagrams are provided in Appendix C.

There is one service reservoir for the potable water supply system, located at Pine Street. Treated water from the WTP is pumped to this reservoir, which has a capacity of 2.3 ML.

The raw water supply, although chlorinated, is non-potable and is intended for external residential use only. There are 3 service reservoirs (Leonard Street, Pine Street and Lang Street) with a combined capacity of 9.2 ML.

The towns of Maude and Booligal are not connected to the reticulated water supply. These towns are supplied by rainwater tanks and/or privately owned groundwater bores.

3.4 Process Flow Diagram

A conceptual flow diagram for the potable water supply system is shown in Figure 3-6. The purpose of this diagram is to show key inputs, steps and flow direction.

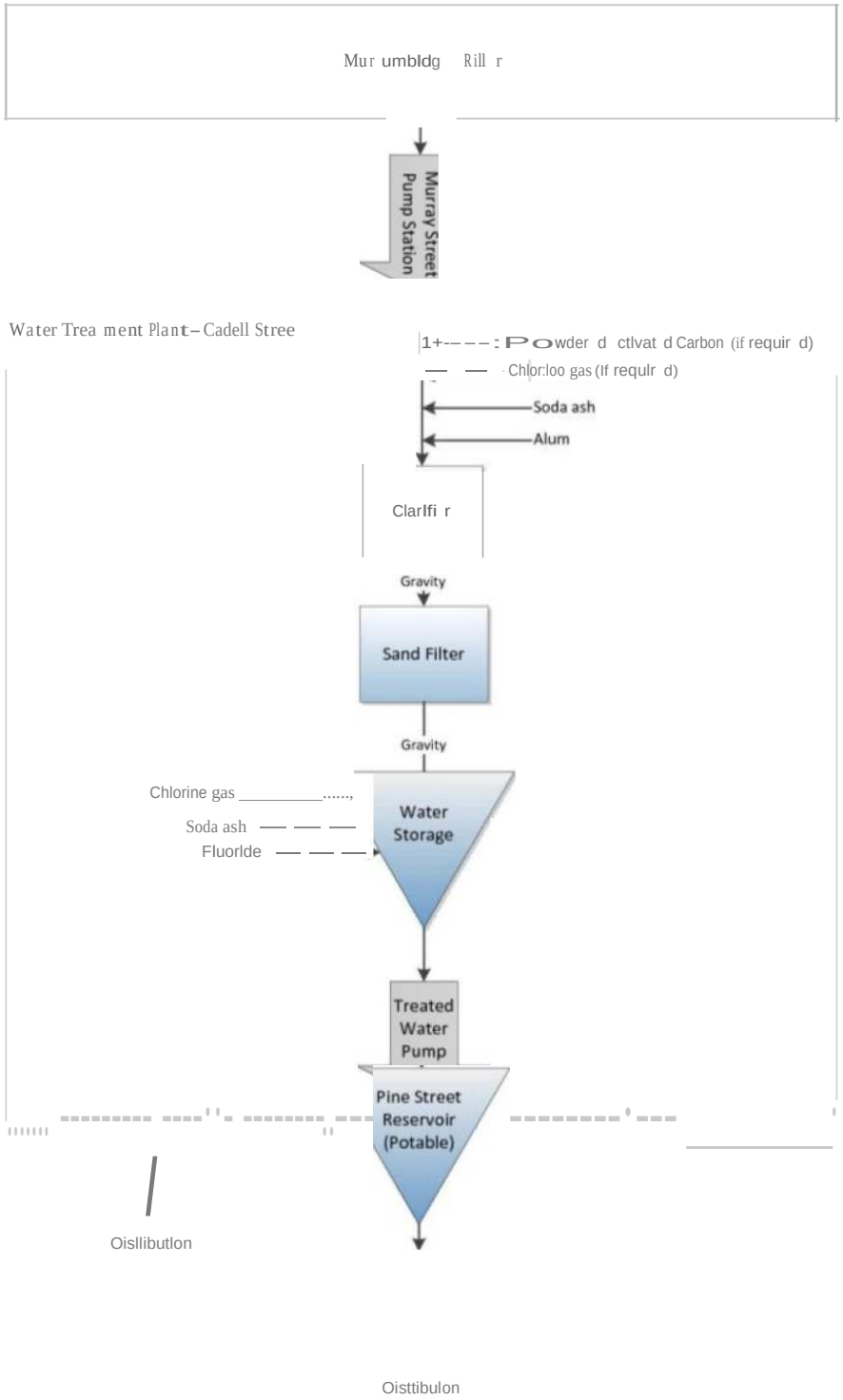


Figure 3-6: Conceptual Process Flow Diagram of the Potable Water Supply System (Source: HSC)

A conceptual flow diagram for the raw water supply system is shown in Figure 3-6.

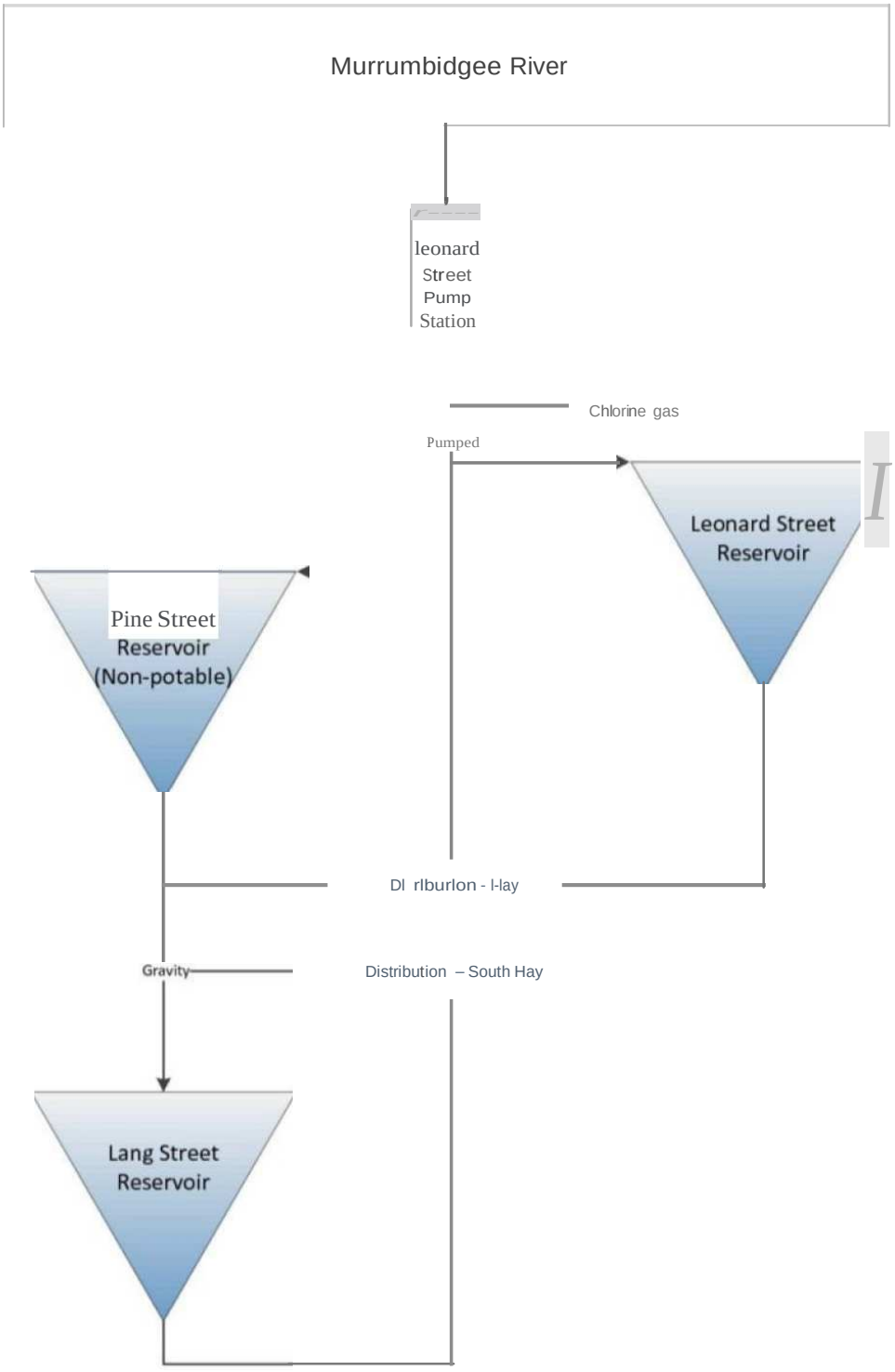


Figure 3-7: Conceptual Process Flow Diagram of the Raw Water Supply System (Source: HSC)

4 Water Quality Risks

4.1 Risks Identified in Previous Studies

HSC's Strategic Business Plan for Water Supply & Sewerage Services 2009/10 states that in 2006/07, 2007/08 and 2008/09 Hay's potable water supply system was fully compliant with Australian Drinking Water Guidelines (ADWG 2004) in terms of chemical and microbiological (E. coli) water quality results. The NSW Office of Water's 2010-11 NSW Benchmarking Report also states that Hay was fully compliant in 2010/11.

The 2009/10 Strategic Business Plan highlighted asset condition as an area to be assessed, being generally assessed at "fair to poor", as summarised below:

- Treatment Plant: Superficial deterioration – Good to Fair
- Reticulation: Requires major reconstruction – Poor to Fair
- Intake Works: Showing some deterioration– Good
- Reservoirs: Some deterioration evident – Fair to Good

4.2 Risks Identified Through Water Quality Analysis

Reticulated water quality data were extracted from the NSW Health verification monitoring database for testing carried out in the Hay water supply over the period 01/12/2000 to 24/07/2012. Water was tested for 36 quality parameters. To allow statistical formulae to handle the full body of data, non-detects were transformed to half the detection limit and values above the upper dynamic range of the assay to twice the upper limit.

An analysis of the results against the Australian Drinking Water Guidelines 2011 is provided in the tables below. Table 4-1 provides statistics for common parameters, and Table 4-2 provides descriptions for all parameters where any excursions were recorded.

Graphs of the water quality parameters can be found in Appendix B.

Table 4-1: Summary of Water Quality Data for Hay Supply System (NSW Health Data)

PARAMETERS	NO. OF SAMPLES	MINIMINUM	MEAN	90%ILE	MAXIMUM	ADWG 2011 GUIDELINE VALUE[5]		NO. OF EXCEEDANCES	
						Health	Aesth.	Health	Aesth.
pH	98	7.1	7.8	8.2	8.9	-	6.5-8.5	-	4
True Colour (HU)	18	0.5	1.4	3	5	-	15	-	0
Turbidity (NTU)	92	0.05	0.29	0.52	2.3	1 [6 7]	5	1	0
Iron (mg/L)	19	0.005	0.01	0.012	0.06	-	0.3	-	0
Manganese (mg/L)	24	0.005	0.016	0.030	0.157	0.5	0.1	0	1
Aluminium (mg/L)	19	0.005	0.029	0.072	0.14	-	0.2	-	0
Total Chlorine (mg/L)	10	0.13	0.43	0.76	0.62	5	0.6	0	1
Free Chlorine (mg/L)	60	0.05	0.48	1.0	1.3	5	0.6	0	20
Fluoride[8] (mg/L)	5841	0.03	0.95	1.07	1.7	-	1.5	-	1
Total Coliforms (cfu/100 mL)	556	0	0.3	0	34	-	-	-	-
(cfu/100 mL)	552	<1	<1	<1	<1	<1	-	<1	-
Total (mg/L as $CaCO_3$)	19	17	37.3	53.4	57.5	-	200	-	0

[5] Note: A dash indicates that no guideline has been set in ADWG 2011 for this parameter.
[6] ADWG 2011: "A turbidity of less than 1 NTU is desirable at the time of disinfection with chlorine…"
[7] ADWG (2011) also states that "the target for the turbidity of water leaving individual filters should be less than 0.2 NTU and should not exceed 0.5 NTU at any time".
[8] Combines results labelled as "Fluoride", "Fluoride (daily WU)", "Fluoride (weekly WU)" and "Fluoride (WU result)".

Table 4-2: Water Quality Issues/Comments for the Hay Potable Water Supply System

ISSUE	FREQUENCY	COMMENT
pH	Rarely	pH was generally quite high in the past and exceeded the guideline value of 8.5 on a few occasions but has recently improved.
Turbidity	Rarely	One turbidity result exceeded the ADWG limit of 1 NTU for disinfection with chlorine (2.3 NTU at Moama St on 05/05/2005).
Manganese	Rarely	Manganese exceeded the aesthetic limit on one occasion
Chlorine	Occasionally	17 free chlorine results were less than the recommended minimum of 0.2 mg/L and this may present a risk to disinfection in some parts of the reticulation
Fluoride	Rarely	Fluoride was generally low (although there is no lower limit in ADWG this is still a regulatory issue as NSW Health requires the fluoride concentration to be in the range 0.95-1.5mg/L). It is noted that the fluoride dosing system is soon to be replaced and the new system is expected to improve dosing control. One result exceeded the ADWG health limit of 1.5 mg/L on 01/10/2002. It is understood that an air break has since been installed.
Total Coliforms	Rarely	A number of Total Coliforms results were observed in the past years. This may be as a result of their release from pipe or sediment biofilms.
Total Hardness (mg/L as $CaCO_3$)	Always	Hardness is always lower than the recommended minimum of 60 mg/L

5 Risk Assessment Process

5.1 Risk Assessment

Events and hazards were identified for each process step. Risks posed by each of the events were assessed. Participants were asked to identify the:

Hazardous event — A hazardous event is one that introduces contaminants (hazards) to the water.

For this risk assessment the hazardous event was for the level of contamination to be unacceptable for treatment through the downstream processes. Examples of a hazardous event might be:

- Cyanobacterial bloom resulting in toxins that cannot be removed by downstream processes
- Distribution reservoir contamination by vermin resulting in pathogens in the distribution system

Hazard — A hazard is a physical, chemical or biological agent in the water with the potential to cause an adverse effect.

Examples of hazards might be:

- Human-infectious pathogens and nutrients from failing septic tanks
- Particles and nutrients from land clearing practices

Controls in place — Controls are practices and equipment that reduce the hazard or the hazardous event.

Examples of controls include:

- Catchment management programs to reduce nutrients in the river, thereby reducing cyanobacterial blooms
- A water treatment plant
- A backflow prevention program

Controlled Risk — Controlled or 'residual' risk was assessed by identifying the likelihood and consequence of the hazardous event occurring with the control in place. The risks were assessed as Likelihood (Table 5-1) x Consequence (Table 5-2).

A risk assessment matrix (ADWG, 2011) was used to assess risks to the identified end uses (Table 5-3).

Maximum Risk — Likelihood and consequence of the hazardous event occurring if the controls were to fail or are inadequate.

The results were captured during the workshop via a Microsoft Excel® spreadsheet.

Table 5-1: Likelihood Table (ADWG, 2011)

Level	Descriptor	Example description
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur or should occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

Table 5-2: Consequence Table (ADWG, 2011)

Level	Descriptor	Example description
1	Insignificant	Insignificant impact, little disruption to normal operation, low increase in normal operation costs
2	Minor	Minor impact for small population, some manageable operation disruption, some increase in operating costs
3	Moderate	Minor impact for large population, significant modification to normal operation but manageable, operation costs increased, increased monitoring
4	Major	Major impact for small population, systems significantly compromised and abnormal operation if at all, high level of monitoring required
5	Catastrophic	Major impact for large population, complete failure of systems

Table 5-3: Risk Matrix (ADWG, 2011)

Likelihood	Consequences				
	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
A (almost certain)	Moderate	High	Very high	Very high	Very high
B (likely)	Moderate	High	High	Very high	Very high
C (possible)	Low	Moderate	High	Very high	Very high
D (unlikely)	Low	Low	Moderate	High	Very high
E (rare)	Low	Low	Moderate	High	High

5.2 Summary

A total of 57 hazardous events were identified for the HSC system. All events have been captured within an Excel®-based Risk Register.

Prior to the workshop, the Risk Register template was populated with typical hazardous events relevant to similar systems for consideration. During the workshop, these hazardous were added to and subtracted from as required in order to produce a list relevant to HSC. Where a hazardous event was considered by the workshop and deemed not relevant to HSC, "N/A" was inserted in place of the Risk Scores.

Note that 'uncertainty' was captured along with any other comments, in the 'Basis/Notes' section of the Risk Register. The register will be reviewed at a set frequency and/or on system changes. The Risk Register, as determined at this workshop, is presented in Appendix D.

Risks remaining very high after controls were assessed are as follows:

- Non-potable water being consumed as if it were potable.

Risks remaining high after controls were assessed are as follows:

- Potential cross connection between Pine Street raw and potable reservoirs;
- Catastrophic system failure, e.g. bushfire, flood or earthquake taking out key infrastructure e.g. Hay Water Treatment Plant or pump station;
- Terrorism or disgruntled employees or contractors leading to malicious damage resulting in poor water quality (or perceived poor water quality) (Note that employees and contractors understand the system so would know where to act to cause most damage e.g. altering SCADA, contaminating clearwater tank etc);
- Resourcing issues due to greying of the workforce, unavailability of appropriately qualified staff, staff turnover leading to water quality issues; and
- Contamination from sharing of equipment across sewer and drinking water operations, unsanitary repairs.

Risks reduced from Very High to Low with controls in place are as follows:

- Rain events leading to erosion from river bank, land uses, forestry, unsealed roads and private access roads and driveways leading to water quality issues;
- Releases from Tom Bullen storage by State Water leading to water quality issues;
- Under or no dosing of PAC;
- Failure to clarify properly leading to water quality issues at the filter;
- Short circuiting of filters leading to breakthroughs;
- Poor filter performance e.g. filter nozzles, filter media loss, high loads in water, aborted backwash;
- Filter ripening issues leading to pathogen breakthrough;
- Underdosing of chlorine resulting in lack of free chlorine residuals in distribution system;
- Low chlorine residuals resulting in the potential for water quality failure;
- Reduced velocities in the main resulting in conditions that favour biofilm formation and sediment accumulation;
- Operator training is not kept up to date resulting in potential for water contamination through incorrect operation of the water supply system; and
- Contractor error causing water quality issues.

Risks reduced from High to Low with controls in place are as follows:

- Catchment runoff (agriculture, dead animals, on-site sewage management systems, native and feral wildlife, stock) causing problems with water quality issues;
- Under or no dosing of soda ash causing pH lower than optimal for coagulation;
- Overdosing of soda ash causing pH higher than optimal for coagulation;
- Underdosing of coagulant leading to failure to achieve flocculation;
- Overdosing of coagulant;
- Mechanical/equipment failure/maintenance of flocculators leading to water quality issues;
- Raw water has low turbidity and high colour causing problems with coagulation control;
- Rapid change in raw water turbidity resulting in inability to treat;
- Overdosing of chlorine leading to high levels in finished water;
- Overdosing or underdosing of Soda ash;
- Water carters can connect to Clearwater Tank and potential for backflow to arise;
- Potential water quality contamination of Pine St Reservoir e.g. vermin access (see also Figure 5-1and Figure 5-2);

- Seasonal conditions affecting water temperature in the raw and treated water and longevity of chlorine residual in the distribution system;
- Dead end in reticulation systems leading to stagnation and water quality issues;
- Commissioning new mains leading to water quality issues;
- Incorrect or reduced quality of materials resulting in potential for water quality contamination; and
- Retrofits and Upgrades (unauthorised modification (without s.60 approval)) causing water quality issues

Figure 5-1: Corrugations in Roof of Pine St (Potable) Reservoir

Figure 5-2: Holes (Missing Bolts) in Roof of Pine St (Potable) Reservoir

A total of 29 actions were identified in the workshop to address the identified risks. An Action Plan has been developed and is presented in Appendix E.

An overall summary of the uncontrolled ('maximum') and controlled ('residual') risks is presented in tabular and graphical form below (Table 5-4, Table 5-5 and Figure 5-3).

Table 5-4: Uncontrolled Risk Summary – No. of risks by location in water supply system

System Components	Low	Moderate	High	Very High	Uncertain	Not Applicable	Grand Total
Catchment	1	3	1	2			8
Adsorption				1			1
Pre-dose pH correction	2		2				2
Coagulation	5		5				5
Clarification				1			1
Filtration				4			4
Disinfection (chlorine gas)	1		1	3			4
Post Dosing (stabilisation)	1		1				1
Fluoridation		1					2
Clearwater Tank	1	1	1				2
Pine St Reservoir	2		2	1	1		4

System Components	Low	Moderate	High	Very High	Uncertain	Not Applicable	Grand Total
Distribution	2	3	2	3		2	10
Whole of System	4		4	7			12
Non-Potable Water				1			1
TOTAL	19	4	8	2	22	2	57

Table 5-5: Controlled Risk Summary – No. of risks by location in water supply system

System Components	Low	Moderate	High	Very High	Uncertain	Not Applicable	Grand Total
Catchment	2	3	1				8
Adsorption							1
Pre-dose pH correction			2				2
Coagulation			5				5
Clarification							1
Filtration							4
Disinfection (chlorine gas)			1				4
Post Dosing (stabilisation)			1				1
Fluoridation	1	1					2
Clearwater Tank		1	1				2
Pine St Reservoir			2		1		4
Distribution		3	2			2	10
Non-Potable Water				1			1
Whole of System	1		4				12
TOTAL	42	6	5	1	1	2	57

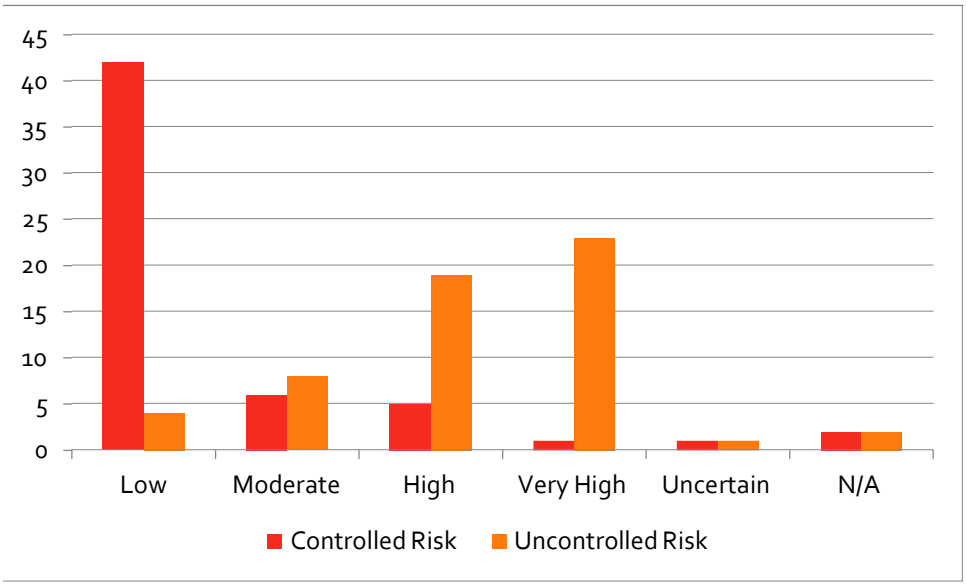


Figure 5-3: Graphical Representation of Risks (x-axis – risk rating; y-axis – number of risks identified)

6 Critical Control Point Identification

Critical control points are the operational core of the drinking water management system. CCPs are covered under Element 3 of the Framework. In the Framework, CCPs are defined as:

".....an activity, procedure or process at which control can be applied and which is essential to prevent a hazard or reduce it to an acceptable level."

For a point to be considered critical it must:

- Control hazards that represent a significant risk and require elimination or reduction to assure supply of safe drinking water.
- Have a parameter (surrogate) that can be measured in a timely manner for the hazardous event
- Be able to have a correction applied in response to a deviation in the process

The key risks from the risk assessment were reviewed and the critical control points will be identified.

The points in the HSC system identified as critical control points (or future critical control points) were (see also Table 6-1):

- Coagulation;
- Clarification;
- Filtration;
- Primary Disinfection;
- Fluoridation; and
- Distribution Reservoirs.

It is noted that coagulation/flocculation and clarification are often grouped and considered as part of the filtration CCP however the workshop elected to treat these as separate CCPs.

Table 6-1: Critical Control Point Workshop Outcomes

Critical Control Point	Controls	Parameters	How Measured	Operating Target	Adjustment Limit	Critical Limit	Comments
Coagulation	Pathogens/Turbidity	pH	Manual grab sampling from clarifier	6 - 7	<6 or >7	<5.8	Rely on operator training and experience. Operators contact NSW Health and/or NOW if water quality goes outside limits
Clarification (clarifier effluent)	Pathogens/Turbidity	Turbidity	Manual grab sampling (daily or as required)	1 - 2 NTU	>2.5 NTU	>5 NTU	Investigate (including visual inspection of clarity in clarifier - e.g. count number of rungs of ladder can be seen), consider draining clarifier (>10NTU). Rely on operator training and experience.
Clarification (clarifier effluent)	Pathogens/Turbidity	Colour	Manual grab sampling (daily or as required)	2.5 - 5 HU	>10 HU	>15 HU	Rely on operator training and experience.
Filtration	Pathogens	Turbidity	Grab sample	0.15 - 0.25 NTU	>0.3 NTU	>0.5 NTU	Shut down plant, drain clarifier and start again. Try to run the plant during the day only to keep a better eye on this (~7am-4pm). Rely on operator training and experience. There are currently no alarms on this.
Filtration	Pathogens DBPs	Colour	Grab sample	0 HU	>3 HU	>5 HU	Shut down plant, drain clarifier and start again. Try to run the plant during the day only to keep a better eye on this (~7am-4pm). Rely on operator training and experience.
Primary Disinfection (outlet of CWT)	Chlorine sensitive pathogens	Free chlorine residual	Online	1.0 - 1.2 mg/L	<0.9 mg/L or >1.2 mg/L	<0.5 mg/L or >1.5 mg/L	Operating target limit is season-dependent. Rely on operator training and experience. Automatic shutdown and shutdown call-out alarm at 0.5 mg/L. High alarm at 1.3 mg/L does not call out or shut down. Consider shutdown alarm at about 2 mg/L?

Critical Control Point	Controls	Parameters	How Measured	Operating Target	Adjustment Limit	Critical Limit	Comments
Primary Disinfection (outlet of CWT)	Chlorine sensitive pathogens	pH	Online	7.6 - 7.8	<7.3 or >8.2	<6.8 or >8.5	Rely on operator training and experience. Shutdown and call-out alarm (for shutdown) at 6.8 and 8.5.
Primary Disinfection (outlet of CWT)	Chlorine sensitive pathogens	Turbidity	Online	0.1 - 0.2 NTU	>0.3 NTU	>1 NTU	?Automatic shutdown and call-out alarm (for shutdown) at 1 NTU. Jar test.
Fluoridation	Fluoride	Fluoride	Daily grab sample and weekly reticulation	0.95 - 1.1 mg/L	<0.95 mg/L or >1.3 mg/L	<0.9 mg/L or >1.5 mg/L	Investigate (including drop test), re-check and submit Form 5 if outside these critical limits.
Distribution Reservoirs	Pathogens	Free chlorine residual	Grab sample (weekly or as required)	0.3 - 0.5 mg/L	<0.3 mg/L or >0.8 mg/L	<0.2 mg/L or >1.5 mg/L	Adjust chlorine dose at WTP. Overflow and flush if required. Record on WTP logs. Rely on operator training and experience.
Distribution Reservoirs	Pathogens	Vermin-proofed, secure and leak-proof	Observation	Inspections at the time of sampling	Hatches closed. Perimeter fence intact and locked. Corrugations are still blocked (when in place). No evidence of roosting. No leaks.	Hatches open. Loose roofing. Evidence that corrugation caps have come out (when in place). Evidence of roosting. Leaks.	Evidence of bird faeces and low chlorine.

The critical limits will be considered further as the critical control points are refined during development and implementation

6.1 Areas of Additional Work to Support CCP Development

The risk and CCP workshops identified that the majority of operational activities rely on operator training and experience and are not formally documented. Procedures surrounding the CCPs shall be formalised and records and documentation supporting these should also be formalised and signed off.

Filtration

Although the system seems to be well-managed, consideration should be given to individual filter effluent turbidity analysis. ADWG (2011) states that in order to address risks from Cryptosporidium and Giardia the turbidity target for water leaving the filters should be less than 0.2 NTU and should not exceed 0.5 NTU at any time.

Distribution Reservoirs

The workshop identified that an Incident Management Plan is required. This should cover any contamination of distribution reservoirs and will become an important reference document for this CCP.

7 References

ADWG (2011) NHMRC/NRMMC (National Health and Medical Research Council/ Natural Resource Management Ministerial Council) Australian Drinking Water Guidelines (ADWG) National Water Quality Management Strategy. ISBN Online: 1864965118.

Hay Shire Council (2009) Strategic Business Plan for Water Supply & Sewerage Services 2009/10. (Provided by Ashwan Datt, HSC).

Murray-Darling Basin Commission (2004) The Living Murray – Health of the River Murray, Information Paper No. 14. MDBC Online: IPTLM0014

NSW Health Drinking Water Database. Online: www.drinkingwaterdb.nsw.gov.au (accessed 09/08/2012)

NSW Office of Water (2012) 2010-11 NSW Benchmarking Report. NSW Office of Water Online.

Murray-Darling Basin Commission (2011) Murrumbidgee River Profile. MDBA Online.

Process diagrams for raw and potable water systems (provided by Ashwan Datt, HSC).

Appendix A – Workshop Details

Workshop Agenda

ITEM	DESCRIPTION
Date/Time	5th September 2012 / 8:30 am for a 9:00 am start to 5:00 pm (risk assessment) 6th September 2012 / 8:30 am for a 9:00 am start to 12:30 pm (CCP identification)
Venue	Council Chambers, Hay Shire Council, 134 Lachlan Street, Hay NSW 2711
Contacts	Sarah Loder, (02) 9498 1444, sarah@citywater.com.au (Consultant representative)

TIME	SESSION	ITEM	PERSON
Wednesday 5 September 2012			
8:30 – 9:00	Arrival	Arrival and tea/coffee	All
9:00 – 9:05	Welcome	Introduction roundtable	City Water Technology (CWT)
9:05 – 9:10	Introduction	Overview of project	NSW Health
9:10 – 9:30	System Description	Scope of workshop Description of the water supply system including catchment description, water quality data analysis and presentation of flow diagram	CWT
9:30 – 9:45	Flow Diagram	Workshop to confirm flow diagram	All facilitated by CWT
9:45 – 10:15	Workshop Overview	Workshop Methodology	CWT
10:15 – 10:30	Break	Morning tea	All
10:30 – 12:30	Risk Assessment	Events, Hazards, Risks and Controls: Workshop events, hazards, identify control measures then assess 'maximum' and 'residual' risks and identify any additional controls required	All facilitated by CWT
12:30 – 13:00	Break	Lunch	All
13:00 – 15:00	Risk Assessment	Continued	All facilitated by CWT
15:00 – 15:15	Break	Afternoon tea	All
15:15 – 17:00	Risk Assessment	Concluded	All facilitated by CWT

TIME	SESSION	ITEM	PERSON
Thursday 6 September 2012			
8:30 – 9:00	Arrival	Arrival and tea/coffee	All
9:00 -10:15	Critical Control Points	Review CCPs Assign critical limits where possible	All facilitated by CWT
10:15 – 10:30	Break	Morning tea	All
10:30-12:20	Critical Control Points	Concluded	All facilitated by CWT
12:20 – 12:30	Close	Workshop close and next steps	CWT

Workshop Participants

Name	Role	Organisation
Ashwan Datt	Deputy Manager of Technical Services, Council Representative	Hay Shire Council
Tony Davies	Water and Sewer Operator	Hay Shire Council
Les Wall	Superintendent of Works	Hay Shire Council
Philip Ruddick	Technical Support Officer	Hay Shire Council
Uzma Bashir	Water Unit Representative	NSW Health
Kevin Prior	Public Health Unit Representative	NSW Health
Bernie Barnes	Inspector	NSW Office of Water
Annette Davison	Facilitator	Risk Edge (for City Water Technology)
Sarah Loder	Capture	City Water Technology

Workshop Attendance Sheet

Event	Risk Assessment Workshop
Purpose	Drinking Water Management System Risk Assessment Workshop
Date / Time	5th September 2on/g:oo am to s:oo pm
Venue Name	Council Chambers, Hay Shire Council, 134 Lachlan Street, Hay NSW 2711

	Role	Organisation	Signature
Ashwan Datt	Deputy Manager ofTechnicaiServices, Council Representative	Hay Shire Council	
Tony Davies	Water and Sewer Operator	Hay Shire Council	
Les Wall	Superintendent of Works	Hay Shire Council	
Philip Ruddick	Technical Support Officer	Hay Shire Council	
Uzma Bashir	Water Unit Representative	NSW Health	
Kevin Prior	Public Health Unit Representative	NSW Health	
Bernie Barnes	Inspector	NSW Office of Water	
Annette Davison	Facilitator	Risk Edge Pty Ltd (for City Water Technology Pty Ltd)	
Sarah Loder	Capture	City Water Technology Pty Ltd	

Workshop Attendance Sheet

Event	Critical Control Point Workshop
Purpose	Drinking Water Management System CCP Workshop
Date / Time	6th September 20u / g:oo am to 1.2:30 pm
Venue	Council Chambers, Hay Shire Council, 1.34 Lachlan Street, Hay NSW 271.1.

Name	Role	Organisation	Signature
Ashwan Datt	Deputy Manager of Technical Services, Council Representative	Hay Shire Council	
Tony Davies	Water and Sewer Operator	Hay Shire Council	
LesWall	Superintendent of Works	Hay Shire Council	
Philip Ruddick	Technical Support Officer	Hay Shire Council	
Uzma Bashir	Water Unit Representative	NSW Health	
Kevin Prior	Public Health Unit Representative	NSW Health	
Bernie Barnes	Inspector	NSW Office of Water	
Annette Davison	Facilitator	Risk Edge Pty Ltd (for City Water Technology Pty Ltd)	
Sarah Loder	Capture	City Water Technology Pty Ltd	

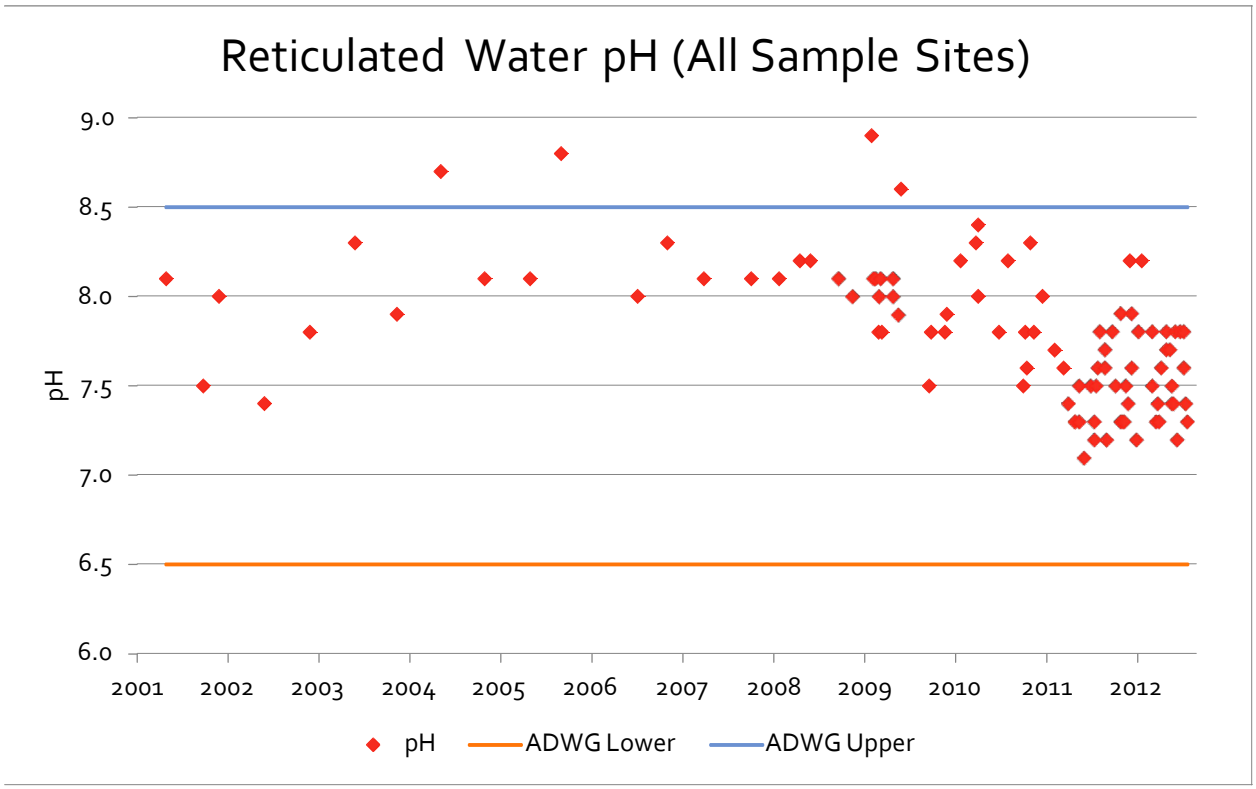
Appendix B – Water Quality Data

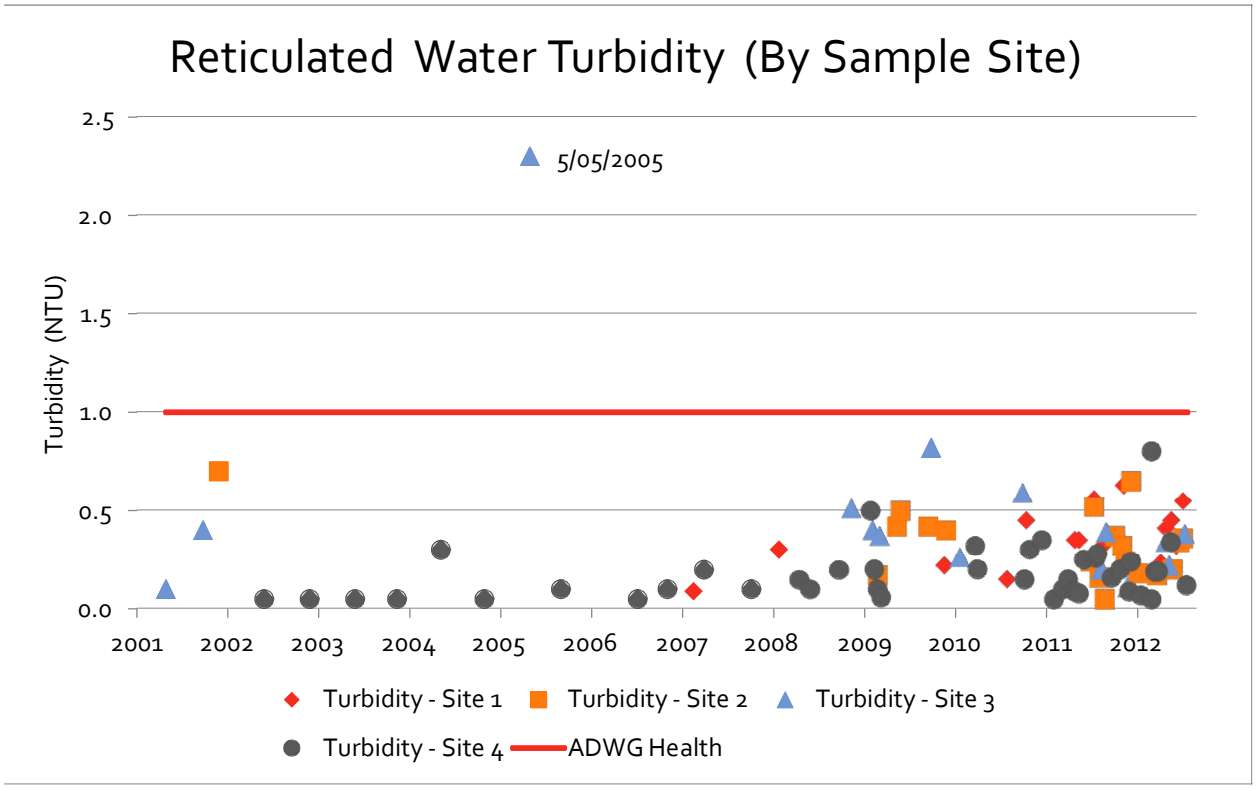
All water quality data presented in this section was sourced from the NSW Health Drinking Water Database which contains results from samples collected at various sites in the reticulation.

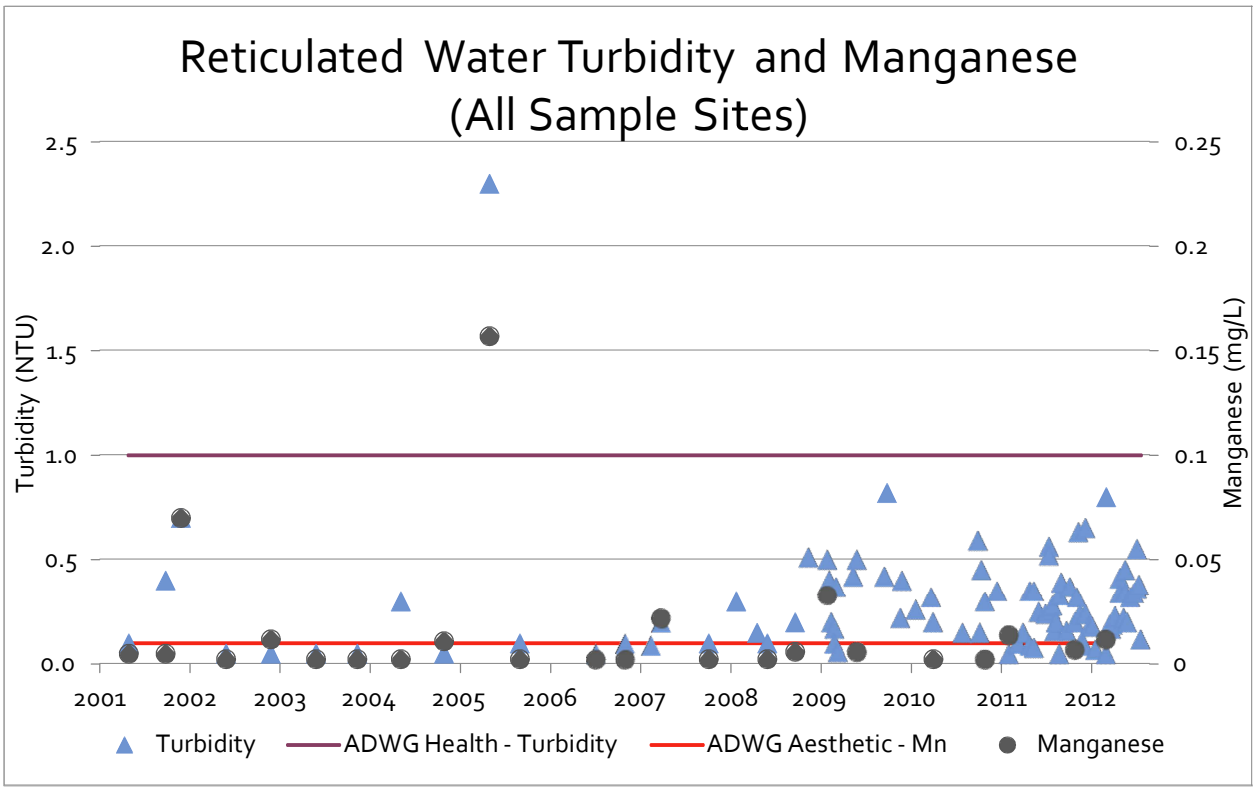
Sample sites referred to in this section are as follows:

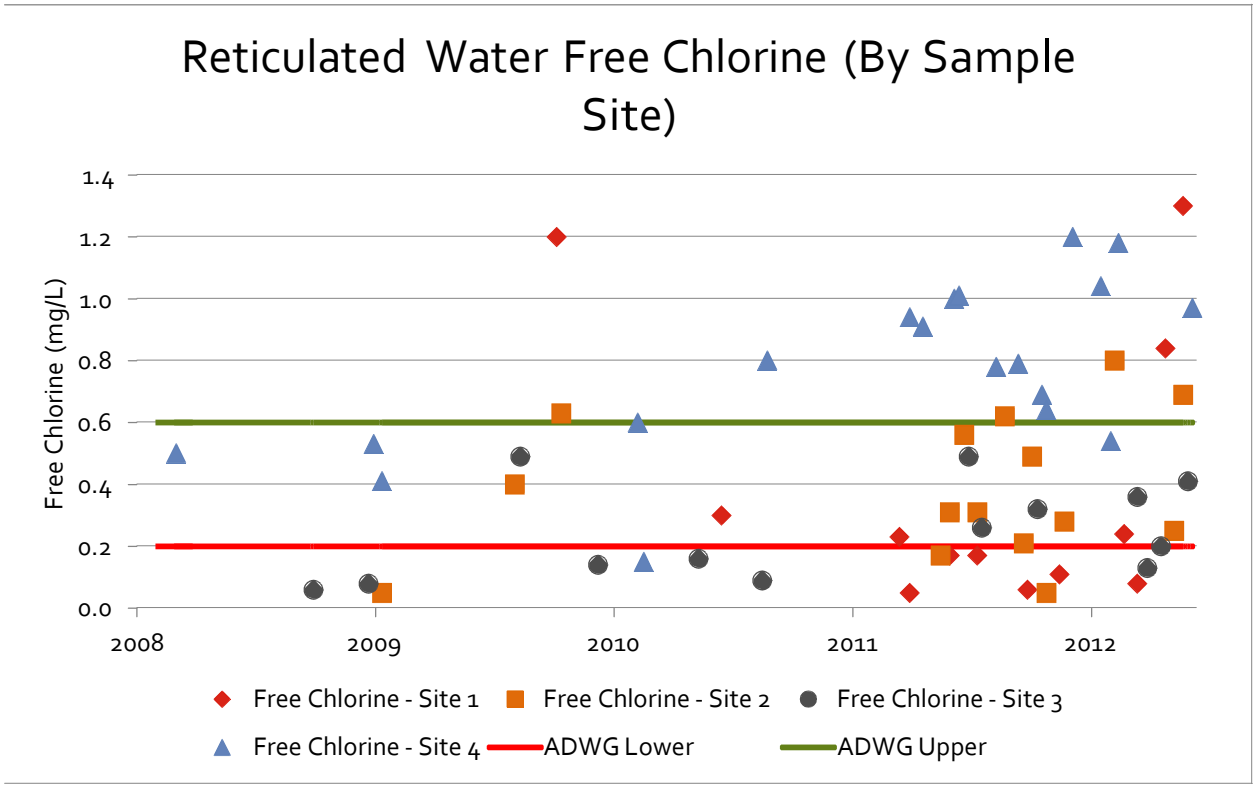
- Site 1 = Piper/ Murray Street, Hay
- Site 2 = George Street, Hay
- Site 3 = Moama Street, Hay
- Site 4 = Cadell Street, Hay

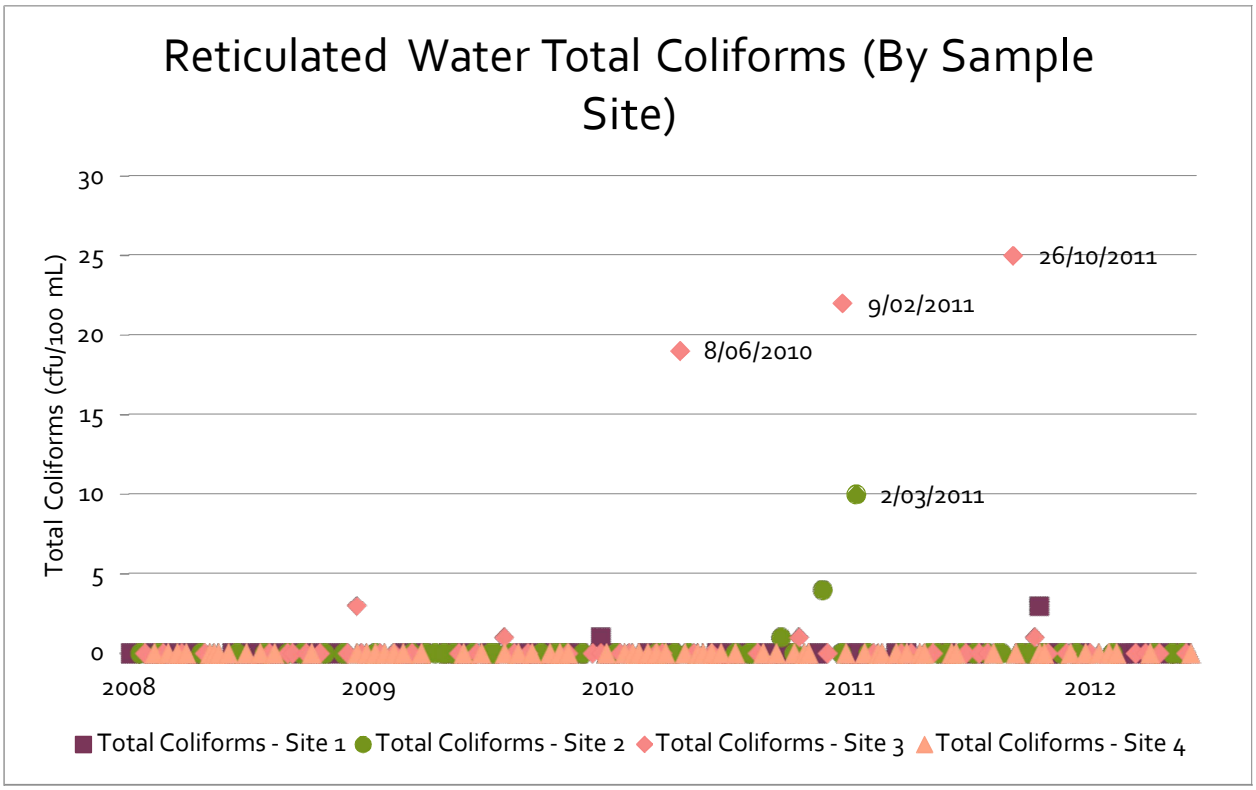
All guideline values included in these graphs are from the 2011 Australian Drinking Water Guidelines.

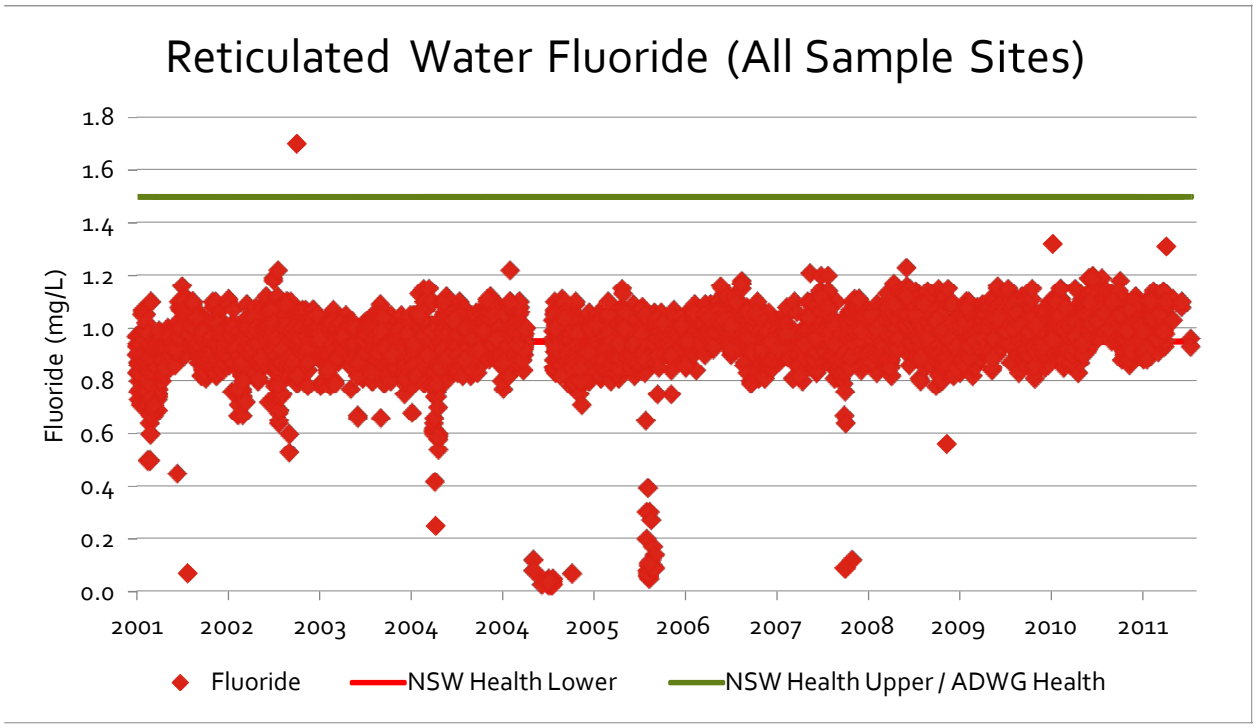


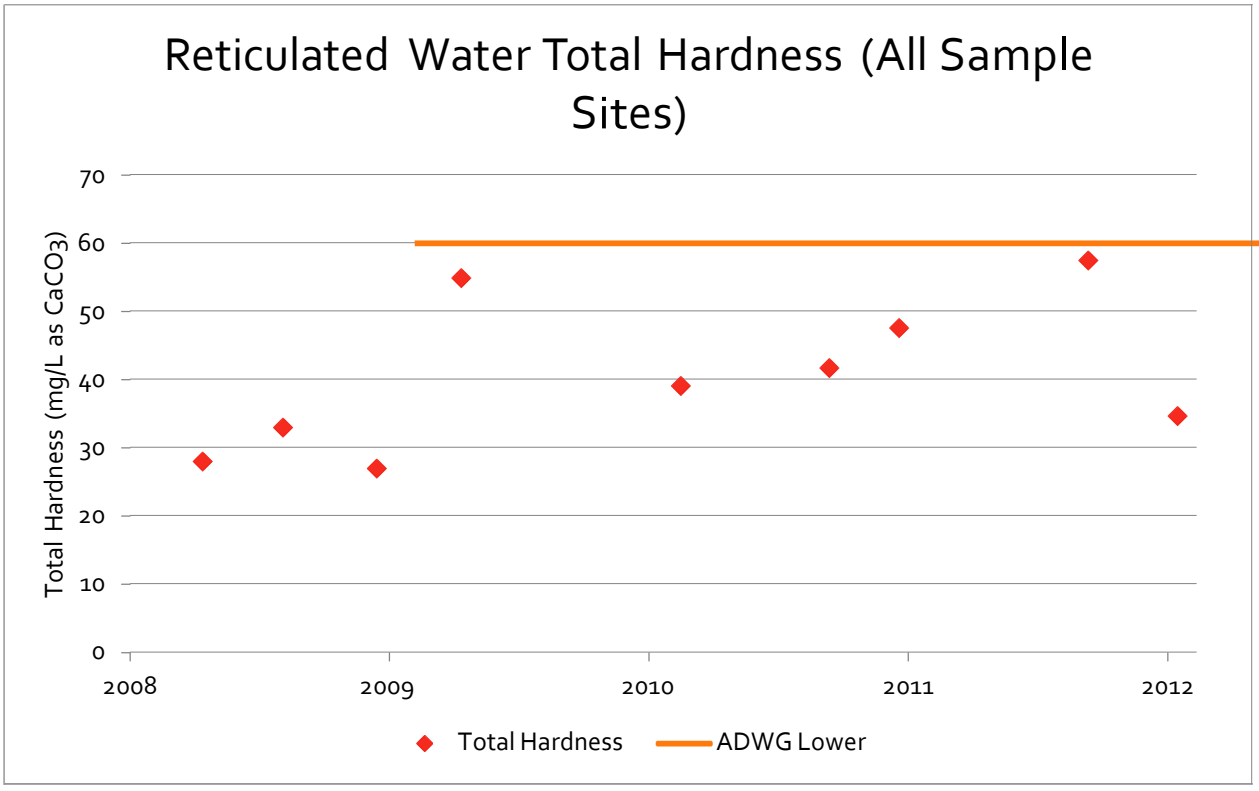

Reticulated Water Turbidity (By Sample Site)
Turbidity (NTU)
2.5
2.0
1.5
1.0
0.5
0.0
5/05/2005
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Turbidity - Site 1
Turbidity - Site 2
Turbidity - Site 3
Turbidity - Site 4
ADWG Health


Reticulated Water Turbidity and Manganese (All Sample Sites)
Turbidity (NTU)
Manganese (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
0.25
0.2
0.15
0.1
0.05
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Turbidity
ADWG Health - Turbidity
ADWG Aesthetic - Mn
Manganese


Reticulated Water Free Chlorine (By Sample Site)
Free Chlorine (mg/L)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2008
2009
2010
2011
2012
Free Chlorine - Site 1
Free Chlorine - Site 2
Free Chlorine - Site 3
Free Chlorine - Site 4
ADWG Lower
ADWG Upper


Reticulated Water Total Coliforms (By Sample Site)
Total Coliforms (cfu/100 mL)
30
25
20
15
10
5
0
2008
2009
2010
2011
2012
26/10/2011
9/02/2011
8/06/2010
2/03/2011
Total Coliforms - Site 1
Total Coliforms - Site 2
Total Coliforms - Site 3
Total Coliforms - Site 4

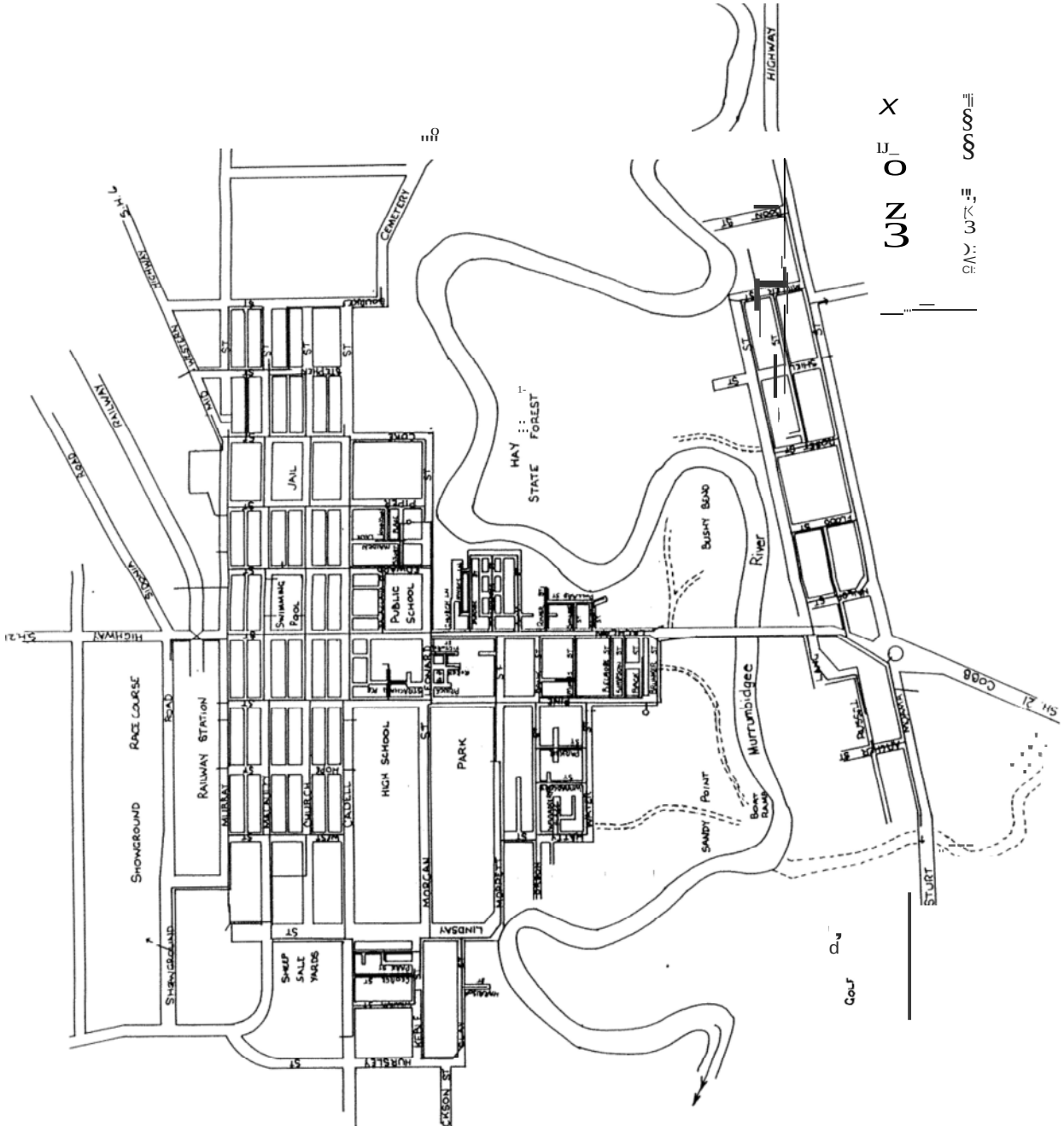

Reticulated Water Fluoride (All Sample Sites)
Fluoride (mg/L)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2001
2002
2003
2004
2004
2005
2006
2007
2008
2009
2010
2011
Fluoride
NSW Health Lower
NSW Health Upper / ADWG Health


Reticulated Water Total Hardness (All Sample Sites)
Total Hardness (mg/L as CaCO3)
70
60
50
40
30
20
10
0
2008
2009
2010
2011
2012
Total Hardness
ADWG Lower

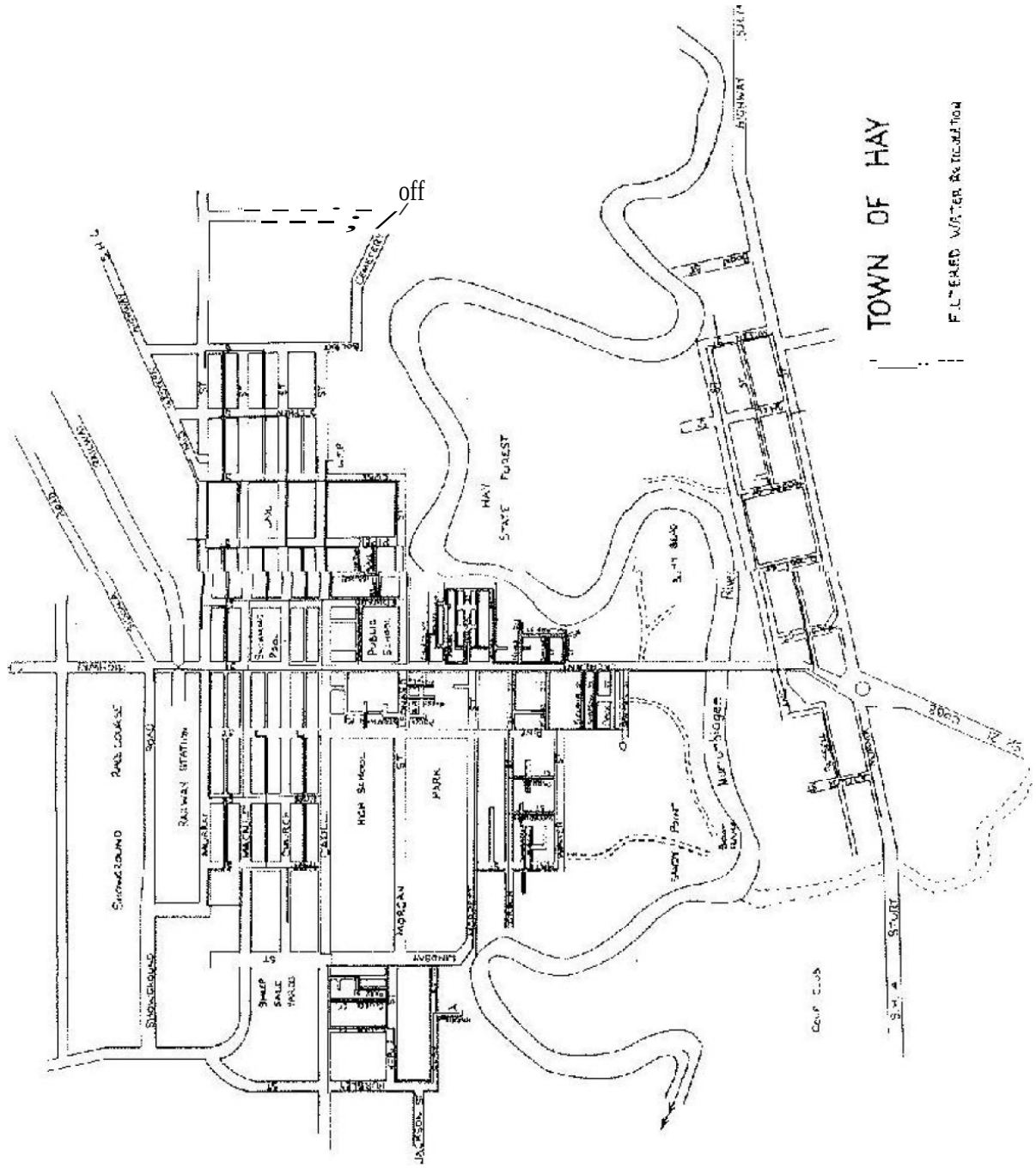
Appendix C - Reticulation Diagrams

Source: Hay Shire Council- Strategic Business Plan- Water Supply and Sewerage Services

RAW (NON-POTABLE) WATER RETICULATION



TREATED WATER RETICULATION



Appendix D – Workshop Risk Register

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
C1	Hay	Catchment	Normal chemical and pesticide use (and misuse) including aerial spraying leading to detection of trace levels of chemicals for prolonged period	Various chemicals and pesticides	Test for pesticides in treated water twice-annually Industry ChemCert required for on-farm chemical usage Licence in place for contract sprayers PAC (raw water is boiled daily during algal season for assessment of odour)	HSC DPI	E	1	Low	D	1	Low	Cotton crops upstream but not familiar with specific chemicals used. No pesticides detected above ADWG.
C2	Hay	Catchment	Catchment runoff (agriculture, dead animals, on-site sewage management systems, native and feral wildlife, stock) causing problems with water quality issues	Nutrients (algae, toxins, taste and odours) Pathogens	LEP Register of on-site sewage management systems Regulation of point sources Trained operators Farming controls HSC testing of water (raw, process, treated) Treatment (PAC, pH control, coagulation and flocculation, clarification, filtration, disinfection) NSW Health drinking water monitoring RACC algae testing Boiled raw water algae (odour) assessment	HSC NSW Health RACC	E	2	Low	C	3	High	Certificate II trained, looking at Certificate III and NOW training Chlorine connection and disconnection training. Backflow prevention training (NOW). Fluoride training (NSW Health).
C3	Hay	Catchment	Illegal dumping of untreated sewage	Pathogens	Locked batch discharging system Onsite treatment approval system Water treatment plant NSW Health reticulation monitoring Operational monitoring	HSC	E	2	Low	D	3	Moderate	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
C4	Hay	Catchment	Illegal dumping and accidents leading to breach of guideline values for chemicals for short period	Various chemicals and pesticides	HAZMAT response (NSW Health liaison with Council) DrumMuster Pesticides Act 1999 Chemical user's certificate through ChemCert Farming practices and Codes Water treatment Twice-yearly pesticide monitoring	HSC EPA DPI NSW Health	E	2	Low	D	2	Low	Road crossings are a long way upstream (major road crossing is at Darlington Point). No pesticides detected above ADWG.
C5	Hay	Catchment	Rain events leading to erosion from river bank, land uses, forestry, unsealed roads and private access roads and driveways leading to water quality issues	Turbidity Colour DOC Disinfection by-products Pathogens Various	Landcare programs - on farm Environmental regulatory controls CMA controls Water treatment plant NSW Health monitoring Operational monitoring Operator training and experience	HSC EPA CMA DPI	D	2	Low	B	4	Very High	
C6	Hay	Catchment	Releases from Tom Bullen storage by State Water leading to water quality issues	Taste and odour Algae Colour DOC Turbidity	Water treatment plant NSW Health monitoring Operational monitoring Operator training and experience	HSC	D	2	Low	B	4	Very High	Council and NOW used to be notified before releases (allowing 3 days for response) but this no longer occurs.
C7	Hay	Catchment	Rain event following extensive bush fires (directly through turbidity or indirectly through more algal growth)	Various chemicals and physical material (turbidity, fire retardants, ash, hydrocarbons, fire foams)	DisPlan Water treatment plant NSW Health monitoring Operational monitoring Operator training and experience	HSC	E	2	Low	E	3	Moderate	Historically has not occurred.
C8	Hay	Catchment	Drought and climate change affecting level in river and decreasing raw water quality	Turbidity DOC Taste and odour Pathogens	Water treatment plant NSW Health monitoring Operational monitoring Operator training and experience	HSC	E	2	Low	D	3	Moderate	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Ads1	Hay	Adsorption	Under or no dosing of PAC	Algae Taste and odour DOC	Trained operators HSC testing of raw water PAC dosing Disinfection O&M - scheduled maintenance of PAC dosing system, drop tests NSW Health drinking water monitoring RACC algae testing Boiled raw water algae (odour) assessment	HSC	E	2	Low	C	4	Very High	Taste and odours are an issue with this system.
PPh1	Hay	Pre-dose pH correction	Under or no dosing of soda ash causing pH lower than optimal for coagulation	pH lower than optimal for coagulation	Operator monitoring (alkalinity, pH) Jar testing Operator training and experience Manual control over the dosing O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring	HSC	E	2	Low	C	3	High	
PPh2	Hay	Pre-dose pH correction	Overdosing of soda ash causing pH higher than optimal for coagulation	pH higher than optimal for coagulation	Operator monitoring (alkalinity, pH) Jar testing Operator training and experience Manual control over the dosing O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring	HSC	E	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Coag1	Hay	Coagulation	Underdosing of coagulant leading to failure to achieve flocculation	Turbidity Pathogens Colour DOC	Operator monitoring (floc size and formation) Jar testing Operator training and experience Flow paced dosing with manual control over the dosage rate O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring	HSC	D	2	Low	C	3	High	
Coag2	Hay	Coagulation	Overdosing of coagulant	Aluminium Turbidity Pathogens Colour DOC	Operator monitoring (floc size and formation) Jar testing Operator training and experience Flow paced dosing with manual control over the dosage rate O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring	HSC	D	2	Low	C	3	High	
Coag3	Hay	Coagulation	Mechanical/equipment failure/maintenance of flocculators leading to water quality issues	Turbidity Pathogens	Operator monitoring (floc size and formation) Jar testing Operator training and experience Flow paced dosing with manual control over the dosage rate O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring	HSC	D	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Coag4	Hay	Coagulation	Raw water has low turbidity and high colour causing problems with coagulation control	Turbidity Pathogens	Operator monitoring (floc size and formation) Jar testing Operator training and experience Flow paced dosing with manual control over the dosage rate O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring	HSC	D	2	Low	C	3	High	
Coag5	Hay	Coagulation	Rapid change in raw water turbidity resulting in inability to treat	Turbidity Pathogens	Operator monitoring (floc size and formation) Jar testing Operator training and experience Flow paced dosing with manual control over the dosage rate O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring Monitor river height on NOW website Shut down WTP overnight	HSC	D	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Clar1	Hay	Clarification	Failure to clarify properly leading to water quality issues at the filter	Turbidity Pathogens	Operator monitoring (floc size and formation and ladder test) Jar testing Operator training and experience O&M on equipment Calibration of testing equipment Operator checks (as required) NSW Health monitoring Shut down WTP overnight Some ability to control flow through plant Desludging (automatic with manual override) Ability to manually initiate backwash Disinfection	HSC	E	1	Low	B	4	Very High	
Filt1	Hay	Filtration	Short circuiting of filters leading to breakthroughs	Turbidity Pathogens	Backwash on headloss and time Clarifier level alarm Operator checks (observe filters and filter effluent during filtration, observe bed when drained, observe air scour) Hose down filter walls when drained for backwash (plus high pressure annually or as required) O&M on equipment Operator training (and experience) Plant shutdown followed by jar test (and daily jar testing) Chlorination for chlorine sensitive pathogens Operational flexibility Monitoring (grab samples for turbidity)	HSC	E	2	Low	C	4	Very High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Filt2	Hay	Filtration	Poor filter performance e.g. filter nozzles, filter media loss, high loads in water, aborted backwash	Turbidity Pathogens	Backwash on headloss and time Clarifier level alarm Operator checks (observe filters and filter effluent during filtration, observe bed when drained, observe air scour) Hose down filter walls when drained for backwash (plus high pressure annually or as required) O&M on equipment Operator training (and experience) Plant shutdown followed by jar test (and daily jar testing) Chlorination for chlorine sensitive pathogens Operational flexibility Monitoring (grab samples for turbidity)	HSC	E	2	Low	C	4	Very High	
Filt3	Hay	Filtration	Filter ripening issues leading to pathogen breakthrough	Turbidity Pathogens	Built-in cycle for ripening Operator experience Disinfection for chlorine sensitive pathogens	HSC	E	2	Low	C	4	Very High	
Filt4	Hay	Filtration	Filter ripening issues leading to pathogen breakthrough	Crypto	Turbidity monitoring (grab sample, combined filter effluent)	HSC	D	2	Low	C	4	Very High	
Dis1	Hay	Disinfection (chlorine gas)	Overdosing of chlorine leading to high levels in finished water	Taste and odour DBPs Chlorine	Operator training and experience Operational monitoring O&M of equipment Automatic changeover of gas bottles Online chlorine monitoring Manual dosing controls Flushing	HSC	D	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Dis2	Hay	Disinfection (chlorine gas)	Underdosing of chlorine (including equipment failure or running out) leading to chlorine sensitive pathogen survival in finished water (primary kill)	Turbidity Pathogens	Operator training and experience Operational monitoring O&M of equipment Automatic changeover of gas bottles Online chlorine and turbidity monitoring Manual dosing controls Flushing Shutdown plant Residual check in reticulation Water direction and zoning is understood in this system	HSC	E	3	Moderate	C	4	Very High	
Dis3	Hay	Disinfection (chlorine gas)	High pH in the water causing reduced disinfection efficiency	Pathogens	Operator training and experience Operational monitoring O&M of equipment Online chlorine, turbidity and pH monitoring Manual dosing controls Flushing Shutdown plant Residual check in reticulation Water direction and zoning is understood in this system	HSC	E	3	Moderate	C	4	Very High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Dis4	Hay	Disinfection (chlorine gas)	Underdosing of chlorine resulting in lack of free chlorine residuals in distribution system	Pathogens	Operator training and experience Operational monitoring NSW Health monitoring program O&M of equipment Online chlorine, turbidity and pH monitoring with automatic shutdown on low chlorine and alarms back to duty operator Manual dosing controls Flushing Shutdown plant Weekly distribution residual check Water direction and zoning is understood in this system	HSC	E	2	Low	C	4	Very High	
PD1	Hay	Post Dosing (stabilisation)	Overdosing or underdosing of Soda ash	High or low pH	Operator training and experience Operational monitoring NSW Health monitoring program O&M of equipment Online pH monitoring with automatic shutdown on low or high pH and alarms back to duty operator Manual dosing controls Flushing Shutdown plant Weekly distribution pH check Water direction and zoning is understood in this system	HSC	D	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Fluo1	Hay	Fluoridation	Overdosing of fluoride leading to high levels in finished water (health/safety issue)	Fluoride	Operator training and experience Operational monitoring NSW Health monitoring program O&M of equipment Fluoridation Act and Code of Practice Manual dosing controls Flushing Weekly distribution fluoride check Anti-siphoning (air break) Water direction and zoning is understood in this system	HSC	E	2	Low	D	2	Low	There has been one exceedance at 1.7mg/L (prior to installation of air break).
Fluo2	Hay	Fluoridation	Underdosing of fluoride (including equipment failure or running out) leading to low levels in finished water (regulatory issue)	Fluoride	Operator training and experience Operational monitoring NSW Health monitoring program O&M of equipment Fluoridation Act and Code of Practice Manual dosing controls Flushing Weekly distribution fluoride check Water direction and zoning is understood in this system	HSC	D	1	Low	C	2	Moderate	
CWT1	Hay	Clearwater Tank	Ingress into tank through integrity issues and potentially flood inundation from river	Pathogens	Chlorine residual Operational checks NSW Health monitoring program Operational monitoring (reticulation)	HSC	E	2	Low	D	3	Moderate	Historically there has been no record of flooding of WTP site.
CWT2		Clearwater Tank	Water carters can connect to Clearwater Tank and potential for backflow to arise	Various	RPZ Air break on standpipe	HSC	E	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
Pine1	Hay	Pine St Reservoir	Low turnover leading to water quality issues (common inlet outlet but with riser pipe to facilitate mixing)	Taste and odour Pathogens	Operator training and experience Operational monitoring Weekly check of reservoir NSW Health monitoring program	HSC			Uncertain			Uncertain	
Pine2	Hay	Pine St Reservoir	Potential water quality contamination e.g. vermin access	Pathogens Turbidity Taste and odour	Operator checks Roofed reservoir NSW Health testing Operational testing Chlorine residual	HSC	E	2	Low	C	3	High	No E. coli detects noted
Pine3		Pine St Reservoir	Potential cross connection between Pine St raw and potable reservoirs	Pathogens	Chlorination of raw water Chlorine residual in potable water Reservoirs contained within locked compound Valve is locked by key Operator training and experience	HSC	E	5	High	D	5	Very High	The valve is there to allow raw water reservoir to be used when the potable water reservoir has to be taken offline - planned redundancy (has happened on one occasion in about 20 years).
Pine4	Hay	Pine St Reservoir	Seasonal conditions affecting water temperature in the raw and treated water and longevity of chlorine residual in the distribution system	Opportunistic pathogens	Most pipes buried Chlorine residual maintained Chlorine is increased in warmer weather to compensate for chlorine decay NSW Health monitoring Operational monitoring including temperature readings	HSC	D	1	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
D1	Hay	Distribution	Low chlorine residuals resulting in the potential for water quality failure	Pathogens	Operator training and experience Operators are aware of problem and manage system accordingly Upstream processes Maintain high residual leaving WTP NSW Health monitoring program Operational reticulation checks Frequency of refill Closed reservoirs Flushing	HSC	D	2	Low	C	4	Very High	No E. coli detects noted but low chlorine at extremities.
D2	Hay	Distribution	Aging infrastructure leading to ingress and water quality issues	Rust Pathogens Chemicals	Mains are relatively new PVC mains Asset condition assessment NSW Health monitoring program Operational monitoring Chlorine residual	HSC	E	2	Low	D	3	Moderate	Because this is a relatively new system (1988), risk is likely to increase over time.
D3	Hay	Distribution	Reduced velocities in the main resulting in conditions that favour biofilm formation and sediment accumulation	Biofilms causing taste and odour problems, dirty water, turbidity	Flushing as required - reactive, not programmed Chlorine residual NSW Health monitoring Operational monitoring	HSC	D	2	Low	C	4	Very High	
D4	Hay	Distribution	Mains break or perforation leading to water quality issues	Pathogens	No air valves Chlorine residual Positive pressure Flow monitoring (but relies on being picked up by operator) NSW Health monitoring Operational monitoring Public surveillance	HSC	D	2	Low	D	3	Moderate	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
D5	Hay	Distribution	Backflow/cross connection leading to water contamination events	Various	DA Process Plumbing Code Different pipes for raw and potable systems Different meter systems for raw and potable systems NSW Health monitoring Operational monitoring Backflow devices installed Dual check valves at meters	HSC	E	3	Moderate	C	4	Very High	No cross-connections in the system that Council is aware of (other than Pine St).
D6	Hay	Distribution	Dead end in reticulation systems leading to stagnation and water quality issues	Taste and odour Pathogens	Flushing points Operational monitoring NSW Health monitoring No dead ends in new developments	HSC	D	2	Low	C	3	High	
D7	Hay	Distribution	Corrosion of metal pipes	Dirty water Copper Zinc Iron Lead (from packed joints) Hardness	PVC mains and PE service lines NSW Health monitoring Operational monitoring Chlorine residual	HSC			N/A			N/A	Not an issue in this system.
D8	Hay	Distribution	Use of flushing hydrants stirring up the system and causing water quality incidents	Pathogens Chemicals	Designed not to be easy to use. Only 3 access points in system - only used for flushing. Raw water is used for firefighting. Positive pressure.	HSC			N/A			N/A	Not an issue in this system.
D9	Hay	Distribution	Illegal connections resulting in introduction of unknown hazards	Various	Checked when meters (raw and potable) are read. Licensed plumbers. Recently completed check for dual connections.	HSC	E	1	Low	D	3	Moderate	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
D10	Hay	Distribution	Commissioning new mains leading to water quality issues	Turbidity	Flushing WMS (needs to include water quality) Council in-house procedures not contractors NSW Health monitoring Operational monitoring Chlorine residual	HSC	E	1	Low	C	3	High	
NPW1	Hay	Non-potable water	Non-potable water being consumed as if it were potable	Pathogens	Signs at park Chlorination	HSC	C	4	Very High	B	4	Very High	
WOS1	Hay	Whole of System	Catastrophic system failure, e.g. bushfire, flood or earthquake taking out key infrastructure e.g. Hay Water Treatment Plant or pump station	All	Levy bank around pump station DisPlan	HSC	E	5	High	E	5	High	Access to pump station could be an issue. ALARP.
WOS2	Hay	Whole of System	Incorrect or reduced quality of chemicals or wrong specification of chemicals resulting in overdosing, underdosing or contamination	Chemicals	Purchase from reputable suppliers Certificate of compliance supplied with every chemical batch MSDS register in place and maintained Test SG of liquid alum on delivery Operational checks NSW Health monitoring Operational monitoring	HSC	E	3	Moderate	C	4	Very High	
WOS3	Hay	Whole of System	Incorrect or reduced quality of materials resulting in potential for water quality contamination	Various	Purchase from reputable suppliers Specify that materials must be suitable for use with potable water Plumbing Code NSW Health monitoring Operational monitoring	HSC	E	2	Low	C	3	High	
WOS4	Hay	Whole of System	Power failure resulting in non-conforming water	Various	Liaison with Essential Energy re planned outages	HSC	E	2	Low	E	2	Low	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
WOS5	Hay	Whole of System	Terrorism or disgruntled employees or contractors leading to malicious damage resulting in poor water quality (or perceived poor water quality) (Note that employees and contractors understand the system so would know where to act to cause most damage e.g. altering SCADA, contaminating clearwater tank etc)	Various	Fencing around WTP and reservoir. SCADA security access passwords. Locked ladders. Locked hatches. Customer call-in. Treatment plant - intrusion alarms on SCADA cabinets. Locked brick building for pump station. Federal government education campaign. Low risk setting. Site inspections. SCADA system serviced by external contractors.	HSC	E	5	High	E	5	High	ALARP
WOS6	Hay	Whole of System	Failure of critical monitoring devices resulting in inability to pick up water quality issues	Various	Annual instrumentation contract service Meters calibrated in-house as per manufacturer's instructions NSW Health monitoring program Operational monitoring program Repeat checks for erroneous results	HSC	E	3	Moderate	C	4	Very High	
WOS7	Hay	Whole of System	Chemicals are delivered to incorrect storage resulting in process contamination or incorrect dosage	Chemicals Pathogens	Operators on site for each delivery Specific fittings and marked bags/bottles Delivery dockets signed off by operators NSW Health monitoring Operational monitoring Operational checks	HSC	E	3	Moderate	C	4	Very High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
WOS8	Hay	Whole of System	Operator training is not kept up to date resulting in potential for water contamination through incorrect operation of the water supply system	Various	Operator training (including lab skills, risk management and incident investigation, fluoridation of public water supplies, Water Operator Training Course, confined space training) Annual currency review NOW update course every 2 years Training record for operators maintained by WHS Officer Chlorine residual	HSC	E	2	Low	C	4	Very High	
WOS9	Hay	Whole of System	Contractor error causing water quality issues	Various	Some use of preferred contractors. Contractors are inducted onto the site for WHS but not for water quality. IT access control. Procurement process in progress of being implemented. Licensed plumbers refer to Plumbing codes. Walk-around checks post-contractors. Treatment plant and alarms, etc.	HSC	D	2	Low	C	4	Very High	
WOS10	Hay	Whole of System	Retrofits and Upgrades (unauthorised modification (without s.60 approval)) causing water quality issues	Various	Liaison with NOW prior to retrofits and upgrades Producing plans and drawings, verified by council Supervision of major works Review of plans by appropriate person Work as Ex plans NSW Health monitoring Operational monitoring Operational checks	HSC	E	2	Low	C	3	High	

No.	Supply System	Process Step	How can the hazard be introduced? (hazards/causes)	Contaminants (hazards)	Control measures currently in place	Responsibility to manage risk	L	C	Controlled Risk Score	L	C	Uncontrolled Risk Score	Basis/Notes
WOS11	Hay	Whole of System	Resourcing issues due to greying of the workforce, unavailability of appropriately qualified staff, staff turnover leading to water quality issues	Various	Trainee operators coming through O&M Manual for WTP	HSC	E	4	High	B	4	Very High	
WOS12	Hay	Whole of System	Contamination from sharing of equipment across sewer and drinking water operations, unsanitary repairs	Pathogens	Training and experience Washing down equipment with water only Chlorine residual	HSC	C	3	High	C	4	Very High	

Appendix E – Action Plan

Action No.	Event	Risk No.	Follow-up Actions	Responsibility	Procedure
A1	Normal chemical and pesticide use (and misuse) including aerial spraying leading to detection of trace levels of chemicals for prolonged period	C1	Consider formalising liaison with upstream Councils and CMA.	HSC DPI	
A2	Catchment runoff (agriculture, dead animals, on-site sewage management systems, native and feral wildlife, stock) causing problems with water quality issues	C2	Liaison with Planning in relation to water quality issues.	HSC	
A3	Catchment runoff (agriculture, dead animals, on-site sewage management systems, native and feral wildlife, stock) causing problems with water quality issues	C2	Review how on-site sewage management systems are managed.	HSC	
A4	Catchment runoff (agriculture, dead animals, on-site sewage management systems, native and feral wildlife, stock) causing problems with water quality issues	C2	Consider doing operator checks for algae.	HSC	
A5	Catchment runoff (agriculture, dead animals, on-site sewage management systems, native and feral wildlife, stock) causing problems with water quality issues	C2	Incident management plan required.	HSC	Incident management plan
	Underdosing of chlorine (including equipment failure or running out) leading to chlorine sensitive pathogen survival in finished water (primary kill)	Dis2			
	Underdosing of chlorine resulting in lack of free chlorine residuals in distribution system	Dis4			
	Catastrophic system failure, e.g. bushfire, flood or earthquake taking out key infrastructure e.g. Hay Water Treatment Plant or pump station	WOS1			

Action No.	Event	Risk No.	Follow-up Actions	Responsibility	Procedure
	Terrorism or disgruntled employees or contractors leading to malicious damage resulting in poor water quality (or perceived poor water quality) (Note that employees and contractors understand the system so would know where to act to cause most damage e.g. altering SCADA, contaminating clearwater tank etc)	WOS5			
A6	Illegal dumping of untreated sewage	C3	Trade waste program to be implemented (e.g. pump out service providers to have concurrence).	HSC	
	Backflow/cross connection leading to water contamination events	D5			
A7	Releases from Tom Bullen storage by State Water leading to water quality issues	C6	Reinstate liaison with State Water and bring up with other councils at regional meeting.	HSC	
A8	Filter ripening issues leading to pathogen breakthrough	Filt3	Consider filter resting time after re-filling to help reduce breakthrough.	HSC	
A9	Overdosing of chlorine leading to high levels in finished water	Dis1	Customer response system to be implemented.	HSC	
A10	Water carters can connect to Clearwater Tank and potential for backflow to arise	CWT2	Ensure register of water carters regardless of who owns the water cart and documentation to support water carter use (clause 35 PHR).	HSC	
A11	Water carters can connect to Clearwater Tank and potential for backflow to arise	CWT2	Ensure that cap is kept on end of hose - perhaps a sign for RFS.	HSC	
A12	Low turnover leading to water quality issues (common inlet outlet but with riser pipe to facilitate mixing)	Pine1	Consider taking a sample from the top of the reservoir to check for dead zones/stagnation.	HSC	
A13	Potential water quality contamination e.g. vermin access	Pine2	Check that roofs and hatches of reservoirs are properly sealed to prevent birds and reptiles from entering.	HSC	
	Low chlorine residuals resulting in the potential for water quality failure	D1			

Action No.	Event	Risk No.	Follow-up Actions	Responsibility	Procedure
A14	Seasonal conditions affecting water temperature in the raw and treated water and longevity of chlorine residual in the distribution system	Pine4	Check temperature in Pine St Reservoir.	HSC	
A15	Backflow/cross connection leading to water contamination events	D5	Backflow prevention program and register required.	HSC	
A16	Backflow/cross connection leading to water contamination events	D5	Register of rainwater tanks required.	HSC	
A17	Backflow/cross connection leading to water contamination events	D5	Integration of planning and water quality requirements including s.68 approval of devices.	HSC	
A18	Commissioning new mains leading to water quality issues	D10	Ensure that water quality is covered in WMS for commissioning new mains.	HSC	
A19	Commissioning new mains leading to water quality issues	D10	Consider adding chlorination step for commissioning of new mains.	HSC	
A20	Terrorism or disgruntled employees or contractors leading to malicious damage resulting in poor water quality (or perceived poor water quality) (Note that employees and contractors understand the system so would know where to act to cause most damage e.g. altering SCADA, contaminating clearwater tank etc)	WOS5	Consider if IT contractor having higher security is an issue.	HSC	
A21	Failure of critical monitoring devices resulting in inability to pick up water quality issues	WOS6	Calibration logs.	HSC	Calibration logsheets
A22	Chemicals are delivered to incorrect storage resulting in process contamination or incorrect dosage	WOS7	Review how delivery dockets are filed.	HSC	
A23	Contractor error causing water quality issues	WOS9	Consider implementing employee exit checklists.	HSC	Employee exit checklist

Action No.	Event	Risk No.	Follow-up Actions	Responsibility	Procedure
A24	Contractor error causing water quality issues	WOS9	Ensure that water quality protection is covered when contractors are used.	HSC	
A25	Contamination from sharing of equipment across sewer and drinking water operations, unsanitary repairs	WOS12	Consider keeping sodium hypochlorite bottle for cleaning shared equipment and documenting cleaning procedure (within WMS or other).	HSC	Sanitary work practices / Disinfecting tools procedure
A26	Water being consumed as if it were potable	NPW1	Review how people on the non-potable systems are informed.	HSC	
A27	Water being consumed as if it were potable	NPW1	Check legibility and wording of signs (use "not suitable for drinking" rather than "not potable").	HSC	
A28	Water being consumed as if it were potable	NPW1	Check for consistency with NSW Health guidance.	HSC	
A29	Water being consumed as if it were potable	NPW1	Consider extending potable water reticulation.	HSC	

Appendix B CCPs and Operational Information

Critical Control Points Quick Reference Guide

These are the critical parameters for safe management of your system.
Ensure that these parameters are monitored regularly.

	Operational Target	Adjustment Limit	Critical Limit
Coagulation pH	6 – 7	<6 or >7	<5.8
Clarified Water Turbidity	1 – 2 NTU	>2.5 NTU	>5 NTU
Clarified Water Colour	2.5 – 5 HU	>10 HU	>15 HU
Filtered Water Turbidity	0.15 – 0.25 NTU	>0.3 NTU	>0.5 NTU
Filtered Water Colour	0 HU	>3 HU	>5 HU
Treated Water Chlorine	1.0 – 1.2 mg/L	<0.9 mg/L or >1.2 mg/L	<0.5 mg/L or >1.5 mg/L
Treated Water pH	7.6 – 7.8	<7.3 or >8.2	<6.8 or >8.5
Treated Water Turbidity	0.1 – 0.2 NTU	>0.3 NTU	>1 NTU
Treated Water Fluoride	0.95 – 1.1 mg/L	<0.95 mg/L or >1.3 mg/L	<0.9 mg/L or >1.5 mg/L
Reticulated Water Chlorine	0.3 – 0.5 mg/L	<0.3 mg/L or >0.8 mg/L	<0.2 mg/L or >1.5 mg/L
Reservoir Integrity	Secure and Vermin Proof	Evidence of Breaches	Breach not Rectified, or Serious Breach

Operational Target	This is where you should be operating. Aim to keep the system operating at this value.
Adjustment Limit	If you reach this limit, refer to CCP management sheet and try to get back to the operational target. Increase monitoring until returned to normal.
Critical Limit	If you reach this limit, you have lost control of your system. Refer to CCP management sheet and try to return to operational target as a matter of urgency.

CCP 1 – Coagulation – Coagulation pH

What is the control point?	Coagulation
What are the hazards?	Turbidity, pathogens
What is being measured?	Coagulation pH (daily sampling and testing)
How are the hazards controlled?	Optimise coagulation process

Operational Target 6 – 7	Adjustment Limit <6 or >7	Critical Limit <5.8
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Carry out jar test • Adjust dosages if necessary • Inspect dosing system, drop test dosing pump(s) • Test combined filtered water turbidity and pH hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart : 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Consider plant shutdown • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 2 – Clarification – Clarified Water Turbidity

What is the control point?	Clarification
What are the hazards?	Turbidity, pathogens
What is being measured?	Clarifier Effluent Turbidity (daily sampling and testing)
How are the hazards controlled?	Optimise coagulation and clarification process

Operational Target 1 – 2 NTU	Adjustment Limit >2.5 NTU	Critical Limit >5 NTU
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect clarifier and floc size, carry out jar test if necessary • Inspect dosing systems, drop test dosing pumps • Test clarified water turbidity hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Consider draining clarifier if >10 NTU • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 3 – Clarification – Clarified Water True Colour

What is the control point?	Clarification
What are the hazards?	Turbidity, pathogens
What is being measured?	Clarifier Effluent True Colour (daily sampling and testing)
How are the hazards controlled?	Optimise coagulation and clarification process

Operational Target 2.5 – 5 HU	Adjustment Limit >10 HU	Critical Limit >15 HU
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect clarifier and floc size, carry out jar test if necessary • Inspect dosing systems, drop test dosing pumps • Test clarified water true colour hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 4 – Filtration – Filtered Water Turbidity

What is the control point?	Filtration
What are the hazards?	Turbidity, pathogens
What is being measured?	Combined Filtered Water Turbidity (daily sampling and testing)
How are the hazards controlled?	Optimise coagulation and filtration process

Operational Target 0.15 – 0.25 NTU	Adjustment Limit >0.3 NTU	Critical Limit >0.5 NTU
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect filters, backwash if necessary • Test turbidity from each filter to determine if problem is isolated • Inspect clarifier and floc size, carry out jar test if necessary • Inspect dosing systems, drop test dosing pumps • Test combined filtered water turbidity hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Conduct extended manual backwash • Consider shutting down plant, draining clarifier and then recommencing plant operation • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 5 – Filtration – Filtered Water True Colour

What is the control point?	Filtration
What are the hazards?	Turbidity, pathogens
What is being measured?	Combined Filtered Water True Colour (daily sampling and testing)
How are the hazards controlled?	Optimise coagulation and filtration process

Operational Target 0 HU	Adjustment Limit >3 HU	Critical Limit >5 HU
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect filters, backwash if necessary • Test true colour from each filter to determine if problem is isolated • Inspect clarifier and floc size, carry out jar test if necessary • Inspect dosing systems, drop test dosing pumps • Test combined filtered water true colour hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart : 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Conduct extended manual backwash • Consider shutting down plant, draining clarifier and then recommencing plant operation • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 6 – Primary Disinfection System – Treated Water Free Chlorine

What is the control point?	Primary disinfection system
What are the hazards?	Chlorine sensitive pathogens
What is being measured?	Clear Water Tank outlet Free Chlorine (continuous online monitoring)
How are the hazards controlled?	Adjust the chlorine dosage

Operational Target 1.0 – 1.2 mg/L	Adjustment Limit <0.9 mg/L to >1.2 mg/L	Critical Limit <0.5 mg/L or >1.5 mg/L
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect chlorine dosing system • Adjust chlorine dosage • Inspect coagulation, clarification and filtration for issues • Sample and test clear water free chlorine half-hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • If <0.5 mg/L, change chlorine feed to spare cylinder • Adjust chlorine dosage • Consider manual dosing of NaOCl • Sample and test reservoir and reticulation free chlorine • If <0.5 mg/L, consider direct NaOCl dosing into reservoirs • If >1.5 mg/L, consider whether water can be held until excess chlorine has dissipated • Consider plant shutdown • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 7 – Primary Disinfection System – Treated Water pH

What is the control point?	Post chemical dosing system
What are the hazards?	Chlorine sensitive pathogens
What is being measured?	Clear Water Tank outlet pH (continuous online monitoring)
How are the hazards controlled?	Adjust post chemical dosage

Operational Target 7.6 – 7.8	Adjustment Limit <7.3 or >8.2	Critical Limit <6.8 or >8.5
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect both pre and post soda ash dosing systems • Sample and test pH of raw water, coagulation, filtered water, clear water to isolate problem • Sample problem location(s) half hourly • Adjust soda ash dosage • Inspect coagulation, clarification and filtration for issues • Record details in the WTP diary	• Contact Infrastructure Manager - Greg Stewart (0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Sample and test reservoir and reticulation free chlorine and pH • Consider plant shutdown • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 8 – Primary Disinfection System – Treated Water Turbidity

What is the control point?	Post chemical dosing system
What are the hazards?	Chlorine sensitive pathogens
What is being measured?	Clear Water Tank outlet Turbidity (continuous online monitoring)
How are the hazards controlled?	Optimise coagulation and filtration process

Operational Target 0.1 – 0.2 NTU	Adjustment Limit >0.3 NTU	Critical Limit >1 NTU
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Supervisor • Inspect filters, backwash if necessary • Test filtered water turbidity • Inspect clarifier and floc size, carry out jar test if necessary • Inspect dosing systems, drop test dosing pumps • Test treated water turbidity hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Conduct extended manual backwash • Consider plant shutdown • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 9 – Fluoridation System – Treated Water Fluoride

What is the control point?	Fluoridation system
What are the hazards?	Over-fluoridation or under-fluoridation
What is being measured?	Clear Water Tank outlet Fluoride (daily sampling and testing) Reticulated Water Fluoride (weekly sampling and testing)
How are the hazards controlled?	Optimise fluoridation process

Operational Target 0.95 – 1.1 mg/L	Adjustment Limit <0.95 mg/L or >1.3 mg/L	Critical Limit <0.9 mg/L or >1.5 mg/L
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect fluoride dosing system, drop test dosing pumps • Sample and test for background fluoride level • Check for blockages and wear • Adjust fluoride dosage • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Complete and submit Form 5 to NSW Health • Sample and test reservoir and reticulation fluoride • Consider fluoride plant shutdown • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 10 – Distribution Reservoirs – Reticulated Water Free Chlorine

What is the control point?	Distribution Reservoirs
What are the hazards?	Chlorine sensitive pathogens
What is being measured?	Reticulated Water Free Chlorine (weekly sampling and testing)
How are the hazards controlled?	Adjust the chlorine dosage

Operational Target 0.3 – 0.5 mg/L	Adjustment Limit <0.3 mg/L to >0.8 mg/L	Critical Limit <0.2 mg/L or >1.5 mg/L
• WTP water sampling and testing • Plant walkaround and visual inspection • Equipment checks • Dosing rate checks • Instrument calibration	• Contact Senior Operator • Inspect chlorine dosing system • Adjust chlorine dosage at WTP • Inspect coagulation, clarification and filtration for issues • Sample and test reservoir and reticulation free chlorine half-hourly, and other parameters as needed • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Conduct full plant analytical investigation • Change chlorine feed to spare cylinder • Adjust chlorine dosage at WTP • Consider manual dosing of NaOCl • Consider direct NaOCl dosing into reservoirs • Consider plant shutdown • Contact NOW (Bernie Barnes: 0429 604 409) if further advice is required • Record details in the WTP diary

CCP 11 – Distribution Reservoir Integrity

What is the control point?	Distribution Reservoirs
What are the hazards?	Chlorine sensitive pathogens (recontamination)
What is being measured?	Integrity of Reservoirs (weekly visual inspection)
How are the hazards controlled?	Inspect and maintain reservoirs in good condition

Operational Target Secure and vermin proof	Adjustment Limit Evidence of breach	Critical Limit Breach not rectified
• Visual reservoir inspection • Regular reservoir maintenance • Reservoir security procedures	• Contact Senior Operator and organise for repairs • Conduct thorough reservoir inspection • Sample and test reservoir for free chlorine and pH • Sample reservoir water for bacto testing, send to external lab • Monitor daily until rectified • Record details in the WTP diary	• Contact Infrastructure Manager (Greg Stewart: 0429 931 272) • Notify local PHU (Kev Prior: 0429 076 135) • Arrange for urgent repairs • Continue adjustment actions • Record details in the WTP diary

Reservoir Inspection Form (External)

Description:	Regular inspection of reservoir for any damage that could lead to water contamination	
To be carried out by:	Reticulation Crew/ Council Rangers/ Operators	
Frequency:	Weekly	
Version	**Details**	**Date**
1		November 2014
Procedure		

1. Inspection of reservoir grounds	Acceptable	Unacceptable	Action Required
a. Check gate is closed and padlocked.			
b. Check fences for signs of forced entry such as lifted wire, holes, cut barbs etc			
c. Check for overhanging branches, overgrown grass, other plants.			
d. Check ground for any signs of thrown items, such as big rocks, smashed glass bottles, bullets.			
e. Check for signs of animal activity.			

2. Access Roads	Acceptable	Unacceptable	Action Required
a. Check for road damage, blocked guttering, fallen trees etc.			
b. Check access roads provides adequate access to all areas of the reservoir.			

3. Inspection of reservoir – walk all the way around	Acceptable	Unacceptable	Action Required
a. Check for any signs of leaks (staining, damp patches, puddles).			
b. Check for damage to the walls from rocks or other items			
c. Check mesh/netting (if installed) for any holes.			
d. Check for any signs of animal entry.			

4. Roof inspection			
a. Check guttering system for any blockages – water ingress is a major source of reservoir contamination.			
b. Check roof for any damage such as holes, cracks, seal failures or signs of corrosion.			
c. Check for evidence for animal entry – animal droppings, birds nesting etc.			
d. Check that corrugations are sealed.			
e. Check hatch is closed and for any damage.			

5. Walkways			
a. Check walkways are free from debris or anything that present tripping hazards.			
b. Check for any signs of leaking such as puddles.			
c. Check for signs of animals such as animal droppings.			

6. Ladders			
a. Check ladders and ladder cages are padlocked.			
b. Inspect for structural integrity.			
c. Check for corrosion.			

7. Ventilation			
a. Ensure all ventilators are functioning correctly			
b. Check openings for any blockages.			
c. Check for signs of animals – the ventilation holes should be small enough to prevent animal entry and bird nesting.			
d. Check for signs of damage or corrosion.			

Standard Operating Procedure
SOP-PL-100 Backhoe Operation

1 Reminders

- Related documents, etc.
- Certificates Required
- Warning note
- Types of protection
- See tools & materials list
- Special note
- Additional person(s) required
- Related SOP's
- ☐1 Picture in column on right
- ⌗1 Picture in following table

Overview Instructions & Explanations	
1 Pre-Operational Safety Checks 1.1 Ensure all safety devices, guards, switches and shields are fitted, secure and functional. 1.2 Ensure Reverse Alarm and Amber Beacon are operational. 1.3 Check oil levels and usage to ensure there is enough to operate. 1.4 Check fan belt and hoses to ensure they are working properly and not damaged. 1.5 Ensure tyres are in sound and roadworthy condition. 1.6 Ensure there are no broken or cracked parts. 1.7 Check all gauges, instruments, and warning lights to ensure they are operational and the readings are within the correct operating range. 1.8 Check all lighting systems and ensure they are working properly. 1.9 Ensure that seatbelt is in sound condition. 1.10 Faulty equipment must not be used and must be reported to supervisor and/or workshop staff. 1.11 Document pre-start plant check sheet.	☐1 ☐2
2 Operational Safety Checks 2.1 Use hand holds and step plates when exiting or entering backhoe, maintaining three points of contact. 2.2 Do not enter the backhoe from the rear of the machine. 2.3 Seat belts shall be worn when the backhoe is in operation. 2.4 Test brakes against ground speed to be certain they are working properly. 2.5 When operating the backhoe or moving stabilisers, keep bystanders clear of equipment. 2.6 Do not attempt to lift loads that exceed the manufacturers rated capacity. (SWL) 2.7 Do not allow persons to get under the arm of the backhoe or to reach through the arms of the unit when in operation. Use the same practice when using the bucket of the unit. 2.8 Compensate for the terrain. Never set up equipment on loose or soft ground, and always set unit so as to maintain balance. 2.9 To prevent rollover hazard when back hoeing on slopes, avoid using full swing and reach with full bucket to the downhill side of the slope. 2.10 Centre and raise the boom before engaging or disengaging the transport lock. 2.11 Do not make adjustments or tighten hydraulic hoses when the equipment is under pressure.	

2.12 Maintain brakes, pivot pins, hydraulic cylinders, hoses, snap rings and main attaching bolts on the arm, bucket, hydraulic hose couplings and arm attachment of the machine.	
2.13 Wear personal protective equipment. If applicable, hearing protection and hard hats when outside of equipment.	
2.14 When starting the equipment, always check that everyone is clear of the machine.	
2.15 Do not jump on or off the machine.	
2.16 Switch off engine when refuelling .	
2.17 Never leave the machine on an incline or loose material with the motor idling.	
2.18 The equipment shall be equipped with an operational reverse signal alarm.	
3 Housekeeping	
3.1 Keep the working area in a clean and tidy condition.	
3.2 Ensure there are no loose items in cabin that can become a hazard or missile.	
4 Hazard Identification & Risk Controls	

Hazard Identification	Assessed Risk	Possible Controls
Crushing	Falling Material	• Operate vehicle away from overhanging areas. • Seat belt must be worn.
	Uncontrolled Movement	• Ensure park brake is adequate. • Always park vehicle on level ground. • Familiarise with all controls. • Lower all raised equipment when stopped. • Ensure appropriate mechanical locks are fitted to unit as per operators manual. • Ensure all machine guards are fitted before operating. • Ensure reverse alarm is operational. • Ensure flashing light is operational. • Keep bystanders clear at all times. • Keep clear of crush zone areas eg. articulation, etc. • Never short across starter terminals, backhoe could move unexpectedly. • Never coast downhill. • Never work on machine supported only by attachments.
	Stopping / Immobilisation	• Stop and immobilise machine as per operators manual. • Lower all raised equipment. • Chock wheels if necessary.
	Tipping and Rolling	• Refer to operators manual. • ROPS fitted to machine. • Seat belt must be worn. • Never operate across extreme slopes. • Extreme caution is required when working near edges.
Electrical / Gas	Damage to underground & above ground services	• Contact the appropriate authorities for the placement of underground services. • Have a copy of Dial Before Dig plans on site. • Dig permit if required. • Toolbox utility locations with site supervisor.
	Contact with overhead Power Lines	• Maintain minimum working distances (WHS Regulation). • Appropriate training working within 3m. • Ensure spotter is used when working under power lines.
Body Contact	Entanglement, Striking	• Always keep clear of moving parts and attachments. • Keep bystanders clear when operating machine. • Workers close to machine to wear correct PPE e.g. Hard Hats, etc.

		• Allow only operator on the machine. • Always start machine from the driver's position. • Ensure reversing alarm & flashing amber light is in proper working condition. • Ensure all guards are in place before operating machine. • Secure all loose items. • Keep clear when engine running or buckets are off ground.
	Slips/Trips/Falls	• Only mount/dismount unit at locations with steps &/or hand holds. • Ensure steps & hand holds are clean & secure prior to use. • Maintain a 3 point contact with steps & hand holds facing unit at all times. • Do not mount or dismount from a moving machine. • Do not use any controls as handholds when entering or exiting operator's cabin. • Never jump off the machine.
Manual Tasks	Bucket replacement Tyre Changing	• Mechanical aids must be used when removing and replacing buckets / tyres. • Proper manual handling techniques are required when working with objects of weight, eg attachments etc.
Safety Equipment / Registration	Non Functional	• Daily checks must be carried out and Daily Inspection Reports filled out on Safety Equipment listed: • Amber Beacon, Reversing Alarm, Lights, Horn, Mirrors, Wipers/Washers, Reflective Tape.
Pressure	Uncontrolled Discharge	• Hot fluids and high pressure may exist in hoses fitted to machine. Caution must be observed. • Ensure all hydraulic / coolant / air hoses & hydraulic fittings are in good working condition. Relieve pressure prior to any repair. • Tyres must be properly maintained with the correct pressures. Wheel must be caged when filling with air after tyre replacement.
Noise	Noise levels	• Where the noise exceeds 85dBA the following checks shall be made: o Check and rectify that all noise attenuation treatments are in place and in working order. o If unsure of the required treatment check with the OEM (original equipment manufacturer). o Check and rectify engine idle and governed speeds. o Check and rectify any excessive noise source.
Explosion	Fuel / Batteries	• Batteries: Caution must be taken to avoid arcing when checking batteries or jump starting machines to reduce the risk of fire & explosion. • Fuel: Caution, keep fuel away from ignition sources. Failure to follow this may result in a fire/explosion. • Stop engine prior to refuelling.

05 Service Requirement 5.1 Pre-start plant check daily. 5.2 250 Hours.	

PPE Required	Tools & Materials
Safety boots. High visibility clothing. Sunscreen. Safety glasses. First Aid Kit. Hard Hat.	
Pre-Checks (Thing to Check Before)	**Checklist (Things to Check During)**
. xx	
Post-Checks (Things to Check After)	**Information Details**
None.	1
(Additional Person(s) Required)	**Hazards**
None.	xx 1 xx 2 xx 3
Related SOP's	**Certificates Required**
.	Plant Operator Certificate of competency. OHS Induction training for construction work..

Standard Operating Procedure
SOP-WS-002 - Use of Demolition Saw

2 Reminders

See tools & materials list | Related SOP's | Types of protection | Special note | Additional person(s) required

1 Pre start

1.1 Check fuel, check correct abrasive wheel for job, condition of machine and any damage to abrasive wheel.

1.2 Clean air filter daily.

1.3 Check the task to be done. Use the cradle with the saw when there is a long cut, e.g. a driveway.

2 Starting throttle position

2.1 Press the throttle trigger interlock and throttle trigger at the same time. ☐1

2.2 Hold both triggers down. ☐1

2.3 Move the slide control to) (and hold in this position. ☐2

2.4 Release the throttle trigger, slide control and throttle trigger interlock in succession.

3 Set the choke/Start up

3.1 Slide the choke lever to l l if the engine is cold. ☐2

3.2 Always press decompression valve. ☐2

3.3 Place the machine on the ground, keep a good balance and ensure the cut wheel cannot touch any objects or ground.

3.4 Press the machine firmly on the ground, holding it with hand, thumb wrapped around handle.

3.5 Place foot on carburettor box cover.

3.6 Slowly pull the starter handle with your hand as far as the stop, then pull it. through quickly and strongly. ☐2

3.7 Engine will be running.

3.8 Slide the choke lever to off position.

3.9 Briefly depress the throttle trigger at once so the engine returns to idle.

3.10 Let engine warm up.

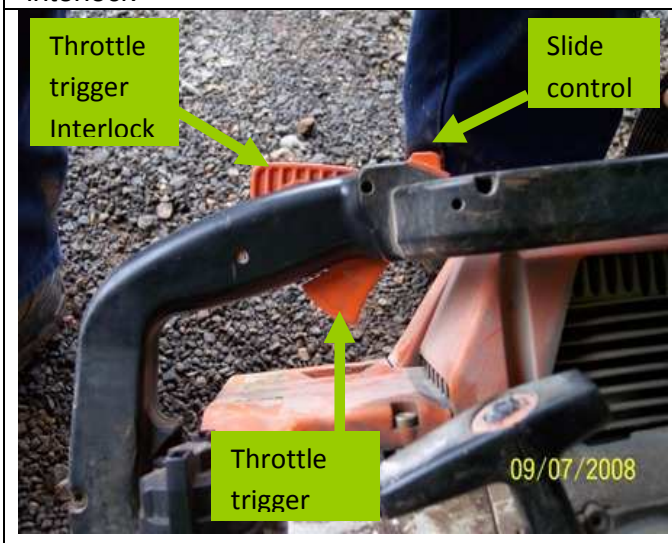
4 Cutting the object

4.1 Grip the machine , one hand at front, one hand at throttle. ⌗1

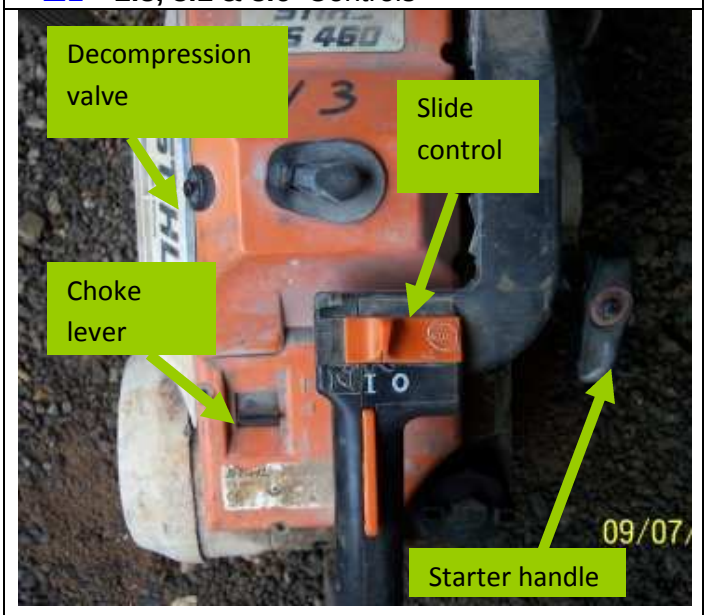
4.2 Avoid standing in direct line of wheel. ⌗1

4.3 Maintain good balance and footing. ⌗1

☐1 **2.1 & 2.2** Throttle trigger and throttle interlock



☐2 **2.3, 3.1 & 3.6** Controls



4.4 Position the machine in such a way that your body is clear of the abrasive. attachment. ⌗1

4.5 Begin cutting and continue at full throttle 4.6 Release the pressure on the machine as you reach the end of your cut. 4.7 Shut down machine, slide control to off position.	

PPE Required	**Tools & Materials**
Safety boots Gloves Eye protection Ear protection No loose fitting clothing High visibility Breathing protection/mask	Demolition saw 2 stroke fuel Abrasive wheel Plug spanner Wheel replacement spanner
✓Pre-Checks(Thing to Check Before)	**☑ Checklist (Things to Check During)**
Check air filter is clean *Visual check of all of unit for any damage* *Check the cutting wheel is in good condition*	*Check blade* *If there is vibration of the saw, the blade may not be straight*
✓Post-Checks (Things to Check After)	**Information Details**
Wipe down machine after use to ensure it is left clean *Check the condition of the blade, replace if required* *Refuel ready for next use*	1.1 Use of incorrect abrasive wheel or material can cause the wheel to shatter causing injury or death 1.1 Replace damaged wheel before use. 3.2 The decompression button must ALWAYS be pressed before starting 3.6 Do not pull the rope out more than 70cm otherwise it may break. Do not let the starter hand snap back.
(Additional Person(s) Required)	
None identified.	1 **4** Positioning 

Standard Operating Procedure
SOP-WS-003 – Decontamination of Plant, Equipment, Tools Vehicles, PPE

3 Reminders

See tools & materials list | Related SOP's | Types of protection | Special note | Additional person(s) required

1 Preliminary Work

1.1 Carry out pre-checks.
1.2 Dial before you dig, locate all utilities.
1.3 Undertake risk assessment at location.
1.4 Implement risk assessment controls.
1.5 Ensure WHS procedures for chemical use and storage are addressed
1.6 Conduct toolbox talk.
1.7 If at any time the scope of works changes, re-assess the work area for additional hazards and record on SWMS.

2 Decontaminate Plant, Equipment Tools Vehicles, PPE at Truck Wash

2.1 Determine all the plant/equipment/vehicles/tools/PPE to be decontaminated.
2.2 Assume anything touched by sewerage is contaminated.
2.3 Discard disposable clothing.
2.4 Move Plant/equipment/vehicles/tools/ PPE to the filter farm.
2.5 Wash down to remove any solids and until visually clean.
2.6 Do not allow any wastewater to enter any drains.
2.7 Apply an approved disinfectant in a well ventilated area.
2.8 Apply the disinfectant to all areas of the affected plant/equipment/vehicle/ tools/PPE. ☐3
2.9 Allow the disinfectant sufficient contact time on the equipment - 15 minutes or as indicated on the product label.
2.10 Hose off after 15 minutes.
2.11 Allow to dry thoroughly

☐1 **2.5**

☐2 **2.7 & 2.8**

PPE Required	**Tools & Materials**
Disposable overalls; gumboots; gloves; goggles	Contaminated plant, equipment, vehicles, tools PPE
✓Pre-Checks (Thing to Check Before)	**☑ Checklist (Things to Check During)**
All solids removed with washing prior to disinfectant use	Disinfectant to remain on equipment for 15 minutes
✓Post-Checks (Things to Check After)	**ⓘ Information Details**
(Additional Person(s) Required)	
None	

Standard Operating Procedure
SOP-WS-004 – Shutdown, Turn in and Flush Watermain

4 Reminders

See tools & materials list | Related SOP's | Types of protection | ⓘ Special note | Additional person(s) required

1 Shutting Down of Water Main

1.1 Locate area to be isolated.

1.2 Find the valves to be shut down using Hay Shire Council water reticulation plans.

1.3 Check if valve(s) are painted blue if so notify person on dialysis of water supply interruption to make alternative arrangements. ⓘ1 ☐1

2 Turning off valve

2.1 Lift the lid.

2.2 Place valve key over spindle. ☐2

2.3 Slowly turn valve anticlockwise to shut valve, unless stipulated on lid as left hand turn (clockwise).

2.4 Listen to make sure valve is turned off. ⓘ2

2.5 Turn valve on, then off again, to clear build up if still leaking, repeat 2.5 & 2.6 until valve has shut off completely.

2.6 Repeat step 2.1 to 2.6 with all other valves until area is isolated.

3 Ensuring Area Has Been Isolated

3.1 Locate a hydrant in isolated are.

3.2 Lift lid.

3.3 Place standpipe under hydrant lugs. ☐3

3.4 Turn standpipe clockwise to tighten.

3.5 Turn hydrant on by hydrant tap – clockwise, initially water will flow until pressure reduce.

3.6 Check that water flow ceases.

3.7 Repeat steps 2.5 and 2.6 if water flow continues (to ensure all valves are turned off).

3.8 Check for missed valves if water flow is still present at hydrant.

3.9 Do required works i.e. replace main, install hydrant, repair valve etc.

4 Prepare for Flushing of Water Main

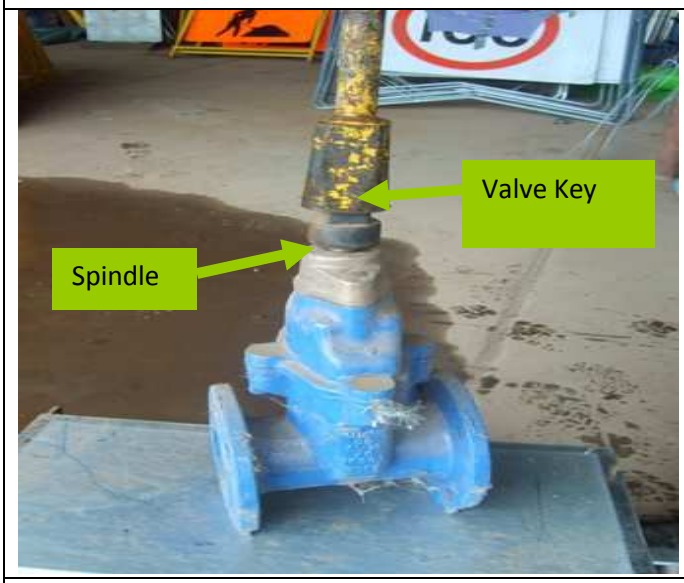
4.1 Locate hydrant as close to the end of isolated area - preferably at the highest elevation.

4.2 Repeat steps 3.2 to 3.4.

4.3 Fit hose to standpipe, ensuring outlet of hose can drain freely.

☐1 **1.3** Blue – Dialysis warning

☐2 **2.2** Inserting valve key



☐3 **0** Hydrant

4.4 Turn hydrant on by hydrant tap – clockwise.

5 Turning on Valves – Flushing Main

5.1 Place valve key over spindle.

5.2 Slowly turn valve clockwise to open valve completely, unless stipulated on lid as left hand turn (anticlockwise)

5.3 turn valve back half a turn.

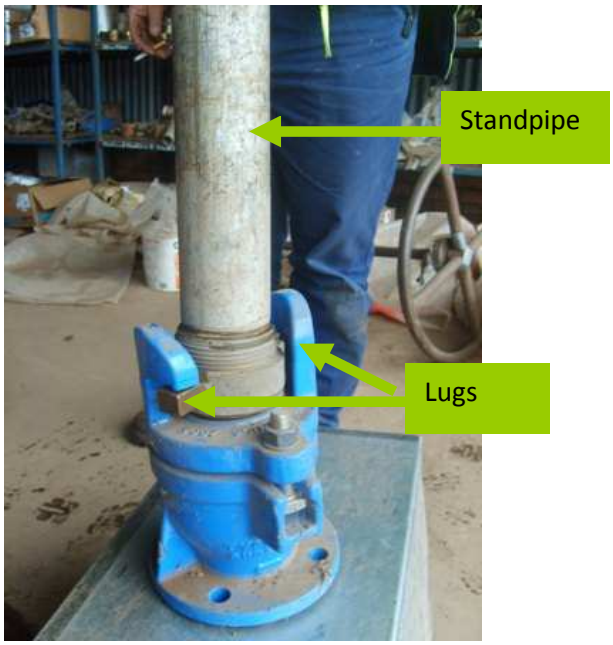
5.4 Remove valve key and close lid.

5.5 Repeat steps 5.1 to 5.4 until all valves in isolated area are turned on.

5.6 Return to hydrant, wait till air has been removed from main and water flows clear.

5.7 Perform Chlorine test [1]

5.8 Turn standpipe off slowly, remove standpipe, checks for leaks in hydrant (visual) and close lid.



PPE Required	**Tools & Materials**
Safety boots Hard hat Gloves Eye protection High visibility Sunscreen First Aid kit	Valve key Screw driver Standpipe Hose Chlorine Test Kit Hay Shire Council Water Reticulation Plans
✓Pre-Checks(Thing to Check Before)	**☑ Checklist (Things to Check During)**
None	*None*
✓Post-Checks (Things to Check After)	**ⓘ Information Details**
None	ⓘ1 **0** Blue valves have an address on the lid of people in area on Dialysis ⓘ2 **0** Done by placing ear close to valve key
People (Who are required or need to be notified)	
Persons in the area on Dialysis	

Standard Operating Procedure
SOP-WS-005 – Packing Valves

5 Reminders

See tools & materials list | Related SOP's | Types of protection | Special note | Additional person(s) required

1 Preliminary Work

1.1 Pre checks. ✓

1.2 Locate leaking valve.

1.3 Lift lid ⚠[1]

1.4 Remove valve lid if needed ⚠[2]

2 Repacking the Valve

2.1 Clean spindle under spindle top with emery paper.

2.2 Undo bolts on packing gland.

2.3 Slide packing gland up to spindle top.

2.4 Select the correct size packing.

2.5 Measure and cut packing ☐[3] ⚠[3]

2.6 Wrap packing around spindle.

2.7 Repeat 2.5 and 2.6 if required.

2.8 Replace old bolts if required.

2.9 Slide packing gland down over bolts.

2.10 Replace nuts and tighten.

3 Final Checks

3.1 Check spindle is not to tight.

3.2 Check for leaks.

3.3 Replace cover and clean up.

☐1 **0 & 2.2** Clean spindle, unbolt packing gland

☐2 **0** Slide packing gland up

6 ☐3 **0** Measure and cut packing

PPE Required	Tools & Materials
☐ Safety boots ☐ High visibility clothing ☐ Sunscreen ☐ Safety glasses ☐ Gloves ☐ First Aid Kit Safety boots	☐ Lid lifter ☐ Socket extension and ratchet ☐ Emery paper ☐ Stanley knife ☐ Replacement bolts (stainless steel) ☐ Packing Demolition saw
✓ Pre-Checks (Thing to Check Before)	**☑ Checklist (Things to Check During)**
☐ *Risk Assessment* ☐ *implement Risk Assessment* ☐ *Toolbox Talk*	*None*
✓ Post-Checks (Things to Check After)	**ⓘ Information Details**
None	*None*
(Additional Person(s) Required)	**Hazards**
None identified.	⚠1 **1.3** Bites, Stings **Control:** visual checks ⚠2 **1.4** Sprains and Strains **Control:** Manual Handling Training ⚠3 **2.5** Cuts **Control:** Correct use of Stanley knife

Standard Operating Procedure
SOP WS 006 – TISAB Solution

7 Reminders	Types of protection	Special note	☐1 Picture in column on right
Related documents, etc.	See tools & materials list	Additional person(s) required	⌗1 Picture in following table
Certificates Required		Related SOP's	

Overview Instructions & Explanations	Target 30 min

1 Preparation of TISAB Solution

1.1 Add 40ml of distilled water to the plastic TISAB bottle

1.2 Clean out a 2 ml pipette with distilled water, shake dry

1.3 Clean out the pipette with TISAB III concentrate ⚠1

1.4 Draw up 10ml of TISAB III and add to the plastic TISAB bottle ⚠1

1.5 Shake gently to mix

8 ☐1 Distilled water and TISABIII

PPE Required	Tools & Materials
☐ Safety boots ☐ Gloves	☐ Plastic bottle ☐ TISAB III concentrate ☐ 2ml pipette
✓Pre-Checks (Thing to Check Before)	**☑ Checklist (Things to Check During)**
☐ *None*	☐ *None*
✓Post-Checks (Things to Check After)	**Information Details**
☐ *None*	☐*None*
(Additional Person(s) Required)	**⚠ Hazards**
☐None	**1.3** Hazard Materials **Control:** MSDS
Related SOP's	
SOP WS XXX – Fluoride Testing	

Standard Operating Procedure
SOP-WS-007 – Calibration of Fluoride Meter

9 Reminders

Related documents, etc.

Certificates Required

Warning note

Types of protection

See tools & materials list

Special note

Additional person(s) required

Related SOP's

☐1 Picture in column on right

#1 Picture in following table

Overview Instructions & Explanations	Target 30 min

1 Set up Prior to Calibration

1.1 Do pre checks ✓

2 Prepare Standard Solution

2.1 Locate the 2 standard solution concentrates (0.2 mg/L and 2 mg/L) and put on the bench

2.2 Make up the standards to use:

2.3 Obtain the 2 standard jars ☐1

2.4 Clean 2 magnetic stirrers in distilled water, place one in each standard jar ☐1

2.5 Add approx. 50ml of the 0.2 std. to the 0.2 std. 100ml beaker ⓘ2

2.6 Dry with a clean tissue and put back stirrer

2.7 Using the 50ml measuring cylinder, add 50ml of 0.2 standard to the 0.2 std. beaker

2.8 Repeat steps 2.5 to 2.7 for the 2 standard

2.9 Add 1ml of TISAB solution to each of the 2 standards

2.10 Clean out 2ml pipette with distilled water, then dry

2.11 Repeat step 2.10 using the TISAB solution

2.12 Draw up 1ml of the TISAB solution, add to the standard

3 Prepare Probe

3.1 Wash the probes in distilled water (with a catching beaker underneath)

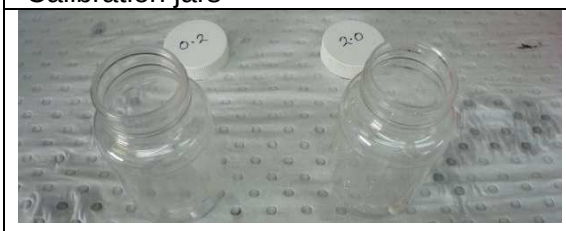
3.2 Wipe the probes sides with a soft tissue, "dab" dry the underneath

3.3 Place the beaker containing the 0.2 std. on the stirrer platform ☐3

3.4 Turn the stirrer on so the mixer is turning slowly☐3

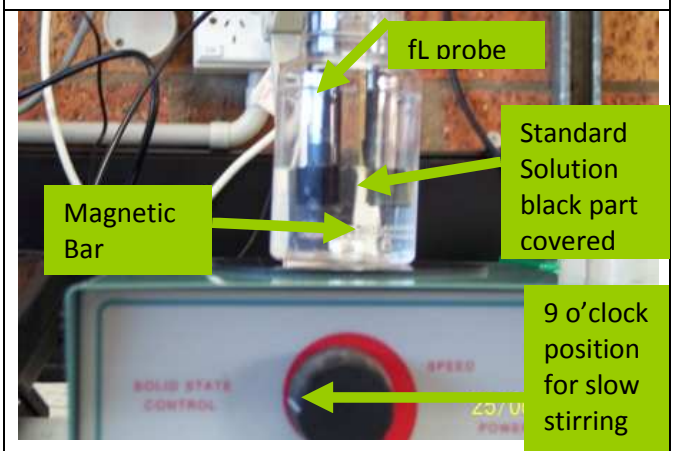
3.5 Lower the probes into the sample to about 15mm depthⓘ1 ☐3

☐1 Error! Reference source not found. **& 2.4** Calibration jars



10 ☐2 Fluoride probe

11 ☐3**3.3, 3.4 & 3.5** Stirrer platform set up



4 Calibration

4.1 Press “calibrate” ☐4

4.2 When “ENTER NO. STDS” comes up on the display, press “2”, the press “yes” ☐4

4.3 When display says “RDY CAL AS #.###”, enter 0.2, then press “yes

4.4 Remove the standard. beaker

4.5 Repeat steps 3.1 to 4.2 inclusive for the 2 standard.:

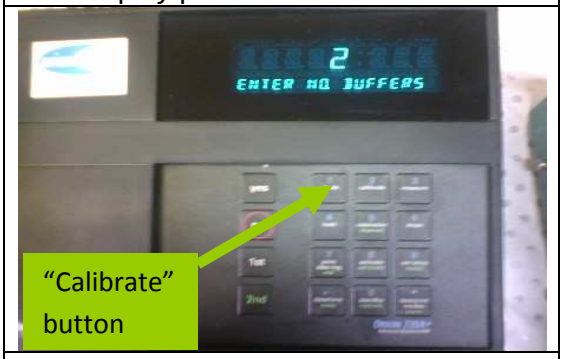
4.6 At step 4.3, enter 2.0, then press “yes”

4.7 Check slope = 60.2 + 4.0. If not, repeat from step 3.1

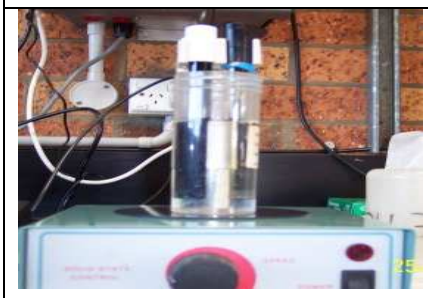
4.8 Clean up and store probe ✓

12 ☐4

Error! Reference source not found. **& 4.2** Display panel



⌗1 Storing probe



PPE Required	Tools & Materials
☐ Safety boots	☐ 50ml measuring cylinder ☐ 2 x 40ml beakers ☐ 2 standard solution concentrates – 0.2mg/L)clear) and 2 mg/L (pink) ☐ Tissues
✓ **Pre-Checks (Thing to Check Before)**	☑ **Checklist (Things to Check During)**
☐ *Turn on Fluoride meter* ☐ Ensure correct FL probe is correct ☐2 ☐ TISAB solution available	☐ None
✓ **Post-Checks (Things to Check After)**	ⓘ **Information Details**
☐ Wash the probe in distilled water and dry as per step 3.2 ☐ Lower probe back into a fresh solution of reticulation water ⌗1	ⓘ1 **3.5** Ensure black part of probe is below the surface of sample ⓘ2 **2.5** If no standard left make up TISAB as per 1
(Additional Person(s) Required)	**Hazards**
☐ None	**2.9** Hazard Materials **Control:** MSDS
Related SOP’s	**Certificates Required**
SOP WS 006 – TISAB III SolutionFluoride Testing	☐ None

Standard Operating Procedure
SOP-WS-009 – Water Main Repair

13 Reminders

Related documents, etc.
Certificates Required
Warning note
Types of protection
See tools & materials list
Special note
Additional person(s) required
Related SOP's
☐1 Picture in column on right
⌗1 Picture in following table

Overview Instructions & Explanations

1 Preliminary Work

1.1 Gather and implement all associated SOP's and their associated pre checks.
1.2 (SOP-WS-004) Shutting down and turning in Mains. 1
1.3 (WS SOP 010) Excavate water mains. 3

2 Removal of Broken Main

2.1 Expose area to be replaced. ☐1 ⓘ1 ☑
2.2 Remove broken pipe. ⚠2 3
2.3 Measure pipe to be replaced.
2.4 Measure and cut replacement pipe. 3

3 Installation of Gibaults

3.1 (SOP-WS-001) Installing Gibaults. 4 ☑

4 Backfill Excavation

4.1 Cover pipe with a minimum 150mm of sand. ☐2
4.2 Replace marker tape trace wire
4.3 (SOP-WS-011) Backfilling of Excavations. 6 ☑

5 Clean Up

5.1 Prepare and Dispose of broken pipe. 5
5.2 Sweep road/footpath/area.
5.3 Remove TCP.

5.4 DO POST CHECKS. ✓

☐1 **2.1** Exposed pipe

☐2 **4.1** Covering main with sand

PPE Required	Tools & Materials
Safety boots. High visibility clothing. Sunscreen. Safety glasses. Asbestos protective clothing/masks/gloves Hard Hat .	Replacement pipe Gibaults Shovel Crow bar Backhoe Probe Cloths Saw Axe Tape measure Sand and backfill material Asbestos bags Asbestos Trailer if required
Pre-Checks (Thing to Check Before)	**Checklist (Things to Check During)**
Check if pipe is Asbestos	Weather conditions Traffic Trench condition
Post-Checks (Things to Check After)	**Information Details**
Ensure water is turned back on. *Check for leaks.* *Ensure all tools and materials are clean and packed away.* *Site is clean..*	2.1 If asbestos expose from collar to collar
(Additional Person(s) Required)	**Hazards**
	2.2 Hazardous Materials **Control**: MSDS
Related SOP's	**Certificates Required**
1 (SOP WS 004) Shutting Down and Turning in Mains 2 (SOP WS 010) Excavate Water Mains 3 (SOP WS 002) Use of Demolition saw 4 (SOP WS 001) Gibault Installation 5 (SWMS-SW-17 Water Main Repairs 6 (SOP WS 011) Backfilling and Compaction	None.

Standard Operating Procedure
SOP-WS-010 – Excavation of Water Main

14 Reminders

Related documents, etc.

Certificates Required

Warning note

Types of protection

See tools & materials list

Special note

Additional person(s) required

Related SOP's

☐1 Picture in column on right

⌗1 Picture in following table

Overview Instructions & Explanations	

1 Preliminary Work

1.1 Do Pre checks. ✓

1.2 Do risk assessment at location.

1.3 Implement risk assessment control.

1.4 Conduct toolbox talk

1.5 Follow Locate utilities $_1$ PPM to determine gas, electricity.

2 Locate Water Main

2.1 Measure from Boundary or Kerb to nearest hydrant or valve.

2.2 Transfer measurement to location of proposed excavation and mark with Marker paint. ⚠$_3$☐$_2$

3 Excavation

3.1 Remove top 200mm of soil from proposed excavation. ⚠$_1$ ☐$_2$

3.2 Probe for water main. ⚠$_2$ ☐$_3$ ⓘ$_1$

3.3 Excavate trench to depth indicated by step 3.2.

3.4 Repeat steps 3.2 and 3.3 until water main is located by probe. ⓘ$_3$ $_2$

3.5 Place probe beside main so excavating machine can dig along side of water main. ⚠$_1$ ☐$_4$

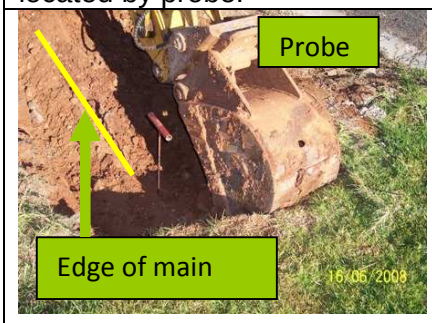
3.6 Commence excavation along side of main shovelling soil at top of main to side excavation at intervals as required until water main is exposed. ⚠$_1$⚠$_2$ ⓘ$_2$ ⌗$_1$

☐1 **2.1** Measuring distance of water main.

☐2 **2.2** & **3.1** Excavation Location.

☐3 **3.2** Probing for Main.

☐4 **3.5** Position of main as located by probe.



⌗1 **3.6** Exposing water main by shovel.

PPE Required	**Tools & Materials**
☐ Safety boots. ☐ High visibility clothing. ☐ Sunscreen. ☐ Safety glasses. ☐ Asbestos protective clothing/masks/gloves. ☐ First Aid Kit. ☐ Hard Hat.	☐ Backhoe. ☐ Probe. ☐ Shovel. ☐ Marker Paint. ☐ Tape measure.
✓ **Pre-Checks (Thing to Check Before)**	☑ **Checklist (Things to Check During)**
☐ Determine the site. ☐ Use DBYD request to locate services. ☐ Gather associated SOP's. 1	☐ None.
✓ **Post-Checks (Things to Check After)**	ⓘ **Information Details**

None.	ⓘ1 3.2 Push probe as far as possible into ground at 50mm intervals for full width of trench to calculate the next dig depth with excavating machine. ⓘ2 3.6 Excavator must not be operational while personnel are shovelling in trench. ⓘ3 3.4 Any trench over 1.5mt should be benched, battered or shored.
(Additional Person(s) Required)	**Hazards**
None.	2.1 3 Chemical. **Control**: MSDS. 3.2 & 3.6 2 Manual handling. **Control:** Use correct manual handling procedures. 3.6 1 Moving Plant. **Control**: Keep clear of moving plant.
Related SOP's	**Certificates Required**
1 (SOP WS 004) Shutting Down and Turning in Mains. 2 (SOP WS 010) Excavate Water Mains. 3 (SWMS-SW-17 Water Main Repairs. 4 (SOP WS 011) Backfilling and Compaction.	Plant Operator Certificate of competency. OHS Induction training for construction work. First Aid training. Manual handling training.

Standard Operating Procedure
SOP-WS-011 – Backfilling and Compaction

15 Reminders

Related documents, etc.

Certificates Required

Warning note

Types of protection

See tools & materials list

Special note

Additional person(s) required

Related SOP's

1 Picture in column on right

1 Picture in following table

Overview Instructions & Explanations	

1 Preliminary Work

1.1 Do pre checks. ✓

1.2 Do DBYD, locate all services.

1.3 Undertake risk assessment at site.

1.4 Implement risk assessment control.

1.5 Conduct toolbox talk.

1.6 If at any time the scope of the work changes, re-assess the work area for additional hazards and record on SWMS.

2 Reinstatement of Gravel Surface

2.1 The trench bed shall be backfilled and thoroughly compacted using moist natural materials to 150mm below finished level.

2.2 Reinstatement of final 150mm shall be with prior stream gravel material.

2.3 The trench will be reinstated in 150mm layers with 5-6 passes each.

2.4 Mechanically compact the trench with a wacker packer or trench roller.

2.5 The moisture content is to be at 70% of optimum for 98% relative compaction. That is, when someone picks the soil in their hand the soil should have enough moisture to stick together after they squeeze it in their hand.

3 Reinstatement of a Sealed Road Opening (Bituminous Surface)

3.1 The trench bed shall be backfilled and thoroughly compacted using moist natural materials to 200mm below finished level.

3.2 Reinstatement of final 200mm shall be with prior stream gravel material.

3.3 The trench will be reinstated in 150mm layers, with 5-6 passes each layer.

3.4 Mechanically compact the trench with a wacker packer or trench roller.

3.5 The moisture content is to be at 70% of optimum for 98% relative compaction. That is, when someone picks the soil in their hand the soil should have enough moisture to stick together after they squeeze it in their hand.

3.6 A crown of approximately 50mm is required to allow for future consolidation.

3.7 Reinstatement of all bituminous surfaces will be carried out by Hay Shire Council.

4 Reinstatement of Nature Strip Opening (oe Similar Surface)

4.1 The trench bed shall be thoroughly compacted before backfilling.

4.2 Fill shall be compacted every 150mm as trench is reinstated.

4.3 Reinstatement material shall be original material (i.e. excavated clean fill).

4.4 The trench shall be reinstated in 150mm layers, with 5-6 passes each.

4.5 Mechanically compact the trench with a wacker packer or trench roller.

4.6 The moisture content is to be at 70% optimum for 98% relative compaction. That is, when someone picks the soil in their hand the soil should have enough moisture to stick together after they squeeze it in their hand. 4.7 A minimum of 100mm of top soil shall be used in the final layer and an appropriate grass sown on the finished surface to complete the restoration. 4.8 A crown of approximately 50mm is required to allow for further consolidation.	

PPE Required	**Tools & Materials**
Safety boots. High visibility clothing. Sunscreen. Safety glasses. Hard Hat	Backhoe. Shovel. Backfill material Tape Measure Wacker Packer
Pre-Checks (Thing to Check Before)	**Checklist (Things to Check During)**
Correct backfill material.	Correct moisture content
Post-Checks (Things to Check After)	**Information Details**
Appropriate signage for reinstated surface.	• Hand Roller (Wacker Packer) for trenches up to 900mm in width. • Hand Roller (Pedestrian Roller) for trenches between 900 – 1500mm in width. • Smooth Drum roller sizes shall have a minimum applied load intensity of 5 tonnes per meter width of drum without vibration for trenches greater than1500mm in width.
(Additional Person(s) Required)	**Hazards**
Spotter when dumping backfill material.	None.
Related SOP's	**Certificates Required**
	Plant Operator Certificate of competency. OHS Induction Training for construction work. First aid training. Manual handling training.

Standard Operating Procedure
SOP-WS-012 – Water Service Installation – Up to 50mm Dia

16 Reminders
Related documents, etc.
Certificates Required
Warning note
Types of protection
See tools & materials list
Special note
Additional person(s) required
Related SOP's
☐1 Picture in column on right
⌗1 Picture in following table

Overview	Instructions & Explanations	

1 Preliminary Work

1.1 Do pre checks. ✓

1.2 Do DBYD, locate all services.

1.3 Undertake risk assessment at site.

1.4 Implement risk assessment control.

1.5 Conduct toolbox talk.

1.6 If at any time the scope of the work changes, re-assess the work area for additional hazards and record on SWMS.

2 Excavate for Service

2.1 Set out for lockable inline ball valve as per ⌗1.

2.2 Excavate for new water.

3 Fit Tapping Saddle

3.1 Clean pipe with rag.

3.2 Fit tapping saddle as per Installation guide ⓘ1 ☐1.

4 Installation of Service

4.1 Measure and cut pipe to length between main cock and one way tap, allowing for 750mm minimum riser, as per ⌗1.

4.2 Bend pipe to 90° angle allowing for 750 mm riser.

4.3 Weld no 3 fitting riser at one way tap end pipe. ☐2

4.4 Weld no 2 fitting to main cock end of pipe. ☐3

4.5 Neal pipe if required.

4.6 Cool off welds - steps 4.3, 4.4 and 4.5.

4.7 Attach one way tap to riser at No 3 fitting and open lockable ball valve. ☐2

4.8 Attach ferrule bend to no 2 fitting at main cock end. ☐3

4.9 Fit main cock to tapping saddle as per Installation guide. ⓘ2

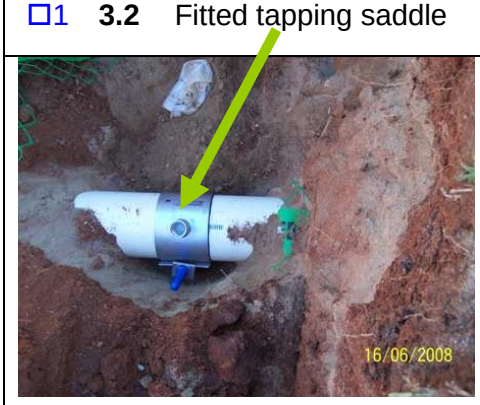
4.10 Attach ferrule bend to main cock.

5 Tapping Water Main

5.1 Remove bonnet of main cock and washer.

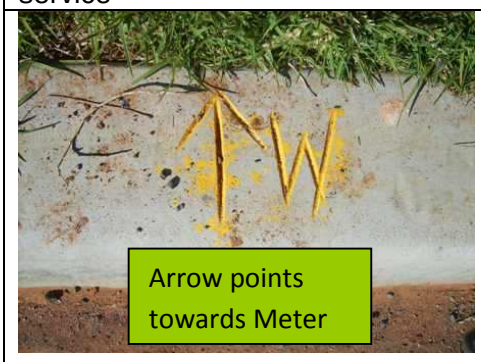
5.2 Loosen the plug valve locking ring.

☐1 **3.2** Fitted tapping saddle

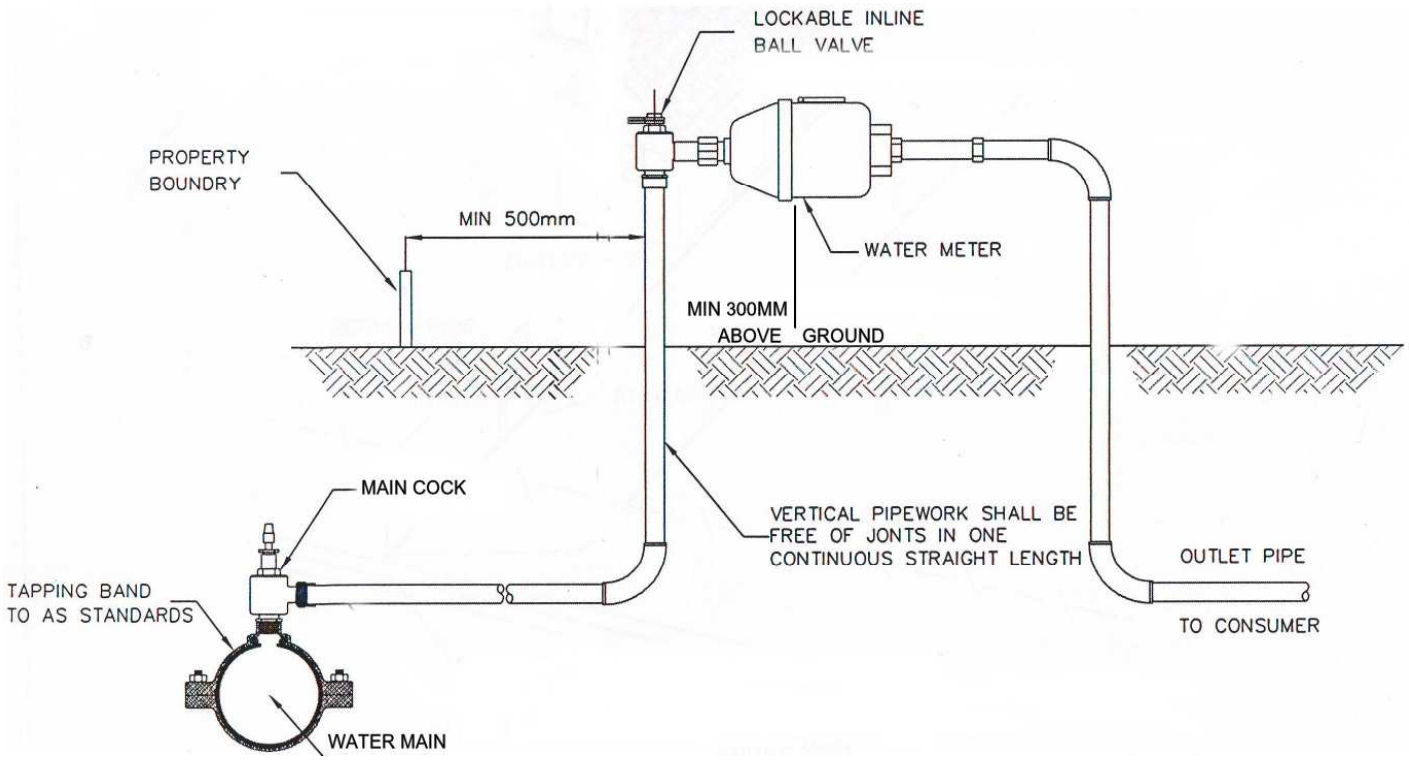


☐2 4.3 & **4.7** No 3 fitting and Meter union

☐3 **4.4** & **4.8** Ferrule bend and No 2 Fitting

5.3 Open the plug valve.	☐4 **6.1 & 6.3** Identifying the service
5.4 Attach ratchet to top of tapping tool. 5.5 Attach ratchet to top of tapping too. 5.6 Rotate the drill feed screw until the drill touches the main – clockwise. 5.7 Turn the drill with the ratchet drive to commence drilling – clockwise. 5.8 Maintain downward pressure on the drill , slowly rotate the drill feed screw – clockwise. 5.9 Keep both the drill and the drill feed turning until the main is pierced. 5.10 Back off the drill feed screw until the drill clears the main cock.	
5.11 Shut off the plug valve to isolate the water supply.	
5.12 Remove tapping tool from main cock.	
5.13 Replace washer and bonnet of main cock.	
5.14 Open the plug valve and flush service.	
5.15 Turn off one way tap.	
5.16 Tighten the plug valve locking ring.	
5.17 Tighten packing gland on top of main cock.	
5.18 Fit meter with washer to lockable line ball valve, check float direction.	
5.19 Fit meter union to resident of water meter with washer.	
5.20 Check for leaks.	
6 Identify the Service	
6.1 Mark kerb in line with main cock with marking pen.	
6.2 Cut with demolition saw. ☐4	
6.3 Paint with yellow marking paint. ☐4	
6.4 Backfill.	
6.5 Do post checks.	
7 Maintenance and Repairs to Metal Water Services	
7.1 Clean pipe thoroughly each side of the length to be cut with emery paper.	
7.2 Must be a good earth.	
7.3 Attach bridging cable to water main side of service and then customer's side of water service meter. Ensure it is securely in place.	
7.4 Always use insulated gloves when working on metallic water pipes on services.	
7.5 Put on the inner glove then the outer glove. **IF YOU RECEIVE AN ELECTRIC SHOCK YOU MUST IMMEDIATELY GO TO EMERGENCY AT THE HOSPITAL**	
7.6 The bridging cable is to remain undisturbed and in good contact until work is completed.	

1 Service Installation Plan



PPE Required	Tools & Materials
☐ Safety boots. ☐ High visibility clothing. ☐ Sunscreen. ☐ Safety glasses. ☐ Hard Hat ☐ Gloves ☐ First Aid Kit ☐ Hearing Protection	☐ Backhoe. ☐ Water meter ☐ Shovel. ☐ Copper pipe ☐ Tape measure. ☐ Tapping Saddle ☐ Main Cock ☐ Lockable inline ball valve ☐ Meter union ☐ 90° ferule bend ☐ No2 & No 3 Bass fittings ☐ Probe ☐ Rags ☐ Spanners ☐ Oxy set ☐ Marker Paint ☐ Pipe cutter ☐ Pipe bender ☐ Footprints ☐ Tapping tool kit ☐ Demolition saw
✓ **Pre-Checks (Thing to Check Before)**	☑ **Checklist (Things to Check During)**
☐ Collect water meter application form from Supervisor ☐ Pick up required materials. ☐ Determine Site ☐ Use Dial before you dig request to find location of Gas, Telstra and power Item Description ☐ Gather all associated PPMs.	☐ Housekeeping.
✓ **Post-Checks (Things to Check After)**	ⓘ **Information Details**
☐ Check water pressure at meter ☐ Fill in “Water Connection Detail Form” ☐ Return paperwork to supervisor	ⓘ1 3.1 Installation guide will be attached to tapping saddle ⓘ2 4.9 Installation guide supplied with main cock
(Additional Person(s) Required)	**Hazards**
☐ None.	☐ None.
Related SOP’s	**Certificates Required**
SOP WS 010 Excavate Water Main SOPWS 002 Use of Demolition Saw SOP WS 011 Backfill compaction SOP WS 004 Shutting Down and Turning in Mains	☐ Plant Operator Certificate of competency.

Standard Operating Procedure
SOP-WS-013 – Drain and Clean Reservoir

17 Reminders

Related documents, etc.

Certificates Required

Warning note

Types of protection

See tools & materials list

Special note

Additional person(s) required

Related SOP's

1 Picture in column on right

1 Picture in following table

Overview	Instructions & Explanations	

1 Preliminary Work

1.1 Do pre checks. ✓

1.2 Undertake risk assessment at site.

1.3 Implement risk assessment control.

1.4 Conduct toolbox talk.

1.5 If at any time the scope of the work changes, re-assess the work area for additional hazards and record on SWMS.

1.6 Install appropriate sedimentation traps/controls where outlet enters the drainage system.

2 Valve Shutdown and Drainage

2.1 Reason for reservoir drainage, contamination, low chlorine, cleaning (removal of sludge) inspections.

2.2 Close inlet and outlet valve (as appropriate) to isolate the reservoir from the reticulation system.

2.3 Open the outlet valve to drain reservoir contents to waste.

2.4 Monitor sedimentation controls for effectiveness and regulate out flow to suit.

2.5 Monitor level drop using SCADA at WTP.

3 Cleaning of Reservoir

3.1 Once level has dropped to below access opening remove access plate and visually inspect interior.

3.2 It will be reasonable to expect that there will be a depth of sediment in the raw water reservoirs.

3.3 Assess depth of sediment and conduct confined space entry including 'gas detection'. Enter when safe.

3.4 Access reservoir when safe and physically remove sludge by 'brooming material in suspension' towards the outlet. It will be necessary to periodically add water to the sludge to create a solution that can be moved by 'brooming towards the outlet.

3.5 A number of employees are required to perform this task. Assess best method to achieve result depending on condition of sludge, depth/quantity and available manpower.

3.6 Continue to monitor atmospheric conditions during disturbance/removal of the sludge.

3.7 High pressure water blasting may be employed (if effective) to remove accumulated sludge on lower reaches of the internal walls.

4 Refilling	
4.1 Remove all tools and employees from within reservoir	
4.2 Refit access plate to reservoir.	
4.3 Close outlet valve.	
4.4 Open inlet and outlet valve (as appropriate) to re-instate the reservoir to the reticulation system.	
4.5 Monitor inflow and rate of fill using SCADA system at the WTP.	
4.6 As the reservoir fills it will 'come on line'.	

PPE Required	**Tools & Materials**
☐ Safety boots. ☐ High visibility clothing. ☐ Sunscreen. ☐ Safety glasses. ☐ Hard Hat	☐ Gas Detector. ☐ Valve keys. ☐ Spanners. ☐ Shovels. ☐ Brooms. ☐ Sedimentation controls materials.
✓ Pre-Checks (Thing to Check Before)	**☑ Checklist (Things to Check During)**
☐ Sedimentation Control devices Installed correctly.	☐ Sedimentation Control is working effectively. ☐ Reservoir is draining. ☐ Reservoir is filling.
✓ Post-Checks (Things to Check After)	**ⓘ Information Details**
☐ Reservoir is full and all valves are open/closed appropriately. ☐ Remove Sedimentation from Drainage line once dry. ☐ Remove sedimentation control devices.	•
(Additional Person(s) Required)	**Hazards**
☐ Adequate number to effect cleaning. ☐ Observer outside the reservoir as per Confined space requirements.	☐ None if appropriate precaution taken.
Related SOP's	**Certificates Required**
	☐

Standard Operating Procedure
SOP-WS-019 – Hydrant and Valve Maintenance

18 Reminders
Related documents, etc.
Certificates Required
Warning note
Related SOP's
Types of protection
See tools & materials list
Special note
Additional person(s) required
Related SOP's
☐1 Picture in column on right
⌗1 Picture in following table

Overview Instructions & Explanations	

1 Preliminary Work

1.1 Do pre checks. ✓

1.2 Undertake risk assessment at site.

1.3 Implement risk assessment control -TCP.

1.4 Conduct toolbox talk.

1.5 If at any time the scope of the work changes, re-assess the work area for additional hazards and record on SWMS.

2 Traffic Control

2.1 Set up men at work sign at either end of street where maintenance is taking. ☐1

3 Cleaning and Measuring Hydrant (Height)

3.1 Open Hydrant Lid. ☐2

3.2 Clear and remove any obstructions, grass, rocks, dirt etc with brush

3.3 If excess dirt/debris organise vacuum excavator to clear

3.4 Measure height from top of hydrant lugs to ground level ☐3 ⓘ1

3.5 Record data in hydrant maintenance spreadsheet in Hydrant tough book

4 Painting and Installing marker Plates

4.1 Pressure wash lid.

4.2 If painting is still required, apply yellow marker paint to hydrant lid. ☐4

4.3 Replace HP marker plate if required. ☐5

4.4 Place cover plate over marker plate to prevent paint on marker. ☐6

4.5 Apply yellow marker paint to HP area of gutter. ☐6

5 Installing Cats Eyes

5.1 Place cone(s) in front of area where cats eye is to be installed ☐7

5.2 One crew member act as traffic controller to prevent injury/ accidents

☐1 **Step 2.1** TCP set up

☐2 **Step 3.1** Open hydrant/valve

☐3 **Step 3.4** Measure depth of hydrant

☐4 **Step 4.1** Paint Hydrant

☐5 **Step 4.2** Replace marker plate

5.3 Place tar mat on area for cats eye installation ⓘ2 ☐8

5.4 Melt tar patch with gas gun until it produces a flame ☐8

5.5 Place cats eye on molten tar patch, secure in place by pressing down with foot ☐9 ☐10

5.6 Record maintenance data in hydrant spreadsheet

6 Valve Maintenance

6.1 Follow steps 1.1 to 4.4, substituting HP marker for SV marker (when replacing marker) omitting step 3.4

6.2 Record maintenance data in hydrant spreadsheet

7 Pack Up

7.1 Remove all TCP, place in vehicle, ensure site is tidy and debris removed

☐6 **Step 4.3,4.4** Paint gutter using protective cover

☐7 **Step 5.1** TCP

☐8 **Step 5.3** Tar patch, flame present

☐9 **Step 5.5** Place Cats eye

☐10 **Step 5.5** Press down Cats eye


PPE Required	**Tools & Materials**
☐ Safety boots. ☐ High visibility clothing. ☐ Sunscreen. ☐ Face Shield. ☐ Gloves. ☐ First Aid Kit. ☐ Hat. ☐ TCP signs. ☐ Cones.	☐ Flat Screw Driver. ☐ Marker Paint. ☐ HP & SV marker plates. ☐ Tar patches. ☐ Gas gun. ☐ Protective cover. ☐ Tape measure. ☐ Dust pan & brush. ☐ Vaccuum excavator – if needed. ☐ Bucket.
✓ **Pre-Checks (Thing to Check Before)**	☑ **Checklist (Things to Check During)**
☐ Traffic Control.	☐
✓ **Post-Checks (Things to Check After)**	ⓘ **Information Details**
☐ Housekeeping.	▪ ⓘ1 If distance is greater than 300mm hydrant must be raised. • ⓘ2 Position cats eye off centre line of road approx 1meter on hydrant side.
(Additional Person(s) Required)	**Hazards**
☐	☐
Related SOP's	**Certificates Required**
	☐

Standard Operating Procedure
SOP-WS-020 – Using Hand Tools

19 Reminders

Related documents, etc.

Certificates Required

Warning note

Related SOP's

Types of protection

See tools & materials list

Special note

Additional person(s) required

Related SOP's

☐1 Picture in column on right

⌗1 Picture in following table

Overview Instructions & Explanations	

1 Preliminary Work

1.1 Do pre checks. ✓

1.2 Dial before you dig, locate all utilities

1.3 Undertake risk assessment at site.

1.4 Implement risk assessment control -TCP.

1.5 Conduct toolbox talk.

1.6 If at any time the scope of the work changes, re-assess the work area for additional hazards and record on SWMS.

2 Choose the Right Tool for the Right Job

2.1 Use tools in accordance with the design capacity and solely for their intended purpose.

2.2 Do not use hand made attachments.

2.3 Choose tools that can be used in either hand so that left handers are provided for.

2.4 Heavy tools can cause problems, lighter tools can be held or used longer and more easily.

3 Tool Handles

3.1 Ensure there is a good fit.

3.2 Have a good gripping surface e.g. dimpled, or made of compressible material.

3.3 Ensure there are no sharp edges which could dig into the fingers or palm of the hand.

3.4 Have a grip span of about 6cm and not more than 9cm.

4 Chisels

4.1 Never use a chisel with a mushroomed head.

4.2 Wear eye protection, eye injuries can be caused by flying material.

4.3 Hold the chisel correctly between the thumb and forefinger with palm of hand facing person and point of chisel directed away. ☐1

5 Wrenches

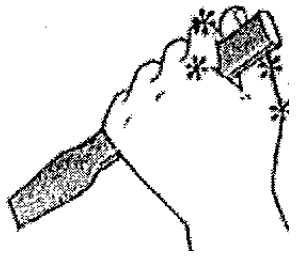
5.1 Use a wrench that is the right size for the type of job.

5.2 Stay alert and prepare for the possibility that the wrench may slip or the fastener may turn free.

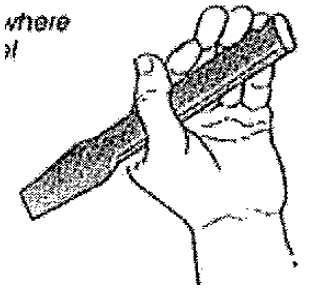
5.3 Keep tool sharp and clean to ensure that the tool fits securely onto the bolt or nut.

5.4 Place the wrench so that the pull on the handle tends to force the jaws further into the nut. ☐2

☐1

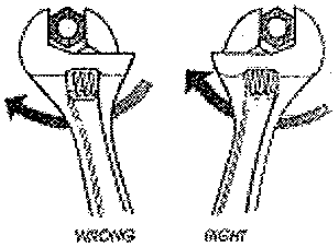


Incorrect



Correct

☐2



5.5 Pull on the wrench rather than pushing.	
5.6 When jaws on the wrench are no longer square replace the wrench.	
5.7 Do not overload the wrench by using a pipe extension.	
5.8 Replace if the locking mechanism no longer works easily.	
5.9 Do not use a hammer on the wrench.	
6 Hammers	
6.1 Keep clean and free from oil which might cause the handle to slip or the face to slide from the object being struck.	
6.2 Make sure the head is wedged securely and that the head and handle are not chipped or broken.	
6.3 Grasp the handle firmly near the end.	
6.4 Keep your eye on the point to be struck.	
7 Knives and Sharp Cutting Tools	
7.1 Keep hands behind the cutting edge.	
7.2 Do not cut towards yourself.	
7.3 Pass sharp tools handle first.	
7.4 Keep sharp tools sharp, blunt tools are more dangerous.	
7.5 Replace or sharpen any cutting tool that has lost its edge at the correct angle.	
8 Files	
8.1 Ensure teeth are sharp and clean	
8.2 Hold the file correctly – grasp the file handle firmly in one hand and use the thumb and forefinger of the other to guide the point. Push the file forward while bearing down on it. Release the pressure and bring the file back to its original position	
9 Screwdrivers	
9.1 Use the correct blade for the slot.	
9.2 Don't use to pry things open.	
9.3 Use insulated tools around energized equipment.	
9.4 Replace a screwdriver if the tip is chipped, bent or broken.	
9.5 Do not hold the work piece in the palm of your hand while using the screwdriver.	

PPE Required	Tools & Materials
Safety boots. High visibility clothing. Sunscreen. Hearing Protection. Gloves. Dust Mask. Eye Protection. No jewellery, loose clothing or loose hair.	The tool appropriate for the task.
Pre-Checks (Thing to Check Before)	**Checklist (Things to Check During)**
Visual check that tools are in good condition.	Tool remains in good condition.
Post-Checks (Things to Check After)	**Information Details**
Clean tools where required	▪ Maintain tools and keep them tidy so they can be found easily. ▪ Keep moving parts lubricated where required. ▪ Keep them dry. ▪ Cuts,abrasions, amputations and punctures are the types of injuries which can occur from a single slip of the tool. ▪ Eye injuries can be caused by flying “chips”. ▪ Tools can cause injury from falls from heights. ▪ Tools can cause injury by throwing them.
(Additional Person(s) Required)	**Hazards**
Related SOP’s	**Certificates Required**

Appendix C Continuous Improvement Plan

Actions arising from the Risk Assessment are listed in the following table. Note that the first two numbers of each action refer to the Element and Component numbers for ease of cross-referencing actions back to the Framework).

Action No.	Description
1.1.1	Expand the strategic objective 'to provide supplies of both filtered and raw water in sufficient quantity to meet the realistic demands of the town area and of a quality that conforms to current public health standards' and the community strategy to 'provide a clean and safe water supply' into a full drinking water quality policy.
1.1.2	Once developed, communicate the drinking water policy throughout the organisation (examples include through awareness programs, posting the policy on Council intranet, including policy in induction materials, stating requirement to understand policy content in position descriptions).
1.2.1	Develop and maintain the currency of a Drinking Water Legal and Formal Compliance Register and refer to this in subsequent Strategic Business Plans. The register should include at least the jurisdiction of the instrument, the type, the relevance to drinking water, who is responsible for keeping the document current and the next review date.
1.2.2	Ensure that the drinking water compliance requirements are communicated to employees and contractors (examples include articulating responsibilities in position descriptions and/or induction form, within the Drinking Water Quality Policy, via the website).
1.2.3	Consider completing Integrated Water Cycle Management evaluation in accordance with requirements of NSW Best-Practice Management of Water Supply and Sewerage Framework and Best Practice Management of Water Supply and Sewerage Guidelines.
1.3.1	Develop a drinking water specific Stakeholder Register and show how HSC's current activities relate to stakeholder communication. The document should include at least the stakeholder, the jurisdiction, the relevance to the drinking water system, mode of communication (MoU, seminar etc.), current responsible position from HSC and currency of the register.
1.3.2	Review how interagency communication is undertaken.
1.3.3	Consider formalising liaison with upstream Councils and CMA. See Risk Register C1.
1.3.4	Improve liaison with Planning Department in relation to water quality issues. See Risk Register C2.
1.3.5	Review how the non-potable water system is dealt with in terms of communication and education (see guidance from NSW Health). See risk register NPW1.
2.1.1	Develop a clear team details table to show current positions and responsibilities for drinking water quality to help improve compliance with this component. The table should include at least the position, drinking water responsibilities and DWMS responsibilities in particular.
2.1.2	Ensure that responsibility for maintaining currency of the conceptual system flow diagram is assigned to someone within the water quality team. It is suggested that the Infrastructure Manager be assigned this responsibility.
2.1.3	Consider undertaking an Integrated Water Cycle Management evaluation of the system (note: this is not mandatory but is considered best practice)
2.2.1	Set up a comprehensive spreadsheet or database of WTP operational data to facilitate trend analysis of data in the future.
2.2.2	Ensure that when set up, data from CCPs are logged and analysed on a regular basis to allow for any emerging trends at these critical points to be picked up quickly.

2.2.3	Include water quality details in the Management Plan.
2.3.1	Ensure that responsibility for maintaining currency of the Risk Register is assigned to someone within the water quality team. It is suggested that the Infrastructure Manager be assigned this responsibility.
2.3.2	Ensure that a review frequency is set for the Risk Register and record when the Risk Register is reviewed and any changes made.
3.1.1	Review how on-site sewage management systems are managed. See Risk Register C2.
3.1.2	Develop and maintain a trade waste management program. See Risk Register C3, D5.
3.1.3	Develop and maintain a backflow prevention program and register. See Risk Register D5.
3.1.4	Develop and maintain a register of rainwater tanks. See Risk Register D5.
3.1.5	Develop and maintain a register of water carters regardless of who owns the water cart and documentation to support water carter use (clause 35 PHR). See Risk Register CWT2.
3.1.6	Integrate planning and water quality requirements including s.68 approval of devices. See Risk Register D5.
3.1.7	Ensure that cap is kept on end of hose – perhaps a sign for RFS. See Risk Register CWT2.
3.1.8	Check that roofs and hatches of reservoirs are properly sealed to prevent birds and reptiles from entering. See Risk Register Pine2, D1.
3.1.9	Consider filter resting time after re-filling to help reduce breakthrough. See Risk Register Filt3.
3.1.10	Consider adding chlorination step for commissioning of new mains. See Risk Register D10.
3.1.11	Consider keeping sodium hypochlorite bottle for cleaning shared equipment and documenting cleaning procedure (within WMS or other). See Risk Register WOS12.
3.1.12	Consider extending potable water reticulation network. See Risk Register NPW1.
4.1.1	Review the formalisation and development of operational procedures, covering all aspects of the water supply system from catchment to tap. Training in the formalised procedures will also be required.
4.1.2	Consider formalising reservoir inspection procedures and checklists. Refer to draft reservoir inspection procedure provided as part of the first draft of this DWMS.
4.1.3	Document cleaning procedure for equipment shared between water and sewer (within WMS or other). See Risk Register WOS12.
4.1.4	Ensure that water quality is covered in WMS for commissioning new mains. See Risk Register D10.
4.1.5	Consider formalising mains repair procedures. Refer to draft mains repair procedure provided as part of the first draft of this DWMS.
4.1.6	Review all existing WMS and ensure that water quality is adequately covered.
4.2.1	Review the need for individual filter turbidity meters.
4.2.2	Consider doing operator checks for algal species. See Risk Register C2.
4.2.3	Consider taking a sample from the top of the reservoir to check for dead zones/stagnation. See Risk Register Pine1.
4.2.4	Check temperature in Pine St Reservoir. See Risk Register Pine4.
4.2.5	Consider formalising monitoring protocols within an operational monitoring plan.
4.3.1	Ensure that CCP response procedures (Appendix B) are displayed at the WTP and that operators are trained in their use.
4.3.2	Consider the need for corrective action procedures in addition to those covered by CCPs.
4.4.1	Implement calibration logsheets. See Risk Register WOS6.
4.5.1	Consider having a system in place where operators check chemicals delivered against a range of set criteria for each chemical e.g. observation of chemical state (colour, smell (where safe to do so), liquid, solid etc.) and record of findings for each delivery.

4.5.2	Consider amending purchasing policy to specifically include water quality assessment when purchasing chemicals and materials in contact with drinking water.
5.1.1	Consider formally documenting sampling and monitoring activities within a monitoring plan that includes location and frequency of sampling for each characteristic. See also Action 4.2.5 above.
5.2.1	Review how customer service staff are trained in taking and dealing with water quality complaints.
5.2.2	Implement customer response system. See Risk Register Dis1.
5.3.1	Consider having water quality and operational data reviewed on a regular basis (e.g. at the end of the week) by someone other than the person who recorded the data (e.g. by a supervisor or manager).
5.4.1	Develop specific formal protocols with external laboratories in the event of non-compliant results.
6.1.1	Reinstate liaison with State Water and request notification of incidents such as releases from Tom Bullen dam. See Risk Register C6.
6.1.2	Liaise with other Councils in the area (for example at RAMROC meetings) regarding notification of Murrumbidgee River incidents. See Risk Register C6.
6.1.3	Compile an emergency contacts list for drinking water quality.
6.1.4	Consider formalising communication protocols.
6.2.1	Prepare an Incident Management Plan required. See Risk Register C2, Dis2, Dis4, WOS1, WOS5.
6.2.2	Consider having an agreement in place with emergency services in the event that something happens in the water supply catchment.
7.1.1	Ensure that water quality protection is covered when contractors are used. Consider including specific water quality awareness and protection clauses in contracts with service providers. See Risk Register WOS9.
7.1.2	Consider using RAMROC meetings to initiate general discussion of water quality issues. See also Action 6.1.2 above.
7.1.3	Consider introducing regular (daily or at least weekly) meetings with operators to discuss water quality issues (perhaps combine with safety talks).
7.2.1	Consider documenting water quality responsibilities and authorities within position descriptions for operators.
7.2.2	Consider whether IT contractor having higher security is an issue. See Risk Register WOS5.
7.2.3	Review how contractors and outgoing staff are managed and consider implementing employee exit checklists. See Risk Register WOS9.
8.1.1	Review effectiveness of existing community involvement strategy.
8.2.1	Check legibility and wording of signage regarding non-potable systems (use "not suitable for drinking" rather than "not potable"). See Risk Register NPW1.
8.2.2	Ensure that residents on non-potable water are informed on a consistent basis that their water is not intended for drinking.
8.2.3	Consider placing the DWMS (or a summary of it if information is considered too sensitive) on the website when finalised.
9.1.1	Consider using distribution system modelling techniques to track water distribution and age for chlorine residual maintenance purposes.
9.1.3	Consider the need for contractor review of assets such as reservoir inspection and cleaning by Aqualift.
9.1.4	Consider implementing policy of taking one-off samples to investigate customer complaints.

9.2.1	Confirm and record disinfection C.t to verify that adequate disinfection is occurring prior to the first customer.
9.2.2	Ensure that future system changes are reviewed and validated by bench testing, pilot testing or other experimental studies.
9.3.1	Ensure that the water quality impacts of future infrastructure works (e.g. extension of potable water network) are determined during initial design phases.
9.3.2	Ensure that any new technologies are subject bench testing, pilot testing or other experimental studies before implementation.
9.3.3	Consider developing standard technical specification clauses which states Councils minimum requirements for inclusion with future design and construct contracts for water supply upgrades
10.1.1	Review how delivery dockets are filed. See Risk Register WOS7.
10.1.2	Consider formalising procedure for filing and naming of files on TRIM.
10.2.1	Review effectiveness of existing internal reporting procedures.
11.1.1	Consider improving use of the NSW Health Drinking Water Database to help with long-term trending and review of water quality data.
11.2.1	Consider formalising and recording inspections undertaken by the operators by using templates, checklists etc. to guide the inspections. See also Action 4.1.2 above.
11.2.2	Develop an internal audit schedule for the system and then implement it.
12.1.1	Review how senior executives within Council are involved in review and improvement of the water supply system.
12.1.2	Ensure that this DWMS and its implementation are reviewed regularly (at least annually and on system change) so that it maintains currency with the water supply.
12.2.1	Develop the above-listed actions into a full Continuous Improvement Plan that includes responsibilities, priorities, progress and effectiveness.

Actions listed above will be developed into a full plan based on the following template:

Improvement Plan No.	Actions	Responsibility	Priority (timeframe)	Progress	Comments
1.1.1	Expand the strategic objective into a full drinking water quality policy.				

Document Control Information

Document:	Continuous Improvement Plan for Drinking Water Management System
Date Created:	17-Jun-14
Created by:	S. Loder of City Water Technology Pty Ltd on behalf of Hay Shire Council
Last Updated:	2-Jul-14
Responsible Officer:	Tony Davies and Phil Ruddick
Review Date:	1-Jul-15
Approved By:	Greg Stewart
Date Approved:	3-Jul-14
Trim No:	

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
1.1.1	Expand the strategic objective *'to provide supplies of both filtered and raw water in sufficient quantity to meet the realistic demands of the town area and of a quality that conforms to current public health standards'* and the community strategy to *'provide a clean and safe water supply'* into a full drinking water quality policy. Refer to the example policy provided in ADWG 2011.	1	1/09/2014	1/09/2015	Councillors	In Progress	Policy developed for consideration by SMT and Councillors (June 2014).
1.1.2	Once developed, communicate the drinking water policy throughout the organisation (examples include through awareness programs, posting the policy on Council intranet, including policy in induction materials, stating requirement to understand policy content in position descriptions).	2	1/09/2014	1/09/2016	All Managers and Employees		
1.2.1	Develop and maintain the currency of a Drinking Water Legal and Formal Compliance Register and refer to this in subsequent Strategic Business Plans. The register should include at least the jurisdiction of the instrument, the type, the relevance to drinking water, who is responsible for keeping the document current and the next review date (refer to the example provided in Appendix B).	1	1/09/2014	1/09/2015	General Manager	Done	Appendix B.
1.2.2	Ensure that the drinking water compliance requirements are communicated to employees and contractors (examples include articulating responsibilities in position descriptions and/or induction form, within the Drinking Water Quality Policy, via the website).	2	1/09/2014	1/09/2016	Senior Engineering Assistant		
1.2.3	Consider completing Integrated Water Cycle Management evaluation in accordance with requirements of *NSW Best-Practice Management of Water Supply and Sewerage Framework and Best Practice Management of Water Supply and Sewerage Guidelines* .	2	1/09/2014	1/09/2016	Infrastructure Manager		
1.3.1	Develop a drinking water specific Stakeholder Register and show how HSC's current activities relate to stakeholder communication. The document should include at least the stakeholder, the jurisdiction, the relevance to the drinking water system, mode of communication (MoU, seminar etc.), current responsible position from HSC and currency of the register (refer to the example provided in Appendix C).	1	1/09/2014	1/09/2015	Infrastructure Manager	Completed	Stakeholder Register prepared.
1.3.2	Review how interagency communication is undertaken.	2	1/09/2014	1/09/2016	Infrastructure Manager		
1.3.3	Consider formalising liaison with upstream Councils and CMA. See Risk Register C1.	3	1/09/2014	1/09/2017	General Manager		
1.3.4	Improve internal liaison relation to water quality issues. See Risk Register C2.	2	1/09/2014	1/09/2016	Water and Sewer Manager	On Going	Not an issue as mains replacement planning and implementation done by Infrastructure Department.
1.3.5	Review how the non-potable water system is dealt with in terms of communication and education (see guidance from NSW Health). See risk register NPW1.	1	1/09/2014	1/09/2015	Infrastructure Manager	On Going	Install appropriate signs at locations where public can access non potable water.
2.1.1	Develop a clear team details table to show current positions and responsibilities for drinking water quality to help improve compliance with this component. The table should include at least the position, drinking water responsibilities and DWMS responsibilities in particular.	1	1/09/2014	1/09/2015	Infrastructure Manager	Completed	DWMS Responsibilities and Authorities Matrix prepared.
2.1.2	Ensure that responsibility for maintaining currency of the conceptual system flow diagram is assigned to someone within the water quality team. It is suggested that the Infrastructure Manager be assigned this responsibility.	2	1/09/2014	1/09/2016	Infrastructure Manager		

Date of last update: 27/6/2014

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
2.1.3	Consider undertaking an Integrated Water Cycle Management evaluation of the system (note: this is not mandatory but is considered best practice)	3	1/09/2014	1/09/2017	Infrastructure Manager		
2.2.1	Set up a comprehensive spreadsheet or database of WTP operational data to facilitate trend analysis of data in the future.	1	1/09/2014	1/09/2015	Water and Sewer Manager	Complete	Spreadsheet developed. Need for ongoing management.
2.2.2	Ensure that when set up, data from CCPs are logged and analysed on a regular basis to allow for any emerging trends at these critical points to be picked up quickly.	1	1/09/2014	1/09/2015	Water and Sewer Manager Water and Sewer Operators	Completed	Need for on going management.
2.2.3	Include water quality details in the Management Plan.	2	1/09/2014	1/09/2016	Infrastructure Manager		Include in 2016 Management Plan.
2.3.1	Ensure that responsibility for maintaining currency of the Risk Register (Appendix D) is assigned to someone within the water quality team. It is suggested that the Infrastructure Manager be assigned this responsibility.	1	1/09/2014	1/09/2015	Infrastructure Manager Senior Engineering Assistant	On Going	Reviewed on Annual basis by Senior Engineering Assistant.
2.3.2	Ensure that a review frequency is set for the Risk Register and record when the Risk Register is reviewed and any changes made.	1	1/09/2014	1/09/2015	Infrastructure Manager Senior Engineering Assistant	On Going	Review Appendix D annually - June.
3.1.1	Review how on-site sewage management systems are managed. See Risk Register C2.	2	1/09/2014	1/09/2016	Director Community Development		An out of date register exists. Managed by Community Development - Planning Department.
3.1.2	Develop and maintain a trade waste management program. See Risk Register C3, D5.	5	1/09/2014	1/09/2019	Infrastructure Manager		Trade waste does not pose a risk to Way STP operations. Low Priority within Council and Community. Some units exist BUT Council has no records of Installation nor Maintenance.
3.1.3	Develop and maintain a backflow prevention program and register. See Risk Register D5.	5	1/09/2014	1/09/2019	Infrastructure Manager Water and Sewer Manager		No significant Commercial developments in Hay. Hay Shire facilities have Backflow devices as does Hospital and some other public facilities. Currently there are no records of Installations nor maintenance regime.
3.1.4	Develop and maintain a register of rainwater tanks. See Risk Register D5.	5	1/09/2014	1/09/2019	Infrastructure Manager Water and Sewer Manager		Hay has a dual Potable and Raw water supply system. There is no benefit for potable water to be connected to the Potable supply as it would negate the purpose of the rain water tank and provide reduced pressure to the residence. No known instances

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
3.1.5	Develop and maintain a register of water carters regardless of who owns the water cart and documentation to support water carter use (clause 35 PHR). See Risk Register CWT2.	5	1/09/2014	1/09/2019			There are no commercial water carter operators accessing the Potable supply. Hay Shire permits controlled public access to a standpipe connection to the potable supply in times of low rainfall. The purpose of use is not controlled/managed by Hay Shire.
3.1.6	Integrate planning and water quality requirements including s.68 approval of devices. See Risk Register D5.	5	1/09/2014	1/09/2019	Infrastructure Manager Water and Sewer Manager		See comments in 3.1.3.
3.1.7	Ensure that cap is kept on end of hose – perhaps a sign for RFS. See Risk Register CWT2.	1	1/09/2014	1/09/2015	Water and Sewer Manager Water and Sewer Operators	Partly Complete	Cap is in place. Sign is yet to be sourced.
3.1.8	Check that roofs and hatches of reservoirs are properly sealed to prevent birds and reptiles from entering. See Risk Register Pine2, D1.	1	1/09/2014	1/09/2015	Water and Sewer Manager	Partly Complete	Roof has been checked, holes sealed. New hatch is being manufactured and will be installed.
3.1.9	Consider filter resting time after re-filling to help reduce breakthrough. See Risk Register Filt3.	1	1/09/2014	1/09/2015	Water and Sewer Manager	Partly Complete	Procedure is being reviewed
3.1.10	Consider adding chlorination step for commissioning of new mains. See Risk Register D10.	2	1/09/2014	1/09/2016	Water and Sewer Manager	Review Annually	No new Reticulation mains planned in current year.
3.1.11	Consider keeping sodium hypochlorite bottle for cleaning shared equipment and documenting cleaning procedure (within WMS or other). See Risk Register WOS12.	1	1/09/2014	1/09/2015	Water and Sewer Manager Senior Engineering Assistant		Reviewing SWMS's.
3.1.12	Consider extending potable water reticulation network. See Risk Register NPW1.	5	1/09/2014	1/09/2019	Councillors		Not currently being considered.
4.1.1	Review the formalisation and development of operational procedures, covering all aspects of the water supply system from catchment to tap. Training in the formalised procedures will also be required.	2	1/09/2014	1/09/2016	Water and Sewer Manager Senior Engineering Assistant		
4.1.2	Consider formalising reservoir inspection procedures and checklists. Refer to draft reservoir inspection procedure provided as part of the first draft of this DWMS.	1	1/09/2014	1/09/2015	Water and Sewer Manager	On Going	Implemented as weekly inspection. Format in DWMS adopted.
4.1.3	Document cleaning procedure for equipment shared between water and sewer (within WMS or other). See Risk Register WOS12.	1	1/09/2014	1/09/2015	Water and Sewer Manager Senior Engineering Assistant	In Hand	See also 3.1.11 Reviewing SWM's.
4.1.4	Ensure that water quality is covered in WMS for commissioning new mains. See Risk Register D10.	2	1/09/2014	1/09/2016	Water and Sewer Manager		Refer 3.1.10 and 3.1.12 No work anticipated in 2014/2015.
4.1.5	Consider formalising mains repair procedures. Refer to draft mains repair procedure provided as part of the first draft of this DWMS.	1	1/09/2014	1/09/2015	Water and Sewer Manager Senior Engineering Assistant	In Hand	Review current SWMS.

Date of last update: 27/6/2014

Hay Shire COUNCIL

Appendix C

DWMS CONTINUOUS IMPROVEMENT PLAN

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
4.1.6	Review all existing WMS and ensure that water quality is adequately covered.	1	1/09/2014	1/09/2015	Water and Sewer Manager Senior Engineering Assistant	In Hand	Review current SWMS.
4.2.1	Review the need for individual filter turbidity meters.	3	1/09/2014	1/09/2017	Water and Sewer Manager		
4.2.2	Consider doing operator checks for algal species. See Risk Register C2.	3	1/09/2014	1/09/2017	Water and Sewer Manager		
4.2.3	Consider taking a sample from the top of the reservoir to check for dead zones/stagnation. See Risk Register Pine1.	1	1/09/2014	1/09/2015	Water and Sewer Manager Water and Sewer Operators	Current work practice	Continue current work practice and incorporate temperature check. Refer 4.2.4.
4.2.4	Check temperature in Pine St Reservoir. See Risk Register Pine4.	1	1/09/2014	1/09/2015	Water and Sewer Manager Water and Sewer Operators		Refer to 4.2.3.
4.2.5	Consider formalising monitoring protocols within an operational monitoring plan.	1	1/09/2014	1/09/2015	Infrastructure Manager Water and Sewer Manager		Adopt relevant CCP guidelines as in Appendix B: ie Fluoride - NSW Health, Chlorine - NSW Health.
4.3.1	Ensure that CCP response procedures (Appendix E) are displayed at the WTP and that operators are trained in their use.	1	1/09/2014	1/09/2015	Water and Sewer Manager Senior Engineering Assistant	On Going	CCP Response Procedures are displayed at WTP and Operators are trained in their use.
4.3.2	Consider the need for corrective action procedures in addition to those covered by CCPs.	2	1/09/2014	1/09/2016	Water and Sewer Manager		
4.4.1	Implement calibration log sheets. See Risk Register WOS6.	1	1/09/2014	1/09/2015	Water and Sewer Manager	On Going	Currently logged in Daily Dairy maintained at WTP.
4.5.1	Consider having a system in place where operators check chemicals delivered against a range of set criteria for each chemical e.g. observation of chemical state (colour, smell (where safe to do so), liquid, solid etc.) and record of findings for each delivery.	2	1/09/2014	1/09/2016	Water and Sewer Manager		
4.5.2	Consider amending purchasing policy to specifically include water quality assessment when purchasing chemicals and materials in contact with drinking water.	3	1/09/2014	1/09/2017	General Manager		
5.1.1	Consider formally documenting sampling and monitoring activities within a monitoring plan that includes location and frequency of sampling for each characteristic. See also Action 4.2.5 above.	1	1/09/2014	1/09/2015			Refer to 4.2.5.
5.1.2	Develop water quality database in Council's network which is available to operators, engineers and directors.	2	1/09/2014	1/09/2016	Infrastructure Manager		
5.2.1	Review how customer service staff are trained in taking and dealing with water quality complaints.	2	1/09/2014	1/09/2016	Senior Engineering Assistant		
5.2.2	Implement customer response system. See Risk Register Dis1.	2	1/09/2014	1/09/2016	Infrastructure Manager		
5.3.1	Consider having water quality and operational data reviewed on a regular basis (e.g. at the end of the week) by someone other than the person who recorded the data (e.g. by a supervisor or manager).	2	1/09/2014	1/09/2016	Water and Sewer Manager		

Date of last update: 27/6/2014

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
5.4.1	Develop specific formal protocols with external laboratories in the event of non-compliant results.	3	1/09/2014	1/09/2017	Infrastructure Manager		
6.1.1	Reinstate liaison with State Water and request notification of incidents such as releases from Tom Bullen dam. See Risk Register C6.	4	1/09/2014	1/09/2018	Infrastructure Manager		
6.1.2	Liaise with other Councils in the area (for example at RAMROC meetings) regarding notification of Murrumbidgee River incidents. See Risk Register C6.	1	1/09/2014	1/09/2015	Infrastructure Manager		Hay Shire is not responsible for Murrumbidgee River. State Water should be informing all councils drawing water from the Murrumbidgee River. RAMROC meeting are 3 monthly - events would have occurred and been resolved.
6.1.3	Compile an emergency contacts list for drinking water quality.	1	1/09/2014	1/09/2015	Infrastructure Manager		Include in Incident Management Plan. Refer 6.2.1.
6.1.4	Consider formalising communication protocols.	1	1/09/2014	1/09/2015			Include in Incident Management Plan. Refer 6.2.1.
6.2.1	Prepare an Incident Management Plan. See Risk Register C2, Dis2, Dis4, WOS1, WOS5.	1	1/09/2014	1/09/2015	Infrastructure Manager		Engage 3rd party to develop an Incident Management Plan.
6.2.2	Consider having an agreement in place with emergency services in the event that something happens in the water supply catchment.	2	1/09/2014	1/09/2016	General Manager Infrastructure Manager		Include in Incident Management Plan. Refer 6.2.1.
7.1.1	Ensure that water quality protection is covered when contractors are used. Consider including specific water quality awareness and protection clauses in contracts with service providers. See Risk Register WOS9.	2	1/09/2014	1/09/2016	Water and Sewer Manager Senior Engineering Assistant		
7.1.2	Consider using RAMROC meetings to initiate general discussion of water quality issues. See also Action 6.1.2 above.	2	1/09/2014	1/09/2016	Infrastructure Manager		
7.1.3	Consider introducing regular (daily or at least weekly) meetings with operators to discuss water quality issues (perhaps combine with safety talks).	1	1/09/2014	1/09/2015	Water and Sewer Manager	On Going	Standard practice. Daily toolbox meetings (undocumented) held. Procedures at WTP are defined.
7.2.1	Consider documenting water quality responsibilities and authorities within position descriptions for operators.	3	1/09/2014	1/09/2017	General Manager		
7.2.2	Consider whether IT contractor having higher security is an issue. See Risk Register WOS5.	3	1/09/2014	1/09/2017	Infrastructure Manager Water and Sewer Manager		
7.2.3	Review how contractors and outgoing staff are managed and consider implementing employee exit checklists. See Risk Register WOS9.	3	1/09/2014	1/09/2017	General Manager		
8.1.1	Review effectiveness of existing community involvement strategy.	1	1/09/2014	1/09/2015	Water and Sewer Manager	On Going	Community has minimal input into operational issues at WTP. However the community are encouraged to advise any water quality issues which are documented (CRM), investigated and resolved.

Date of last update: 27/6/2014

Hay Shire COUNCIL

Appendix C

DWMS CONTINUOUS IMPROVEMENT PLAN

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
8.2.1	Check legibility and wording of signage regarding non-potable systems (use "not suitable for drinking" rather than "not potable"). See Risk Register NPW1.	1	1/09/2014	1/09/2015	Water and Sewer Manager	On Going	Review locations where signage exists and update as necessary.
8.2.2	Ensure that residents on non-potable water are informed on a consistent basis that their water is not intended for drinking.	1	1/09/2014	1/09/2015	Infrastructure Manager	On Going	Use local media to communicate urgent matters to community.
8.2.3	Consider placing the DWMS (or a summary of it if information is considered too sensitive) on the website when finalised.	2	1/09/2014	1/09/2016	General Manager		
9.1.1	Consider using distribution system modelling techniques to track water distribution and age for chlorine residual maintenance purposes.	3	1/09/2014	1/09/2017	Water and Sewer Manager		
9.1.3	Consider the need for contractor review of assets such as reservoir inspection and cleaning by Aqualift.	1	1/09/2014	1/09/2015	Water and Sewer Manager	In Hand	To be arranged in accordance with NOW circular.
9.1.4	Consider implementing policy of taking one-off samples to investigate customer complaints.	1	1/09/2014	1/09/2015	Water and Sewer Manager Water and Sewer Operators	On Going.	Standard operating practice in response to customer complaint Refer 8.1.1. Results are recorded in Diary (and on CRM if applicable).
9.2.1	Confirm and record disinfection C.t to verify that adequate disinfection is occurring prior to the first customer.	1	1/09/2014	1/09/2015	Water and Sewer Manager	Done	Information provided to 'City Water' to perform calculation and furnish details provided to Council.
9.2.2	Ensure that future system changes are reviewed and validated by bench testing, pilot testing or other experimental studies.	3	1/09/2014	1/09/2017	Infrastructure Manager		
9.3.1	Ensure that the water quality impacts of future infrastructure works (e.g. extension of potable water network) are determined during initial design phases.	5	1/09/2014	1/09/2019	Infrastructure Manager		
9.3.2	Ensure that any new technologies are subject bench testing, pilot testing or other experimental studies before implementation.	3	1/09/2014	1/09/2017	Infrastructure Manager		
9.3.3	Consider developing standard technical specification clauses which states Councils minimum requirements for inclusion with future design and construct contracts for water supply upgrades	3	1/09/2014	1/09/2017	Infrastructure Manager		

Date of last update: 27/6/2014

Action No.	Description	Priority	Start Date	Due Date	Responsibility	Status	Comments
10.1.1	Review how delivery dockets are filed. See Risk Register WOS7.	1	1/09/2014	1/09/2015	Senior Engineering Assistant		Risk of supply to incorrect storage overstated. eg Alum is delivered in bulk as a liquid. Chlorine gas is delivered in 920kg pressure cylinders. Continue existing order and supply practices. Fluoride is supplied in 5kg sealed containers. Carbon is delivered by 'plastic wrap pallet load' in 20kg bags and is distinctively marked and coloured 'black'. Soda Ash is delivered by 'plastic wrap pallet load' in 20kg bags and is distinctively marked and coloured 'white'.
10.1.2	Consider formalising procedure for filing and naming of files on TRIM.	2	1/09/2014	1/09/2016	Senior Engineering Assistant		
10.2.1	Review effectiveness of existing internal reporting procedures.	2	1/09/2014	1/09/2016	Senior Engineering Assistant		
11.1.1	Consider improving use of the NSW Health Drinking Water Database to help with long-term trending and review of water quality data.	3	1/09/2014	1/09/2017	Water and Sewer Manager		
11.2.1	Consider formalising and recording inspections undertaken by the operators by using templates, checklists etc. to guide the inspections. See also Action 4.1.2 above.	1	1/09/2014	1/09/2015	Water and Sewer Manager Other	On Going	Building inspected annually for repair budget - March. Reservoir inspected weekly. WTP inspected routinely on daily basis as part of operator duties.
11.2.2	Develop an internal audit schedule for the system and then implement it.	3	1/09/2014	1/09/2017	Infrastructure Manager		
12.1.1	Review how senior executives within Council are involved in review and improvement of the water supply system.	2	1/09/2014	1/09/2016	Infrastructure Manager		
12.1.2	Ensure that this DWMS and its implementation are reviewed regularly (at least annually and on system change) so that it maintains currency with the water supply.	1	1/09/2014	1/09/2015	Infrastructure Manager	To be coordinated	Review all documentation associated with DWMS annually. Next review June 2015.
12.2.1	Develop the above-listed actions into a full Continuous Improvement Plan that includes responsibilities, priorities, progress and effectiveness.	1	1/09/2014	1/09/2015	Infrastructure Manager	On Going	This is the document.

Priority	1	2	3	4	5
Anticipated Completion Date	Sep-15	Sep-16	Sep-17	Sep-18	Sep-19

Date of last update: 27/6/2014

Document Control Information

Document:	Regulatory and Formal Requirements for Water Services
Date Created:	17-Jun-14
Created by:	S. Loder of City Water Technology Pty Ltd on behalf of Hay Shire Council
Last Updated:	2-Jul-14
Responsible Officer:	Ken Cunningham
Review Date:	1-Jul-15
Approved By:	Greg Stewart
Date Approved:	3-Jul-14
Trim No:	

Instrument	Jurisdiction	Type	Relevance
Australian Drinking Water Guidelines 2011	National	Guideline	Sets frameworks and guidance for the provision of safe, quality drinking water
Catchment Management Authorities Act 2003	NSW	Statute	Catchment management
Contaminated Land Management Act 1997	NSW	Statute	Environment protection from contaminated land sources
Crown Lands Act 1989	NSW	Statute	Land care, in particular land under tenure
Dams Safety Act 1978	NSW	Statute	Impacts of dam safety on water quantity and potentially water quality
Environmental Planning and Assessment Act 1979	NSW	Statute	Planning activities which require assessment
Environment Protection and Biodiversity Conservation Act 1999	Commonwealth	Statute	Catchment management in particular for areas of national environmental significance
Fair Trading Act 1987	NSW	Statute	Includes provisions for goods (and services) to be fit for purpose
Fisheries Management Act 1994	NSW	Statute	Protection of fish habitats (including threatened and protected species management) and aquaculture management
Fluoridation of Public Water Supplies Act 1957	NSW	Statute	Sets out the requirements for fluoridation of public water supplies
Fluoridation of Public Water Supplies Regulation 2007	NSW	Regulation	Sets out the requirements for fluoridation of public water supplies
NSW Code of Practice for the Fluoridation of Public Water Supplies 2011	NSW	Best practice	Sets out the requirements for fluoridation of public water supplies
Food Act 2003	NSW	Statute	Need to maintain water quality
AS ISO 22000-2005 Food safety management systems-Requirements for any organization in the food chain	National	Standard	Analogous to the ADWG Framework but would allow certification to that standard if sought
Forestry Act 1916	NSW	Statute	Management of State Forests
Heritage Act 1977	NSW	Statute	Protection of state and/or locally significant heritage (important to be cognisant of in planning new infrastructure)
Independent Pricing and Regulatory Tribunal Act 1992	NSW	Statute	Impacts of pricing on the provision of infrastructure and consequent potential impacts on water quality
Local Government Act 1993	NSW	Statute	Urban water services and management/review of on-site sewage management systems; Have only persons licensed or certified under the Home Building Act 1989 (or supervised by such a person) carry out any water supply work, sewerage work or stormwater drainage work. Council could be seen to be negligent should it not implement both management and review programs for on-site sewage management systems (Clause 29 of the Local Government (General) Regulation 2005 (NSW)).
Local Government (General) Regulation 2005	NSW	Regulation	Audit and management of onsite sewage management systems (protects water quality from leaking sewage)
Mining Act 1992	NSW	Statute	Possible extraction of resources within catchment areas
National Parks and Wildlife Act 1974	NSW	Statute	Protection of natural, social and cultural value (important to be cognisant of in planning new infrastructure)
Native Vegetation Act 2003	NSW	Statute	Native vegetation management (in the context of catchment management)
Natural Resources Commission Act 2003	NSW	Statute	Catchment management
NSW Health Drinking Water Monitoring Program	NSW	Guidelines	Free-of-charge testing for water supply system monitoring of indicator bacteria and health-related inorganic chemicals. Includes NSW Health Response Protocols for chemical and microbial quality, treatment failure and *Cryptosporidium* and *Giardia* .

Instrument	Jurisdiction	Type	Relevance
NSW Water and Sewerage Strategic Business Planning Guidelines	NSW	Guidelines	Prepare Strategic Business plans including a review of the operating environment and IWCM which should identify key water quality issues in the catchment.
Plantations and Reafforestation Act 1999	NSW	Statute	Regional forest agreements
Plumbing and Drainage Act 2011	NSW	Statute	Largely for management of the distribution system including legislative requirements for plumbing and drainage works
Plumbing and Drainage Regulation 2012	NSW	Regulation	Largely for management of the distribution system including legislative requirements for plumbing and drainage works
Plumbing Code of Australia 2004	National	Best practice	Largely for management of the distribution system including standards for plumbing and drainage issues
AS/NZS 3500 Plumbing and Drainage Set	National	Standard	Largely for management of the distribution system including standards for plumbing and drainage issues
Protection of the Environment Operations Act 1997	NSW	Statute	Environmental protection including licensed discharges.
Protection of the Environment Operations Regulation 1998	NSW	Regulation	Submit annual National Pollutant Inventory (NPI) returns if any of the specified reporting thresholds are exceeded (water contamination issues)
Public Health Act 2010	NSW	Statute	Protection of public health, follow any advice issued from the Chief of Health regarding drinking water safety to the public; sample drinking water in accordance with NSW Health recommendations. Prepare a drinking water management system.
Public Health Regulation 2012	NSW	Regulation	Requirement to prepare a drinking water management system in accordance with the ADWG Framework for Management of Drinking Water Quality. Requirement to keep records of all water carters supplied.
AS/NZS 4360:2004 Risk Management	National	Standard	Includes guidance on the use of risk assessment and management. Note that the risk assessment matrix in the Framework for the Management of Drinking Water Quality is based on AS/NZS 4360.
Rivers and Foreshores Improvement Act 1948	NSW	Statute	Protection of rivers and lakes
Roads Act 1993	NSW	Statute	Planning of roads (and how they might impact on source waters)
Rural Lands Protection Act 1998	NSW	Statute	Catchment management
Soil Conservation Act 1938	NSW	Statute	Soil management (in the context of catchment management)
Threatened Species Conservation Act 1995	NSW	Statute	Catchment management
Trade Practices Act 1974	Commonwealth	Statute	Fitness for purpose of drinking water, evaluate capacity for third party access within Council's operations
US EPA Surface Water Treatment Rules	International	Legislation	Includes information and guidance (as well as other things) on the levels of treatment (in log reduction terms) from water sourced from catchments with varying levels of protection. Not yet included in concept in the ADWG but likely to be included in revisions.
Water Act 1912	NSW	Statute	Still applies to areas where water sharing plans have not yet been developed
Water Industry Competition Act 2006	NSW	Statute	Possible introduction of hazards to the network through a third party connection
Water Management Act 2000	NSW	Statute	Water management, drainage, water licences, water/river management committees, strategic business planning; fulfil the functions of a Water Supply Authority
Water Management (General) Regulation 2011	NSW	Regulation	Installation and maintenance of fire hydrants (at s27); supply or approval of relevant water meters (at s20) (relevance to distribution system integrity)
Water Management (Water Supply Authorities) Regulation 2004	NSW	Regulation	Water supply authority must issue a plan showing the point of connection to its sewerage system of any land (possible backflow/wrong connection hazards)
Water Services Association of Australia Water Supply Codes	National	Best practice	Includes methodologies for undertaking a range of water supply works including distribution system management
Wilderness Act 1987	NSW	Statute	Catchment management
World Health Organization's Water Safety Plan	International	Guideline	Analogous to the ADWG Framework

Document Control Information

Document:	Stakeholder Register for Water Services
Date Created:	17-Jun-14
Created by:	S. Loder of City Water Technology Pty Ltd on behalf of Hay Shire Council
Last Updated:	2-Jul-14
Responsible Officer:	Ken Cunningham
Review Date:	1-Jul-15
Approved By:	Greg Stewart
Date Approved:	3-Jul-14
Trim No:	

Appendix E

DWMS STAKEHOLDER REGISTER

Stakeholder	Role in Drinking Water Management	Communication Between Utility and Stakeholder	Current Contact	Current Contact Details	Key Contact from HSC
Drinking water customers	Those to whom safe, quality water is to be provided	Customer complaint follow up Customer contract Water bills Internet	Hay Shire Council	Hay Shire Office 02 6990 1100	Hay Shire Office Enquiry Counter
Commercial and industrial customers	Those to whom safe, quality water is to be provided but whose operations may contaminate HSC water	Backflow prevention requirements including annual site inspections and check of test certificates	Water Operator Hasy Shire Council	02 6990 1100	Tony Davies
Residents/ businesses within Catchment areas	Notify Council of changes in catchment. Potential to impact of source water quality.	Information sharing and education	General Manager Hay Shire Council	02 6990 1100	Allen Dwyer
Irrigators	Those who require a quality, reliable water supply for irrigation		State Water	P O Box 1018, Dubbo NSW 2830	Allen Dwyer
Downstream water users	Those who require a quality, reliable water supply downstream		State Water	P O Box 1018, Dubbo NSW 2831	Allen Dwyer
Environmental groups	Environmental responsibility, pollution minimisation and environmental sustainability issues.	Liaison regarding environmental issues	State Water	P O Box 1018, Dubbo NSW 2832	Allen Dwyer
Tourists	Those to whom safe, quality water is to be provided	Signs and notices in public areas and through accommodation providers.	Hay Tourist Centre	02 6993 4045	Gayleen Stevens
Councillors	Carriage and ownership of essential activities of the Drinking Water Management System	Communication regarding internal polices, objectives, priorities and resource allocation	General Manager Hay Shire Council	02 6990 1100	Allen Dwyer
Council Employees	Carriage and ownership of essential activities of the Drinking Water Management System	Communication on operations, maintenance	General Manager Hay Shire Council	02 6990 1100	Allen Dwyer
NSW Health (Water Unit)	General advice on drinking water management and powers under the *Public Health Act 2010* (NSW)	General advice sought on drinking water management	Kevin Prior, Environmental Health Officer	02 6933 9128 0429 076 135 kevin.prior@gsahs.health.nsw.gov.au	Infrastructure Manager Greg Stewart
NSW Health (Public Health Unit)	Local advice on drinking water management and powers under the *Public Health Act 2010* (NSW)	Local advice sought on drinking water management and liaison on disease outbreaks (if possible link to drinking water borne route)	Kevin Prior, Environmental Health Officer	02 6933 9128 0429 076 135 kevin.prior@gsahs.health.nsw.gov.au Department of Health, Public Health Unit, PO Box 201, Wagga Wagga NSW 2650	Infrastructure Manager Greg Stewart
Department of Primary Industries (NSW Office of Water)	Utility activities regulator, water allocation and access issues	Licence, inspection reports, liaison over resource issues	Bernie Barnes, Officer	0429 604 409 Bernie.Barnes@water.nsw.gov.au NSW Office of Water, PO Box 493, Cootamundra NSW 2590	Tony Davies 0429 328 959 tdavies@hay.nsw.gov.au
Department of Premier and Cabinet (Division of Local Government)	General advice and powers under the *Local Government Act 1993* (NSW).	Liaison regarding accountability and financial stability.	General Manager Hay Shire Council	02 6990 1100	Allen Dwyer
Department of Premier and Cabinet (Office of Environment and Heritage)	Polluting activities regulator, advice on spills in catchment, environmental flows advice	Referral of concerns relating to pollution in source waters and environmental flows	General Manager Hay Shire Council	02 6990 1100	Allen Dwyer

Appendix E

DWMS STAKEHOLDER REGISTER

Stakeholder	Role in Drinking Water Management	Communication Between Utility and Stakeholder	Current Contact	Current Contact Details	Key Contact from HSC
Murrumbidgee Catchment Management Authority	Oversight and coordination of source water catchment management	Liaison regarding catchment management	General Manager Hay Shire Council	02 6990 1100	Allen Dwyer
Police	Control of emergency spills and site security issues	Support in control of site security Response to spills and bursts	Police	Emergency 000 Hay Police Station 02 6993 1100	Infrastructure Manager Greg Stewart
Rural Fire Service	Response to emergencies (in particular bushfires)	Response to spills and bursts Response to emergencies such as bushfires	Rural Fire Service	Bush Fire Information 1800 NSW RFS (1800 679 737) Hay Rural Fire District 02 6993 4213	Infrastructure Manager Greg Stewart
State Emergency Service	Response to emergencies	Response to spills and bursts & co-ordinate evacuations	State Emergency Service	General 132 500 Murrumbidgee Region 02 6932 9199	Infrastructure Manager Greg Stewart
IPART	Determines the annual rate peg for local government	Representations on specific aspects of local government rates	IPART	Level 8, 1 Market Street, Sydney NSW 2000	General Manager Allen Dwyer
Local Government and Shires Association	Provision of information relevant to drinking water production and management such as conferences and regulatory changes	Maintain professional relationship Share knowledge	Local Government and Shires Association	GPO Box 7003, Sydney NSW 2001	General Manager Allen Dwyer
National Health and Medical Research Council and National Resource Managers Ministerial Council	National drinking water guideline authors	Review and comment on revisions to guidelines	National Health and Medical Research Council and National Resource Managers Ministerial Council	GPO Box 1403, Canberra ACT 2601	Infrastructure Manager Greg Stewart
Water Services Association of Australia (WSAA)	Professional body	Use of, and contribution to the development of, standards and codes of practice	Water Services Association of Australia (WSAA)	GPO Box 915, Sydney NSW 2001	Infrastructure Manager Greg Stewart
Water Directorate	Professional body		Water Directorate	Level 12, 447 Kent Street, Sydney NSW 2000	Infrastructure Manager Greg Stewart
Research and technical organisations (CRCs, universities, technical experts)	Sources of technical expertise and services	Maintain professional relationships Procure services			Infrastructure Manager Greg Stewart
Industry peers (e.g. utilities of similar size)	Sources of technical expertise, peer review and benchmarking	Maintain professional relationships Procure services			Infrastructure Manager Greg Stewart
Standards Australia	Professional body	Use of, and contribution to the development of, standards and codes of practice	Standards Australia	Level 10, The Exchange Centre, 20 Bridge Street, Sydney NSW 2000	Infrastructure Manager Greg Stewart
NSW Fair Trading	Water fitness for purpose and related trading issues. Administrator of the Plumbing and Drainage Act 2011 (NSW).	Liaison over water product issues	NSW Fair Trading	NSW Fair Trading, 60 Station Street, Sydney NSW 2000	General Manager Allen Dwyer

Document Control Information

Document:	Drinking Water Management System Responsibilities and Authorities Matrix
Date Created:	17-Jun-14
Created by:	S. Loder of City Water Technology Pty Ltd on behalf of Hay Shire Council
Last Updated:	2-Jul-14
Responsible Officer:	Ken Cunningham
Review Date:	1-Jul-15
Approved By:	Greg Stewart
Date Approved:	3-Jul-14
Trim No:	

Appendix F

	All Water & Sewer Employees	Councillors	General Manager Water & Sewer	Infrastructure Manager	Senior Engineering Assistant	Water and Sewer Manager	and Water Operators	OTHERS?
General								
Understand, implement, maintain and continuously improve the DWMS	✓	✓	✓	✓	✓	✓	✓	
Be aware of: - the Drinking Water Quality Policy - characteristics of the water supply system and preventive strategies in place throughout the system - regulatory and legislative requirements - roles and responsibilities of employees and departments - how their actions can impact on water quality and public health	✓	✓	✓	✓		✓		
DWMS								
Establish a DWMS in accordance with the *Framework for the Management of Drinking Water Quality* in the Australian Drinking Water Guidelines				✓		✓		
Maintain and continuously improve the DWMS in accordance with the *Framework for the Management of Drinking Water Quality* in the Australian Drinking Water Guidelines				✓		✓		
Review and approve the Drinking Water Quality Policy		✓	✓					
Support and promote the Drinking Water Quality Policy	✓	✓	✓	✓	✓	✓		
Develop and implement processes for the assessment of the drinking water supply system and preventive measures for drinking water quality management, with a focus on critical control points					✓	✓		
Develop and implement operational procedures, process control and verification of drinking water quality					✓	✓		
Develop and implement processes to ensure that employees and contractors maintain the appropriate experience and qualifications					✓	✓		
Develop and implement processes and communication procedures to increase employees' awareness of and participation in drinking water quality management				✓	✓	✓		
Develop and implement processes to identify, communicate and review compliance requirements				✓	✓	✓		
Develop and implement processes for identifying stakeholders who could affect, or be affected by, Council decisions or activities			✓	✓	✓			
Develop and implement processes to identify and act on drinking water quality improvements, including communication and monitoring of effectiveness of improvements					✓	✓		
Develop and implement processes for effective community consultation, communication and involvement				✓	✓	✓		
Develop and implement processes for the systematic evaluation of activites and processes to confirm that objectives are met through internal and external audits				✓	✓	✓		
Develop, maintain and continually improve relevant DWMS processes and documentation including procedures, work instructions and forms				✓	✓	✓		
Maintain the DWMS documents in accordance with the requirements of the Document Control Procedure				✓				
Maintain preventative measures identified in water quality risk assessments						✓		
Review and continually improve the DWMS in accordance with the *Framework for the Management of Drinking Water Quality* in the Australian Drinking Water Guidelines				✓		✓		
Maintain oversight of the effectiveness of the DWMS			✓					
Employ personnel, including personnel involved with drinking water management, and ensure that only appropriately qualified and experienced personnel are employed by Council			✓					
Management Review								
Participate in the management review meeting			✓	✓	✓	✓		
Evaluate the need for change			✓	✓	✓			
Review reports from audits, drinking water quality performance and previous management reviews			✓	✓				
Consider concerns of consumers, regulatory and other stakeholders			✓	✓				
Evaluate the suitability of Drinking Water Quality Policy, objectives and preventative strategies.			✓		✓			
Communication Strategy								
Act as media spokesman			✓					
Communicate with regulatory and other stakeholders			✓					
Communicate with consumers			✓	✓	✓	✓	✓	
Operational								
Manage incidents and emergencies				✓	✓	✓		

Appendix F

	All Water & Sewer Employees	Councillors	General Manager Water & Sewer	Infrastructure Manager	Senior Engineering Assistant	Water and Sewer Manager and Water Operators	OTHERS?
Provide primary response to significant incidents	✓			✓	✓	✓	
Provide field support and customer liaison	✓		✓	✓	✓	✓	
Maintain and repair equipment throughout the water supply chain	✓					✓	✓
Deliver asset maintenance plans				✓			
Provide breakdown responses	✓					✓	
Conduct condition assessments				✓		✓	
Implement the maintenance management system	✓					✓	
Management of SCADA, electronics and communications systems	✓					✓	
SCADA response (interpreting and responding to SCADA alarms)	✓					✓	✓
Operate and conduct minor maintenance of the water treatment facilities	✓					✓	✓
Operate and maintain mechanical projects including pump stating upgrades	✓			✓		✓	✓
Coordinate water quality sampling and analyses functions to meet operational and reporting needs	✓					✓	
Develop prioritised work packages				✓	✓	✓	
Interpret and respond to reactive work requests	✓					✓	
Coordinate the allocation, prioristation and procurement of internal and external resources				✓	✓	✓	
Administrative support (office management, admin support, staff rotation planning)							✓

C.t Calculation

C.t Calculation Methodology and Results

DOCUMENT ISSUE RECORD

ISSUE DATE	REVISION	ISSUE	ISSUED TO	PREPARED BY	APPROVED BY
15/01/2014	A	Cancelled	Ashwan Datt	S Loder	
03/07/2014	B	For consideration	Ken Cunningham	S Loder	K Francis

1. Introduction

Effective C.t of disinfection at Hay Water Treatment Plant (WTP) was calculated for 3 different cases:

- Worst disinfection case;
- Typical disinfection case;
- Best disinfection case

Depending on the C.t case, the following parameters were considered:

Table 1: C.t Parameters

C.t Case	Free Cl_2 residual (mg/L)	Flow (L/s)	Tank Level (%)
Minimum C.t	Lowest expected free Cl_2 value	Maximum flow rate	Minimum level in contact tank
Typical C.t	Average free Cl_2 value	Average flow rate	Average level in contact tank
Best C.t	Highest expected free Cl_2 value	Minimum flow rate	Maximum level in contact tank

2. Calculation Inputs

Contact time is provided in the Clear Water Storage Tank at Hay WTP which has a calculated capacity of 146.53 kL (7.73m x 8.9m x 2.13m). The baffling factor for this tank was determined to be 0.3 given the lack of baffles in the Clear Water Storage Tank (see Table 2 for baffling description). Chemicals, including chlorine, are injected into the stream flow as it free falls into the Clear Water Storage Tank.

Table 2: Contact Tank Baffling Factor[1]

Baffling Condition	T10/T	Baffling Description
Unbaffled (mixed flow)	0.1	None, agitated basin, very low length to width ratio, high inlet and outlet flow velocities. Can be approximately achieved in flash mix tank
Poor	0.3	Single or multiple unbaffled inlets and outlets, no intra-basin baffles

[1] Source: LT1ESWTR Disinfection Profiling and Benchmarking Technical Guidance Manual (USEPA 2003)

Baffling Condition	T10/T	Baffling Description
Average	0.5	Baffled inlet or outlet with some intra-basin baffles
Superior	0.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders
Perfect (plug flow)	1	Very high length to width ratio (pipeline flow), perforated inlet, outlet, and intra-basin baffles

The data in Table 3 was obtained from Hay Shire Council (HSC) for the purpose of the C.t calculations.

Table 3: C.t Calculation Inputs

C.t Case	Free Cl_2 residual (mg/L)	Flow (L/s)	Tank Level (%)
Minimum C.t	0.8	27	69
Typical C.t	1.0	27	85
Best C.t	1.2	27	100
Basis/ Assumptions	Free chlorine residual leaving the WTP is generally maintained in the range 0.8-1.2 mg/L. The typical value was calculated as the average of the minimum and maximum.	Instantaneous flowrate at the outlet of the Clear Water Tank was used. This is constant and independent of inlet flowrate.	The outlet pumps stop pumping when the capacity is shown as 48% remaining (equating to 101460L/146530L = 69% full.) Full represents steady state (i.e. no inflow or outflow) and was calculated as 146530 L. When full capacity is shown as 90%. The typical value was calculated as the average of the minimum and maximum.

3. Methodology

C.t calculations were performed according to the following procedure, which is based on that defined by the United States Environmental Protection Agency (2003):

1. Determination of the instantaneous flow rate (L/s)
2. Conversion of flow rate to ML/min
3. Determination of contact tank capacity (ML)
4. Determination of tank level (%)
5. Determination of baffling factor according to Table 2:
6. Determination of free chlorine residual over a defined period (mg/L)
7. Determination of effective contact time (mins)

$$Effective\ Contact\ Time\ (mins) = \frac{Contact\ Tank\ Capacity\ (ML)}{Plant\ Production\ (\frac{ML}{min})} \times Baffling\ Factor \times Tank\ Level\ (\%)$$

8. Effective C.t:

$$Effective\ C.t\ \left(\frac{mg.min}{L}\right) = Effective\ Contact\ Time\ (mins) \times Free\ Chlorine\ Residual\ \left(\frac{mg}{L}\right)$$

4. Results

4.1. C.t Calculation

Using the data and methodology described above, the following results were obtained for Hay WTP:

Table 4: C.t Results - Hay WTP

Parameter	Units	Value			Data Source
		Worst Case	Typical Case	Best Case	
Contact tank capacity	m^3	146.53	146.53	146.53	Calculated
Contact tank level	%	69	85	100	HSC
Baffling factor (T10/T)	-	0.3	0.3	0.3	Estimated
Instantaneous flowrate	L/s	27	27	27	HSC
Theoretical contact time	mins	62.4	76.9	90.5	Calculated
Effective contact time	mins	18.7	23.1	27.1	Calculated
Free Cl_2 residual	mg/L	0.8	1.0	1.2	HSC
Effective C.t	**min.mg/L**	**15.0**	**23.1**	**32.6**	**Calculated**

4.2. Factors Affecting Effectiveness of Chlorine Disinfection

Note that the effectiveness of disinfection with chlorine is influenced by a number of factors including pH, temperature, organic matter and turbidity.

Chlorine reacts with water to form hypochlorous acid (HOCl), a very effective disinfectant which can dissociate to form the hypochlorite ion (OCl-). At 25°C, hypochlorous acid is the predominant species between pH 1 and pH 7.5 and hypochlorite ion predominates at pH values greater than 7.5. Lower pHs are preferred for chlorine disinfection because the hypochlorite ion is estimated to be 150 to 300 times less effective than hypochlorous acid (NHMRC/NRMMC 2013). It is noted that treated water pH is typically maintained in the range 7.6 to 7.8 at Hay WTP, to avoid corrosion issues in the distribution system.

Chlorine disinfection is generally more effective at higher temperatures although it is noted that chlorine decay is also greater at higher temperatures.

The impact of pH and temperature on chlorine disinfection effectiveness can be demonstrated by the USEPA's table of C.t values for 3-log (99.9%) inactivation of *Giardia* cysts by free chlorine at various temperatures, pH and chlorine concentration, as shown overleaf.

Table 5: C.t values for 3-log inactivation of *Giardia* cysts by free chlorine (USEPA 2003)

TABLE B-1
CT VALUES* FOR 3-LOG INACTIVATION
OF *GIARDIA* CYSTS BY FREE CHLORINE

Chlorine Concentration (mg/L)	Temperature <=0.5°C							Temperature =5°C							Temperature = 10°C						
	pH							pH							pH						
	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0
<=0.4	137	163	195	237	277	329	390	97	117	139	166	198	236	279	73	88	104	125	149	177	209
0.6	141	168	200	239	286	342	407	100	120	143	171	204	244	291	75	90	107	128	153	183	218
0.8	145	172	205	246	295	354	422	103	122	146	175	210	252	301	78	92	110	131	158	189	226
1.0	148	176	210	253	304	365	437	105	125	149	179	216	260	312	79	94	112	134	162	195	234
1.2	152	180	215	259	313	376	451	107	127	152	183	221	267	320	80	95	114	137	166	200	240
1.4	155	184	221	266	321	387	464	109	130	155	187	227	274	329	82	98	116	140	170	206	247
1.6	157	189	226	273	329	397	477	111	132	158	192	232	281	337	83	99	119	144	174	211	253
1.8	162	193	231	279	338	407	489	114	135	162	196	238	287	345	86	101	122	147	179	215	259
2.0	165	197	236	286	346	417	500	116	138	165	200	243	294	353	87	104	124	150	182	221	265
2.2	169	201	242	297	353	426	511	118	140	169	204	248	300	361	89	105	127	153	186	225	271
2.4	172	205	247	298	361	435	522	120	143	172	209	253	306	368	90	107	129	157	190	230	276
2.6	175	209	252	304	368	444	533	122	146	175	213	258	312	375	92	110	131	160	194	234	281
2.8	178	213	257	310	375	452	543	124	148	178	217	263	318	382	93	111	134	163	197	239	287
3.0	181	217	261	316	382	460	552	126	151	182	221	268	324	389	95	113	137	166	201	243	292

Chlorine Concentration (mg/L)	Temperature = 15°C							Temperature = 20°C							Temperature = 25°C						
	pH							pH							pH						
	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0	<=6.0	6.5	7.0	7.5	8.0	8.5	9.0
<=0.4	49	59	70	83	99	118	140	36	44	52	62	74	89	105	24	29	35	42	50	59	70
0.6	50	60	72	86	102	122	146	38	45	54	64	77	92	109	25	30	36	43	51	61	73
0.8	52	61	73	88	105	126	151	39	46	55	66	79	95	113	26	31	37	44	53	63	75
1.0	53	63	75	90	108	130	156	39	47	56	67	81	98	117	26	31	37	45	54	65	78
1.2	54	64	76	92	111	134	160	40	48	57	69	83	100	120	27	32	38	46	55	67	80
1.4	55	65	78	94	114	137	165	41	49	58	70	85	103	123	27	33	39	47	57	69	82
1.6	56	66	79	96	116	141	169	42	50	59	72	87	105	126	28	33	40	48	58	70	84
1.8	57	68	81	98	119	144	173	43	51	61	74	89	108	129	29	34	41	49	60	72	86
2.0	58	69	83	100	122	147	177	44	52	62	75	91	110	132	29	35	41	50	61	74	88
2.2	59	70	85	102	124	150	181	44	53	63	77	93	113	135	30	35	42	51	62	75	90
2.4	60	72	86	105	127	153	184	45	54	65	78	95	115	138	30	36	43	52	63	77	92
2.6	61	73	88	107	129	156	188	46	55	66	80	97	117	141	31	37	44	53	65	78	94
2.8	62	74	89	109	132	159	191	47	56	67	81	99	119	143	31	37	45	54	66	80	96
3.0	63	76	91	111	134	162	195	47	57	68	83	101	122	148	32	38	46	55	67	81	97

*Although units did not appear in the original tables, units are min-mg/L.

As shown in Table 5 above, at 25°C and a typical chlorine concentration of 1.0 mg/L:

- 37 min.mg/L would be required for 3-log inactivation of *Giardia* cysts at pH 7.0
- 45 min.mg/L would be required for 3-log inactivation of *Giardia* cysts at pH 7.5
- 54 min.mg/L would be required for 3-log inactivation of *Giardia* cysts at pH 8.0

At 10°C and a typical chlorine concentration of 1.0 mg/L:

- 112 min.mg/L would be required for 3-log inactivation of *Giardia* cysts at pH 7.0
- 134 min.mg/L would be required for 3-log inactivation of *Giardia* cysts at pH 7.5
- 162 min.mg/L would be required for 3-log inactivation of *Giardia* cysts at pH 8.0

The effect of temperature and pH is also demonstrated by USEPA's table of C.t values for 4-log (99.99%) inactivation of viruses by free chlorine, as shown below:

Table 6: C.t values for 4-log inactivation of viruses by free chlorine (USEPA 2003)

TABLE B-2

CT VALUES* FOR
4- LOG INACTIVATION OF VIRUSES BY FREE CHLORINE

	pH	
Temperature (°C)	6-9	10
0.5	12	90
5	8	60
10	6	45
15	4	30
20	3	22
25	2	15

*Although units did not appear in the original tables, units are min-mg/L.

As shown in above, at a given temperature, the C.t value required for 4-log inactivation of viruses by free chlorine at pH 10 is approximately 7.5 times that at pH 6-9. At a given pH, the C.t value required for 4-log inactivation of viruses by free chlorine at 10°C is double that at 20°C.

Turbidity and organic matter in water reduce the effectiveness of chlorine disinfection by increasing the chlorine demand, as well as contributing to formation of potentially harmful disinfection byproducts. Turbidity also reduces disinfection effectiveness by shielding microorganisms in particles. In considering the impact of turbidity on chlorine disinfection, ADWG 2011 (NHMRC/NRMMC 2013) states that "*a turbidity of less than 1 NTU is desirable at the time of disinfection with chlorine unless a higher value can be validated in a specific context*".

5. Guidelines

ADWG 2011 (NHMRC/NRMMC 2013) includes a guideline C.t value of 15 min.mg/L which is based on the World Health Organisation's recommendation that effective disinfection for bacteria and viruses can generally be achieved by applying a 30 minute contact time to a free chlorine concentration of 0.5 mg/L.

Note that required C.t varies significantly depending on the target microorganism, as outlined in Table IS1.3.1 of ADWG 2011 which shows C.t ranging from <1 min.mg/L for *E. coli* (10-15 °C, pH 6-9) to 7,200 min.mg/L for *Cryptosporidium* (25°C, pH 7).

6. References

NHMRC/NRMMC 2013, Australian Drinking Water Guidelines 6 2011, Version 2.0, available online https://www.nhmrc.gov.au/guidelines/publications/eh52

USEPA 2003, LT1ESWTR Disinfection Profiling and Benchmarking Technical Guidance Manual, available online http://water.epa.gov/lawsregs/rulesregs/sdwa/mdbp/upload/2003_06_23_mdbp_profile_lt1profiling.pdf

APPENDIX C

UPSS Sensitive Zones

144° 144.25° 144.5° 144.75° 145° 145.25°

-33.25° -33.5° -33.75° -34° -34.25° -34.5° -34.75° -35°

CENTRAL DARLING

CARRATHOOL

BALRANALD

HAY

Hay

MURRUMBIDGEE

WAKOOL

CONARGO

Legend

- Council Area
- Main Road
- Railway
- Sensitive Zone

UPSS Regulation - Sensitive Zones Map

HAY SHIRE COUNCIL

Copyright Department of Environment, Climate Change and Water (NSW)
This map is not guaranteed to be free from error or omission
The Department of Environment, Climate Change and Water (NSW) and its employees disclaim liability for any act done on the information in the map and any consequences of such acts or omissions

Datum/Projection: GCS GDA 1994

Jan 12, 2010

0 9
Kilometres

Department of Environment, Climate Change and Water NSW

Scale at A3
1 cm equals 5.5 km

N

APPENDIX D

Important Information about this Report

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

golder.com