



# **ATTACHMENTS**

**UNDER SEPARATE COVER**

**Ordinary Council Meeting**

**18 February 2025**



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# 6 Monthly Action Update

1 July 2024 to 31 December 2024

2022-2026 Delivery Program



**1: DELIVERY PROGRAM 2022-2026**

**1: OUR COMMUNITY**

**1.1: To live in an inclusive, healthy and tolerant community with a positive attitude toward others**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.1.1	Acknowledge and celebrate our local Wiradjuri culture	Progress the implementation of the Cultural Plan to value our Wiradjuri Culture.	A community that is more aware of its Wiradjuri heritage.	In October 2025 Council completed and held the opening ceremony for the Wiradjuri Honour Wall, which highlights the achievements of local indigenous community members as well as recognises our returned Servicemen. Council continues to hold quarterly meetings with the Aboriginal Elders Liaison group to discuss current and emerging issues within the Aboriginal community. Council's Community Liaison Officer has help establish an interagency meeting with workers in identified roles or roles that work directly with the Aboriginal community both locally and in surrounding areas.	Community Support Manager	Progressing	90%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.1.2	Support opportunities for community participation in diverse arts and cultural activities	Our Cultural Plan supports opportunities for the community in arts and our community through cultural events, programs and initiatives.	Number of events supported with details on participation and attendance.	The goals, actions and outcomes of the Cultural Plan are facilitated by Council through its S.355 and Advisory Committees, Western Riverina Arts, various community groups, artists, artisans and community members. These groups support the aims and outcomes listed for the plan's 6 Goals. Inclusive activities such as the official opening of the Wiradjuri Memorial Wall and NAIDOC celebrations have been coordinated by Committees such as the Aboriginal Elders Liaison Group and the NAIDOC Committee and supported by Council's Community Liaison Officer. To increase usage of the Arts Centre and to promote Arts opportunities the Arts and Cultural Committee proposed a subsidy (approved by Council) offering specific discounts to approved local community organisations. Applications must be made and approved prior to the hire. The Arts Centre is increasingly being utilised for more diverse activities including Youth programs.	Community Development (including Library) Manager	Ongoing commitment	90%
1.1.3	Work with event organisers to promote and improve participation in local events and festivals	Community events that are highly publicised and promoted with high levels of community participation and positive feedback.	Event statistics and participant feedback.	This is an ongoing commitment - an initial meeting was held in 2024 with the subject being communication with council about upcoming events; although somewhat successful it is still not to the level hoped for. A forum has been scheduled for 10 February 2025 with the Narrandera Business Group and all event organizers to attend - one of the outcomes is for a community event calendar to be created to ensure all events are promoted and to avoid scheduling clashes.	Events and Visitor Services Team Leader	Progressing	50%

**1.2: Work together to advocate for quality health, education, youth and social services**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.2.1	Continue to work with the Aboriginal community fostering mutual respect and understanding through consultation seeking valuable feedback on important projects and initiatives	Build on the existing relationship and strengthen connections.	Summary of meetings held and the outcomes of consultation on projects and initiatives.	In October 2025 Council completed and held the opening ceremony for the Wiradjuri Honour Wall, which highlights the achievements of local indigenous community members as well as recognises our returned Servicemen. Council continues to hold quarterly meetings with the Aboriginal Elders Liaison group to discuss current and emerging issues within the Aboriginal community. Council's Community Liaison Officer has help establish an interagency meeting with workers in identified roles or roles that work directly with the Aboriginal community both locally and in surrounding areas.	Community Support Manager	Ongoing commitment	100%
1.2.2	Work with the Youth Council to implement the Youth Strategy	A Youth Council that is considered as part of Council.	Update of actions relating to the Youth Strategy also engagement and member recruitment opportunities.	The Youth Council has not been active in this space due to lack of representation, however recruitment for new members will commence in February 2025. Once new memberships have been established, a review of the Youth Strategy will commence.	Community Support Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.2.3	Integrate the Youth Council into official Council and community events	A Youth Council that is engaged with leadership activities.	Outcomes achieved within the Youth Strategy, particularly the section of 'Voice' where the objective is to involve youth in the decisions that affect them.	The Youth Advisory Council provided school holiday events in July 2024 which included paint workshops, craft sessions and movie night. The Youth Council has not been active since this time and recruitment for new members will commence in February 2025.	Community Support Manager	Progressing	50%
1.2.4	Continued advocacy for the delivery of integrated health services and well-being programs.	Continued improvements in the delivery of integrated health services and wellbeing programs.	Improvements resulting from continued advocacy also outcomes from participation in the Narrandera Health Advisory Group.	Continue to meet with Murrumbidgee Local Health District leaders to discuss service levels. Currently working with the Narrandera Medical Centre in relation to the recruitment of Doctors.	General Manager	Progressing	50%



**1.3: To feel connected also safe**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.3.1	Maintain and enhance the connection between Council and the community using available communication channels	A community and Council that is engaged.	Statistical information from the monthly media report submitted to the Executive Leadership Team.	Council is very proactive in engaging with the community utilising various communication channels including social media, website, radio, newspaper, digital newsletters, physical newsletters and television.	Communications Officer	Ongoing commitment	100%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.3.2	Continued advocacy for the strengthening of critical emergency services personnel and 'fit for purpose' infrastructure; also commence the Disaster Risk Reduction Fund Project which is 'building knowledge and improving practice in disaster risk reduction within the Riverina and Murray Joint Organisation footprint (RAMJO)'.	Critical emergency services and personnel are readily and consistently available to meet the current and emerging needs of the community.	Details of advocacy opportunities and outcomes relating to personnel numbers and infrastructure improvements.	Council is leading the Riverina and Murray Joint Organisation of Council's to complete the Disaster Risk Reduction grant program and also commenced the implementation at a local level the Drought Resilience Project.	General Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.3.3	Ensure that the CCTV network is functional and there is a program for enhancement	An enhanced CCTV network that captures anti-social behaviour.	A CCTV network that provides NSW Police with information to address anti-social behaviour leading to a reduction in requests to view footage.	Contractors have finished replacing the existing public CCTV cameras and are installing additional cameras at selected locations around the Shire as part of the grant funded project. Narrandera Police have been given access to live and recorded footage from the public cameras.	Information Technology Manager	Progressing	80%
1.3.4	Provide transport opportunities to support independent living at home	A community transport service that supports independent living at home.	The number of trips provided to clients by funding demographic, kilometres travelled cumulative per financial year and comparative to the previous year.	Narrandera Leeton Community Transport provided 1,920 trips to CHSP clients aged 65 years and over or 50 years and over for Aboriginal and Torres Strait Islander, 3,115 trips to transport disadvantaged including taxi vouchers, 36 DVA trips, 515 trips through brokerage arrangements, 776 trips for non-emergency health related trips and 44 trips to NDIS participants for the period 1 July 2024- 31 December 2024. Total kilometres travelled was a staggering 95,009.	Community Support Manager	Ongoing commitment	100%

**2: OUR ENVIRONMENT**

**2.1: To value, care for and protect our natural environment**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.1.1	Establish strong partnerships to protect, expand and promote Narrandera's unique koala population with a vision to establish a research centre in Narrandera	Our koala population is protected by the scientific and broader community, and a koala research centre is established in Narrandera.	Progress in establishing a research centre in Narrandera, but also the actions taken to protect our koala population and data on the population when available.	Council continues collaboration with the Narrandera Koala Regeneration Committee to support its ongoing work to protect and grow the region's koala population. During this period Council also authorised two Environmental Studies - Koala Studies which are being undertaken by NSW Department of Planning, Housing and Infrastructure in conjunction with Charles Sturt University.	Economic Development Manager	Progressing	70%
2.1.2	Key environmentally sensitive areas under the control of Council are managed with awareness and sensitivity	Environmentally sensitive areas controlled by Council area managed appropriately.	Details of actions taken to prevent environmental damage; where there is a breach, remedial actions taken and measures to prevent reoccurrence.	To protect environmentally sensitive areas, actions such as the upgrade of the Bundigerry Walking Track along the northern boundary of Lake Talbot have been undertaken to keep pedestrian traffic off significant sites. The Weeds Action Plan and associated inspection plan for the Shire has now been completed.	Open Space Recreation Manager	Progressing	90%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.1.3	Preservation and enhancement of our significant tree assets to maintain our signature streetscapes	The preservation and enhancement of trees within our townscapes is practiced and encouraged by Council.	Continuation of the tree audit to identify risks and potential early issues with specific tree species also details of ongoing maintenance to our tree assets and comparative statistical data on trees removed, plantings and any projects where trees will be a significant feature.	The specifications for the next Tree Audit quotation is currently being prepared, other tree maintenance works have been completed including the planting of replacement and additional trees. Ways to reduce costs in this space are being considered and discussed.	Open Space Recreation Manager	Progressing	90%

**2.2: Enhance our public spaces to enrich our community**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.2.1	Continually assess playgrounds to determine if fit for purpose, ensure compliance with the relevant standards and they meet community needs relevant to the level of use of the area	All playgrounds are considered fit for purpose to applicable service standards and by the community.	Compliance with relevant playground standards and Council's insurer StateWide Mutual best practice manual titled 'Playgrounds'. Details of grant funding applications to maximise opportunities also details of planned improvement works.	A substantial upgrade of infants/toddlers play area at Marie Bashir Park are currently underway and will revitalise the original Adventure Park concept. All other playgrounds across the Shire are regularly inspected, maintained and repaired as required.	Open Space Recreation Manager	Progressing	80%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.2.2	Implement a renewal and maintenance schedule to support a diverse range of building facilities for the community	Facilities are maintained so that they are fit for purpose and continue to support both organisational and community activities and that there is a strategic plan in place for their replacement or renewal.	Details of actual and proposed renewal and maintenance activities achieved in the financial year in accordance with the schedule and allocated budgets.	Council buildings renewal and maintenance program for the 2024-2025 financial year is underway - this includes scheduled air-conditioning servicing, test and tag electrical services, spider spraying and gutter cleaning. Renewal/maintenance activities such as air-conditioner replacement, roof and gutter replacement, external painting of the Council Chambers and reseal of the Grong Grong Commemorative Hall hard wood flooring are either underway or have been completed. Due to extensive white ant damaged at the Community Services Building, an extensive program of renewing damaged walls and ceilings has commenced.	Projects and Assets Manager	Progressing	40%

**2.3: Maximise greater re-use of resources to increase sustainability within our community**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.3.1	Implementation of the Narrandera Shire Waste Management Plan and identify realistic opportunities for re-use of waste streams	Options to minimise waste streams to landfill to promote reuse and recycling are identified and progressed.	Statistical information for waste diverted from landfill obtained from the current EPA reporting regime.	The new transfer area is nearly complete with green waste management the main concern at this time. Additional support is being sought from RAMJO to seek a cost-effective solution for this waste steam.	Deputy GM Infrastructure	Progressing	40%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.3.2	Source funding and implement short to medium term actions from the Narrandera Shire Council Climate Action Strategy	Council progresses the 24 short term to medium actions identified under its November 2020 Climate Action Strategy as funding opportunities arise.	Progress on the 24 short term to medium term actions.	Council will commence a 6-year fixed price contract on the 1 January with Iberdrola Energy for Councils large sites and streetlighting as part of the regional Council Power Purchasing Agreement (PPA) along with other partners such as the Hunter and Mid North Coast Joint Organisations of Councils.	Projects and Assets Manager	Progressing	45%



**3: OUR ECONOMY**

**3.1: Create strong conditions for investment and job creation through quality infrastructure and proactive business support**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.1.1	Identify and develop targeted campaigns to attract industry/business also building on our distinctive strengths in agriculture and its related supply chains	New industries/businesses that situate their operation in the Shire as a result of targeted campaigns.	Outcomes of targeted campaigns that align with the Economic Development Strategy.	Following the formal adoption of the Narrandera Shire Economic Development Strategy 2024-2028 Council has made continued efforts to seek grant funding to expand the Red Hill Industrial Estate. This action underpins Council's commitment to enhancing the region's infrastructure to facilitate the growth of established and emerging businesses - Council staff have received a number of enquiries about stage 2 of the Red Hill Estate. In December 2025 Council resolved to assist a large industry to relocate to Narrandera using land owned by Council along Red Hill Road, Narrandera.	Economic Development Manager	Progressing	40%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.1.2	Promote collaborative marketing initiatives through regular meetings between businesses and Council on both a formal and informal basis	The business group and Council view their working relationship as constructive and progressive.	Details of meetings held, such as attendance also the outcomes achieved or proposed to be achieved.	Council continues to support the Narrandera Business Group (NBG) by assisting with the creation of an annual schedule of events for local businesses; by securing funding from the NSW Government Council was able to support the expansion of the annual Spring Fair - it is anticipated that this will become a regular event that can be self-sustaining through fund-raising activities. Council staff are in regular contact with the NBG and provide information for dissemination to members that will assist the development of individual businesses.	Economic Development Manager	Completed	100%
3.1.3	Promotion of Narrandera Shire using our heritage buildings, culture, location, waterways, ecotourism also business and sporting facilities	Promotion of the natural, cultural and built environments of our Shire results in increased tourism, business and sporting activity.	Details of promotional campaigns also the measuring of value-adding effects such as maximising visitor stays.	Council continues to actively promote the assets of Narrandera Shire including through the destination marketing material including the print material such as the Heritage Walk brochure, the second edition of Murrumbidgee Trails, Visit Riverina digital campaigns and Narrandera Tourism's social media and website collateral. Council also promotes various assets through paid advertising intermittently with various print medias.	Economic Development Manager	Ongoing commitment	100%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.1.4	Advocate and support the expansion of the Narrandera-Leeton Airport and increased business opportunities	The Narrandera-Leeton operations are strengthened by infrastructure upgrades including the parallel taxiway.	Outcomes measured by usage of the airport also advocacy for the enhancement of the Narrandera-Leeton Airport.	Council continues to seek opportunities to grow the Narrandera-Leeton Airport, through aviation-related activities and by leasing land for aviation linked purposes. Through the Narrandera Shire Economic Development Strategy 2024-2028 - Project 4.5 identifies the need to develop a Narrandera Airport Master Plan, focusing on commercialisation opportunities and investment priorities to support airport growth.	Economic Development Manager	Progressing	10%

**3.2: Encourage new housing supply to meet the needs of the community**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.2.1	Actively seek and where possible, assist prospective developers to facilitate a mixed housing development that includes an independent living complex and affordable housing in Narrandera	A mixed housing development that includes independent living and affordable housing opportunities is built in Narrandera.	Advocacy actions to promote such a development within Narrandera.	Council maintains open channels of communication with prospective developers and local real estate agents to help facilitate potential housing developments in Narrandera, including an independent living complex and affordable housing. Council has also identified Council-owned land and is actively in discussions with possible housing developers for such a development.	Economic Development Manager	Progressing	30%
3.2.2	Strategic land use planning for future housing, recreational, commercial and industrial needs	A housing and industrial land strategy is developed and implemented.	Land is identified within the new Local Environment Plan for future housing, recreational, commercial and industrial needs.	Actions identified within the Local Housing and Employment Zone Land Strategy. Planning proposals for the rezoning for additional industrial land is progressing and expected to be complete by June 2025. Support being provide for additional residential development whenever the opportunity presents.	Deputy GM Infrastructure	Progressing	45%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.2.3	Continue to lobby NSW Government to resolve Aboriginal Land Claims on lands suitable for potential development	Aboriginal Land Claims relevant to the Shire's desired housing and industrial development strategies are heard and resolved.	Progress of any land claims proposed for settlement.	This issue is continually raised in meetings with Crown Lands Department officials, however there is no indication of NSW Government immediate intention to resolve claims quickly.	General Manager	Progressing	50%

**4: OUR INFRASTRUCTURE**

**4.1: To have an improved and appropriately maintained road network**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.1.1	Submit funding applications to maximise opportunities to upgrade the local and regional road network	Commonwealth and State funding is sourced to upgrade the local and regional road network.	Details of financial applications submitted for road related funding also the details of successful applications.	No funding was applied for during the reporting period due to the limited opening of funding opportunities and what was deemed as an eligible project.	Works Manager	Progressing	50%
4.1.2	Plan and undertake road maintenance and upgrades based on available funding	Local roads are maintained within budget with reference to the strategic 3 year works plan for upgrades and maintenance.	Details of works undertaken also statistical data such as kilometres and costing.	Works program is well underway and is achieving the outcomes proposed in the 3 year works plan.	Works Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.1.3	Strategic lobbying for the replacement or upgrade of the bridge across the main irrigation canal on Irrigation Way	The bridge across the main canal along Irrigation Way is upgraded or replaced.	Lobbying outcomes until a successful outcome is achieved.	Lobbying for the replacement or upgrade of the bridge continues to be undertaken, with representation to the Minister for Regional Transport and Roads made during the period, with further representation to follow in the second half of the year.	Deputy GM Infrastructure	Ongoing commitment	50%

**4.2: Actively investigate opportunities to enhance our potable water quality**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.2.1	Implement the adopted Integrated Water Cycle Management Plan (IWCM)	Implementation of the IWCM.	Actions taken to implement the IWCM.	Amendments to the Integrated Water Cycle Management Strategy IWCM are progressing. The scoping study of a new Water Treatment Plant is in draft form and will be finalised and presented to Council in February 2025. Taste testing study was completed in December 2023, this involved pouring a different type of water into a cup with the participant rating the taste of each sample.	Water Sewer Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.2.2	Continue to address water quality issues within the potable water supply network	Continued improvements to the Narrandera potable water supply as outlined in 2020 Clean Water Strategy.	Implementation of the action plan and statistical analysis of water quality monitoring reports.	Household water filters continue to be installed at the request of property owners. Replacement of water mains and hydrants to improve water quality and reliability has continued throughout the year. Funding for a new Water Treatment Plant was again sought under the National Water Grid Fund round 2, however Council was unsuccessful.  Narrandera Water Treatment Plant Scoping study draft report has been received and will be presented to Council in February 2025. Funding to proceed to design and construct phase will be sought with Council endorsement.	Water Sewer Manager	Progressing	50%
4.2.3	Ensure that wastewater returned to the environment is in line with guidelines from relevant authorities	Wastewater is appropriately treated and returned to the environment.	Reporting on the wastewater testing regime and any variations outside of parameters of acceptable load limits of pollutant discharge.	The Environment Protection Authority return for 2023-2024 was submitted and approved in April 2024. Treated effluent discharge to the environment during the reporting year had 2 incidents of exceeding the permissible levels. Next reporting period closes at end of February 2025.	Water Sewer Manager	Progressing	50%



Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.2.4	Keep the community informed of water supply matters and proposed infrastructure upgrades, encourage water customers to register and use the new water billing portal	An informed community about improvements to the Narrandera potable water supply.	The number of media items issued to the community relating to the potable water supply.	The timeline has progressed with the scoping study moving to the next phase, where water taste testing events were held on Friday 15 December 2023. As part of this process content was created and distributed using social media, the website of Council, the Narrandera Argus - at the event there were many face to face discussions held with consumers and key staff. There are regular posts using social media about emergency water and sewer works or planned works where there may be disruption to service availability or traffic impediments.	Communications Officer	Completed	100%

**4.3: To improve, maintain and value-add to our essential public and recreational infrastructure**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.3.1	Undertake stages 1 & 1A of the Narrandera Business Centre Upgrade, including the implementation of improved stormwater drainage and seek funding for the additional stages of the project	Stages 1 and 1A of the Narrandera Business Centre upgrade and improved stormwater drainage are implemented.	Milestones achieved as the project progresses.	Funding for stormwater upgrades being sought, however there have been limited grant opportunities. Initial upgrades to footpaths to be undertaken post the Easter events.	Deputy GM Infrastructure	Progressing	10%
4.3.2	Through stakeholder consultation, in any project consider the diverse mobility needs of our community, consistent with the Disability Inclusion Action Plan	That the Disability Inclusion Action Plan is considered in any project.	Consideration of the Disability Inclusion Action Plan in any project and what elements of the Plan have been included in the project.	Council staff are and will continue to undertake stakeholder consultation to determine the mobility needs of our community in accordance with the Disability Inclusion Action Plan	Projects and Assets Manager	Progressing	30%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.3.3	Through community consultation develop a new masterplan for Marie Bashir Park	A masterplan for Marie Bashir Park is developed.	Details of actions taken to deliver a new masterplan, including a timeline and budget predictions.	The Master Plan for Marie Bashir Park has been completed.	Open Space Recreation Manager	Completed	100%
4.3.4	Through consultation with all user groups of Narrandera Shire sporting facilities, prioritise improvements for venues and seek funding to implement the improvements	Sporting facilities are improved through works agreed with key stakeholders, users and the community.	Feedback from advisory groups and user groups also details of grant submissions.	There are regular meetings with users group discussing potential funding and improvements like netball courts, score boards, playgrounds, goal posts and the needs of little athletics. Recent improvements include new video score boards at Barellan Sportsground also chain link fencing at the Barellan Netball Courts to ensure the safety of users.	Open Space Recreation Manager	Progressing	90%
4.3.5	Establish an off-leash companion animal area adjacent to Henry Mathieson Oval	A purpose built off-leash companion animal park at Henry Mathieson Oval is available to the community.	Development of a new off-leash for companion animals.	Off-leash companion animal area is operational with additional furniture and activities to be provided when funding becomes available.	Deputy GM Infrastructure	Progressing	80%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.3.6	Source funding to improve vehicle parking at the Lake Talbot Water Park	Parking at the Lake Talbot Water park is maximised for all users.	Investigation and presentation to Council on available parking options and how the project is intended to be funded.	A detailed line marking layout has been completed with comments from the Lessee of the Lake Talbot Swimming Pool considered. Council staff are currently searching for suitable financial grant funding opportunities for this project.	Projects and Assets Manager	Progressing	15%

**5: OUR CIVIC LEADERSHIP**

**5.1: Have a Council that provides leadership through actions and effective communication**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.1	Manage the functions of ARIC also the schedule of Internal Audits and Service Reviews.	Internal audits completed in accordance with the adopted program also service reviews carried out on identified areas of operation.	ARIC at its July 2022 meeting affirmed its commitment to 4 Internal Audits per financial year.	The Audit, Risk and Improvement Committee (ARIC) continues to progress to conformance with the guidelines for the management of ARIC released by the Office of Local Government mid December 2022. The ARIC have adopted the Terms of Reference and Internal Audit Charter and have appointed Mr Stuart Todd as the 3rd independent member. Since the last update, the National Audits Group can continue in its capacity of Internal Auditor finalising 2 audits being Personnel Succession Planning/Attraction also Corporate Governance Framework - the other 2 internal audits for Community Transport and Treasury Functions - Investments are progressing.	Governance & Engagement Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.2	Support ethical, transparent and accountable corporate governance	A Council that supports ethical, transparent and corporate governance such as reporting on the Delivery Program every 6 months which is presented to Council and published to the community.	Presentation of information to Council and the community such as 6 monthly reporting of the actions contained within the Delivery Program being 31 December and 30 June.	Good governance promotes public confidence & is paramount to service delivery & the economic and efficient use of public money. Governance is the high-level processes & behaviours that ensure an organisation performs by achieving its intended purpose, complies with relevant laws, codes & directions while meeting community expectations of probity, accountability & transparency. Council achieves this in many ways - the most visible is the Council business paper & live streaming of Council meetings. The overarching document of Council is the Community Strategic Plan supported by documents such as the Delivery Program contains the strategies, actions & targets of Council with outcomes reported to Council & the community every 6 months - for 1 July 2024 to 31 December 2024 this will be reported February 2025 & published to the community using the website. The 2023-2024 Annual Report & 2021-2024 State of our Shire Report, adopted by Council November 2024, are available on the website.	Governance & Engagement Manager	Progressing	75%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.3	Gauge customer and resident satisfaction with services and operations	Identify trends within the areas of importance identified from the 2021 community survey and in 2024 action a new community survey and report on variation to important issues.	From the 2021 Community Survey identify areas of importance and identify trends. In the 2023-2024 budget ensure there are financial resources to conduct a third Community Survey to be used to develop the new Community Strategic Plan and other supporting documents for adoption prior to 30 June 2025.	During the reporting period, Council partnered with Projectura Pty Ltd to review the existing Community Strategic Plan from which the 4 year Delivery Program and the annual Operational Plan will be developed. Using a number of consultation methods such as face to face sessions held at venues in Narrandera, Barellan and Grong Grong, an online and manual survey, targeted consultation sessions and a pop-up session, Karina Dooley of Projectura will provide Council with a summary of issues and recommendations to use during the upcoming review. It is expected that the high-level overview will be received before the 18 February 2025 Council meeting.	Governance & Engagement Manager	Progressing	50%
5.1.4	Report on compliance with the financial performance measures within the annual financial statements	Financial reporting is compliant with measures set by the Office of Local Government also the NSW Audit Office.	Attaining or exceeding the benchmark ratios for the financial performance measures.	Council's financial reporting is compliant with requirements established by Office of Local Government and NSW Audit Office. The external audit was finalised during the reporting period, and Council's audited Financial Statements were included in Council's Annual Report, which has been adopted and published to Council's website.	Deputy GM Corporate & Community	Completed	100%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.5	Continue strategic advocacy for the strengthening of the Shire centres of learning	Improvements to our centres of learning.	Learning centre outcomes such as improved course availability and advancements in technology to assist in remote learning.	Held discussions with Narrandera High School leaders in relation to course delivery and student outcomes. The Minister for Education has been urged to include girls in Clontarf Academy opportunities.	General Manager	Progressing	50%
5.1.6	Continue strategic advocacy for the improvement of telecommunication networks across the Shire	Improved telecommunications network in the Shire.	Outcomes of advocacy, improved infrastructure and reduction in the number of 'black spots'.	There have been 2 meetings with Telstra officials and with representatives of NBN discussing service levels in Narrandera Shire. Cabling of NBN services in Narrandera are currently being upgraded.	General Manager	Progressing	50%
5.1.7	Make representations to both Federal and State Government agencies to determine the feasibility of the Lake Mejum and Lake Coolah concept	An informed decision of the feasibility of the Lake Mejum and Lake Coolah water storage concept is made and relayed to all stakeholders.	Progress of representations and outcomes of any study.	The General Manager has met with staff of NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) and subsequently had Council authorise the preparation and lodgement of a grant application to fund a feasibility study for the project. - the grant application has been determined as unsuccessful with the General Manager currently seeking feedback and explanations.	General Manager	Progressing	50%



Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.8	Ensure that workforce policies remain current in a changing environment	An organisation where workforce policies suit a changing work environment and succession planning is in place for key roles.	Compliance to the policy review schedule also details of organisational training and successes in attaining qualifications. Succession planning for key roles is in place.	The Human Resources team have a large number of policies and procedures to manage, therefore the review of these policies will always have conflicting timelines with other urgent work requirements - however the team review policies as time permits. Four policies will be tabled at the next Executive Leadership Team meetings to be held in February 2025.	Human Resources Manager	Progressing	40%
5.1.9	Maintain the connection with Price Waterhouse Cooper to complete the LG Performance Excellence Program on an annual basis	Participation in the annual Price Waterhouse Cooper survey titled LG Performance Excellence Program.	Completion of the survey on time, reporting the findings to the Executive Leadership Team.	Price Waterhouse Cooper have discontinued the LG Performance Excellence Program, as a substitute the HR team will complete the NSW Analytical Survey annually.	Human Resources Manager	Completed	100%
5.1.10	Ensure our workforce is well trained and meets the needs of the organisation now and into the future with succession planning for key roles within the organisation	A workforce that is well skilled and succession planning for key roles in place.	Details of organisational training and successes in attaining qualifications also details of successional appointments where appropriate.	During 2024 the HR team participated in an internal audit of Council succession planning documents and processes. The risks identified from the audit were all low to medium risks. The Human Resources Manager is currently working through the requirements of the audit. Spreadsheets have been developed for each directorate identifying critical positions and suitable relief arrangements.	Human Resources Manager	Progressing	40%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.11	Recognise the achievements of the Council workforce	A workforce that is recognised for performance, qualifications and service.	Continue the practice of hosting breakfasts with recognition of improved work outcomes as well as qualifications attained and service awards, also use the internal Communicate to recognise individual and team efforts.	In October of each year Council hold an Employee Awards Function. This function involves all employees and recognises and celebrates those who have completed an academic qualification in the past twelve months and also those who have reached a significant milestone in their years of service. Employees are also recognised through normal leadership functions such as the annual Performance Appraisal process.	Human Resources Manager	Completed	100%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.12	Maintain an Information Technology Strategy that meets the needs of the organisation, is fit for purpose and provides best value for money	An appropriate Information Technology Strategy is in place and operating.	System availability (or uptime) indicating whether critical business operating systems are fully functioning during the standard business hours of operation but excluding scheduled maintenance or scheduled downtime.	The current Information Management Strategy is referenced each year for the budget preparation process. Information Technology staff have completed staff consultation for the next strategy update.	Information Technology Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.13	Actively protect the organisation from cyber threats such as spear phishing emails and unauthorised access to the network	Cyber threats to the organisation are reduced.	Addressing issues detected from periodic auditing or penetration testing.	The elected Councillors have completed mandatory cyber security training since the commencement of their term in office. All new staff are completing cyber security training as part of the Pulse induction process. All existing staff are due to start the next round of Cyber Security Training early 2025. IT staff have just completed Penetration Testing with Cyber Security NSW. Staff and Councillors are informed weekly of any threats discovered by the Information Technology section or alerted to Council through Cyber Security NSW. IT staff are providing 6 monthly reports to the Executive Leadership Team of recorded cyber Incidents at Council. IT will be reviewing the Cyber Incident Response Plan and adding playbooks in the next couple of months.	Information Technology Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.14	Monitor the availability of Federal and State funding grants payable to Council	Income from funding sources is accounted for and acquitted.	Maintenance of documents that detail grant funding opportunities applied for and if the application was successful and the acquittal of funds.	Council has developed a centralised register that records grant applications and from where the funding is being sourced. Should the funding be successful then other information is required such as the date and the amount of the funding received, the proposed date of acquittal as well as the actual date of acquittal. The centralised register also provides other essential financial information including the amount received, amount expended and remaining funds of the grant as well as if a contract liability or contract asset exists.	Finance Manager	Completed	100%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.15	Maximise the revenue streams of Council	Revenue for Council is maximised.	Arrears collection statistics comparative to previous years, investment return against investment benchmark.	Council's Revenue Officer closely monitors property arrears and manages these cases in accordance with established policies and procedures. Arrears statistics are reported to Council monthly along with details on the number of assessments being managed by Council's debt recovery agency. Throughout the year assessments are monitored for rateability i.e., rateable to non-rateable and non-rateable to rateable. The Finance Manager regularly reviews financial investments in accordance with the Investment Policy and a report detailing the invested monies of Council is presented to each Council meeting - this report details all transactions that have taken place within the preceding month and gives a snapshot of the portfolio and credit limits to make sure that Council remains within the prescribed amount allowed for each financial institution.	Finance Manager	Completed	100%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.16	Provide a summary of ranger activities, including the number of dogs and cats registered in accordance with the Companion Animals Act 1998	Monitoring of Companion Animal statistics and compliance statistics.	Community awareness activities and information on companion animal registration, impounding, release, re-homing and euthanasia.	Report presented to Council at each meeting. 174 stray animal reports were received and investigated, with 76 dogs and 71 cats impounded in the period. There was a total of 33 animal registrations and 102 impounded animals rehomed in the six-month period.	Deputy GM Infrastructure	Ongoing commitment	50%
5.1.17	Provide a summary of Development Applications received and assessed	Development applications received and assessed within established timeframes also statistical information on development applications received cumulative annually and comparatively to the previous year.	Development application activity statistics based on annual cumulative and previous year comparative information.	Report presented to each Council meeting. July to November 25 development applications determined at a value of \$7,364,666, with the determination timings being 12.2 days.	Deputy GM Infrastructure	Ongoing commitment	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.18	Maintain an up to date Asset Management Strategy and supporting Asset Management Plans which are reflected within the 10 year capital works program.	Measurement will be the completion of projects identified in the Long Term Financial Plan or other supporting plans.	The performance target will be to have contemporary Asset Management Plans that have a 10 year rolling forecast, a 4 year timeline to guide asset decision making with detailed actions to be included or referenced within the annual Operational Plan.	Updated Asset Management Strategy and supporting management plans have been adopted by Council. Staff are working on finalising long term renewal plans to be included into the relevant asset plans	Projects and Assets Manager	Progressing	55%



Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.1.19	Investigate solutions that will assist in the financial stability of Narrandera Shire Council to undertake major capital expenditure such as a Special Rate Variation (SRV). A SRV would enable the commencement of the major capital works project - Narrandera CBD stormwater infrastructure duplication project.	Measurement will be the listing of outcomes and where successful the resulting benefits to the community.	The performance target would be to list the solutions being considered with commentary on the progress of assessing, planning, consultation and implementation.	Obtained IPART approval for an SV that will assist in asset renewal and in financing the urban stormwater upgrades planned for Narrandera.	General Manager	Progressing	50%

**5.2: Promote a community spirit that encourages volunteerism and values effective partnerships**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.2.1	Through energised Advisory Committees seek input for the improvement of facilities and services under their management	Advisory Committees that are proactive and provide input for improvements to amenities as outlined in their Terms of Reference.	Outcomes achieved for improvements.	Over the last 6 months the Parkside Museum S.355 Committee has made great strides in improving and reinvigorating the Museum through hard work and some strategic grant funding. The Committee has established new exhibits, facilitated the completion of the Stones Project, prepared exhibits to be repatriated to the Australian Museum also working diligently on developing plans and improving processes. The project to improve the streetscape appeal also access to the Museum - funded under the 'Lights on Doors Open program' - has been completed and has resulted in a cleaner and more easily maintained front area. The Arts and Cultural Committee is working to promote the Arts Centre while the Bettering Barellan and Grong Grong Community Committees are deeply connected to their respective villages. Representatives of the Railway Facility Management Committee work diligently in a volunteer capacity to keep the station building operating for passengers.	Community Development (including Library) Manager	Progressing	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
5.2.2	Encourage volunteerism within Council operations and across the Shire where possible with recognition of volunteers at key times such as 'National Volunteer Week'	Identify opportunities where additional volunteers may be able to become involved in the operations of Council and strategies to retain the volunteers.	Statistical information on the number of volunteers within the organisation and the tasks performed, also details of recognition events.	Volunteer numbers and hours remain high at the Narrandera Shire Library, Parkside Museum also Community Transport. A dedicated group of volunteers also remain involved in with Museum S.355 Committees also advisory committees. Volunteerism is also well established within other sectors of the community with Narrandera enjoying the benefit of a number of active and involved service organisations and community groups. Traditional service organisations such as Rotary, CWA and Lions are joined by Arts focused organisations such as NACNET and the 'With One Voice Community Choir' to provide the community with the opportunity to come together to participate, learn and enjoy what Narrandera has to offer. Volunteers are acknowledged and celebrated by Council in appreciation of the effort they make to support their community.	Community Development (including Library) Manager	Progressing	50%



# 6 Monthly Action Updates

1 July 2024 to 31 December 2024

2022-2026 Disability Inclusion Action Plan



**2: DISABILITY INCLUSION ACTION PLAN 2022-2026**

**1: POSITIVE COMMUNITY ATTITUDES AND BEHAVIOURS**

**1.1: Elevate the profile and importance of people with a disability in our community**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.1.1	Identify opportunities for an inclusive event recognising people with a disability and promoting inclusion.	Community events that are inclusive.	Events that are widely promoted with high levels of participation and positive feedback.	Library staff provide ad hoc technology training for community members, both individuals and groups. Staff also provide training and support for clients of the Centrelink Rural Agency hosted by the Library. In addition, Tec Exec training sessions have been run by the trainer and local mentors to improve assess for clients with all levels of experience and ability - a small group of community members have also received training to act as mentors for individuals seeking to improve their skills and embrace changes in technology. Library staff continue to work with individuals and groups providing a safe, friendly space as well as access to materials for NDIS clients.	Community Development (including Library) Manager	Ongoing commitment	50%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.1.2	Through the Australia Day Committee consider an award recognising a significant contribution to the disability sector or the promotion of inclusivity and/or accessibility.	A community that recognises significant contributions made to the disability sector.	An annual award included as part of the Narrandera Shire Australia Day celebrations.	The Australia Day awards ceremony to be held 26 January 2025 will for the second year, include an award for Disability Advocacy.	Events and Visitor Services Team Leader	Completed	100%

**1.2: Include disability awareness within Committee and Advisory Groups Terms of Reference.**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.2.1	Education delivered to the organisation on disability awareness also that disability awareness is to be included within the new employee induction program.	An organisation that is aware of disability inclusion within its operations.	An awareness campaign delivered to the organisation on disability inclusion.	At present the Human Resources area a concentrating on other issues within the organisation, however more information and actions will be included in the Equal Employment Opportunity and Diversity Management plan when reviewed. Disability awareness is included within the new employee induction program.	Human Resources Manager	Progressing	20%

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
1.2.2	Include disability awareness within Committee and Advisory Groups Terms of Reference.	Committees and Advisory Groups are inclusive and welcome the contributions from persons with a disability.	Terms of Reference for Committees and Advisory groups reviewed and updated when the opportunity arises.	Following the 2024 Council election, the Terms of Reference for all Committees will be reviewed as they are reconstituted. Both outgoing and incoming Committees commit to ensuring that access to the Council facilities that they are involved with are well maintained within the constraints of the buildings involved. Access to the Museums has been improved and work has been undertaken on both the Barellan and Grong Grong Halls. Safe spaces for persons with special needs are provided so that patrons can enjoy community activities at the Arts Centre, Destination and Discovery Hub also the Library. With the assistance of NSW Trains, improvements to access and safety have been made at the Narrandera Railway Station which houses both Narrandera Community Radio and NACNET as well as being the hub for rail and bus services.	Community Development (including Library) Manager	Progressing	50%
1.2.3	Use media resources to promote disability awareness within the community.	An organisation that actively promotes disability inclusivity.	Details of disability inclusion activities and actions promoted to the community.	The Communications Officer is currently looking to include alternative captions on social media posts and to review the Council style guide to ensure digital inclusion, diversity and accessibility for all members of the community.	Communications Officer	Progressing	80%



**2: LIVEABLE COMMUNITIES**

**2.1: Ensure the needs of people with a disability are properly considered when upgrading or developing Council infrastructure, recreational and cultural areas.**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.1.1	Commitment to disability awareness when considering, designing and executing projects.	An organisation that considers disability awareness in projects and activities.	Disability inclusivity when planning, designing and executing projects.	Disability access and other requirements are considered and included within all Council projects.	Deputy GM Infrastructure	Ongoing commitment	70%

**2.2: Advocate to the Shire business community the importance of disability access to premises.**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
2.2.1	When opportunities arise, promote disability access to commercial property owners and retailers.	An awareness campaign directed toward commercial property owners and tenants about the importance of disability access for consumers.	Commercial property owners and retail tenants made aware of the benefits of providing all ability access to premises.	Council continues to seek opportunities to promote disability access to commercial property owners and retailers.	Economic Development Manager	Progressing	20%

**3: SUPPORT ACCESS TO MEANINGFUL EMPLOYMENT**

**3.1: Consider opportunities for people living with a disability to work with Council**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.1.1	Council's Workforce Management Strategy to include meaningful guidelines for inclusion and Equal Employment Opportunities	An organisation that recognises Equal Employment Opportunities.	Other than appointments based on merit selection, consider opportunities to engage people living with a disability into our workforce.	Council's Workforce Management Plan references information about inclusion and Equal Employment Opportunities contained within Council's Equal Employment Opportunity and Diversity Management Plan which are both due to be reviewed. One action in the Workforce Management Plan is to investigate ways to encourage minority groups. The Human Resources team maintain statistics on the percentage of employees working with disability - at this point in time Council employs one long-term part-time employee and two volunteers considered as having a disability.	Human Resources Manager	Progressing	50%

**3.2: Recognise workers with a disability and those performing a carer role for people with a disability**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.2.1	Promote Council as an 'employer of choice' by considering flexible working arrangements for staff to facilitate a better work/life balance	An organisation that has flexibility for most workforce positions to allow for a better work/life balance where required.	Requests for a flexible working arrangement due to circumstances centering around disability are given due consideration.	Council has completed the transition to more flexible working arrangements. While Council had a number of flexible work arrangements in place it was considered by expanding the options to all employees (where possible) it would improve Councils attraction and retention, and may result in those living with disability to apply for suitable vacancies	Human Resources Manager	Completed	100%

**3.3: Work proactively with employment service providers to match capabilities with workforce needs at Council and other workplaces**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
3.3.1	Identify and work with disability employment organisations to assist with opportunities for employment at both Council and advocate to other workplaces where possible.	An organisation that assists persons with a disability to gain employment, if not possible advocate for employment at another suitable location.	Details of any direct requests to engage a person living with a disability into the workforce, after consideration, what were the outcomes.	Council has an ongoing commitment to assist disability employment organisations to place clients in meaningful employment. Council has built a strong working relationship with local NDIS provider Kurrajong Narrandera - at the present time one long term client is engaged weekly for data entry which is proving to be very successful. All applications for employment are assessed on merit, qualifications and capacity, should a preferred applicant have a disability, every effort will be made to modify workspaces and practices where possible.	Human Resources Manager	Completed	100%

**4: IMPROVING ACCESS TO SERVICES**

**4.1: Identify gaps and limitations in Commonwealth and State services and provide a voice for advocacy**

Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.1.1	Where gaps are identified and are impacting members of the community, advocate for appropriate levels of support services	Actively participate in various community forums and use this resource to identify emerging issues affecting service delivery.	Emerging issues identified and a strategy actioned to address the issue.	Current emerging issues include access to transport for residents of aged care facilities, access to mental health services and access to medical services. Council is assisting the Narrandera Medical Centre in the retention and attraction of GPs. Council, through grant funding, will provide mental health workshops throughout 2025 to the youth community. Council has advocated to officials the need to provide accessible transport to residents of the local aged care facilities.	Community Support Manager	Progressing	50%

**4.2: Recognise the essential services that provide connectivity and support to members of our community, where necessary provide support and advocacy for improved services**

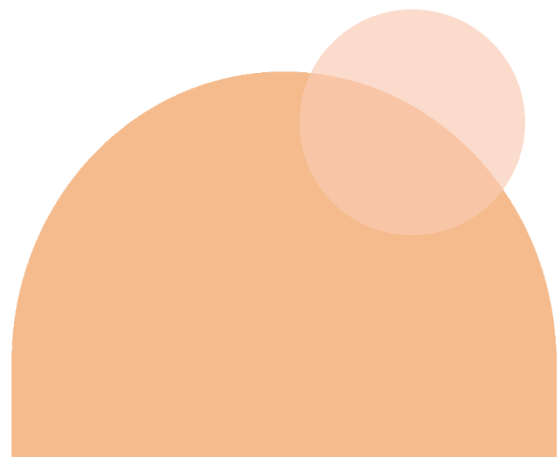
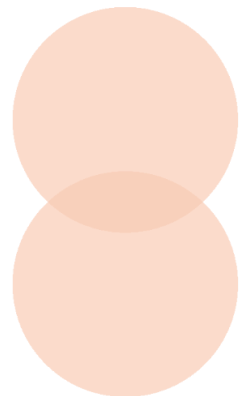
Action Code	Action Name	Performance Measure	Performance Target	Comments	Responsible Officer Position	Status	Progress
4.2.1	Strong voice of advocacy where reductions in community connectivity and services occur	Provide a voice for those who are affected by any reductions in service.	Reduced service levels identified with strategies and actions for advocacy developed.	Council is assisting the Narrandera Medical Centre in the retention and attraction of GPs. Council, through grant funding will provide mental health workshops throughout 2025 to the youth community. Council has advocated for accessible transport to residents of the local aged care facilities.	Community Support Manager	Completed	100%



**Stronger Together**  
**Community Strategic Plan and Disability Inclusion**  
**Action Plan review**

**Engagement Report**

January 2025

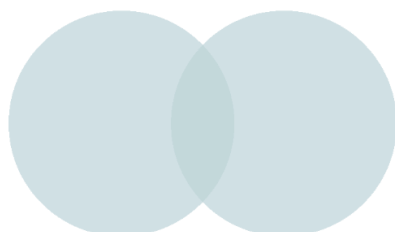


projectura



Stronger Together, Engagement Report

**Prepared for** Narrandera Shire Council  
**Date** January 2025  
**Version** v1.0 FINAL  
**Author** Karina Dooley  
Projectura



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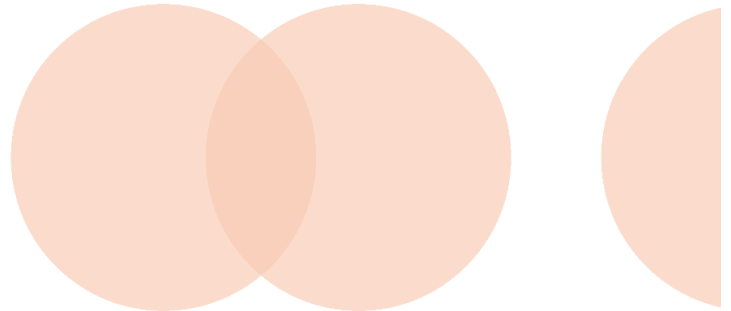


Projectura acknowledges the Traditional Custodians of the land on which we work and recognise their ongoing connection to the Wiradjuri land and waterways.

We also recognise the many other Aboriginal and Torres Strait Islander community members across the region who make up the vibrant communities where our organisation visits and works.

Projectura pays respect to the wisdom of Elders, past, present, and emerging and shares a commitment to engaging communities with a spirit of reconciliation and respect.

EXECUTIVE SUMMARY



**The Narrandera Shire Council Stronger Together Engagement Report documents the community’s aspirations, priorities, and concerns as part of the review of the Community Strategic Plan (CSP) 2040 and Disability Inclusion Action Plan (DIAP) 2030.**

This engagement process ensures Council’s strategic planning aligns with community needs and priorities, fostering an inclusive and sustainable future for the Shire.

**Engagement overview**

The Stronger Together project was conducted in two stages, with this report summarising findings from Stage 1: Broad Engagement which was conducted between October and December 2024.

Engagement aimed to gather diverse perspectives on what residents’ value about their community, the challenges they face, and their aspirations for 2040.

Council engaged with 183 people through a combination of:

- Workshops across Narrandera, Barellan, and Grong Grong.
- Pop-up engagement sessions.
- Stakeholder meetings with local organisations and service providers.
- Online and hard-copy surveys.
- Interviews and written submissions.

The engagement methods used ensured accessibility and broad community reach. Participants represented a broad cross-section of the community, including young people, business owners, residents, and people with disabilities.

**Community Strategic Plan (CSP) insights**

**Community Vision**

The community largely supports the incumbent **Vision** but suggests refining it to be clearer and better aligned with community aspirations.

**Where we are now**

Key strengths include:

- Beautiful natural environment, such as the Murrumbidgee River, Lake Talbot, and Rocky Water Holes.
- Strong personal ties to family and friends.
- Sporting, community, and recreational facilities that support an active lifestyle.
- Peaceful rural lifestyle, offering safety, space, and a family-friendly environment.
- Dedicated community groups and volunteers who enrich the social fabric.

Key challenges that require attention include:

- Ageing population and lack of independent living options.
- Narrandera town water taste and quality.
- Social issues including family violence, homelessness, mental health, and social isolation.
- Limited job diversity and employment opportunities, particularly for young people.
- Crime and public safety concerns, including vandalism and drug-related issues.
- Poor access to medical services, with long wait times for GP appointments and a lack of specialists.
- Housing affordability and availability, especially for key workers and retirees.
- Infrastructure concerns, including road conditions, and public transport.

**2040 priorities**

The top priorities for Narrandera Shire’s future are:

- **Infrastructure and connectivity:** Improve water, roads, paths, public spaces, digital communications and public transport.
- **Health and community services:** Improve access to GPs, mental health services, aged care, and childcare.

- **Better Council:** Improve council transparency, digital services, financial sustainability and community engagement processes.
- **Economic growth:** Diversify industries, support local businesses, and promote tourism, retail and hospitality.
- **Education and training:** Strengthen education, expand vocational training and tertiary access to improve workplace readiness.
- **Environment:** Expand renewable energy projects, increase tree canopy cover, and protect koala habitats.
- **Events and entertainment:** Expand family-friendly events, provide more recreational options for young people, and promote a vibrant night-time economy.
- **Housing:** Increase affordable and diverse housing options, that address homelessness and support ageing-in-place.

**Disability Inclusion Action Plan (DIAP) priorities**

**Positive community attitudes and behaviours**

Increase awareness and education on disability inclusion, improve digital accessibility, and ensure public spaces are welcoming.

**Liveable communities**

Upgrade accessible toilets, pedestrian crossings, and public transport links. Expand housing, independent living options, and access to attractions.

**Support access to meaningful employment**

Expand disability employment programs, educate employers on inclusive hiring practices.

**Improve access to services**

Increase local health services, reduce GP wait times, improve transport to specialist care, and establish a disability services hub for easier access to support.

**Next steps**

Community members will have further opportunities to review and provide feedback on the Draft Community Strategic Plan 2040 and Draft Disability Inclusion Action Plan 2030 in Stage 2: Testing the Draft Documents. Council is committed to working collaboratively with the community to ensure a shared and inclusive future for Narrandera Shire.



How we engaged

## Project overview

**Stronger Together is a community engagement project designed to inform updates to Narrandera Shire’s Community Strategic plan and Disability Inclusion Action Plan, fostering a shared vision for the future and identifying ways to enhance accessibility.**

### Community Strategic Plan

The Community Strategic Plan (CSP) is a shared vision of what our community wants for Narrandera Shire for the future. It is reviewed every four years to align with community aspirations and priorities.

The current Our Narrandera Shire 2034 Community Strategic Plan (CSP) was prepared with the community in 2022. Narrandera Shire Council is currently engaging the community to review the CSP and create a vision through to 2040.

The CSP is the highest-level planning document required for NSW councils, outlining a minimum 10-year vision for the community’s aspirations. Although Council guides its development and houses it, the CSP is a community-owned plan that ensures public resources align with community priorities.

### Disability Inclusion Action Plan

The Disability Inclusion Action Plan (DIAP) outlines strategies to reduce barriers and promote participation for people with disability.

The current Our Disability Inclusion Action Plan 2022-2026 (DIAP) was developed in 2021, and Council is working with the community to create a new plan for 2030.

Required under the NSW Disability Inclusion Act 2014, DIAP focuses on fostering positive community attitudes and behaviours, creating liveable communities, enabling accessible employment, and improving access to services. The plan integrates these priorities into Council’s strategic planning, enhancing inclusivity and quality of life.

### Project stages

The Stronger Together project is being delivered across two stages:

1. **Stage 1:** Broad engagement
2. **Stage 2:** Testing the Draft documents.

Each stage incorporates community engagement, ensuring the Plan reflects the community’s aspirations and priorities. This document summarises the findings from Stage 1 engagement.

### Engagement objectives

The communications and engagement approach were guided by the Community Engagement Plan finalised by Narrandera Shire Council in October 2024.

The objectives of the engagement are to:

- Raise awareness of the project across those who live, work, and play in Narrandera Shire.
- Provide interested community members with an opportunity to contribute their views and identify long-term priorities for local identity, growth and lifestyle through to 2040.
- Use a variety of engagement techniques to connect with stakeholders within the Shire to gather a range of feedback on the long-term vision for their municipality.
- Use a variety of engagement techniques to connect with stakeholders within the Shire to gather a range of feedback to improve access within the shire.
- Effectively engage using the social justice principles of equity, access, participation and rights.
- Use targeted engagement approaches to connect with specific target groups, and relevant departments and agencies to identify how to deliver new strategic actions.

How we engaged

## Stage 1 engagement overview

**Between October and December 2024, Council shared project information and ways to get involved, and engaged with 183 people.**

The campaign employed a mix of methods, designed to reach a broad cross-section of the community and gather diverse, personalised perspectives. The five engagement methods included workshops, which accounted for most of the participants, as well as online surveys, pop-up sessions, interviews, and submissions.

Community members will have opportunity to review the Draft Community Strategic Plan and Draft Disability Inclusion Action Plan when they are released.

The engagement campaign was broadly publicised through a range of channels including media release, Council's website, social media promotion via Facebook, news articles in local media, flyers and posters distributed to businesses, direct mail to all residents, and formal and informal email networks and e-newsletters.

Both internal Council and community audiences were engaged, including Councillors, Council executive and officers, Council committees, people with disabilities, service providers, children and young people, business and community groups, women, and residents.

The same questions were used across each method to guide discussion and provide localised perspectives. Time and age-appropriateness meant that an abridged version of questions was asked at in-person engagements.

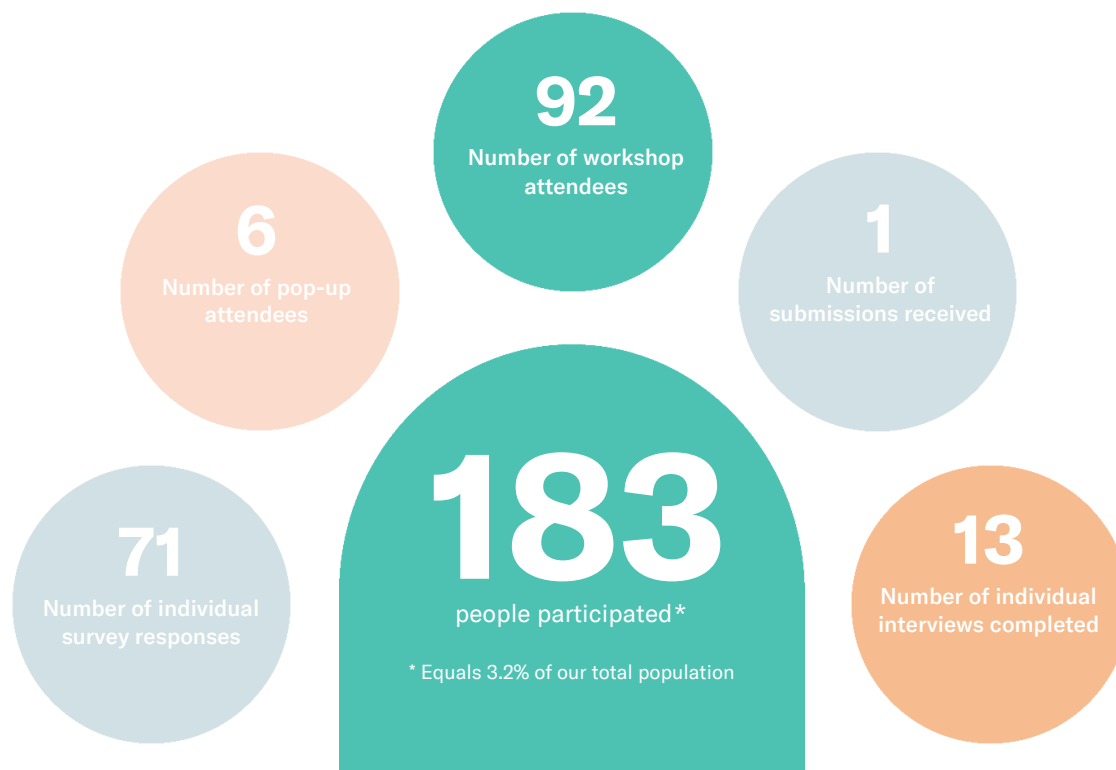


Table 1. Participation by activity

Name	Date	Location	Participation
<b>Joint project engagement</b>			
Workshop Narrandera	12 Nov 2024, 6-7:30pm	Narrandera Ex-Serviceman's Club, Bolton St, Narrandera	16
Workshop Barellan	13 Nov 2024, 6-7:30pm	Barellan and District War Memorial Club, Bendee St, Barellan	18
Workshop Narrandera	14 Nov 2024, 10-11:30am	Narrandera Ex-Serviceman's Club, Bolton St, Narrandera	10
Pop-up Narrandera	14 Nov 2024, 1-2:30pm	Keisling Lane, Narrandera	6
Workshop Grong Grong	14 Nov 2024, 6-7:30pm	Grong Grong Commemorative Halls, Balaro St, Grong Grong	3
Stakeholder meetings	26 Nov – 2 Dec 2024	St Joseph's Catholic Primary School, Narrandera Meals on Wheels, Narrandera Landcare	7
Submissions	21 Oct –2 Dec 2024	Various	1
Interviews	21 Oct –2 Dec 2024	Various	6
<b>CSP targeted engagement</b>			
CSP survey	21 Oct –2 Dec 2024	Online and hard copy.	55
Targeted workshop: Young people	26 Nov 2024, 11am-12:30pm	Narrandera High School, Elizabeth St, Narrandera	16
Targeted workshop: Council Committees	27 Nov 2024, 10-11:30am	Community Services Building, Victoria Ave, Narrandera	6
Targeted workshop: Business	26 Nov 2024, 4-5:15pm	Community Services Building, Victoria Ave, Narrandera	3
Workshop Narrandera	27 Nov 2024, 1-2:30pm	Community Services Building, Victoria Ave, Narrandera	0
Workshop Online	29 Nov 2024, 10-11:30am	Online (Microsoft Teams)	0
<b>DIAP targeted engagement</b>			
DIAP survey	21 Oct –2 Dec 2024	Online and hard copy.	16
Targeted workshop: People with disability	28 Nov 2024, 9:30-11am	Kurrajong Centre, East St, Narrandera	20
Workshop: Narrandera	28 Nov 2024, 1-2:30pm	Community Services Building, Victoria Ave, Narrandera	0
Workshop Online	29 Nov 2024, 12-1:30pm	Online (Microsoft Teams)	0
<b>Total</b>			<b>183 people</b>

**Who did we hear from?**

The profile of the participants shows a broad cross-section of the Narrandera Shire community were involved in terms of age, gender, location, and diversity characteristics.

Engagement activities were designed to enable broad participation (in-person, online and in writing, as well as at both structured

times, and at times that suited the participants). Consequently, participant demographic details were captured to varying degrees and some individuals may have participated in more than one engagement activity. The full suite of characteristics was collected through the survey and telephone interviews, partial demographic characteristics were collected through the pop-ups (age, gender, location), and the workshops (location).

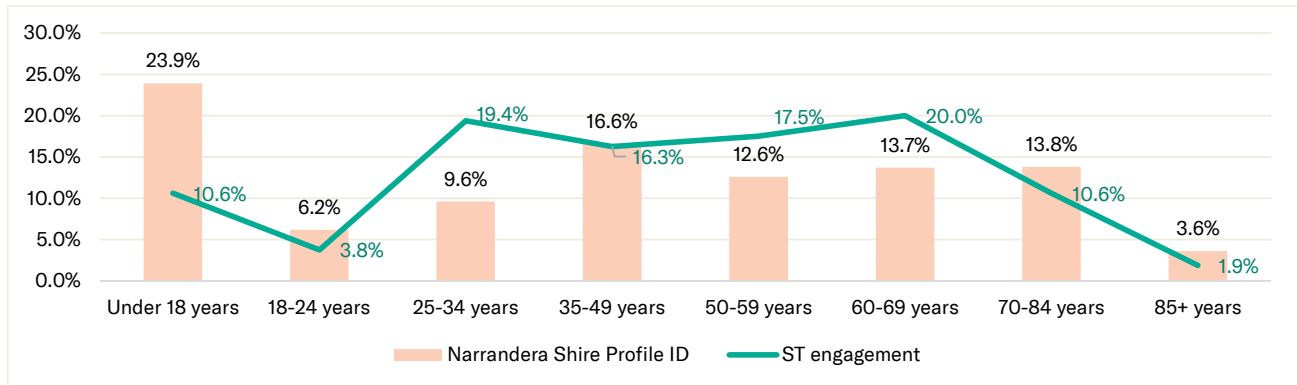


Figure 1. Respondent age

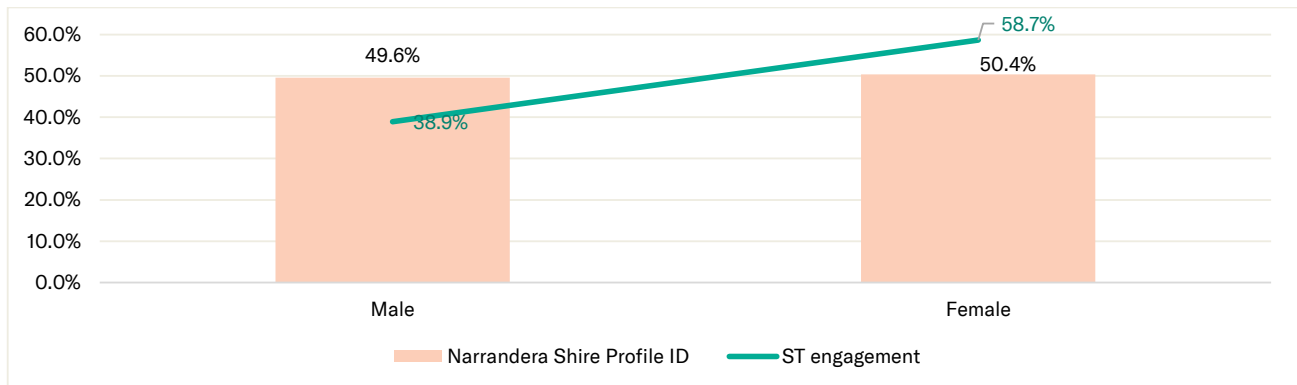


Figure 2. Respondent gender

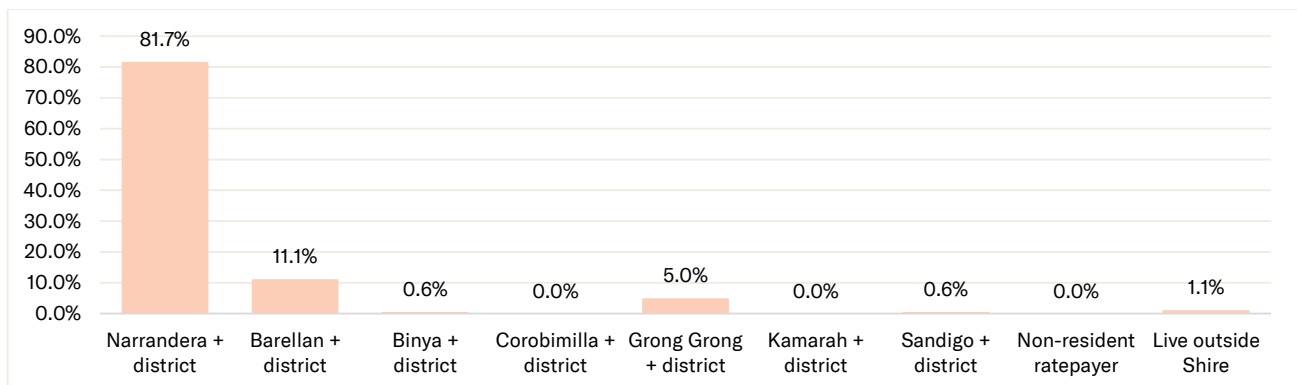
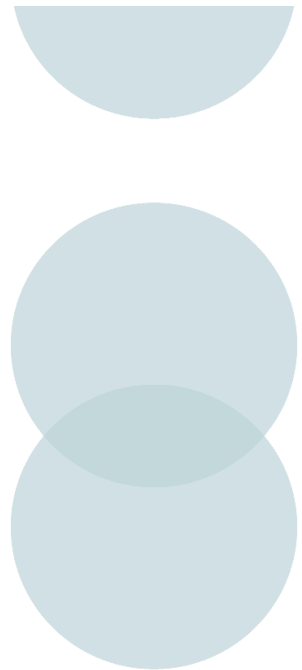


Figure 3. Respondent location

What we heard



**The engagement process provided valuable insights into the strengths, challenges, and priorities of the Narrandera Shire community.**

Qualitative insights and quantitative data have been combined to provide a comprehensive overview of the community’s current landscape and its roadmap for the future.

This section explores the findings, which are presented as follows:

- **Vision:** Feedback on the overarching community vision for Narrandera Shire.
- **Where are we now:** Explores the community’s current strengths and challenges.
- **Where do we want to be in 2040:** Key priorities for the future, reflecting the community’s collective goals for growth, sustainability, and inclusivity.
- **How will we get there:** Insights into services and projects that residents believe should be prioritised for Narrandera Shire.
- **For each CSP theme:** This section addresses the strengths, challenges and priorities for each of the five themes in the current CSP:
  - 1. Our community.
  - 2. Our environment.
  - 3. Our economy.
  - 4. Our infrastructure.
  - 5. Our civic leadership
- **For each DIAP theme:** This section addresses the strengths, challenges and priorities for each of the four themes in the current DIAP:
  - Positive community attitudes and behaviours.
  - Liveable communities.
  - Support access to meaningful employment.
  - Improve access to services.





What we heard

## Vision

The vision in the current CSP is: 'to preserve and enhance the lifestyle of our communities by encouraging, promoting and facilitating the sustainable development of the Shire'.

*Q. How do you feel about the vision in the endorsed Narrandera Shire Council Community Strategic Plan 2032? n=62*

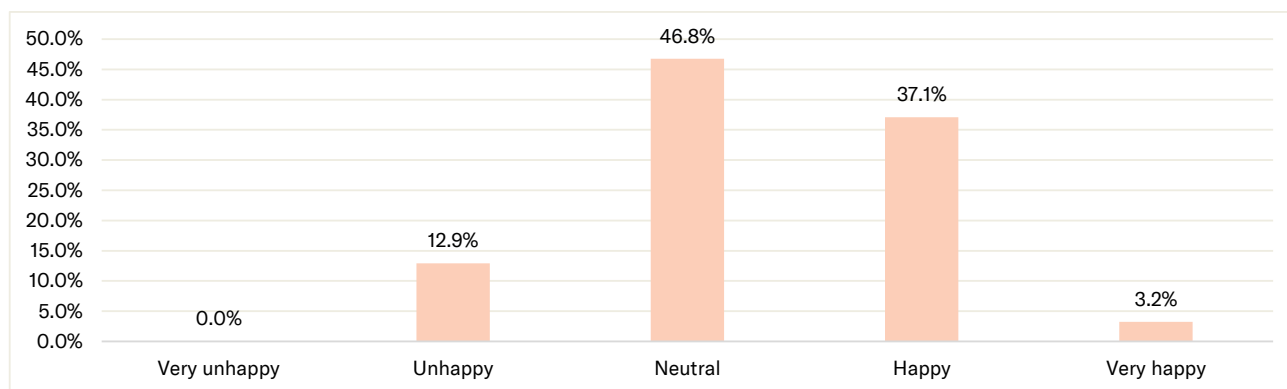


Figure 4. Vision satisfaction

Feedback from Narrandera Shire respondents suggested that the incumbent Vision required some refinement. The community recommend the following alterations or improvements to the vision.

- Make the statement shorter, sharper, and less wordy.
- Reword it to be memorable and more relevant to the community.
- Eliminate *dull, wishy-washy language*.
- Shift focus from soft terms like *encourage, promote, facilitate* to stronger action-oriented language such as *driving change*.
- Consider word replacements, including changing *enhance* to either *improve, progress*, and replacing *facilitating* with words like *advocating* or *enabling*.
- Remove redundant statements like *"We do this by Achieving Together."*
- Align the vision more closely with the aspirations listed in the CSP.
- Provide clarity or definition around the term *sustainability* as it has many interpretations.
- Avoid overly corporate or generic language.

What we heard

## Where we are now

### Strengths

We asked respondents “What makes your community a great place to live’ so that we could take a strengths-based approach to future planning and get clear on what we needed to protect and retain.

*Q. What makes your community a great place to live? n=117*

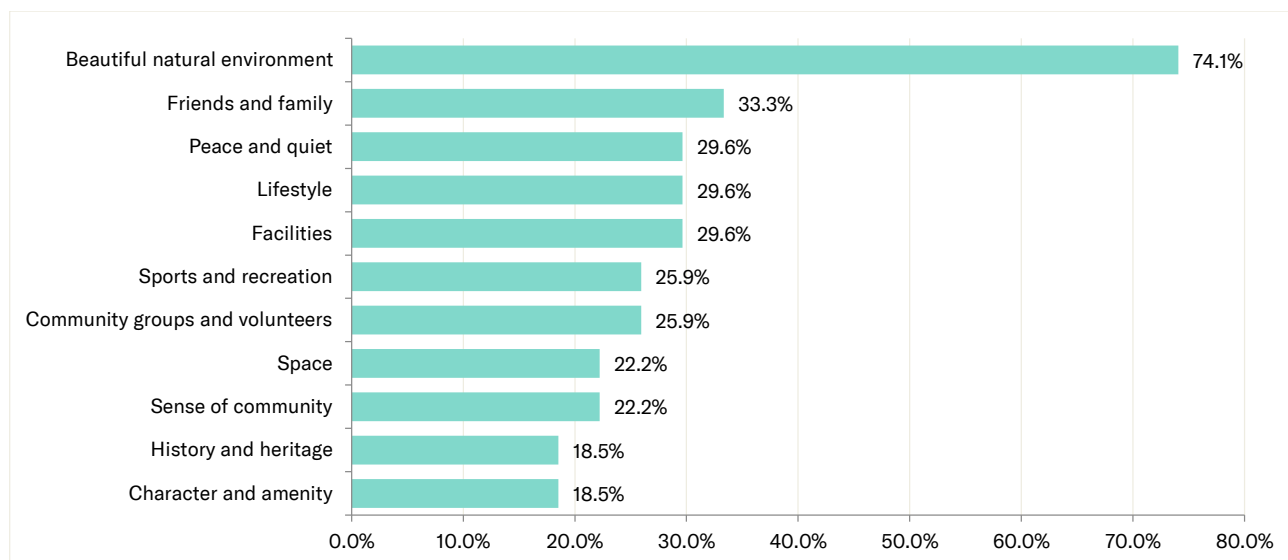


Figure 5. Strengths

The table below provides further detail on the top ten strengths.

Table 2. Strengths

Strength detail	
Strength	Detail
1. Beautiful natural environment	<ul style="list-style-type: none"> <li>– Respondents valued the natural environment, especially the beauty, waterways, bushland, wildlife and koalas.</li> <li>– Specific places mentioned included the Murrumbidgee River, Lake Talbot, Koori’s Beach, Five Mile, and the Rocky Water Holes.</li> </ul>
2. Friends and family	<ul style="list-style-type: none"> <li>– People are deeply connected to each other and value close strong personal ties to their family and friends.</li> </ul>

Table 2. Strengths

Strength detail	
Strength	Detail
	<ul style="list-style-type: none"> <li>- <i>"It's where my roots are".</i></li> </ul>
3. Facilities	<ul style="list-style-type: none"> <li>- Respondents appreciated the great facilities that support daily life, including schools, sporting and recreation facilities, parks, and community centres.</li> <li>- Quotes include <i>"Facilities for people," "Good school," "Education options,"</i> and <i>"Amenities and close facilities," "Lake Talbot Swimming Complex."</i></li> </ul>
4. Lifestyle	<ul style="list-style-type: none"> <li>- The attractiveness of the country lifestyle is focused around being easy going, good for raising families, and having a sense of safety.</li> <li>- Quotes include <i>"Freedom from the hustle and bustle of inner-city life,"</i> and <i>"Tidy and safe," "good place to bring up kids,"</i> and <i>"great country town".</i></li> </ul>
5. Peace and quiet	<ul style="list-style-type: none"> <li>- Respondents highlighted the appeal of a relaxed, slower pace of living with a lack of traffic, and reinforce the quiet, peaceful, and tranquil environment within the shire.</li> <li>- Quotes include <i>"A nice quiet town to live in,"</i> and <i>"Peaceful lifestyle."</i></li> </ul>
6. Community groups and volunteers	<ul style="list-style-type: none"> <li>- Community groups and the people who make them happen are seen as the backbone for connection and social support. Appreciation was given to the active participation of community members in creating a vibrant and connected society.</li> <li>- Quotes included <i>"Volunteer contributor," "Strong community groups," "Movers and shakers,"</i> and <i>"Volunteerism".</i></li> </ul>
7. Sports and recreation	<ul style="list-style-type: none"> <li>- The importance of sports facilities, sporting groups, recreational facilities, and outdoor activities were highlighted.</li> <li>- Specific mentions were made regarding football and netball clubs, netball team, pool, parks, golf, fishing, and walks.</li> </ul>
8. Sense of community	<ul style="list-style-type: none"> <li>- The welcoming atmosphere is evident for newcomers, who find it easy to integrate and feel at home. People feel safe and cared for with a strong and supportive social fabric.</li> <li>- Quotes include <i>"Sense of belonging," "Lovely people," "Safe for families to grow,"</i> and <i>"Caring community".</i></li> </ul>
9. Space	<ul style="list-style-type: none"> <li>- The Shire is celebrated for its lack of congestion and spacious living conditions.</li> <li>- Comments such as <i>"Open space," "Wide tree-lined streets,"</i> and <i>"Short travel time"</i> demonstrate the value placed on having room to breathe and move freely.</li> </ul>
10. Character and amenity	<ul style="list-style-type: none"> <li>- Respondents reflect pride in the shire's unique charm, aesthetic appeal, and comfort. Specific mentions were made of amenities that enhance the areas amenities such as footpaths, streetscapes, seating, and lighting.</li> <li>- Quotes included <i>"Narrandera is such a charming country town," "It's got so much personality," "Picture perfect,"</i> and <i>"Character and amenity"</i></li> </ul>

## Challenges

We asked respondents ‘What are the main challenges facing your community’ to gain insight into the challenges and changes affecting communities and their progress. These challenges arise at environmental, economic, societal and local levels. By identifying them, the Community Strategic Plan seeks to develop strategies that effectively address, adapt to, and respond positively to these challenges.

*Q. What are the main challenges facing your community? n=123*

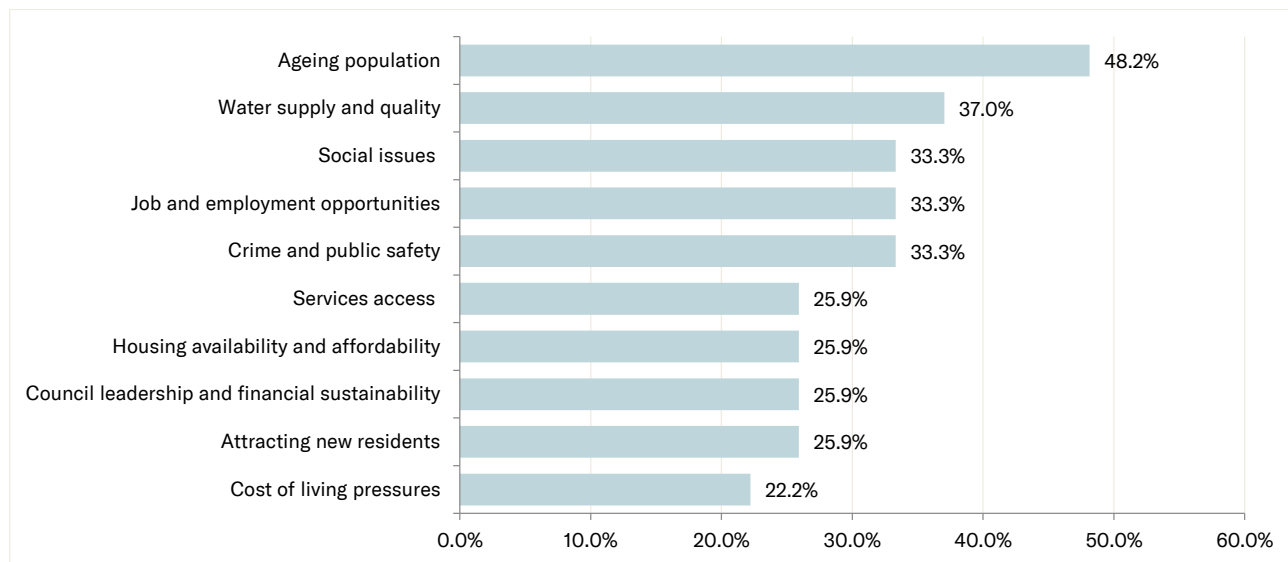


Figure 6. Challenges

The table below provides further detail on the top ten strengths.

Table 3. Challenges

Challenges detail	
Challenge	Key issue
1. Ageing population	<ul style="list-style-type: none"> <li>– Growing elderly population requiring aged care services and facilities.</li> <li>– Lack of independent living options and support for ageing in place.</li> <li>– Reduced volunteer base as people live and work longer.</li> <li>– Long-term implications for council services and workforce planning.</li> </ul>
2. Water supply and quality	<ul style="list-style-type: none"> <li>– Concerns about water taste, quality, and seasonal changes.</li> <li>– Limited focus on environmental sustainability and actions.</li> <li>– Need for improved drought resilience planning.</li> </ul>
3. Social issues	<ul style="list-style-type: none"> <li>– Drug addiction, domestic violence, and homelessness.</li> <li>– Social isolation, especially among the elderly and vulnerable populations.</li> <li>– Poor mental health support and high suicide rates.</li> <li>– Lack of cultural diversity and inclusion.</li> <li>– Community negativity and division (e.g., online criticism).</li> </ul>
4. Job and employment opportunities	<ul style="list-style-type: none"> <li>– Difficulty attracting and retaining skilled workers, including GPs and tradespeople.</li> <li>– Barriers to employment, especially in trades and apprenticeships.</li> </ul>

Table 3. Challenges

Challenges detail	
Challenge	Key issue
	<ul style="list-style-type: none"> <li>- Limited career opportunities for youth and professionals.</li> <li>- Business succession planning challenges due to ageing business owners.</li> </ul>
5. Crime and public safety	<ul style="list-style-type: none"> <li>- Rising petty crime, vandalism, theft, and drug abuse.</li> <li>- Limited police resources to address safety concerns.</li> <li>- Community concerns about safety and cohesion.</li> </ul>
6. Services access	<ul style="list-style-type: none"> <li>- Limited access to medical, dental, and specialist services.</li> <li>- Lack of childcare and out-of-school-hours care.</li> <li>- Constrained public transport options.</li> <li>- Need to travel to larger towns for essential services.</li> <li>- Gaps in services for vulnerable and elderly populations.</li> </ul>
7. Housing availability and affordability	<ul style="list-style-type: none"> <li>- Limited affordable and diverse housing options (e.g., smaller units for older people).</li> <li>- Lack of key worker and social housing.</li> <li>- Difficulty attracting businesses and professionals due to housing constraints.</li> </ul>
8. Council leadership and financial sustainability	<ul style="list-style-type: none"> <li>- Community negativity toward council decisions.</li> <li>- Reliance on grant funding for major projects.</li> <li>- Need for proactive leadership and transparent communication.</li> <li>- Clunky processes and outdated infrastructure (e.g., website and forms).</li> <li>- Financial strain in maintaining and improving services.</li> </ul>
9. Attracting new residents	<ul style="list-style-type: none"> <li>- Population decline and ageing population.</li> <li>- Lack of housing options for families and professionals.</li> <li>- Limited job opportunities and career diversity.</li> <li>- Perceptions of Narrandera as a poor or less attractive town.</li> <li>- Need for better promotion and town appeal.</li> </ul>
10. Cost of living pressures	<ul style="list-style-type: none"> <li>- Increasing costs of property, rates, and essential services.</li> <li>- Economic strain on younger families, older people, and farming communities.</li> <li>- Rising costs for businesses, including stock and staffing.</li> </ul>

What we heard

## Where we want to be in 2040

We asked two key questions to elicit where people want to be in ten years' time, and what their priorities are for the future:

*Q. What have you seen in another area that would work well in your community? n=22*

*Q. What would you like to see achieved in your community in the next ten years? n=116*

The key priorities for the Narrandera Shire, guiding its vision through to 2040 are outlined below in order of importance.

<p><b>1. Infrastructure and connectivity</b></p> <ul style="list-style-type: none"> <li>• Rectify water supply and quality concerns.</li> <li>• Enhance roads, footpaths, and pedestrian crossings and pathways to improve accessibility.</li> <li>• Upgrade streetscapes, public spaces and facilities.</li> <li>• Improve internet and mobile connectivity across the Shire.</li> <li>• Improve public and community transport options.</li> </ul>	<p><b>2. Better community and health services</b></p> <ul style="list-style-type: none"> <li>• Permanent mental health facilities.</li> <li>• Improved access to GPs and medical services.</li> <li>• Disability and aged care facilities (e.g., therapy pools, respite care, independent living options).</li> <li>• Better childcare and early childhood services.</li> </ul>	<p><b>3. Better Council</b></p> <ul style="list-style-type: none"> <li>• Stronger community engagement and partnership opportunities.</li> <li>• Improved communication and transparency with the community.</li> <li>• Modernised council website for easier access to services.</li> <li>• Financial sustainability to support long-term goals.</li> </ul>
<p><b>4. Economic growth</b></p> <ul style="list-style-type: none"> <li>• Attract diversified industries beyond agriculture.</li> <li>• Increase tourism opportunities (e.g., eco-tourism, nature-based tourism).</li> <li>• Support local businesses and improve retail offering, night-time economy and hospitality sector.</li> <li>• Encourage investment opportunities and expand industrial areas.</li> </ul>	<p><b>5. Education and training</b></p> <ul style="list-style-type: none"> <li>• Support for P-12 education and early childhood development.</li> <li>• Improved access to tertiary education and vocational training (e.g., buses to universities, online programs).</li> <li>• More programs to engage youth in education and training.</li> <li>• Focus on training to meet industry needs.</li> </ul>	<p><b>6. Employment</b></p> <ul style="list-style-type: none"> <li>• Create diverse employment opportunities to retain youth, increase employment diversity and wages.</li> <li>• Attract and retain skilled workers in key industries (e.g., trades, healthcare).</li> <li>• Support trainee and apprenticeship programs.</li> <li>• Promote local job fairs and resources for job seekers.</li> </ul>

**7. Environmental impact**

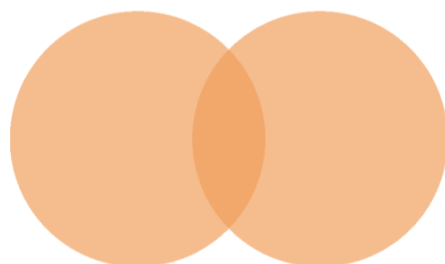
- Achieve 100% renewable energy and carbon neutrality.
- Implement kerbside FOGO collection services and green waste bins.
- Enhance environmental stewardship and protect natural assets.
- Conduct ecological restoration (e.g., koala habitats and wetlands).
- Develop community energy projects (e.g., mid-scale solar, battery storage).

**8. Events and entertainment**

- More for young people to do (e.g., cinemas, entertainment venues, outdoor events, bowling, splash parks).
- Arts and cultural opportunities (e.g., public art, cultural vibrancy).
- Expand community events calendar.
- Promote family-oriented and nighttime events.

**9. Housing for all**

- Increase affordable housing options for families and key workers.
- Support housing diversity, including small townhouses for older residents and medium-density housing.
- Address homelessness through public and social housing initiatives.
- Expand land availability for residential development.



What we heard

## How we will get there

Respondents were asked what services or projects should be prioritised for the Shire. A list was provided, and respondents were asked to select their top five (5) options. The top twelve responses are in the figure below.

*Q. What services or projects do you think should be prioritised for the shire? n=23*

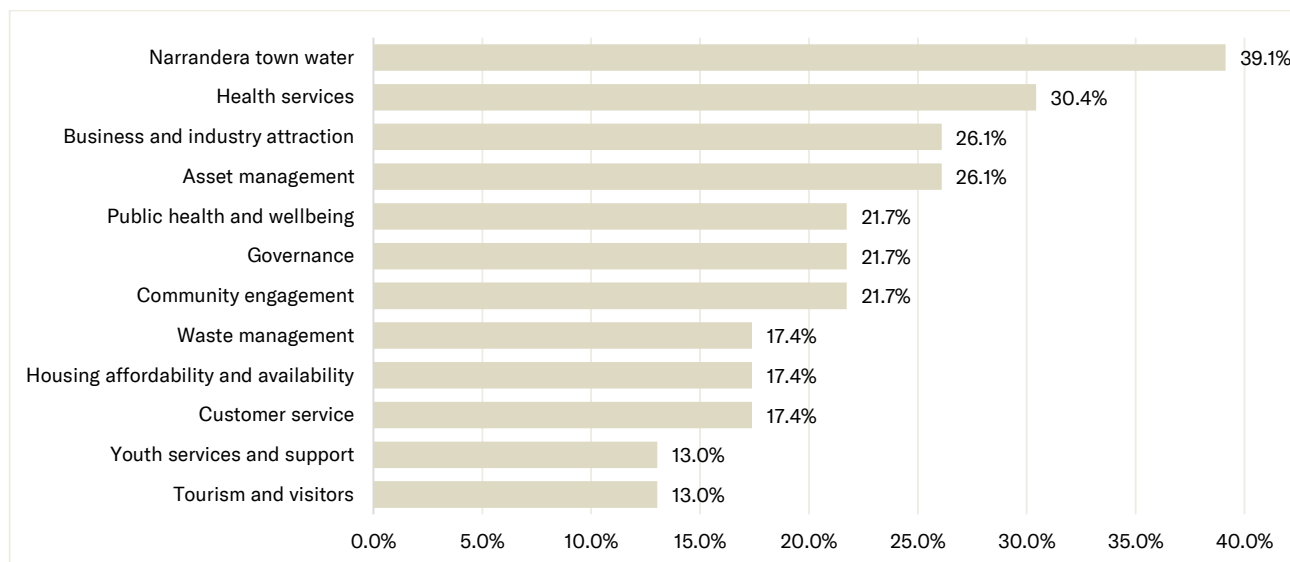


Figure 7. Services and projects

*“We deserve better tasting town water.”*

*“More doctors available, better health care.”*

*“Encourage more businesses and investment opportunities.”*

*“Clean up derelict properties.”*



**NSW Government services**

*Q. Thinking about NSW State Government services rather than Council services, how important are the following State Government Services to you? 1 is lowest importance, and 5 is highest importance. n=22*

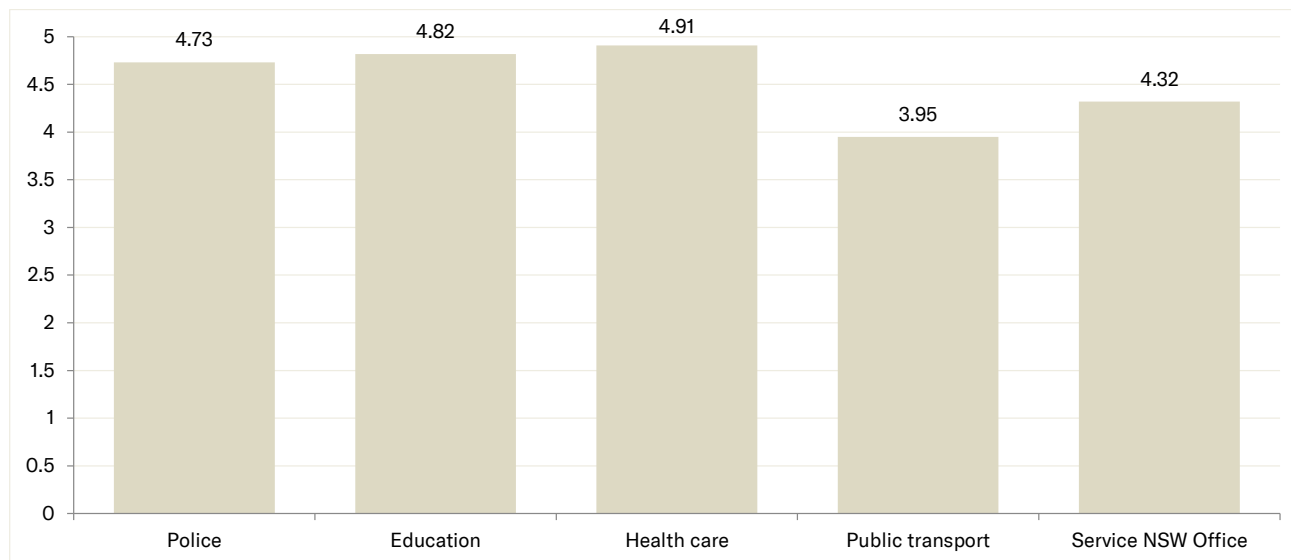


Figure 9. Importance of NSW Government services

*Thinking about NSW State Government services rather than Council services, how satisfied are you with the State Government's delivery of those services? 1 is lowest satisfaction, and 5 is highest satisfaction. n=22*

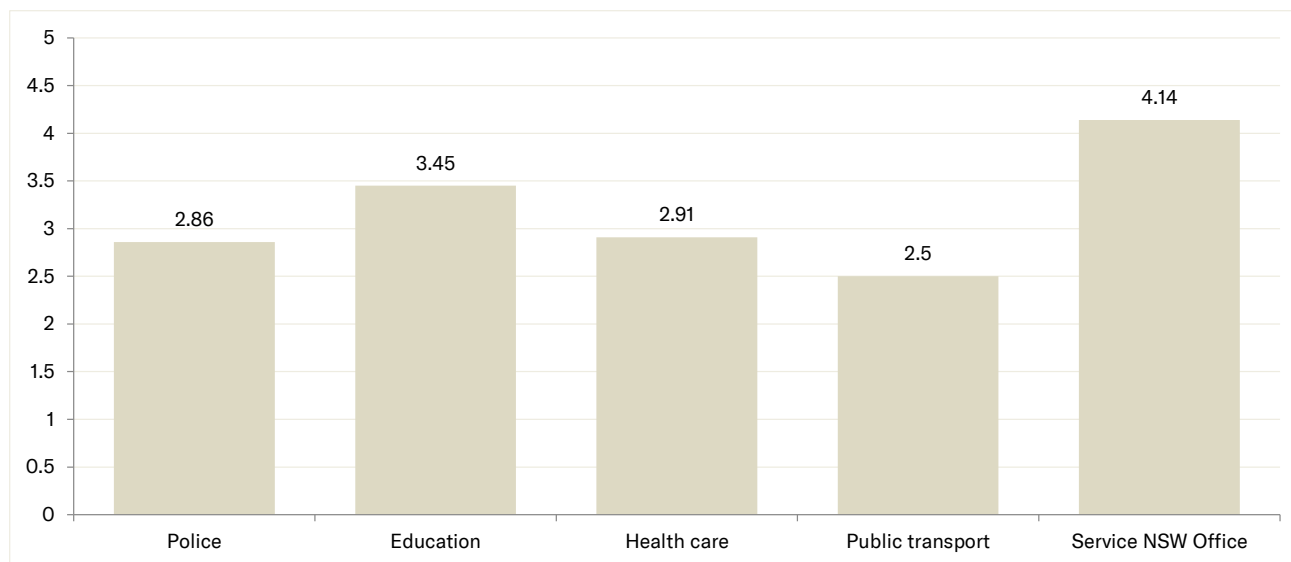


Figure 10. Satisfaction with NSW Government services

What we heard

## By the CSP themes

### 1. Our community

#### Current: Where we are now

- Friendly and welcoming people create a strong sense of belonging.
- An ageing population places increasing pressure on community services.
- Active community groups and volunteers support local connections and initiatives.
- Safe and family-oriented environment is valued.
- Limited access to mental health services and social support.
- Rising crime, including petty theft and vandalism, impacts community safety.
- Social isolation concerns, particularly for the elderly.
- Lack of activities and spaces for young people and families.

#### Future: Where we want to be in 2040

- We're a cohesive and inclusive community where everyone feels welcome and supported.
- Narrandera Shire is a great place to raise a family, offering a safe and supportive environment.
- When we're not feeling great, we can access high-quality medical and health services.
- We're connected to our family, friends, and neighbours, fostering a strong sense of belonging.
- Our cultural life is alive and vibrant, with diverse events, activities, and programs available.
- We celebrate together, with a vibrant calendar of events that bring people together.
- Our volunteer base is growing because we value and contribute to our great community.
- Residents can equitably participate fully in community life.
- Our young people can choose to stay in the Shire because there are opportunities for jobs and recreation.
- Our local community groups and clubs are strong, well-funded, and equipped with excellent facilities.

*“Narrandera is such a charming country town; it's got so much personality, and everyone is super friendly.”*

#### Priorities: How we will get there

- Increase police presence and resources in the Shire.
- Establish community-driven safety programs and neighbourhood watch initiatives.
- Provide more family-friendly spaces and amenities, such as parks, playgrounds, and splash parks.
- Expand childcare options and early childhood programs.
- Attract and retain healthcare professionals, including GPs and mental health specialists.
- Establish a permanent mental health service within the Shire.
- Increase community events and gatherings, ensuring the venues and programming are accessible and promote social connection.
- Ensure all public spaces and events are accessible to people with disabilities.
- Establish annual signature events or expand free or low-cost events to bring people together.
- Strengthen programs to reduce social isolation, particularly for the elderly.
- Support local arts, music, and cultural festivals.
- Develop arts and cultural spaces.
- Provide support and recognition programs for volunteers.
- Strengthen partnerships with local community groups to increase volunteer participation.
- Create youth-oriented programs and spaces.
- Provide pathways for employment and education.
- Increase funding and grant opportunities for community groups.
- Upgrade facilities for sports, arts, and cultural clubs.
- Promote initiatives that celebrate diversity and inclusion.

*“We need more for young people to do in town. Losing more young people once they leave school is a real issue.”*

## 2. Our environment

### Current: Where we are now

- The Shire’s natural beauty, including rivers, rural landscapes, and open spaces, is a key strength.
- The Murrumbidgee River, Lake Talbot, Koori’s Beach, Five Mile, and the Rocky Water Holes. are deeply appreciated for their environmental and recreational values.
- Climate resilience challenges, including drought and flood impacts.
- Underutilised natural assets for recreation and tourism.
- Insufficient shade and tree canopy in urban areas.
- Limited focus on renewable energy and ecological restoration initiatives.
- Limited shade and tree canopy cover in urban areas.

### Future: Where we want to be in 2040

- Our natural assets are thriving and well-cared for, with enhanced access to rivers, parks, and open spaces.
- Our koala population is protected and continues to thrive.
- We lead in sustainability, with renewable energy and ecological restoration at the forefront.
- Climate resilience is embedded in our way of life, with shaded urban areas and cooling zones.
- We enjoy the outdoors with pathways, boardwalks, and accessible facilities connecting us to nature.
- Our Shire is a recognised eco-tourism destination, showcasing its unique environment and biodiversity.
- We protect and celebrate our environment for future generations.

### Priorities: How we will get there

- Upgrade and maintain walking/running/cycling tracks, particularly connecting Brewery Flats to The Common.
- Improve wayfinding signage around town and at natural sites.
- Increase investment in weed control, habitat restoration, and native revegetation.
- Conduct staged repair and revegetation of the koala reserve and its neighbouring areas.
- Strengthen protections for key koala habitats through conservation programs.
- Expand community awareness initiatives on koala conservation.
- Introduce kerbside FOGO collection services to reduce landfill waste.
- Encourage investment in solar projects and community battery storage.
- Expand the urban tree canopy by implementing a street tree planting program.

- Develop cooling corridors in public spaces by using native vegetation.
- Introduce water-sensitive urban design solutions, such as spongy city concepts, to absorb and filter stormwater.
- Develop accessible fishing spots with stable, flat areas and designated disability parking.
- Install pedestrian crossings at key areas, including north of Coles and near IGA, Kurrajong, and the library.
- Improve existing parks by adding shade, seating, and picnic facilities.
- Develop and promote nature-based tourism, such as hiking trails to Bogoalong Range and guided river experiences.
- Invest in ecotourism infrastructure, such as observation decks, interpretive signage, and visitor-friendly amenities.
- Strengthen tourism partnerships to market Narrandera as an eco-tourism destination.
- Conduct an audit of ecological hotspots and develop targeted conservation strategies.
- Implement community-led tree planting and restoration programs.
- Expand environmental education and awareness campaigns, including native species protection and sustainability initiatives.

*“The Murrumbidgee River, Lake Talbot, and Rocky Water Holes are amazing, but they’re underutilised. We could do so much more with these natural assets.”*

*“Water quality is questionable—the taste is bad, and we need a more reliable supply.”*

*“We need more shade and tree planting in urban areas—our streets get too hot in summer.”*

### 3. Our economy

**Current: Where we are now**

- Strategic location near regional centres and major highways.
- Limited job diversity, with a reliance on agriculture and retail.
- Underdeveloped tourism sector and visitor amenities.
- Rising costs of living create financial stress for residents and businesses.
- Challenges in attracting and retaining skilled workers.
- Declining population limits workforce availability and economic resilience.

**Future: Where we want to be in 2040**

- We have a thriving, diversified economy with industries beyond agriculture.
- There are plenty of local job opportunities.
- Young people choose to stay in the Shire to work and live.
- Our town is a vibrant destination for visitors, with strong tourism infrastructure and eco-tourism options.
- Businesses thrive in our community, supported by proactive policies and infrastructure.
- Our local shops, eateries, and services provide a wide range of options to meet community needs.
- Our prosperity comes from bold and creative thinking about ways to drive our economic growth.
- Families and businesses choose Narrandera Shire for its opportunities and lifestyle.

**Priorities: How we will get there**

- Attract and support new industries, including manufacturing, renewable energy, and technology.
- Expand the Red Hill Industrial Estate to encourage business investment.
- Develop a Local Housing and Employment Strategy to support workforce growth.
- Provide targeted business incentives to create new jobs in emerging industries.
- Establish a jobs fair to connect employers with job seekers.
- Promote vocational training and apprenticeships in trades, hospitality, and emerging sectors.
- Strengthen education-to-employment pathways through local TAFE and university partnerships.
- Support youth engagement programs that foster leadership, entrepreneurship, and innovation.
- Develop more entertainment and lifestyle options to appeal to younger demographics.
- Improve tourism marketing and branding to promote Narrandera as a must-visit destination.

- Invest in eco-tourism opportunities, such as guided river tours and wildlife experiences.
- Develop and enhance key visitor amenities, including RV and caravan facilities, signage, and streetscape improvements.
- Streamline business approval processes to encourage new business startups.
- Modernize Council services, including an improved business-friendly website.
- Establish small business support networks to foster collaboration and knowledge-sharing.
- Encourage more diverse retail and dining options through business grants and incentives.
- Activate the main street with pop-up shops, food vendors, and cultural events.
- Improve parking, shade, and accessibility in shopping precincts to enhance the customer experience.
- Foster partnerships with state and federal governments to attract economic development funding.
- Support community-led initiatives that enhance economic opportunities.
- Encourage sustainable business practices and investment in green industries.
- Improve housing affordability and availability to attract new residents.
- Enhance digital connectivity (internet and mobile coverage) to support remote work and business expansion.
- Promote Narrandera as a great place to live, work, and invest through targeted marketing campaigns.

*“We need to attract more industry and employment opportunities to retain young people and bring in new residents.”*

*“Tourism is an untapped opportunity—we need to improve our attractions, accommodation, and promotion to get more visitors to stop and stay.”*

*“Businesses are struggling. Owners are working longer hours instead of hiring staff because costs are too high.”*

## 4. Our infrastructure

### Current: Where we are now

- Concerns over water quality, including taste and reliability of supply.
- Valued community assets, such as parks, sporting facilities, and the library, support a rural lifestyle.
- Minimal traffic and easy navigation within the town.
- Poor road conditions and ageing water and sewer systems require upgrades.
- Limited footpaths and pedestrian crossings hinder accessibility and mobility.
- Public transport options are minimal, reducing connectivity within and outside the Shire.
- Parks, gardens, and sporting facilities are highly valued for promoting an active and connected lifestyle.
- The libraries and riverfront areas are considered integral to community wellbeing.
- The Shire’s infrastructure supports a relaxed, country feel that the community is eager to maintain.
- Streetscapes and town centres need revitalisation to attract visitors and businesses.

### Future: Where we want to be in 2040

- Our water tastes great, is safe, and is readily available through improved supply systems.
- We can move around the community easily due to quality, connected roads and active paths and trails.
- Public transport is reliable and connects us to regional centres and opportunities.
- Our town centres are vibrant meeting places that attract visitors and locals alike.
- Staying connected is a breeze due to our excellent mobile and internet connectivity.
- We are resilient to floods and extreme weather events well due to our modern and maintained drainage systems.
- Community assets like parks, splash parks, and playgrounds are inclusive, modern, and utilised.
- Infrastructure meets the needs of all residents, including people with disabilities and the elderly.
- Our Shire is well-equipped to handle growth while maintaining its unique rural charm.

### Priorities: How we will get there

- Upgrade water treatment infrastructure to improve taste and reliability.
- Ensure long-term investment in sustainable water management and supply security.
- Repair and maintain key road networks.

- Upgrade drainage infrastructure to prevent flooding and damage.
- Ensure new developments incorporate flood resilience measures.
- Upgrade footpaths and create dedicated pedestrian and cycling trails, linking key areas such as parks, schools, and shopping districts.
- Improve pedestrian crossings in high-traffic areas, such as corner King and Easts Streets, Narrandera).
- Advocate for improved public transport connecting to major centres such as Wagga Wagga and Griffith.
- Improve community transport services, especially for elderly and mobility-restricted residents.
- Revitalise the Main Street precinct with enhanced lighting, seating, and improved accessibility.
- Increase shade through street tree planting programs.
- Enhance outdoor dining, public art, and event spaces.
- Advocate for improved digital infrastructure, including better mobile reception and high-speed internet access.
- Work with telecommunications providers to address black spots and unreliable connections.
- Establish public Wi-Fi in key community areas.
- Implement sustainable urban design solutions, such as permeable pavements and rain gardens.
- Develop a splash park and improve existing recreational facilities.
- Upgrade Narrandera Pool with improved accessibility, including a pool hoist.
- Increase shade, seating, and amenities in parks and playgrounds.
- Install accessible fishing platforms with stable, flat areas and designated disability parking.
- Install adult change facilities in public toilets.
- Ensure all new and upgraded infrastructure meets accessibility standards.
- Plan for future population growth by investing in infrastructure upgrades.
- Maintain the rural character of the Shire while allowing for sustainable development.

*“Street needs shade and beautification— it’s the heart of our town, and it should be welcoming for visitors and locals.”*

*“Public transport doesn’t connect us to the services we need.”*

## 5. Our civic leadership

### Current: Where we are now

- The community values ethical and transparent governance.
- Concerns over limited communication and consultation with residents.
- Perceptions of disconnected and reactive decision-making.
- Need for modernised Council systems and processes to improve efficiency.
- Frustrations with a lack of forward-thinking strategies to address key challenges.

### Future: Where we want to be in 2040

- We trust our leaders to make decisions that reflect our values and priorities.
- Council displays organisational excellence and is financially sustainable.
- Our Council is transparent and communicates effectively with the community.
- We are proud of our Council's service delivery which remains relevant to our needs.
- operations are modern and efficient, with easy access to services and information.
- Community engagement is regular, meaningful, and provides opportunities for everyone to participate.
- Diverse leadership, including representation from women and young people, reflects our community's makeup.
- Innovative and forward-thinking strategies address long-term challenges and opportunities.
- Collaboration and partnerships drive positive change.
- Resistance to change from vocal minorities, slowing progress.

### Priorities: How we will get there

- Ensure decision-making processes are transparent, with clear explanations of Council actions and priorities.
- Establish community advisory panels to provide input on major projects and policies.
- Improve financial transparency by providing clear, accessible reporting on Council spending and budget allocations.
- Secure diverse funding sources, including grants and partnerships, to reduce reliance on rate increases.
- Implement long-term financial planning to ensure sustainable service delivery.
- Improve Council's website and online platforms to provide easy access to information, forms, and services.
- Expand digital and social media engagement to reach more residents.
- Implement a regular community newsletter to keep residents informed about key issues and upcoming projects.

- Ensure Council services are responsive to community needs.
- Streamline customer service processes to provide more online and self-service options.
- Reduce bureaucracy and simplify Council forms and approval processes.
- Strengthen community consultation and engagement processes to involve all voices.
- Provide multiple engagement channels, including online, in-person, and written submissions, to ensure accessibility.
- Actively promote leadership opportunities for underrepresented groups, including women and young professionals.
- Encourage youth participation in Council through mentorship programs or a youth advisory group.
- Support leadership development initiatives within the community.
- Develop strategic plans that proactively address population decline, economic shifts, and infrastructure needs.
- Foster a culture of innovation by exploring new approaches to governance and service delivery.
- Use data and evidence-based decision-making to guide long-term planning.
- Strengthen relationships with state and federal governments to advocate for local priorities.
- Partner with local businesses, community groups, and non-profits to deliver shared projects and services.
- Encourage regional collaboration to address common challenges and opportunities.

*“The Council needs to be more proactive and less reactive. It often seems to respond to a handful of vocal people instead of looking at the bigger picture.”*

*“We don't feel heard. Communication from the Council is limited, and there's not enough consultation with the community.”*

*“Council needs to modernise—its website is outdated, and a lot of forms are still on paper. Other councils are way ahead in digital services.”*

What we heard

## By the DIAP themes

**While Narrandera Shire is a welcoming community with strong social values, there are significant barriers to accessibility, employment, and service provision for people with disabilities.**

Improvements in infrastructure, transport, employment opportunities, and healthcare access will be essential to fostering a truly inclusive and liveable community for all residents.

### 1. Positive community attitudes and behaviours

*“People are generally supportive of those with disabilities, but more education is needed so businesses and organisations know how to be more inclusive.”*

*“The NDIS has been a game changer for some, but there are still gaps in awareness and understanding of how to access services.”*



#### Key findings

- The National Disability Insurance Scheme (NDIS) has increased awareness and support for people with disabilities, allowing more individuals to access services that enhance their quality of life.
- Community members generally have positive attitudes towards people with disabilities, fostering an inclusive atmosphere.
- Increased visibility of disability supports has led to greater community understanding of accessibility needs.
- Recognising premature homelessness has helped identify and assist vulnerable individuals with disabilities who require additional support.
- Many businesses and community groups show a willingness to be inclusive but lack the knowledge or resources to fully accommodate people with disabilities.
- More training and awareness campaigns are needed to educate businesses, schools, and the wider community on the challenges faced by people with disabilities.
- Ongoing education is needed to address social stigma and promote a culture of inclusion and respect.

## 2. Liveable communities

*“We have beautiful parks and natural spaces, but they’re not accessible to everyone. We need better paths, ramps, and disability-friendly picnic areas.”*

*“Footpaths and pedestrian crossings are lacking, making it hard to walk around safely, especially for older residents and people with disabilities.”*

### Key findings

- There are no adult change rooms in public toilets across the Shire, and public toilets are either locked or close too early.
- Many businesses in the Shire have steps, heavy doors, and tight spaces making entry difficult for people with disability.
- Laneways near Vinnies Fruit Shop and other parts of town are difficult to access.
- Illegal use of disability parking spaces is a persistent issue, making it difficult for those who genuinely need the spaces.
- A 40km/h speed limit and installing a pedestrian crossing near IGA and Kurrajong would make East Street easier to cross.
- More footpaths, ramps, and level paths are needed throughout town, particularly beyond main streets.
- Dark intersections and poorly lit areas are safety risks, and better street lighting is required.
- Housing independence units and more affordable, accessible housing are needed for people with disability.
- Many of Narrandera’s natural attractions are inaccessible. Suggested improvements include accessible fishing spots with disability parking, flat stable areas, and clear entry points, and boardwalks and ramps to key natural attractions.
- The Narrandera Pool lacks a hoist, preventing people with mobility impairments from using the facility.
- Neurodivergent children need fenced playgrounds, as they are prone to running into unsafe areas.
- Better promotion of existing accessibility features, such as available services and accessible facilities, would help people with disability navigate the Shire.
- Community events could be made more inclusive, ensuring people with disability can fully participate in local festivals, markets, and sporting events.

## 3. Support access to meaningful employment

*“I want to work, but finding an employer who understands disability support and job modifications is really difficult.”*

*“Some businesses, like Coles, hire people with disabilities, but we need more workplaces to give us a chance.”*

### Key findings

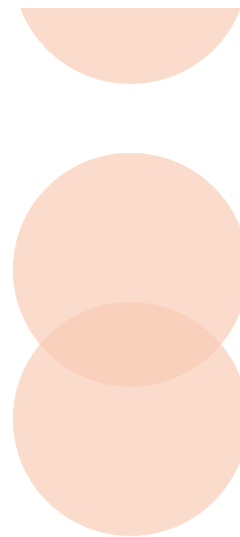
- Employment opportunities for people with disability remain extremely limited, and many businesses don’t offer positions.
- Some businesses, such as Coles, employ people with disability, but many other employers are hesitant due to a lack of understanding of available supports.
- More training and skill development programs would help people with disability transition into meaningful employment.
- Employers need better awareness of disability employment needs, including information about workplace modifications and government funding options.
- People with disability are eager to work and deeply appreciate the businesses and organisations that provide them with opportunities.
- Barriers to employment include employers not understanding how to accommodate employees with disabilities, the lack of suitable job opportunities, and difficulties navigating the job-seeking process.
- Many businesses provide employment experiences for people with disabilities, including East Street Primary School, Narrandera Ex-Servicemen’s Club, Altina Wildlife Park, Narrandera Hospital, Golf Club, Spirit FM, Fusion Café, Council, Meals on Wheels, the nursery, and Subway.
- Provide incentives to businesses to make workplaces more accessible and to hire people with disability.
- A disability employment awareness program should be introduced to inform businesses and the community about inclusive employment opportunities.
- Job-seeker support programs tailored to people with disability could help connect them with career opportunities.
- Flexible working arrangements and remote work options could enable greater workforce participation.
- Transport barriers limit employment opportunities, as people with disability may not have reliable means of getting to and from work.



#### 4. Improving access to services

*“Getting a GP appointment takes weeks. It’s exhausting trying to find someone who understands my needs.”*

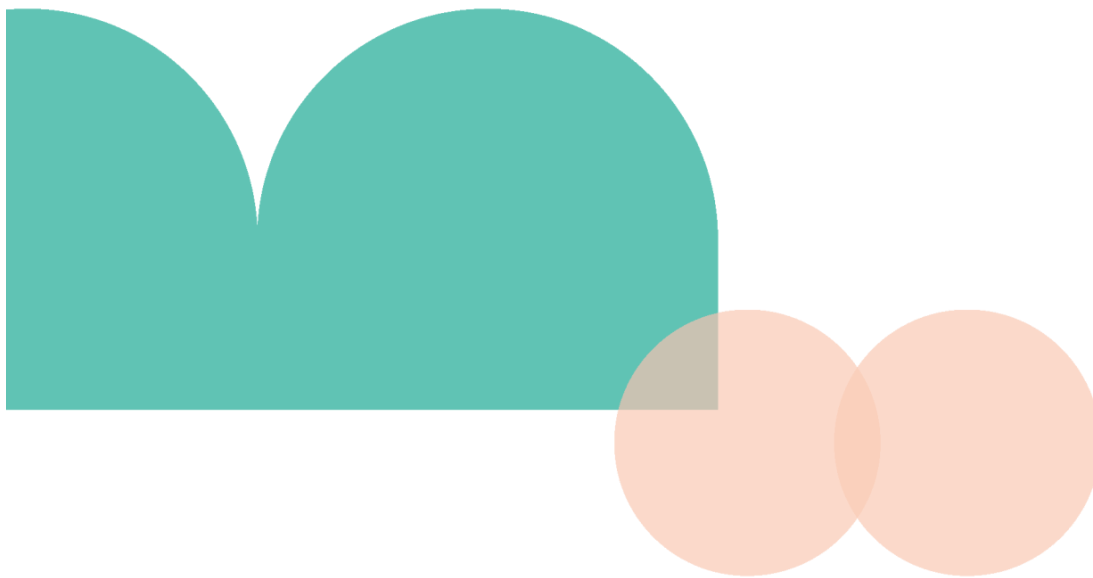
*“Even if you don’t drive, it’s almost impossible to get to medical appointments in Wagga or Griffith.”*



##### Key findings

- Accessing healthcare is a major challenge, with GP appointments taking up to six weeks, a lack of continuity of care, and language barriers affecting people with disability.
- The hospital is understaffed, with no doctor on-site and nurses unable to perform doctors’ roles.
- Allied health services (especially speech pathology, physiotherapy, occupational therapy) are extremely limited, requiring frequent travel to Leeton or Wagga.
- There is no public dental service in the Shire, forcing residents to travel to Wagga or Griffith for care.
- A heated pool is needed for hydrotherapy and rehabilitation.
- Public transport is inadequate. For example, the railway bus to Wagga does not allow for a full-day trip, restricting access to medical appointments.
- More frequent transport services to Leeton, Griffith and Wagga are needed to access to medical services.
- Access to community transport should extend to aged care residents.
- Centrelink is not accessible in-person within the Shire, requiring residents to travel to Leeton for services.
- More mental health services are needed, particularly for people with disability who require ongoing support.
- More disability support services are required to assist people in daily life, from personal care to employment assistance.
- Specialist disability services such as early intervention for children is lacking, forcing families to travel long distances for basic support.
- Better coordination between disability service providers is needed to ensure people are support without delay.
- Improve digital accessibility, ensuring website provide clear, easy-to-read, and screen-reader-friendly content for people with visual impairments.





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# Treatment Options Report

## Narrandera Water Treatment Plant

SSWP243 - Narrandera Shire Council - IWCM Strategy – project



Report Number: P-FY20220803-PWO-WAT-RP-002-01

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Prepared for:



NSW Public Works



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*Cover photo: Existing Narrandera treatment arrangement (Source: NSW PW)*

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## Executive summary

### Project Overview

The Narrandera Water Treatment Plant (NWTP) Treatment Options Report evaluates treatment solutions to address water quality challenges and meet future demands. The project is part of SSWP243 - Narrandera Shire Council's IWCM Strategy.

### Current System Assessment

The existing water supply relies on bore water treated through basic aeration and chlorination. Major challenges include:

- Frequent customer complaints about taste, odour and discoloured water.
- High iron and manganese levels exceeding ADWG aesthetic limits.
- Hydrogen sulphide causing taste and odour issues and chlorine residual control issues.
- Aquifer contamination during 2022 floods leading to E. coli presence and elevated turbidity.

### Design Requirements

The new NWTP will be designed to:

- Treat both Murrumbidgee River water (primary source) and bore water (backup).
- Design capacity of 12.9 ML/day.
- Meet Category 4 Health Based Targets requiring:
  - 5.0 log removal for protozoa.
  - 6.0 log removal for bacteria and viruses.

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### Treatment Options Analysis

Four treatment configurations were evaluated:

1. Conventional clarification with media filtration.
2. Inclined plate clarification with media filtration.
3. Lagoon sedimentation with media filtration.
4. Dissolved air flotation with media filtration.

All options include UV disinfection and chlorination for pathogen control.

### Recommendation

Based on multi-criteria analysis considering technical, operational and economic factors, Option 3 (lagoon sedimentation) emerged as the preferred solution offering:

- Lowest capital and operating costs.
- Simplified operations and maintenance.
- Proven performance in regional NSW applications.
- Integrated residuals management through sludge drying lagoons.

The high-level cost estimate for a 12.9MLD lagoon sedimentation plant is in the order of \$30.5M including 30% contingency.

### Next Steps

The project will proceed with:

- Development of detailed concept design.
- Section 60 approval application submission.
- Preparation of Design & Construct tender specifications.

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## 1 Introduction

### 1.1 Purpose of this Document

As part of the SSWP243 - Narrandera Shire Council - IWCM Strategy project for the proposed new Narrandera Water Treatment Plant (NWTP), NSW Public Works (NSW PW) was engaged to produce a scoping study/ options report.

The purpose of this options/scoping document is to:

- Identify the water quality risks referring to the recently produced Narrandera water quality report by NSW PW.
- Provide details of the candidate treatment options available for the new NWTP.
- Present the multi-criteria assessment (MCA) procedure that will be used by the stakeholders to score each identified treatment option.
- Provide the summary MCA and provide recommendations about the selected treatment arrangement for the new NWTP.

Due to the time constraints, the workshop will be held later after the draft options/scoping report is circulated among interested stakeholders.

The finalised scoping/ options report will then be prepared. That document will be included in the submission for the Section 60 application for the new Narrandera WTP.

### 1.2 Existing Narrandera Water Supply/ Treatment

Narrandera Shire Council (NSC) provides reticulated potable water supply to the town of Narrandera and to rural residential properties on the outskirts of the town.

NSC currently have 5 production bores Bore #1, #2B, #3, #4 and #5.

Raw water is pumped from four (4) bores (bores 1, 2B, 3, and 5) for the treatment plant. Bore 4 is used for non-potable use and is blended with recycled water without any treatment. Bores 2B and 5 are combined and aerated via a packed aeration tower (Aeration Tank #1) to remove hydrogen sulphide and oxidise dissolved iron and manganese into particulate form. Bores 1 and 3 are combined and feed to a second packed aeration tower (Aeration Tank #2) similarly to the other process. The towers are rated for 70 L/s and 110 L/s. Chlorine is dosed after aeration and after the balance tank. There is an additional chlorine booster station after the Dalgetty St low level reservoirs. Aerated water is stored in a 2 ML balance tank before being pumped into the distribution system via clear water pumps.

Narrandera WTP treatment process is shown in the following Figure 1-1.

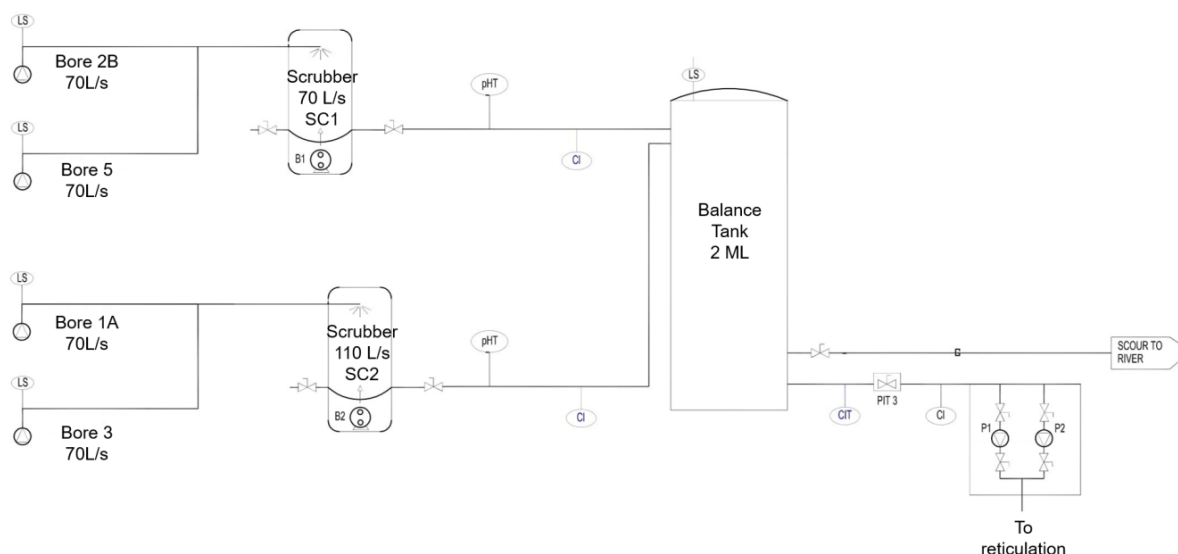


Figure 1-1: Narrandera WTP flow diagram

1.2.1 Catchment

NSW Health assesses catchments used for drinking water on behalf of local water utilities to allow treatment health-based target (HBT) be identified for pathogens. NSW Public Works has requested Narrandera Shire Council to obtain HBT assessment of bore and river catchments at Narrandera. HBT assessment of bore and river catchments is essential to scope treatment requirements for the new Narrandera WTP.

Pathogen risk is determined by NSW Health, in line with Health Based Targets (HBT) which are now included in the Australian Drinking Water Guidelines (ADWG). It is expected that the Narrandera catchment (both bores and river) will be assumed at this stage as Category 4 (High Risk), which requires pathogen log removal (LRV) of 5.0, 6.0 and 6.0 for protozoa, bacteria and viruses respectively.

1.2.2 Existing Distribution systems

There are five reservoirs including the 2 ML balance tank shown in Figure 1-1 in the Narrandera distribution system presented in Figure 1-2.

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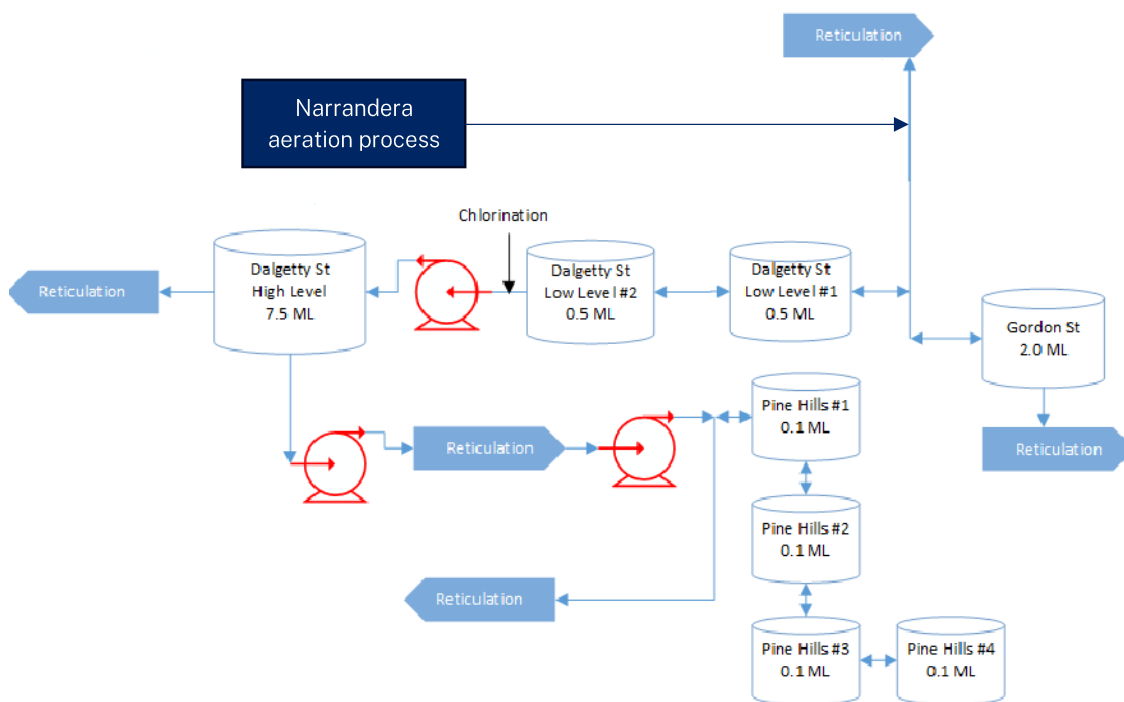


Figure 1-2: Distribution system at Narrandera (CWT, 2017)

## 2 Proposed new Narrandera WTP

### 2.1 Limit of contract

Council’s preference is to go for a design and construct (D&C) tendering process for construction of the NWTP.

The Figure 2-1 below shows the proposed pipeline arrangement and WTP infrastructure for the proposed NWTP.

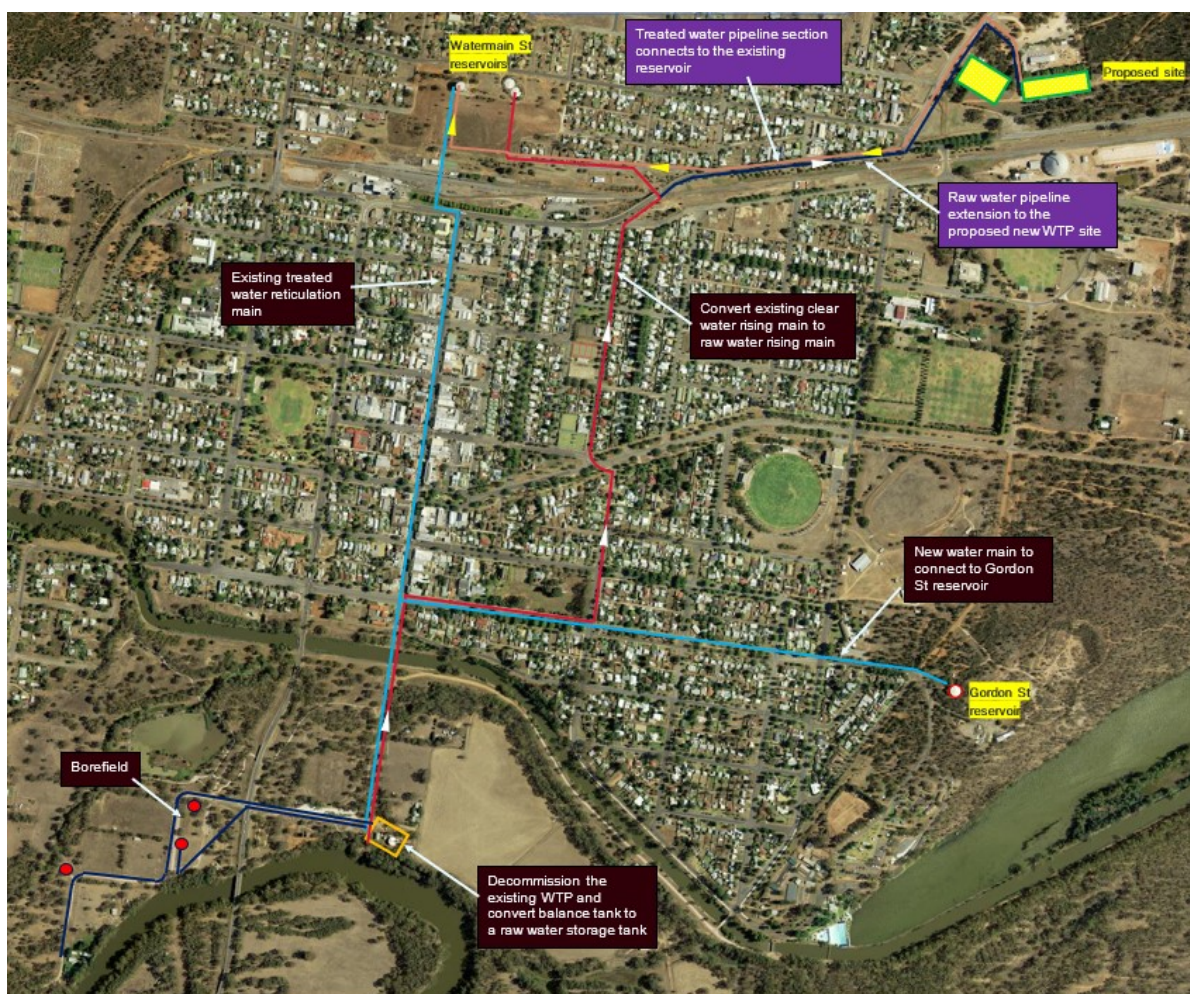


Figure 2-1: Proposed New NWTP and pipeline arrangement

The proposed new work will include;

- New Narrandera WTP.
- Raw water pipeline section to the new WTP site as shown in dark blue referring to Figure 2-1.
- A new pipe section for treated water which is to be connected to the Watermain St reservoirs from the new WTP as shown in light red in Figure 2-1.

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- A new pipe section for treated water which is to be connected to the Gordon St reservoir as shown in light blue in Figure 2-1.
- Decommission the existing WTP and convert balance tank to a raw water storage tank.
- Convert existing clear water rising main to raw water rising main.

2.2 Demand

IWCM issues paper produced in 2019 developed a water production model. This modelled demand is then hind casted over 45 years of available historical climate data to provide a larger data set from which the average year, dry year and peak day demands could be estimated. The hind cast is presented in Figure 2-2.

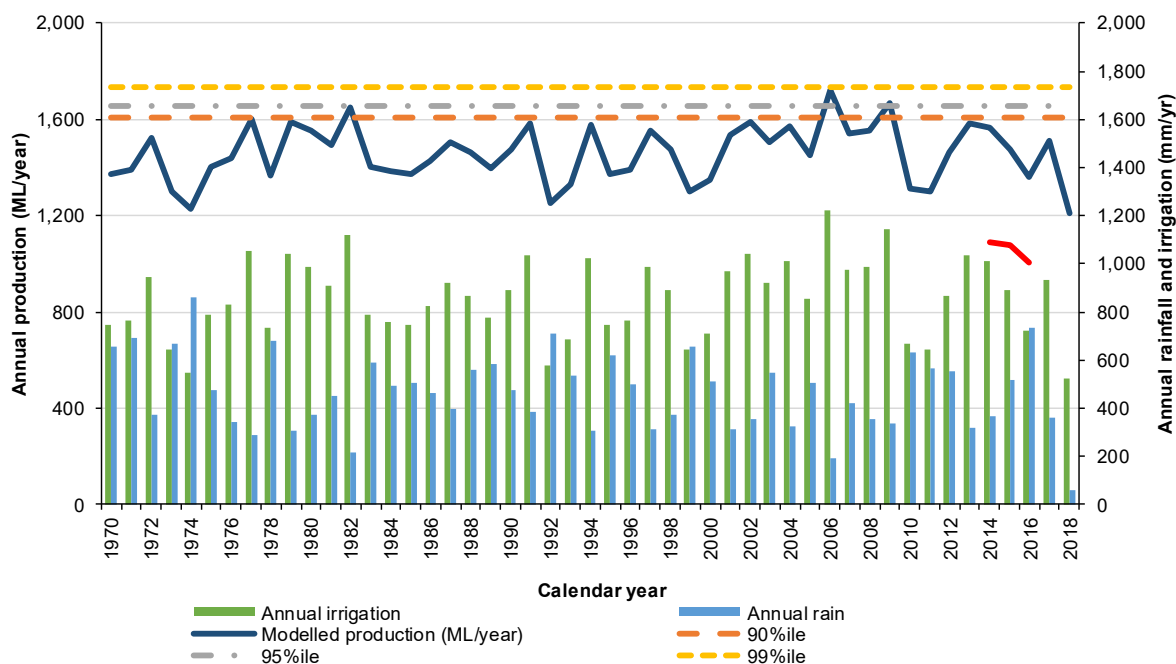


Figure 2-2: Narrandera water production model hindcasting (IWCM Issus Paper, 2019)

For this assessment, the 95th percentile has been considered. Based on the hindcasting model, the corrected demands are:

- Average year demand increases from 1,448 ML/year in 2017 to 1,597 ML/year in 2048.
- 95th percentile dry year demands 1,669 ML/year
- 95th percentile peak day demand 12.2 ML/day

From the demands selected from the model, and Council’s nominated growth strategy, the water demand forecasts are presented in Table 2-1.

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Table 2-1: Water demand forecast

	2017	2022	2027	2032	2037	2042	2047	2048
Average year metered demand (ML/year)	1,448	1,466	1,489	1,516	1,541	1,566	1,592	1,597
Peak day production (ML/day)	12.20	12.28	12.39	12.52	12.63	12.75	12.87	12.90
Dry year extraction (ML/year)	1,704	1,709	1,715	1,722	1,729	1,735	1,742	1,744

2.3 Location

A new WTP site is also being considered next to an existing Council depot near Barellan Road, as shown in Figure 2-3 below.



Figure 2-3 : Location for new NWTP

The new WTP will be designed to treat raw water from the Murrumbidgee River and bores when required.

The ground elevation at the proposed site is relatively flat with a RL of 172m and 173m on the sludge lagoon area. The treatment units are expected to be positioned to facilitate gravity flow across the plant.

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### 3 Raw Water Quality Summary, Issues/ Risks and Remedial actions

#### 3.1 Preliminary raw water quality envelope

The table below provides a summary of the key water quality parameters for both river and bore water sources. Refer to Appendix B for the draft water quality report.

Table 3-1: summary of the key water quality parameters

Parameter	Comments_ River water	Comments_ Bore water
Alkalinity	There is no guideline value given in ADWG for alkalinity. The river water can be low in alkalinity. Sufficient alkalinity is required for coagulation, to allow pH stability and to prevent corrosion.	There is only a limited water quality data regarding the bore water.  Iron levels are generally high in all the 5 bores considered and exceed the ADWG limits apart from Bore #2B. However, Bore #2B has elevated levels of TDS, chlorides and sodium. High dissolved solids can cause taste and odour issues as well as discolours water.  In general, all the bores do not have manganese at a level to be concerned.  Bore #5 has high level of
Hardness	The river water most times appears to be soft in nature.	
TDS	No specific health guideline value is provided for total dissolved solids (TDS) in ADWG, as there are no health effects directly attributable to TDS. However, for good palatability total dissolved solids in drinking water should not exceed 600 mg/L. For Murrumbidgee River, TDS levels are very low.	
pH	Mean pH is neutral while it ranges from 6-8.2.	
True colour	Based on aesthetic considerations in ADWG, true colour in drinking water should not exceed 15 HU. Upstream of Murrumbidgee River at Narrandera, the true colour recorded very high values up to a maximum of 700PCU. True colour is precursor for disinfection by products and chlorine demand. It also contributes to UV transmissivity (UVT) which interferes with UV disinfection. Optimised coagulation and conventional filtration are removal barriers for remove true colour.	
Turbidity	Murrumbidgee River water has recorded turbidity up to 114NTU at Wagga and 52NTU at Narrandera. Coagulation, sedimentation and filtration are effective turbidity barriers.	
Iron	Murrumbidgee River water recorded iron levels up to 1.3mg/L. The ADWG aesthetic iron guideline is 0.3 mg/L. Iron can be effectively removed by processes of coagulation followed by filtration.	

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<p>Manganese</p>	<p>The ADWG aesthetic manganese concentration is 0.1 mg/L. In practice the treated water manganese concentration needs to be &lt; 0.05 mg/L or lower to avoid customer complaints and manganese accumulation in the distribution system.</p> <p>Manganese recorded in Murrumbidgee River at Wagga suggest that 95% of the time it is below 0.1mg/L and occasionally it can go over. The highest recorded was 0.24mg/L.</p> <p>Manganese can be removed by oxidising soluble forms to insoluble precipitates, followed by filtration.</p>	<p>turbidity, hardness while Bore #3 has a high level of TDS and chlorides.</p> <p>A testing program is proposed to monitor the quality of the bore water.</p>
<p>UV transmissivity (UVT)</p>	<p>UVT is an indicator of natural organic matter (NOM), and it is used to design and operate UV disinfection systems. For Murrumbidgee River, it has recorded a minimum UVT of 53% and mean UVT of 77%. UVT can be removed using optimised coagulation and conventional filtration.</p>	
<p>Cyanobacteria</p>	<p>Cyanobacteria can produce taste and odour compounds (MIB and geosmin) as well as toxins.</p> <p>Jar testing was undertaken when low number of non-toxin/taste and odour producing cyanobacteria were present in the Murrumbidgee River. Repeat testing is required when cyanobacteria are present higher numbers. Extracellular toxins can be removed by powdered activated carbon (PAC) and chlorination.</p> <p>Algal cells can be removed by coagulation, clarification and filtration. Extracellular taste and odour compounds can be removed using activated carbon.</p>	

To overcome the current issues at the water supply and to provide safe/secure drinking water supply, Narrandera Shire Council is planning for a new water treatment plant. Currently bore water is used as the raw water source. Recent discussions with Council confirmed that the new treatment would be designed to treat Murrumbidgee River water as the preferred source for the town supplemented by bore water when required. Council preference of the raw water source stemming from the outcome of the taste testing exercise conducted by Council and the recent findings of bore water source contamination. The new Narrandera WTP is required to be robust and flexible in design to treat different raw water sources such as river water only, river and bore water in a shandy mix and bore water only.

The following tables present the final raw water envelop to proceed to the options development stage.



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Water quality data presented in Table 3-3 is for Murrumbidgee River at Wagga WTP. This is the best available data as there is limited water quality data for Murrumbidgee River at Narrandera.

Table 3-2: Narrandera WTP Raw Water Quality Design Envelope for Concept Design (bore water)

Parameter	Units	Lower	Mean	Upper
Alkalinity as CaCO <sub>3</sub>	mg/L	80	125	200
Calcium as CaCO <sub>3</sub>	mg/L	11	22	36
CCPP as CaCO <sub>3</sub>	mg/L	-9.7	-4.9	3.36
Chloride	mg/L	22	148	308
pH	pH	7.5	7.9	8.5
Sulphate	mg/L	4	25	61
TDS	mg/L	150	410	745
Temperature	°C	3	25	45
TOC	mg/L	1	1	4
Total iron	mg/L	0.06	0.63	2.0
Total manganese	µg/L	8	62	200
True colour	HU	1.0	3.0	5.0
Turbidity	NTU	0.6	5.1	22.0

Table 3-3: Narrandera WTP Raw Water Quality Design Envelope for Concept Design (Murrumbidgee River)

Parameter	Units	Lower	Mean	Upper
Alkalinity as CaCO <sub>3</sub>	mg/L	10	52	83
Calcium as CaCO <sub>3</sub>	mg/L	4.94	8	13.1
Chloride	mg/L	5	21	80
pH	pH	6	7	8.2
Sulphate	mg/L	0	3.8	8

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Parameter	Units	Lower	Mean	Upper
TDS	mg/L	11	76	404
Total iron	mg/L	0.01	0.04	1.3
Total manganese	µg/L	0.001	5	9.6
True colour	HU	3	83	700
Turbidity	NTU	0.42	21	114

### 3.2 Raw water quality issues/ risks

There have been numerous customer complaints in the past of discoloured water and taste and odour issues.

Discoloured water is mainly caused by iron and manganese in Narrandera water supply. Iron and manganese are present in bore water at concentrations that exceed the Australian Drinking Water Guideline aesthetic limits of 0.3 mg/L and 0.1 mg/L respectively. The existing treatment does not remove iron or manganese, operators have limited control of Iron and Manganese by management of bore flows and bore selection.

Taste and odours are a major factor in customer perception of drinking water quality. Taste and odours in drinking water can originate from a wide variety of factors. A review of water quality in samples taken from bore water and from the distribution system has identified several possible causes for taste and odour at Narrandera.

- Bore water contains hydrogen sulphide which imparts a rotten egg odour. The existing aerators at Narrandera are intended to remove hydrogen sulphide from water, but complete removal is unlikely as the pH of the water is greater than 7.0. Effective hydrogen sulphide removal by aeration requires water pH to be reduced to 6.0.
- Free chlorine residual in the Narrandera distribution system is often inconsistent, sudden change from low to high can lead to customers complaints due to chlorinous taste and odours. Chlorine reacts with hydrogen sulphide leading to loss in chlorine residual. Maintaining stable chlorine residuals in the Narrandera distribution system is difficult due the presence of hydrogen sulphide in bore water.
- Bore water at Narrandera contains high concentrations of iron and manganese which may impart a metallic taste.

Floods caused by rising river levels above normal in 2022 caused aquifer contamination at all locations with *E. coli*, turbidity, dissolved organic carbon (DOC) and high chlorine demand. Council called a boil water alert for several weeks in response to the contamination. Council believes the contamination occurred through improperly sealed privately owned bores, Council

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has 5 bores that are properly sealed. This issue has not been identified earlier and has driven the need for the new treatment plant to remove turbidity and DOC when treating bore water.

### 3.2.1 Health Based Targets

The river and bore water catchment are likely to be assessed as category 4. The required pathogen LRV target for a category 4 catchment is:

- Protozoa: 5.0
- Virus: 6.0
- Bacteria: 6.0

### 3.2.2 Water quality risks

#### 3.2.2.1 Pathogen risk

Pathogens present the greatest risk to the safety of a drinking water supply (NHMRC, 2011). Pathogen risk in bore water is high at Narrandera as demonstrated during 2022 aquifer contamination event. Water quality at all bore locations was contaminated with E-coli, turbidity and dissolved organic carbon (DOC). It is expected that NSW Health will assess the catchment as HBT category 4.

#### 3.2.2.2 Taste and odour risk

There have been numerous complaints of taste and odour from the customers in the past about Narrandera drinking water hence it can be identified as an extreme risk.

#### 3.2.2.3 Disinfection byproduct risk

Simulated treated water from the jar tests was tested for Trihalomethane Formation Potential (THMFP). THMFP for bore 5 and river water (0.025 mg/L and 0.027mg/L respectively) were less than the ADWG guideline limit for THM. The ADWG guideline value for THMs is 0.25mg/L. These low THMFP results are explained by the very low DOC concentration (<1mg/L) found in all the samples tested at the time of testing. DOC is the precursor for THMs THMFP risk increases if raw water DOC concentration increases.

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## 4 Proposed Treated Water Quality Targets

**Table 4-1** shows the preliminary treated water targets for the new Narrandera WTP.

The targets values for pH, calcium carbonate precipitation potential (CCPP) and alkalinity are based on values recommended by DCCEEW for stable water that does not corrode nor scale.

Table 4-1: Preliminary treated water quality targets

Parameter	Target
Turbidity at individual for a media filter	< 0.2 NTU for 95 % < 0.5 NTU at times
True Colour	< 5 HU
pH	7.8 to 8.2
CCPP (as CaCO <sub>3</sub> )	-4.0 to 0 (slightly corrosive)
*Alkalinity	> 50 mg/L (as CaCO <sub>3</sub> )
Iron	< 0.03 mg/L for 90% in any month
Manganese	< 0.03 mg/L for 90% in any month
UV transmissibility	≥ 85% at all times

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## 5 Critical Control Points and Associated Targets

ADWG (NHMRC, 2011) defines a Critical Control Point (CCP) is an activity, procedure or process that is critical to control a water quality hazard.

**Table 5-1** presents the current CCP targets at Narrandera.

Table 5-1: Current CCP targets for Narrandera water supply

System	Critical Control Point	Parameter	Target	Adjustment Level	Critical Limit
Reservoirs	Distribution reservoirs	Reservoir Integrity	Secure and vermin proof	<0.2 mg/L free chlorine Evidence of breaches	<0.2 mg/L free chlorine for more than 1 day Breach not rectified or serious breach
Bores	Wellhead protection	Reservoir Integrity	Not threatened by surface runoff	Threatened by surface runoff	Wellhead inundated
Chlorination	Chlorine dosing	Free Chlorine	1.5 mg/L	<1.2 mg/L	<0.8 mg/L

These CCPs will be reviewed after the new Narrandera WTP is constructed.



## 6 Comparison of Candidate Treatment Processes

This section provides a brief discussion on potential treatment process options for the proposed Narrandera WTP. A description of each process is detailed in **Appendix A**.

After a discussion with Council on 10<sup>th</sup> October, it was decided not to consider advance treatment options like membrane systems. Council’s preference is a simple treatment arrangement such as lagoon sedimentation.

**Table 6-1** summarises advantages and disadvantages of each the treatment processes.

Table 6-1: Treatment processes unit advantages and disadvantages.

Treatment process	Advantages	Disadvantages
Direct Media Filtration	<ul style="list-style-type: none"> <li>• Lower capital costs as clarification process are not used.</li> <li>• Log removal values (LRVs) for protozoa is 2-3.5, virus is 1, and bacteria is 1.</li> </ul>	<ul style="list-style-type: none"> <li>• Larger filter with increased capital cost.</li> <li>• Less robust than a filter with a clarifier to achieve treated water turbidity targets reliably.</li> <li>• Not frequently used in NSW country town plants.</li> <li>• The high turbidity of Murrumbidgee River Water prevents direct filtration as a treatment option for NWTP.</li> </ul>
Conventional (horizontal flow) Clarifier (CC)	<ul style="list-style-type: none"> <li>• Surface loading rate is typically 1-2 m/hr.</li> <li>• LRVs for protozoa is 2.5-4, virus is 2, and bacteria is 2 (with media filter).</li> <li>• Can achieve effective t removal of turbidity and DOC.</li> <li>• Requires low to moderate maintenance.</li> <li>• Low power consumption.</li> </ul>	<ul style="list-style-type: none"> <li>• Higher capital costs due to larger tank size.</li> <li>• May not be effective in algal cell removal.</li> </ul>

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Treatment process	Advantages	Disadvantages
Inclined Plate Clarifier (IPC)	<ul style="list-style-type: none"> <li>• Surface loading rate is typically 5–7 m/hr.</li> <li>• Higher surface loading rate than traditional sedimentation is used with corresponding smaller footprint.</li> <li>• Lower capital costs than traditional sedimentation clarifier.</li> <li>• Can achieve effective removal of turbidity and DOC.</li> <li>• Low power consumption.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires frequent maintenance to drain tank and clean plates to prevent plate fouling and algal growth.</li> <li>• May not be effective in algal cell removal.</li> <li>• Potential hydraulic issues with clarifier design.</li> <li>• Potential issues with sludge discharge from the clarifier.</li> </ul>
Dissolved Air Flotation (DAF)	<ul style="list-style-type: none"> <li>• Robust and can be optimised to raw water changes.</li> <li>• Requires low to moderate maintenance.</li> <li>• Surface loading rate is typically 8–10 m/hr.</li> <li>• Higher loading rate than traditional sedimentation and conventional clarifiers and correspondingly a smaller footprint.</li> </ul>	<ul style="list-style-type: none"> <li>• High capital costs than DAFF.</li> <li>• High power consumption.</li> <li>• Significant maintenance requirements.</li> <li>• Requires enclosed building (roof and walls) to prevent floated sludge knockdown.</li> <li>• Performance may be reduced when treating raw water with turbidity &gt; 50 NTU.</li> </ul>
Lagoon Sedimentation Clarifier (Clarifier mode)	<ul style="list-style-type: none"> <li>• Low capital and operational costs as compared to conventional clarifier.</li> <li>• Required skill-level for operators is very low.</li> <li>• Surface loading rate is &lt;1 m/hr.</li> </ul> <p>Can achieve effective removal of turbidity and DOC.</p>	<ul style="list-style-type: none"> <li>• Larger footprint required.</li> <li>• Weed growth especially Cumbungi (Typha Latifolia) may be problematic.</li> </ul>
Rapid Gravity Filter (post-clarification)	<ul style="list-style-type: none"> <li>• Proven process in Australia.</li> <li>• Simple, well-established technology.</li> <li>• Low operational costs.</li> </ul>	<ul style="list-style-type: none"> <li>• Large footprint for installation.</li> <li>• Dependent upon optimised coagulation.</li> </ul>

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Treatment process	Advantages	Disadvantages
Lagoons (Sludge drying mode)	<ul style="list-style-type: none"> <li>• Low capital and operational costs.</li> <li>• Required skill-level for operators is very low.</li> <li>• High quality supernatant for recycling.</li> <li>• Polyelectrolyte dosing, flow balancing, and pre-thickening are not required.</li> </ul>	<ul style="list-style-type: none"> <li>• Larger footprint required.</li> <li>• Weed growth especially Cumbungi (Typha Latifolia).</li> </ul>
Drying Beds (sludge drying)	<ul style="list-style-type: none"> <li>• Lower footprint than sludge lagoons.</li> </ul>	<ul style="list-style-type: none"> <li>• Polyelectrolyte dosing, flow balancing, and pre-thickening are all required.</li> <li>• Lower quality supernatant for recycling compared to lagoons.</li> </ul>



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## 7 Treatment Process Train Options

A multi barrier treatment train is required to meet treated water targets and to mitigate water quality risks at Narrandera that challenge the new treatment plant when treating raw water sourced from the Murrumbidgee River and bore water.

### Health Based Targets

The new NWTP is required to meet Health Based Targets (HBT) for a category 4 catchment. Treatment requires conventional filtration to claim 2.5-4 protozoa, 2 LRV virus and 4 LRV bacteria. Conventional filtration means coagulation, flocculation and filtration (NHMRC, 2011).

The new NWTP will include chlorination with CT 15 mg.mins/L to provide 4 LRV virus and bacteria.

However, conventional treatment and chlorination are not adequate to meet HBTs at Narrandera for protozoa resulting in a 1-2.5 LRV shortfall which can be satisfied using UV disinfection with a dose of 8.5 mJ/cm<sup>2</sup>.

Table A-1 in the appendices summarise HBT treatment requirements at Narrandera using conventional filtration, UV disinfection and chlorination (CT 15 mg.min/L).

### Treatment Options

Four (4) treatment trains including conventional filtration, UV disinfection and chlorination are presented in this Briefing Paper as options for the proposed Narrandera WTP.

Coagulation is required to treat bore and river water, the coagulant has not been selected and may be either alum, aluminium chlorohydrate (ACH) or polyaluminium chloride (PACL).

Jar testing has been undertaken and alum was the only coagulant tested. Coagulation using ACH and poly aluminium chloride can be carried out at a wider pH range than alum. This may be beneficial when treating river and bore water separately or in combination at Narrandera given the high alkalinity of both waters. It is recommended that additional jar testing is undertaken when river is contains with high turbidity, colour, DOC or high algal cell numbers.

**Note: When using bore water, the existing air stripping process will continue to operate, and the aerated water will feed to the new WTP.**

Membrane filtration was not considered as a treatment option at Narrandera given increased complexity for membrane filtration as compared with rapid gravity media filtration.

The selected candidate treatment options in this report satisfy the preliminary treated water targets and the ADWG (NHMRC, 2011) cost effectively.

### Residuals management

Two options are provided to manage residuals, sludge and waste backwash water from the clarifier and the rapid gravity filter, sludge drying lagoons and sludge drying beds. Both options dry sludge allowing disposed to landfill and supernatant can be recycled to the head of the treatment plant at a controlled recycle rate less than 10 percent of raw water flow for full treatment.



### 7.1 Option 1: Conventional clarifier, media filtration, UV disinfection, chlorination

Bore and or river water is pumped to the raw water tank. Raw water exits the tank and is dosed with coagulant and flash mixed. Alkali (soda ash or lime) may be dosed if required to control of pH, followed by polyelectrolyte as a coagulant aid. Coagulated water is then flocculated in a two-compartment tank with slow speed mixers. The flocculated water passes through the conventional clarifier, where larger flocs settle and turbidity is reduced.

The water is filtered using rapid gravity filtration to meet required turbidity targets. The filtered water is disinfected using UV irradiation to inactivate protozoa. Chlorine is added to inactivate bacteria and viruses, and additional chemicals such as fluoride and pH correction chemicals may be added. The treated water is pumped to the distribution after being dosed with trim chlorine if required.

Residuals (sludge and waste backwash water) from the conventional clarifier and the rapid gravity filter are directed to the wastewater management system for drying.

Figure 7-1 (with lagoons for waste management) and Figure 7-2 (with drying beds for waste management) shows a block flow diagram for this option indicating all process flows and dosing points.

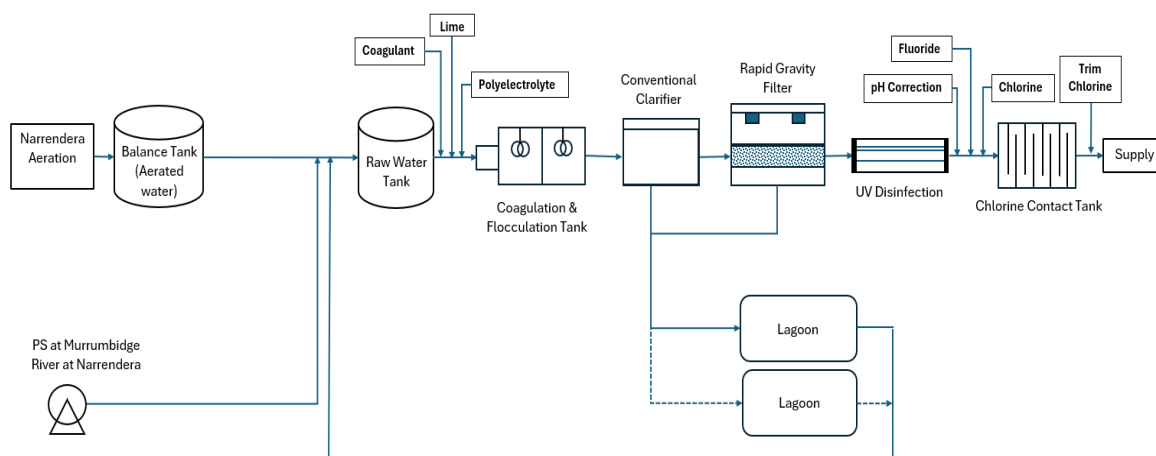


Figure 7-1: Block flow diagram for Option 1 with residual treatment using lagoons

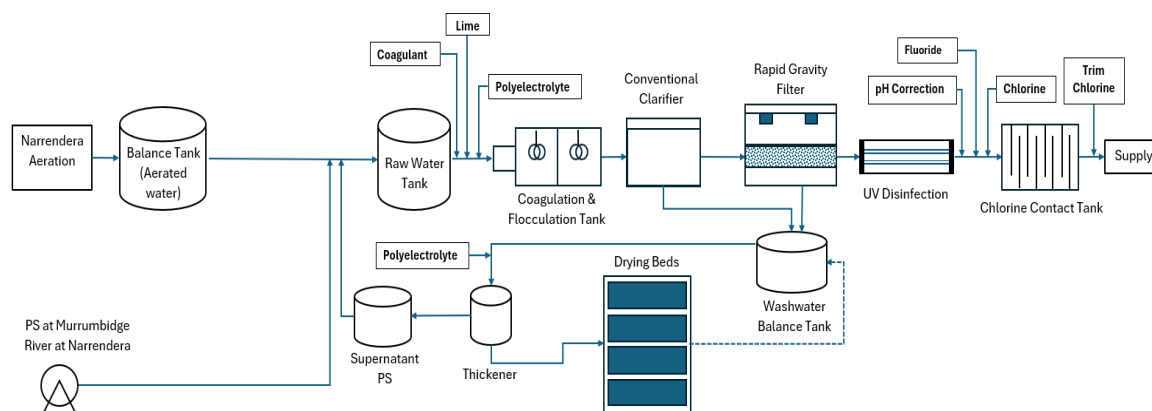


Figure 7-2: Block flow diagram for Option 1 with residual treatment using drying beds

### 7.2 Option 2: Inclined plate clarifier, media filtration, UV disinfection, chlorination

Bore and or river water are transferred to the raw water tank. Raw water exits the tank and is dosed with coagulant and flash mixed. Alkali (soda ash or lime) may be dosed if required to control of pH, followed by polyelectrolyte as a coagulant aid. Coagulated water is then flocculated in a two-compartment tank with slow speed mixers. The flocculated water passes through the inclined plate clarifier, where larger flocs settle out, removing suspended solids from the water.

The water is filtered using a rapid gravity filter to remove turbidity. The filtered water is disinfected using UV irradiation to inactivate protozoa. Chlorine is added to inactivate bacteria and viruses, and additional chemicals such as fluoride and pH correction chemicals may be added. The treated water is sent to consumers after being dosed with trim chlorine if required.

Residuals (sludge and waste backwash water) from the IPC and the rapid gravity filter are directed to the wastewater management system for drying.

Flow diagrams for conventional filtration using IPC clarifier and residual management options using lagoons and sludge drying beds are presented in Figure 7-3 and Figure 7-4 respectively.

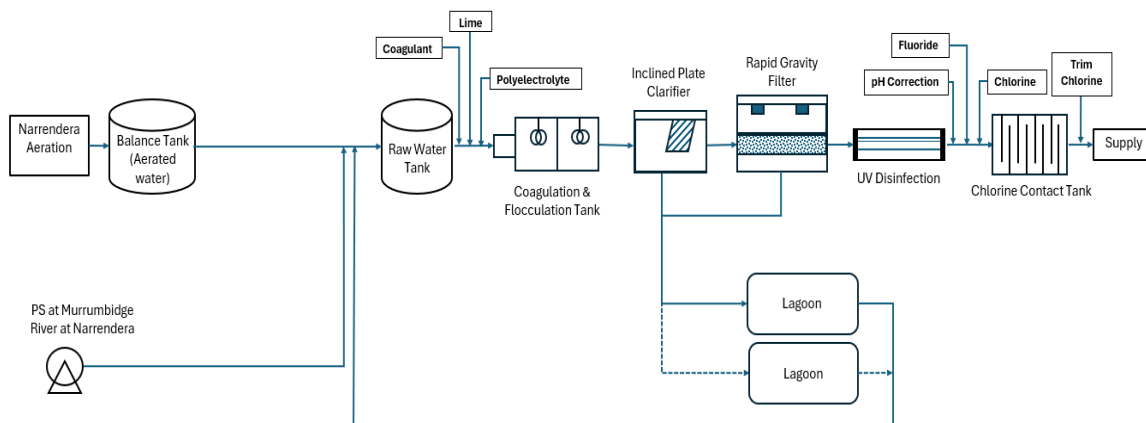


Figure 7-3: Block flow diagram for Option 2 with residual treatment using lagoons

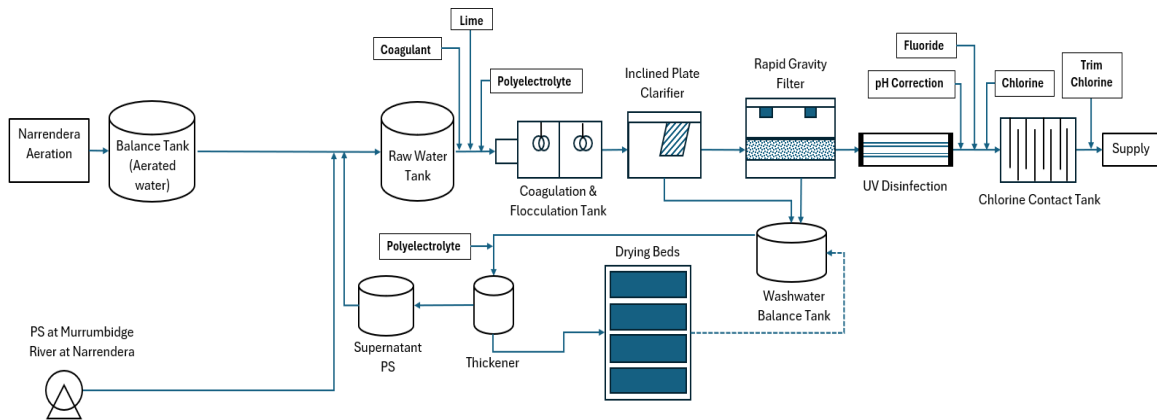


Figure 7-4: Block flow diagram for Option 2 with residual treatment using drying beds

### 7.3 Option 3: Lagoon sedimentation clarifier, media filtration, UV disinfection, and chlorination

Bore and or river water are transferred the raw water tank. Raw water exits the tank and is dosed with coagulant and flash mixed. Alkali (soda ash or lime) may be dosed if required to control of pH, followed by polyelectrolyte as a coagulant aid and mixed using a static mixer before entry to the lagoon sedimentation clarifier. One lagoon is online as a clarifier, the other is used to dry sludge.

Settled water is pumped to the filter inlet and filtered through the bed to remove turbidity. The filtered water is disinfected using UV irradiation to inactivate protozoa. Chlorine is added to inactivate bacteria and viruses, and additional chemicals such as fluoride and pH correction chemicals may be added. Treated water is sent to consumers after being dosed with trim chlorine.

Supernatant from the drying lagoon is recycled to inlet of the WTP. The dried sludge is safely disposed at the landfill.

Figure 7-5 shows a flow diagram for this option indicating all process flows and dosing points.

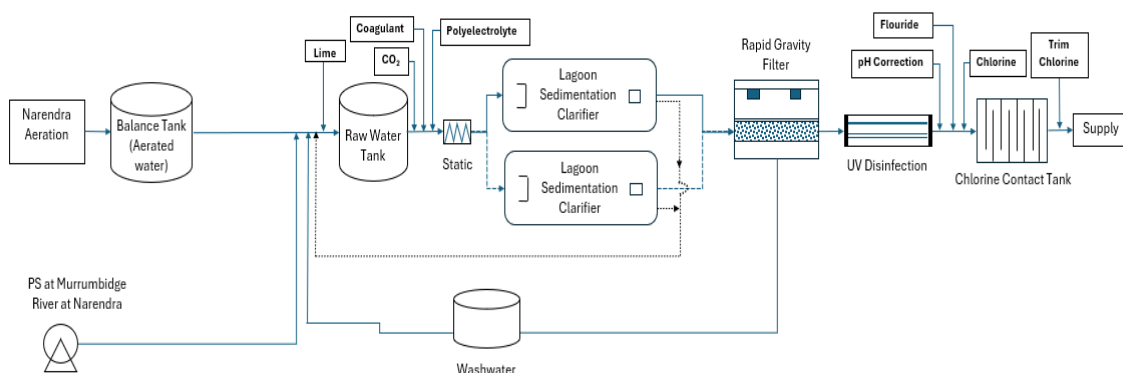


Figure 7-5: Block flow diagram for Option 3



### 7.4 Option 4: Dissolved air flotation, media filtration, UV disinfection, chlorination

Bore and or river water are transferred to the raw water tank. Raw water exits the tank and is dosed with coagulant and flash mixed. Alkali (soda ash or lime) may be dosed if required to control of pH, followed by polyelectrolyte as a coagulant aid. Coagulated water is then flocculated in a two-compartment tank with slow speed mixers. The flocculated water passes through the DAF tank, where larger flocs settle out, removing suspended solids from the water.

The water is filtered via a rapid gravity filter to remove turbidity. The filtered water is disinfected using UV irradiation to inactivate protozoa. Chlorine is added to inactivate viruses and bacteria, and additional chemicals such as fluoride and pH correction chemicals may be added. The treated water is sent to consumers after being dosed with trim chlorine.

Residuals (sludge and waste backwash water) from the DAFF are directed to the wastewater management system for drying.

The dried sludge is disposed at the landfill.

**Figure 7-6** (with lagoons for waste management) and **Figure 7-7** (with drying beds for waste management) shows a block flow diagram for this option indicating all process flows and dosing points.

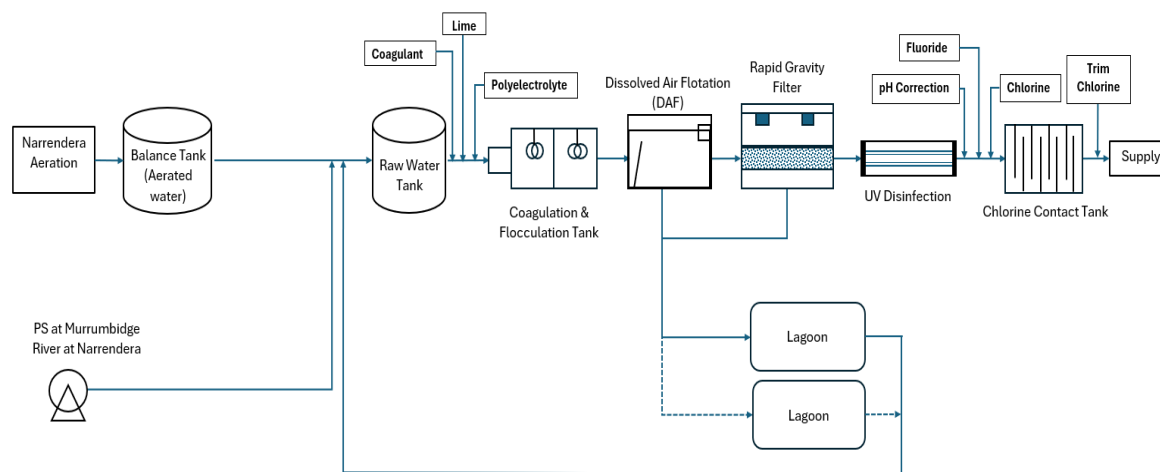


Figure 7-6: Block flow diagram for Option 4 with residual treatment using lagoons

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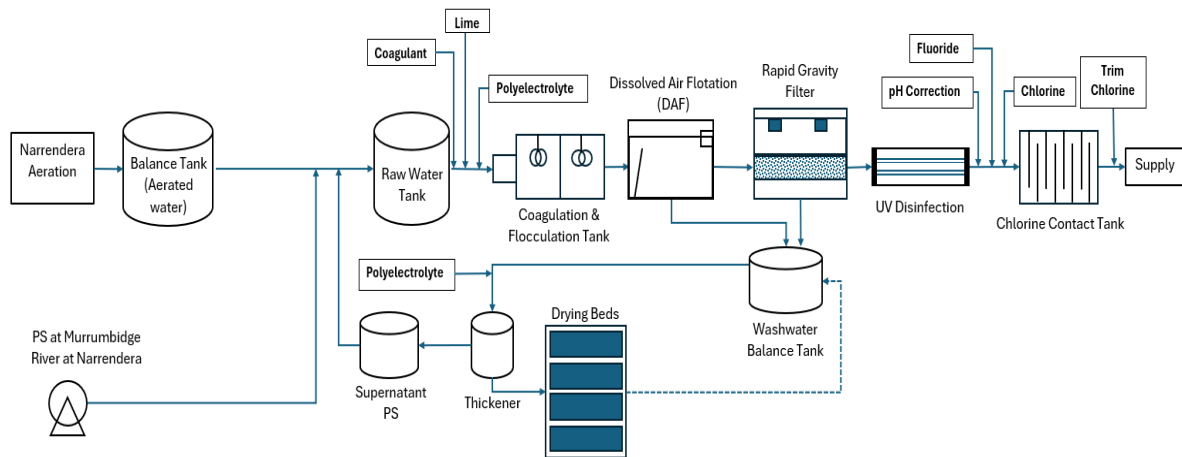


Figure 7-7: Block flow diagram for Option 4 with residual treatment using drying beds

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## 8 Comparison of Options

### 8.1 CAPEX and OPEX

Comparative capital and operating costs for each treatment and residual management option are provided in the following.

#### Treatment options

Assumptions used in developing CAPEX and OPEX ranking are:

- Residual treatment using lagoons is less expensive than treatment using sludge drying beds.
- Clarification represents approximately 30 per cent of the total treatment cost, lagoon sedimentation (LSC) uses sludge drying lagoon as the clarifier and therefore has the lowest CAPEX treatment option and residuals management option.
- CAPEX is inversely proportional to surface overflow rate for settling clarifiers. Inclined plate clarifier (IPC) are normally designed with surface overflow rate typically in the range 5-7, this is higher when h as compared to conventional sedimentation clarifier (CC) which generally use a surface overflow rates in the range 1-2 m/h.
- IPC and conventional clarifiers generally have lower CAPEX than dissolved air flotation options (DAFF, DAF) which require additional and more complex components. However, flotation clarification uses a higher loading than IPC and conventional clarifiers and requires a reduced footprint.
- In filter DAFF (DAFF) has lower CAPEX than separate DAF which uses a dedicated flotation tank and separate filter. DAFF combines clarification and filtration in a single tank.
- Chlorine disinfection ( $Cl_2$ ) is used in all options using a minimum CT of 15 mg.min/L.

#### Comparative treatment CAPEX ranking (lowest CAPEX to highest CAPEX)

- (1) Option 3: LSC + Media Filters + UV +  $Cl_2$
- (2) Option 2: IPC + Media Filters + UV +  $Cl_2$
- (3) Option 1: CC + Media Filters + UV +  $Cl_2$
- (4) Option 4: DAF + Media Filters + UV +  $Cl_2$

### 8.2 Strengths and weaknesses

**Table 8-1** shows a comparison of all the options described in above section. It particularly highlights the strengths, weaknesses and the costs associated (qualitative) with each treatment process option.

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Table 8-1: Ranking and comparison of all four options

Description	Strengths	Weaknesses	Qualitative CAPEX
LSC + Media Filters + UV + Cl <sub>2</sub>	<ul style="list-style-type: none"> <li>• Lowest operational and capital costs</li> <li>• Robust to raw water quality at Narrandera provided coagulation is optimised.</li> <li>• Simple to operate and maintain by competent operators.</li> <li>• CAPEX savings as compared to an options using a dedicated as lagoon provides dual purpose of residual management and clarification.</li> </ul>	<ul style="list-style-type: none"> <li>• Large footprint required</li> <li>• Weed growth may be an issue</li> </ul>	Low
IPC + Media Filters + UV + Cl <sub>2</sub>	<ul style="list-style-type: none"> <li>• Well-established and proven treatment process at NSW country town WTPs.</li> <li>• Robust to raw water quality at Narrandera provided coagulation is optimised.</li> <li>• Lower capital costs compared to conventional clarifier.</li> <li>• Low power consumption.</li> </ul>	<ul style="list-style-type: none"> <li>• Moderate surface loading rate (5-7 m/hr) compared to other clarifiers</li> <li>• IPC may require frequent drain down and cleaning.</li> <li>• Potential hydraulic issues may impact on settled water quality.</li> <li>• IPC may not be effective for algal cell removal.</li> <li>•</li> </ul>	Medium
CC + Media Filters + UV + Cl <sub>2</sub>	<ul style="list-style-type: none"> <li>• Well-established and proven treatment process in NSW.</li> <li>• Requires low to moderate maintenance.</li> <li>• Lower power consumption.</li> </ul>	<ul style="list-style-type: none"> <li>• Low surface loading rate (1-2 m/hr) compared to other clarifiers</li> <li>• Clarifier may not be effective for algal cell removal.</li> <li>• CAPEX may be high compared to IPC option.</li> </ul>	Moderate



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Description	Strengths	Weaknesses	Qualitative CAPEX
DAF + Media Filters + UV + Cl <sub>2</sub>	<ul style="list-style-type: none"> <li>• Very effective removal of DOC and algae when coagulation is optimised.</li> <li>• Highest surface loading rate (8-10 m/hr) compared to other clarifiers</li> </ul>	<ul style="list-style-type: none"> <li>• High capital costs.</li> <li>• Requires covered building to prevent sludge float knockdown due to rain and wind.</li> <li>• OPEX cost is high as compared to sedimentation (recycle pumps)</li> <li>• May not be effective when raw water turbidity is &gt;100 NTU.</li> <li>• Increased maintenance requirements as compared to sedimentation.</li> </ul>	Moderate
Lagoons (Drying mode)	<ul style="list-style-type: none"> <li>• Low capital and operational costs</li> <li>• Required skill-level for operators is very low</li> <li>• High quality supernatant for recycling</li> <li>• Polyelectrolyte dosing, flow balancing, and pre-thickening are not required</li> </ul>	<ul style="list-style-type: none"> <li>• Larger footprint required</li> <li>• Weed growth may be an issue</li> </ul>	Low
Drying Beds	<ul style="list-style-type: none"> <li>• Lower footprint than sludge lagoons</li> </ul>	<ul style="list-style-type: none"> <li>• Polyelectrolyte dosing, flow balancing, and pre-thickening are all required</li> <li>• Lower quality supernatant for recycling compared to lagoons</li> </ul>	Moderate



## 9 Multi-Criteria Analysis of Treatment Process Trains

### 9.1 Methodology

NSW PW has developed a multiple criteria analysis (MCA) framework to effectively compare the treatment options. This MCA would act as a basis for the Treatment Options, where the scoring will be determined by NSCs priorities. The criteria were defined by NSW PW based on the triple bottom line (TBL) approach to sustainable design (environment, economy and community), and experience on other projects.

The weighting of each criterion will reflect the NSC’s community and business needs. NSW PW has recommended weighing for the Narrandera project to cut down the time and costs. The MCA will be scored by each stakeholder of the project. The criteria are summarised in **Table 9-1** below.

**Table 9-1: Multiple criteria analysis – criteria definitions.**

Criteria	Definition
CAPEX and OPEX	Capital and operational expenditure required to construct, operate and maintain the WTP.
Environmental Impact	The potential effects on the environment, including energy consumption, waste generation, and impact on local ecosystems. This also includes the ability to achieve net zero and circular economy.
Performance and Efficiency	The ability of the WTP to consistently meet water quality standards and effectively treat the expected range of contaminants.
Construction Complexity	The level of technical expertise required to construct the WTP, including any use of sophisticated machinery, skilled labour, or specialised training.
Operability	The capability to maintain operations under various conditions, ease of operation and reliability, ensuring consistent water supply.

The scoring system is summarised in **Table 9-2** below.

**Table 9-2: Multiple criteria analysis scoring system.**

Description	Qualitative Score	Quantitative Score
Most preferred	Very high	5
More preferred	High	4
Neutral	Moderate	3
Less Preferred	Low	2
Least Preferred	Very low	1



### 9.2 Discussion of results of the MCA

The following Table 9-3 present the average results from the scoring of Council and NSW PW.

Table 9-3: Average MCA scoring for the treatment options

Option	Option Description	CAPEX & OPEX	Environmental Impact	Performance & Efficiency	Construction Complexity	Operability	Weighted Score	Ranking
<b>Criteria Weighting</b>		46%	8%	31%	8%	8%		
Option 1	CC + media filters + UV + Cl <sub>2</sub>	4	4	4	3	3	3.42	#2
Option 2	IPC + media filters + UV + Cl <sub>2</sub>	4	3	4	3	3	3.38	#3
Option 3	LSC + media filters + UV + Cl <sub>2</sub>	5	4	3	4	4	4.12	#1
Option 4	DAF + media filters + UV + Cl <sub>2</sub>	3	3	4	2	2	2.92	#4
<b>Criteria Weighting</b>		46%	8%	31%	8%	8%		
Lagoons		5	4	3	4	5	4.19	#1
Drying Beds		4	4	4	4	4	3.81	#2

The definitive outcome of the multicriteria analysis of the shortlisted options was Option 3: Lagoon Sedimentation Clarification.

This option was reassessed by Narrandera Shire Council and NSW PW following determination of multicriteria ranking to confirm the robustness of the assessment. It is assumed, based on NSC’s feedback, DCCEEW would also prefer Option 3 over the other based on previous discussions with NSC. It was decided based on the preference of all the interested parties, Option 3 – lagoon sedimentation clarifier, rapid gravity media filtration, UV disinfection and chlorination was the preferred treatment option and lagoons to be used for the waste management.

Since there is a clear preference of the treatment arrangement, no other option be considered further.

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## 10 High-level cost estimate

The following Table 10-1 provides the estimated cost for the 12.9MLD lagoon sedimentation water treatment plant including 30% contingency. This estimate is based on NSW PW’s recent experience on similar projects and budget pricing obtained from a supplier.

Table 10-1: High-level cost estimate for the new NWTP

12.9 MLD Water Treatment Plant		Cost (\$) Excluding GST
1	Contractor's design and documentation including O&M manuals	1,000,000
2	General WTP site works incl. site establishment, disestablishment, clearing, landscaping, etc.	500,000
3	Raw water tank (concrete)	650,000
4	Lime + CO <sub>2</sub> dosing systems	1,300,000
5	Polyelectrolyte dosed to lagoon inlet and filter inlet	450,000
6	Coagulant dosing system (alum or PACL)	300,000
7	Lagoon sedimentation clarifiers (duty/ standby)	3,500,000
8	4 x dual media, rapid gravity filtration system (3 x 6 m surface area each)	7,000,000
9	Chlorine dosing system	250,000
10	Fluoride dosing system (Saturator)	250,000
11	UV disinfection duty, duty standby	390,000
12	Chlorine contact tank (concrete)	750,000
13	Treated water pumps	390,000
14	Waste water balance tank (concrete)	500,000
15	All electrical work including power supply	3,000,000
16	Road works	500,000
17	Office/ lab/ kitchen, etc building	500,000

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18	Chemical storage building	300,000
19	Lab equipment/safety equipment	130,000
20	Testing, demonstration, commissioning, operator training, and consumables during demonstration	650,000
21	12 months Performance Guarantee by contractor	400,000
22	Miscellaneous	750,000
	<b>Subtotal without contingency</b>	<b>23,460,000</b>
	Contingency 30%	7,038,000
	<b>Total cost of WTP including 30% Contingency</b>	<b>30,498,000</b>

Assumptions

- This is a high-level cost estimate.
- Selected site has enough land area as required.
- Any costs associated with land acquisition is excluded.
- No major civil work involved at the selected site.
- Excludes planning, design documentation, procurement and project management costs.
- Any other work related to the WTP upgrade such as decommissioning of the existing WTP components, new pipeline costs, etc are excluded.

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## 11 Next steps

As the outcome of the MCA shows a clear preferred treatment option, a Concept Design report will be prepared, followed by Design, Development and Construct specification indicating Option 3 as the mandatory treatment option.

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## 12 References

NHMRC Colic, M. &. (2005). New developments in mixing, flocculation and flotation for industrial wastewater pretreatment and municipal wastewater treatment.

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## Appendix A Description of Candidate Treatment Processes

This section provides a brief discussion on potential treatment process options for the proposed Narrandera WTP.

### Alkalinity and pH Control

#### Description

Alkalinity refers to the capacity of water to neutralise acids introduced into the system. Alkalinity is measured and expressed in terms of calcium carbonate (CaCO<sub>3</sub>).

Alkalinity in Murrumbidgee River water is low and there is no information available for alkalinity for the bore water. Council’s preference is to use Murrumbidgee River as the main raw water source for the new NWTP. Coagulants and other acidic chemicals that are required for treatment consume alkalinity as indicated in Appendix Table A-1. Sufficient alkalinity is required for coagulants to form flocs as well as produce water with stable pH that is neither corrosive nor scaling.

Alkalinity can be increased by dosing sodium hydroxide, hydrated lime or sodium carbonate as shown in **Appendix Table A-1**. Alkali dosing will also increase pH, carbon dioxide (CO<sub>2</sub>) can be dosed to reduce pH to within a target range without consuming alkalinity.

Appendix Table A-1: Treatment chemicals that affect alkalinity in water

Chemical	Formula	Alkalinity change mg/mg as CaCO <sub>3</sub>
Sodium hydroxide	NaOH	+1.25
Hydrated lime	Ca(OH) <sub>2</sub>	+1.35
Sodium bicarbonate	NaHCO <sub>3</sub>	+0.60
Sodium carbonate (soda ash)	Na <sub>2</sub> CO <sub>3</sub>	+1.0
Sulfuric acid	H <sub>2</sub> SO <sub>4</sub>	-1.02
Hydrochloric acid	HCl	-1.37
Carbon dioxide	CO <sub>2</sub>	0
Alum	Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> .18H <sub>2</sub> O	-0.51

Treated water should neither be corrosive to concrete structures/lined pipes and metallic infrastructure/components nor scaling, i.e. it should be “stable”. The calcium carbonate precipitation potential (CCPP) is an indicator of water stability. Water with a CCPP <0 is corrosive and water with a CCPP > 0 is scale forming. A water slightly negative CCPP (0 to -3) with a pH in the range 7.8 – 8.2 is desirable in protecting the pipes in the reticulation.



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There are benefits in dosing lime and CO<sub>2</sub> dosing at the new NWTP to increase water alkalinity and to improve water stability; however, this will incur additional capital and operating costs.

A lime dosing comprises a storage silo, dry feeder, mixing tank, dosing pumps and delivery pipes. CO<sub>2</sub> is supplied as pressurised gas and stored onsite in a cryogenic vessel. Gas is vaporised and dosed to raw water in a pipe. CO<sub>2</sub> storage systems can be purchased or leased from the gas supplier.

## Coagulation and Flocculation

### Description

Coagulation and flocculation are essential for the effective removal particles, dissolved organics and colloids using sedimentation, dissolved air flotation and media filtration. Particles and colloid include pathogens, algae, turbidity, colour and dissolved organic carbon.

Coagulation is the result of electrical and chemical reactions occurring in water after the addition of coagulant chemicals. It involves reducing the surface charge and forming complex hydrous oxides. This process is nearly instantaneous and completes within seconds of rapid mixing.

Flocculation refers to the process where coagulated particles aggregate once the repulsive forces keeping them apart are removed, along with the entanglement of particles by precipitating hydrous oxides. Unlike coagulation, flocculation requires a specific mixing period to allow particle growth, typically 20 minutes is provided but longer times may be required when treating water with low temperature.

### Coagulants and Flocculants

The primary coagulants commonly used in water treatment are aluminium sulphate (alum), poly aluminium chloride (PACL), and aluminium chlorohydrate (ACH).

When dosed to water, coagulants reducing the repulsive surface charge of particles, dissolved organics and colloids allowing them to form larger aggregates (flocs) which can then be separated from water by clarification and media filtration processes.

Alum, ACH and PACL have different chemical properties that impact on dosed water pH and alkalinity as well as floc formation.

- Alum depresses water pH more than PACL which depresses water pH more than ACH.
- PACL and ACH are pre-hydrolysed meaning they consume less alkalinity than alum.
- PACL and ACH may form flocs faster than alum.
- Specific coagulants may be suited to a treatment process, e.g. ACH is used for MF/UF membrane filtration applications.

Jar testing investigation was undertaken by MJM Environmental Pvt Ltd for Narrandera. The following 3 water samples were undertaken for testing. It is noted that only one of the bores was used for the test. Bore 5 was selected as the bore with poorest water quality.

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- River water
- River /Bore #5 shandy (50/50)
- Bore #5 water

The test simulated treatment for conventional settling, lagoon sedimentation and dissolved air floatation (DAF). River water turbidity and colour used for the jar test was extremely low and jar test results provide little information regarding treatability of Murrumbidgee River water at Narrandera using different treatment processes and coagulants. The jar test should be repeated when the river water contains elevated turbidity and colour and/or algal cells.

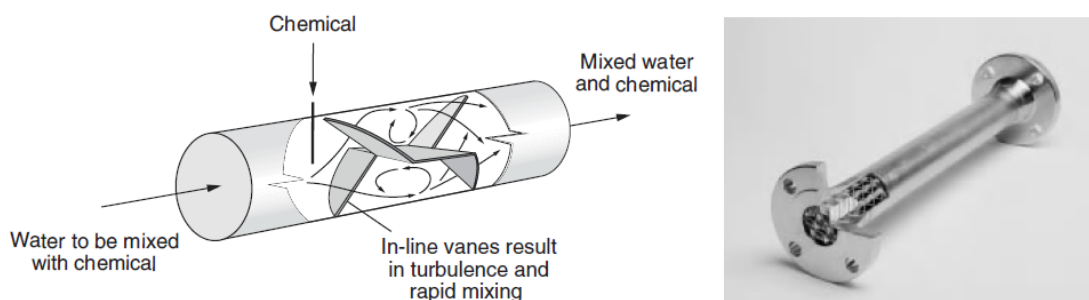
Jar testing will identify the preferred/suitable coagulants as well as the required flocculation time for Narrandera.

Organic polyelectrolytes can be dosed to coagulated water to improve floc removal by clarification and media filtration processes. Polyelectrolytes are also dosed to backwash water and sludge streams prior to thickening in thickener tank.

Equipment

*Coagulation Equipment*

Rapid mixing of chemicals be achieved by dosing the coagulant across a weir or in pipe and using bends, orifice plates or static mixers as shown in **Appendix Figure A-1**. Static mixers do not require power, but they may cause head loss and perform at reduced efficiency if flow rates are lower than designed. Mechanical mixers can also be used and include propellers, impellers, and turbines, they are commonly used in baffled concrete tanks with multiple compartments to allow flexible chemical mixing times (**Appendix Figure A-2**).



Appendix Figure A-1: Static mixer used for blending

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Appendix Figure A-2: Impeller flash mixer

### *Flocculation Equipment*

Flocculation equipment consists of a large basin with a mechanism for slow, gentle mixing. In conventional treatment plants, flocculation basins are often built together with sedimentation tanks, separated by a common wall. Mixing can be done mechanically with rotating paddles or hydraulically, typically in two to three stages with decreasing intensity to promote floc growth. Since floc particles are fragile, the process must be slow to avoid breaking them. Some of the usual flocculator designs include vertical and horizontal types.

Typical two compartment tanks are used with a detention time of 20.

Flocculators are generally located outside and do not require enclosure.

## Clarification

Clarification is the water treatment process that separate flocs from water using gravity or flotation as a pretreatment to filtration.

Effective clarification requires optimised coagulation and flocculation. By optimizing the clarification process, the efficiency of filtration is significantly improved, filter run times are extended and backwash frequency is reduced. This leads to lower maintenance and operating costs, enhancing the overall efficiency and cost-effectiveness of water treatment operations.

Surface loading rate is a key parameter that is used to design clarifiers, surface loading rate is the ratio of the flow rate ( $m^3/hr$ ) and the clarifier surface area ( $m^2$ ). Different clarifiers are

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designed with different surface overflow rates. Clarifiers with high surface overflow rate require a smaller footprint and less land.

### Conventional horizontal flow sedimentation tanks

Conventional horizontal flow sedimentation tanks are typically design with a surface loading rate of 1 to 2 m/hr to provide a large surface area for settling. Coagulation and flocculation are provided upstream as presented in **Appendix Figure A-3**.

Horizontal flow sedimentation tanks are suitable for water that produce larger, heavier, and more settleable solids under gravity after coagulation and flocculation. They can also be used for treating water containing natural organic. Treatment of algal laden water may be problematic as algae cells often float and do not settle.

Horizontal flow clarifiers are located outside and do not require enclosure.

Sludge can be removed in several ways including a vacuum or pumped travelling bridge system or a clarifier conical/hopper bottom and de-sludge valves.

Settled water is polished using either media filter or MF/UF filtration to remove floc carryover and to meet treated water turbidity targets.



Appendix Figure A-3: Conventional horizontal flow sedimentation clarifier

### Inclined plate clarifier

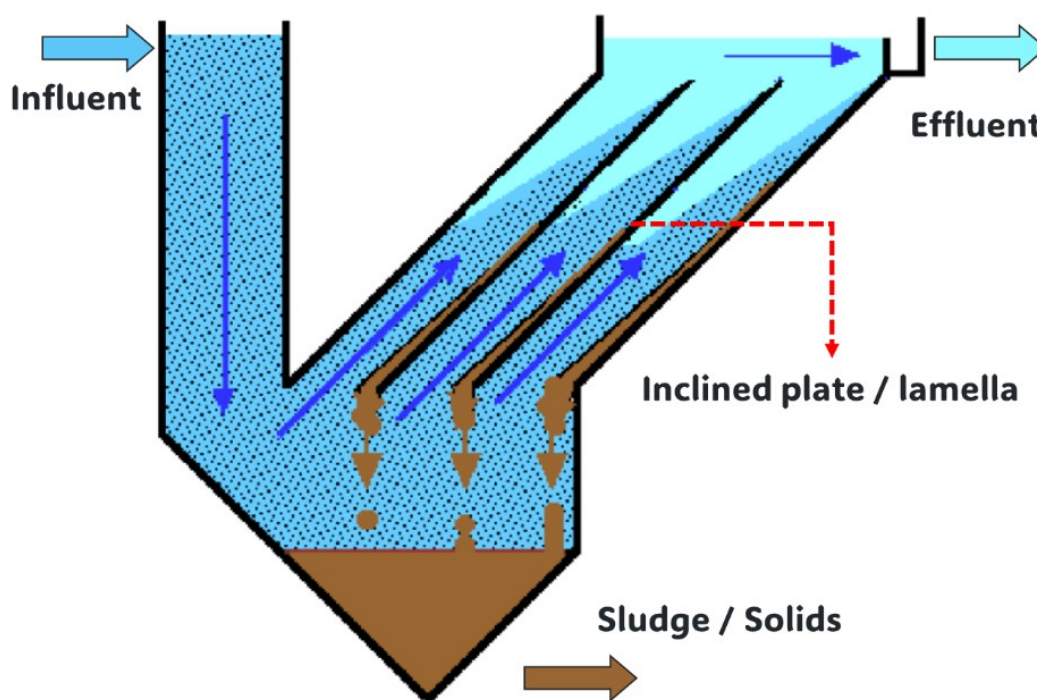
Inclined plate clarifiers (IPC) include inclined plates positioned in the settling tank at an angle typically in the range 45 to 60 degree to increase the projected setting area of settling. IPCs are typically designed with a surface loading rate in the range 5-7m/hr. Inclined plates allow

for greater treatment capacity in a smaller space, making it an attractive option for water treatment facilities with limited land.

**Appendix Figure A-4** illustrates the principle of an IPC. Coagulated and flocculated water is still upon entry into the clarifier. Floc particles settle on the plates and accumulate at the bottom of the clarifier unit. The sludge is drawn off periodically. IPC are generally located outside and do not require enclosure.

The spacing between plates typically ranges from 2.5 cm to 5 cm. Plates can be prone to blockage caused by slime/floc build up requiring the clarifier to be drained down.

Settled water is polished using either media filter or MF/UF filtration to remove floc carryover and to meet treated water turbidity targets.



Appendix Figure A-4: Inclined plate clarifier (Morling, 2019)

### Dissolved air flotation

Dissolved Air Flotation (DAF) is suited to effective treating water high algal cell numbers and high amounts of natural organic alum floc that do not settle easily. This process requires effective coagulation and flocculation as pretreatment to function properly.

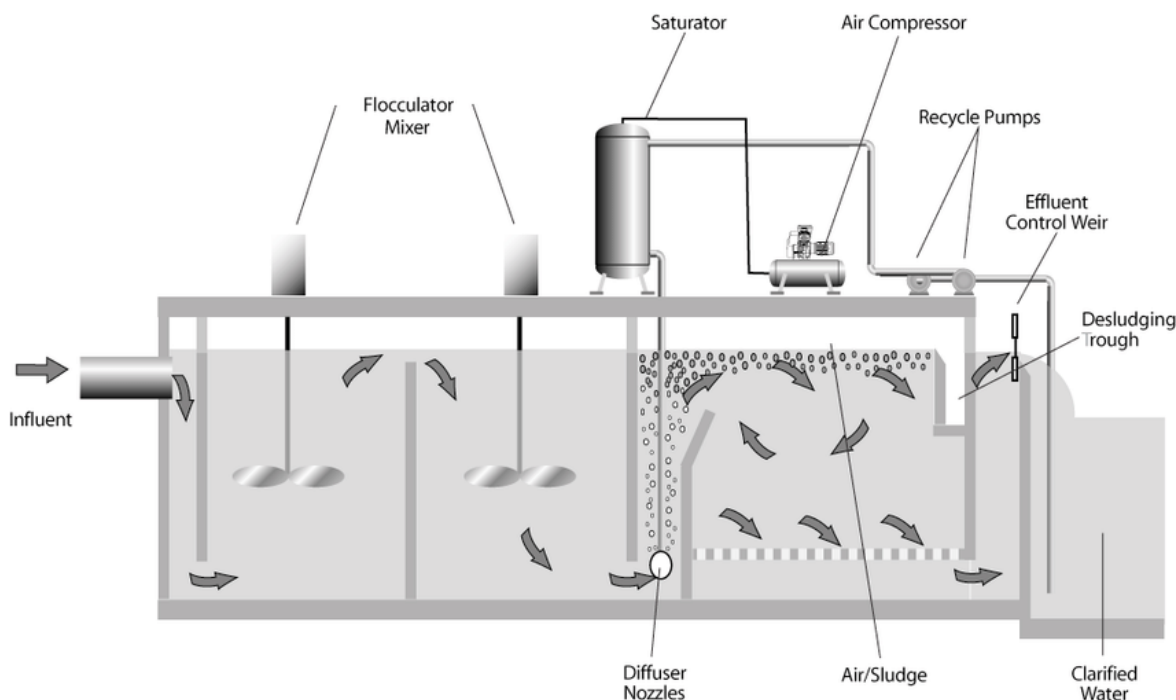
Filtered or floated water back is pumped to the inlet of DAF tank at the diffuser nozzle zone. The recycle rate is typically in the range 10 - 15% of the raw water flow. The recycle stream is saturated with air under high pressure (500-600 kPa) in a saturator tank and air is released as fine bubbles through evenly spaced needle valves/nozzles as shown in Appendix Figure A-5.

Bubbles attach to flocs reducing their density allowing them to rise to the surface of the DAF tank as a floated sludge. DAF float is discharged to the de-sludge trough using a mechanical



roller or by raising the water level in the DAF tank by closing the DAF outlet valve. Sludge scrapers can be included on the floor of the DAF tank to when treating water with increased turbidity.

DAFs are typically designed with a surface loading rate of 8-10 m/hr for NSW country town applications.



Appendix Figure A-5: Illustration of DAF process (Colic, 2005)

Floated water is polished using either media filter or MF/UF filtration to meet treated water turbidity targets.

Flotation can be installed in a dedicated DAF tank:

- DAF/F indicates a separate DAF and media filter F.
- DAF / MF/UF indicates a separate DAF tank and micro or ultra filter (MF/UF).

Alternatively, flotation can be installed in the media filter tank directly above the filter media as an infiltrator DAFF.

Flotation requires more sophisticated instrumentation, increased mechanical equipment, and higher operational costs compared to conventional sedimentation. DAF clarifiers must be located in an enclosed structure with a roof and walls to prevent knock down of floated sludge by rain and wind.

### Lagoon sedimentation clarifier

The lagoon sedimentation clarifier treatment process was specifically designed for country WTPs in NSW and there are more than 20 WTPs using this process. **Appendix Figure A-6** shows an image of a typical lagoon sedimentation clarifier.

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Appendix Figure A-6: Lagoon Sedimentation Clarifier

Unlike conventional or lamella clarifiers which are sized on surface loading rate, sedimentation lagoons are sized according to treatment plant sludge production. Lagoons with underdrains are sized to store 6 months sludge production while lagoons without underdrains are sized to store 12 months sludge production at a depth of 1m sludge and at 3 percent dry solids. This approach significantly reduces the surface over rate as compared to other clarifiers.

The lagoon sedimentation process allows the inclusion of raw water pH correction, coagulation, flocculation, clarification, filter back wash water treatment, sludge thickening and sludge drying. This is achieved using inground earth lagoons. Settled water lagoon clarifier requires polishing using either granular media filters or membrane filtration.

A minimum of two (2) inground earth lagoons are required. One lagoon operates in filling mode for clarification and sludge thickening, the other is used to dry the thickened sludge. Operating duty is switched at the end of the design drying time which is 6 or 12 months for lagoons with and without underdrains respectively.

### Inlet zone

Rapid mixing of coagulant is achieved dosing coagulant to the inlet pipe and mixing using pipe bends, orifice plates static mixer or weirs.

Coagulated raw water is discharged from the raw water pipe to flocculation zone located at the opposite end of the lagoon to the outlet structure.

Mechanical flocculation using mechanical mixers and flocculation tanks external to the lagoon are not required. Flocculation design for the lagoon sedimentation clarifier is less critical than conventional or lamella clarifiers due to the extended residence time in the lagoon which is typically 10 hrs or longer. Hydraulic flocculation occurs in the inlet pipe and in the baffled compartment of lagoon. Wind action also causes flocculation to occur within the lagoon.

### Outlet structure

The outlet structure is generally a prefabricated cylindrical structure with removable stoplogs that can be removed to allow decanting of water from the lagoon during the drying process. It is essential to locate the outlet structure at the deepest part of the lagoon to enable sludge to

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be dried, this is achieved by progressively removing stoplogs to top of the sludge layer and ultimately to the floor of the lagoon. This allows drainage of rainwater from the drying lagoon.

Water drains over the top stop log and free falls into the outlet structure where it exits through a discharge pipe and isolation valve to the pump pit. Settled water is pumped to either granular media or membrane filters for polishing. Settled water can also be pumped back to the inlet of the lagoon in the event of process upset e.g. sub optimal coagulation thus ensuring correct treatment is achieved.

The process is also capable of removing iron and manganese from bore water without additional oxidants, as the long detention times allow for natural oxidation. It consistently produces high-quality clarified water, with settled water turbidity remaining below 2 NTU.

This method offers several advantages over conventional and inclined plate clarifiers, including:

- Lower capital and operational costs due to the integration of clarification and residual management in one unit.
- Effective treatment of dirty filter backwash water
- Provides robust treatment across varying raw water qualities.

However, potential downsides include the larger footprint required for lagoons, which may not be feasible in all locations, and the need for ongoing maintenance to manage weed growth.

## Filtration

Following clarification, filtration using either rapid gravity media filters (RGF) or membrane filtration using microfiltration (MF) or ultrafiltration (UF) are used to remove floc carry over and meet treated water turbidity targets.

The typical individual filter turbidity target for a media filter is < 0.2 NTU as a 95 percentile and < 0.5 NTU as an absolute value.

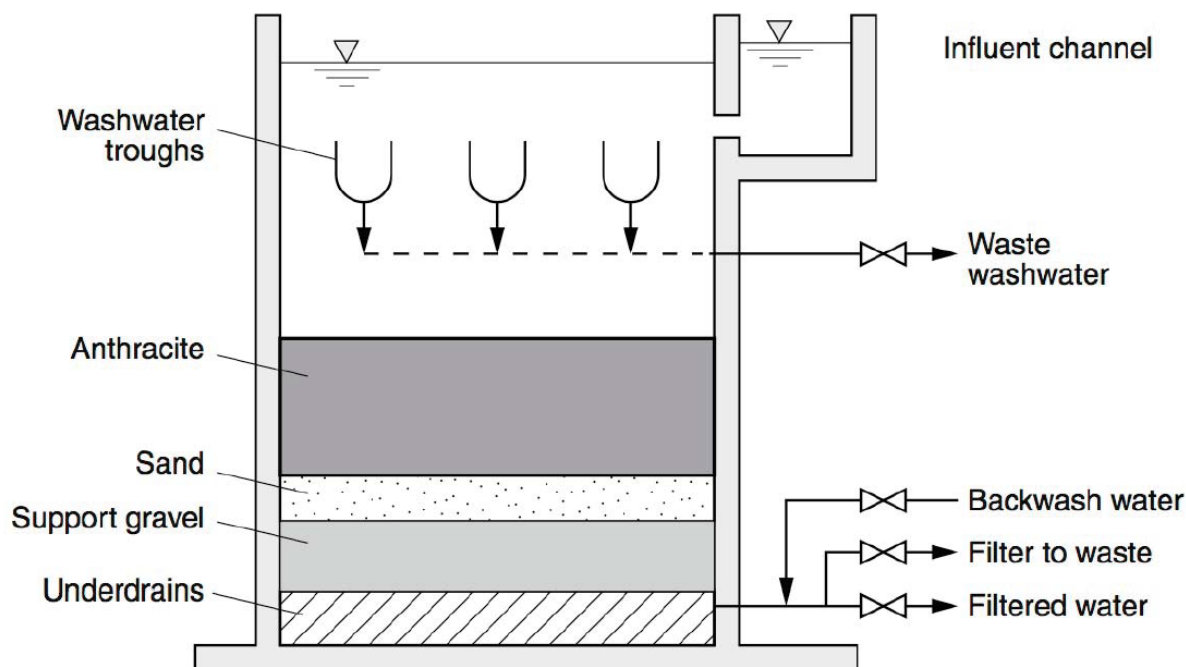
The typical individual filter turbidity target for a MF/UF filter is < 0.1 NTU as a 95 percentile.

### Media filtration

Effective raw water coagulation is essential for media filters to achieve filter turbidity targets.

Media filtration employs a bed of granular materials, this may be filter-coal, sand or granular activated carbon (GAC) to remove particles from water. Particles including pathogens, algae and flocs are removed by interception, diffusion, electrical attraction and sedimentation on media grains. **Appendix Figure A-7** presents a typical media filter.





Appendix Figure A-7: Rapid Gravity Filter (Williams, 2016)

Filtration rate is the ratio of filter flow rate ( $m^3/hr$ ), and filter surface ( $m^2$ ) are key media filter design parameter. Media filters are typically designed with a filtration rate in the range 6 to 10  $m/hr$  and are normally designed to be backwashed using air and water once per day (22 hrs) at treatment plants in NSW country towns.

Clean back wash water is sourced either from a dedicated tank or from the treated water tank. Approximately three percent of raw water flow is used for backwashing. Dirty backwash water must be treated to remove turbidity where it can be recycled to the head of the plant.

There may be a turbidity spike when media filters are returned to service after backwashing, this can be controlled by filtering to waste or by optimising the backwash process.

Conventional filtration is described as a process train that includes coagulation, flocculation, clarification using sedimentation or flotation and media filtration (NHMRC). Conventional filtration is credited with 2.5-4 LRV for protozoa, 2 LRV for virus and 2 LRV for bacteria provided filtered water is  $<0.2$  NTU measured continually at each filter outlet using an online turbidity meter (NHMRC, 2011).

Direct filtration is described as a process train that includes coagulation, flocculation, and media filtration (NHMRC). Media filters used in direct filtration mode are credited with 2.0-3.5 LRV for protozoa, 1 LRV for virus and 1 LRV for bacteria provided filtered water is  $<0.2$  NTU measured continually at each filter outlet using an online turbidity meter (NHMRC, 2011).



## UV disinfection

UV disinfection uses UV wavelengths around 235.6 nm to rearrange genetic material (DNA or RNA) in pathogens thereby preventing replication.

Conventional UV disinfection systems consist of UV lamps enclosed in a cylindrical quartz sleeve, which is transparent to UV light. As water flows over the quartz sleeves, the UV light disinfects it. However, scaling can occur on the sleeves, reducing UV transmission, so regular cleaning is necessary.

The UV dosage, measured in milli joules per square centimetre squared (mJ/cm<sup>2</sup>), determines disinfection effectiveness.

The advantages of UV disinfection include a short detention time of 3 to 6 seconds, no impact on the taste, odour, or chemical composition of the water, and no harmful effects from overdosing. However, the disadvantages are that UV disinfection does not provide any residual disinfection capacity, and the effectiveness can be reduced as UV light is absorbed by various constituents in the water, such as turbidity, organic matter and iron.

**Appendix Table A-2: UV Dose (mJ/cm<sup>2</sup>) for 0.5 to 6.0 log Inactivation of Cryptosporidium, Giardia, and Adenovirus (Qian & USEPA, 2003)**

LRV	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Cryptosporidium	1.6	2.5	3.9	5.8	8.5	12	15	22	30	45	64	85
Giardia	1.5	2.1	3	5.2	7.7	11	15	22	28	42	60	84
Adenovirus	39	58	79	100	121	143	163	186	208	231	253	276

**Appendix Table A-2** presents UV Dose (mJ/cm<sup>2</sup>) for 0.5 to 6.0 log Inactivation of Cryptosporidium, Giardia, and Adenovirus (source USEPA, 2003; Qian et al., 2004). Pathogen LRV is validated for 6.0 LRV, however, ADWG allows a maximum of 4 LRV for any treatment process (NHMRC, 2011).

## Chlorination

The most commonly used chlorine compounds in water treatment are gaseous chlorine (Cl<sub>2</sub>), sodium hypochlorite (NaOCl), and calcium hypochlorite (Ca(OCl)<sub>2</sub>). Chlorine dioxide is another effective disinfectant but is used less frequently due to the need for on-site generation, which can be costly.

ADWG allows 4 LRV for bacteria and 4 LRV for viruses provided a default CT of 15 mg.min/L is achieved.

## Fluoridation

Fluoridation is the process of adding small amounts of a fluoride compound to the water supply to maintain an optimal fluoride level, providing dental health benefits to consumers. This practice helps to strengthen tooth enamel and reduce the incidence of tooth decay, especially among children in the community.

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## Residuals Management

### Sludge and backwash water

In water treatment processes, waste is primarily generated from the discharge of clarifier sludge and filter backwash. The volume of waste produced typically ranges from 2% to 5% of the plant's throughput, but in some cases, it can be as high as 10%. Despite the large volume, this waste contains a low solids content and consists mostly of water. The most suitable treatment method for this type of waste is the sludge lagoon system, as discussed in the previous section.

At least two lagoons are provided, each lagoon is capable of holding 12 months sludge production. Lagoons are typically 2 m deep and sludge depth after 12 months filling is 1 metre. Once the operating lagoon is filled or at the design filling time, the duty of the lagoons is changed. The filled Lagoons remains offline to dry. Stoplogs from the outlet structure are removed progressively to just below the sludge layer. Supernatant is recycled to the plant inlet. At the end of the drying cycle, the dry sludge is typically 50% dry solids or more and is removed by a bobcat.

Although sludge from water filtration plants is not commonly treated using alternative methods, there are other dewatering techniques available for various types of sludge, including:

- Sludge drying beds (natural)
- Mechanical dewatering systems.

### Sludge drying beds

For sludges with a higher solids content (2–3%), air drying can be performed on a bed of porous material equipped with underdrains. The medium used can be sand, concrete, or steel mesh, but it is crucial that the pores remain unclogged by sludge solids; otherwise, the drying bed will function as a lagoon. Water is removed through both free drainage and evaporation. Sludge drying beds are commonly used in sewage treatment plants, with sludge layers typically 100–250 mm deep. In water treatment plants, this underflow can be recycled at a rate not exceeding 10% of the plant's inlet flow rate. Sludge drying beds require pretreatment using flow balancing tank, thickener tank and poly electrolyte dosing.

Sludge drying beds is a candidate option for residual management at Narrandera.

### Mechanical dewatering

In cases where sludges do not dry easily by natural means or when space is limited, mechanical dewatering devices are used. These devices include rotary vacuum filters, filter presses, belt filter presses, and centrifuges, which help to effectively reduce the water content in the sludge.

Given the high power cost and required, mechanical dewatering is not a candidate option for residual management at Narrandera.

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### Dry sludge disposal

Under strict State Regulations the only viable option for sludge disposal at most plants at present is landfill.

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## Appendix B Water quality report by NSW PW (*report # P-FY20220803-PWO-WAT-RP-002-01*)

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# Narrandera Water Treatment Plant Upgrade

## Discussion Paper: Water Quality Review



Report Number: P-FY20220803-PWO-WAT-RP-001-01

September 2024

Prepared for:



**NSW Public Works**

Department of Regional NSW



Report Number: P-FY20220803-PWO-WAT-RP-001-01

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Cover photo: Narrandera Bore 1 site.

Source: NSW Public Works.

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## Executive Summary

### Background

Narrandera Shire Council (NSC) provides reticulated potable water supply to the town of Narrandera and to rural residential properties on the outskirts of the town. NSC supplies the town with potable from four bores referred to as 1, 2B, 3 and 5. Water from Bore 4 is blended with recycled water and used for non-potable purposes.

Water from bores 2B and 5 is combined and aerated via a packed aeration tower (Aeration Tank #1) to remove hydrogen sulphide and carbon dioxide. Water bores 1 and 3 is also combined and feed to a second packed aeration tower (Aeration Tank #2). The towers are rated for 70 L/s and 110 L/s respectively. Water from the two aeration towers is blended in the 2 ML balance tank and then chlorinated for disinfection and then pumped to reticulation. The chlorinated water pumps are rated to pump 160 to 250 L/s.

### Customer complaints/ water quality issues

There have been numerous customer complaints in the past of discoloured water and taste and odour issues.

Discoloured water is mainly caused by iron and manganese in Narrandera water supply. Both iron and manganese are present in bore water at concentrations that exceed the Australian Drinking Water Guideline aesthetic limits of 0.3 mg/L and Manganese 0.1 mg/L respectively. The existing treatment does not remove iron or manganese, operators have limited control of Iron and Manganese by management of bore flows and bore selection.

Taste and odours are a major factor in customer perception of drinking water quality. Taste and odours in drinking water can originate from a wide variety of factors. A review of water quality in samples taken from bore water and distribution system has identified several causes for taste and odour at Narrandera.

- Bore water contains hydrogen sulphide which imparts a rotten egg odour. The aerators are intended to remove hydrogen sulphide from water, but complete removal is unlikely as the pH of the water is greater than 7.0. Effective hydrogen sulphide removal by aeration requires water pH to be reduced to 6.0.
- Free chlorine residual measured in the distribution is variable, sudden change from low to high can lead to customers complaints due to chlorinous taste and odours. Chlorine control at Narrandera may be made more difficult due the presence of hydrogen sulphide in bore water.
- Bore water at Narrandera contains high concentrations of iron and manganese which may impart a metallic taste.

Floods caused by rising river levels above normal in 2022 caused aquifer contamination at all locations with *E. coli*, turbidity, dissolved organic carbon (DOC) and high chlorine demand. Council called a boil water alert for several weeks in response to the contamination. Council believes the contamination occurred through improperly sealed privately owned bores. even though the Council 5 bores are properly sealed. This issue has not been identified earlier and



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has driven the need for the new treatment plant to remove turbidity and DOC when treating bore water.

**Water quality**

The table below provides a summary of the key water quality parameters for both river and bore water sources.

Parameter	Comments_ River water	Comments_ Bore water
Alkalinity	There is no guideline value given in ADWG for alkalinity. The river water can be low in alkalinity. Sufficient alkalinity is required for coagulation, to allow pH stability and to prevent corrosion.	There is only a limited information regarding the bore water.  Iron levels are generally high in all the 5 bores considered and exceed the ADWG limits apart from Bore #2B. However, Bore #2B has elevated levels of TDS, chlorides and sodium. High dissolved solids can cause taste and odour issues as well as discolours water.
Hardness	The river water most times appears to be soft in nature.	In general, all the bores do not have manganese at a level to be concerned.
TDS	No specific health guideline value is provided for total dissolved solids (TDS) in ADWG, as there are no health effects directly attributable to TDS. However, for good palatability total dissolved solids in drinking water should not exceed 600 mg/L. For Murrumbidgee River, TDS levels are very low hence can lead to corrosive water.	Bore #5 has high level of turbidity, hardness while Bore #3 has a high level of TDS and chlorides.
pH	Mean pH is neutral while it ranges from 6-8.2.	A testing program is proposed to monitor the quality of the bore water.
True colour	Based on aesthetic considerations in ADWG, true colour in drinking water should not exceed 15 HU. Upstream of Murrumbidgee River at Narrandera, the true colour recorded very high values up to a maximum of 700PCU. Coagulation can remove the colour of water.	
Turbidity	Murrumbidgee River water has recorded turbidity up to 114NTU at Wagga and 52NTU at Narrandera. Coagulation followed by filtration can easily remove turbidity in water.	
Iron	Murrumbidgee River water recorded iron levels up to 1.3mg/L. Based on aesthetic considerations, the concentration of iron in drinking water should not exceed 0.3 mg/L. Iron salts can be effectively removed by the	

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	standard water treatment processes of coagulation followed by filtration.	
Manganese	<p>The ADWG aesthetic manganese concentration is 0.1 mg/L. In practice the treated water manganese concentration needs to be &lt; 0.05 mg/L or lower to avoid customer complaints and manganese accumulation in the distribution system.</p> <p>Manganese recorded in Murrumbidgee River at Wagga suggest that 95% of the time it is below 0.1mg/L and occasionally it can go over. The highest recorded was 0.24mg/L.</p> <p>Manganese can be removed by oxidising soluble forms to insoluble precipitates, followed by filtration.</p>	
UV transmissivity (UVT)	<p>UVT is an indicator of natural organic matter (NOM) and it is used to design and operate UV disinfection systems. For Murrumbidgee River, it has recorded a minimum UVT of 53% and mean UVT of 77%.</p>	
Cyanobacteria	<p>Cyanobacteria can produce taste and odour compounds (MIB and geosmin) as well as toxins.</p> <p>Jar testing was undertaken when low number of non-toxin/taste and odour producing cyanobacteria were present in the Murrumbidgee River. Repeat testing is required when cyanobacteria are present higher numbers.</p> <p>Extracellular toxins and taste can be removed by powdered activated carbon (PAC) and chlorination.</p> <p>Algal cells can be removed by coagulation, clarification and filtration. Extracellular taste and odour compounds can be removed using activated carbon.</p>	

To overcome the current issues at the water supply and to provide safe/secure drinking water supply, Narrandera Shire Council is planning for a new water treatment plant. Currently bore water is used as the raw water source. Recent discussions with Council confirmed that the new

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treatment would be designed to treat Murrumbidgee River water as the preferred source for the town supplemented by bore water when required. The new Narrandera WTP is required to be robust and flexible in design to treat different raw water sources such as river water only, river and bore water in a shandy mix and bore water only.

The following tables present the final raw water envelop to proceed to the options development stage.

**Narrandera WTP Raw Water Quality Design Envelope for Concept Design (bore water)**

Parameter	Units	Lower	Mean	Upper
Alkalinity as CaCO <sub>3</sub>	mg/L	80	125	200
Calcium as CaCO <sub>3</sub>	mg/L	11	22	36
CCPP as CaCO <sub>3</sub>	mg/L	-9.7	-4.9	3.36
Chloride	mg/L	22	148	308
pH	pH	7.5	7.9	8.5
Sulphate	mg/L	4	25	61
TDS	mg/L	150	410	745
Temperature	°C	3	25	45
TOC	mg/L	1	1	4
Total iron	mg/L	0.06	0.63	2.0
Total manganese	µg/L	8	62	200
True colour	HU	1.0	3.0	5.0
Turbidity	NTU	0.6	5.1	22.0

**Narrandera WTP Raw Water Quality Design Envelope for Concept Design (Murrumbidgee River)**

Parameter	Units	Lower	Mean	Upper
Alkalinity as CaCO <sub>3</sub>	mg/L	10	52	83
Calcium as CaCO <sub>3</sub>	mg/L	4.94	8	13.1
Chloride	mg/L	5	21	80

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Parameter	Units	Lower	Mean	Upper
pH	pH	6	7	8.2
Sulphate	mg/L	0	3.8	8
TDS	mg/L	11	76	404
Total iron	mg/L	0.01	0.04	1.3
Total manganese	µg/L	0.001	5	9.6
True colour	HU	3	83	700
Turbidity	NTU	0.42	21	114

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## Abbreviations and Notations

Item	Description
#	Number
1999 H1, H2, etc	Yearly first half and second half
ADWG	Australian Drinking Water Guidelines
BH1-BH5	Narrandera bore naming (bore hole #1, #2, etc)
CaCO <sub>3</sub>	Calcium carbonate
CWT	City Water Technologies (A private consultancy firm)
DAF	Dissolved air floatation
DOC	Dissolved organic carbon
E-coli	Escherichia coli (used as the primary indicator of faecal contamination of drinking-water supplies)
FCR	Free chlorine residual
GHD	A private consultancy firm
HBT	Health based targets
HU	Hazen units (colour measuring unit)
IWCM	Integrated Water Cycle Management
km	kilometre
L/s	Litres per second
LRV	Log reduction value (measurement used to express how significantly a decontamination process reduces the concentration of a contaminant, typically bacteria or viruses, by calculating the logarithm (base 10) of the ratio between the initial contaminant level and the level after treatment)
mg/L	Milligram per litre (measurement of chemical concentration)
mg/L / µg/L	milligrams per litre \ micro-grams per litre
ML/ MLD/ ML/d	Mega litres/ Megalitres per day
NSC	Narrandera Shire Council
NSWPW	New South Wales Public Works
NTU	Nephelometric Turbidity unit
NTU	Nephelometric Turbidity Unit (measuring unit of turbidity)
Retic	Reticulation
TDS	Total dissolved solids
THM/ THMFP	Trihalomethanes (a group of chemicals that are a byproduct of water disinfection as a result of present of organic carbon) / Trihalomethane forming potential

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UVT                      Ultraviolet transmittance

WTP                      Water treatment plant



# 1. Introduction

## 1.1 Narrandera water supply

Narrandera Shire Council (NSC) provides reticulated potable water supply to the town of Narrandera and to rural residential properties on the outskirts of the town.

NSC currently have 5 production bores as shown in Figure 1-1. Bore BH1, BH2B, BH3, BH4 and BH5 hereafter will be referred as Bore #1, #2B, #3, #4 and #5. More details of the bores are provided in Section 2.

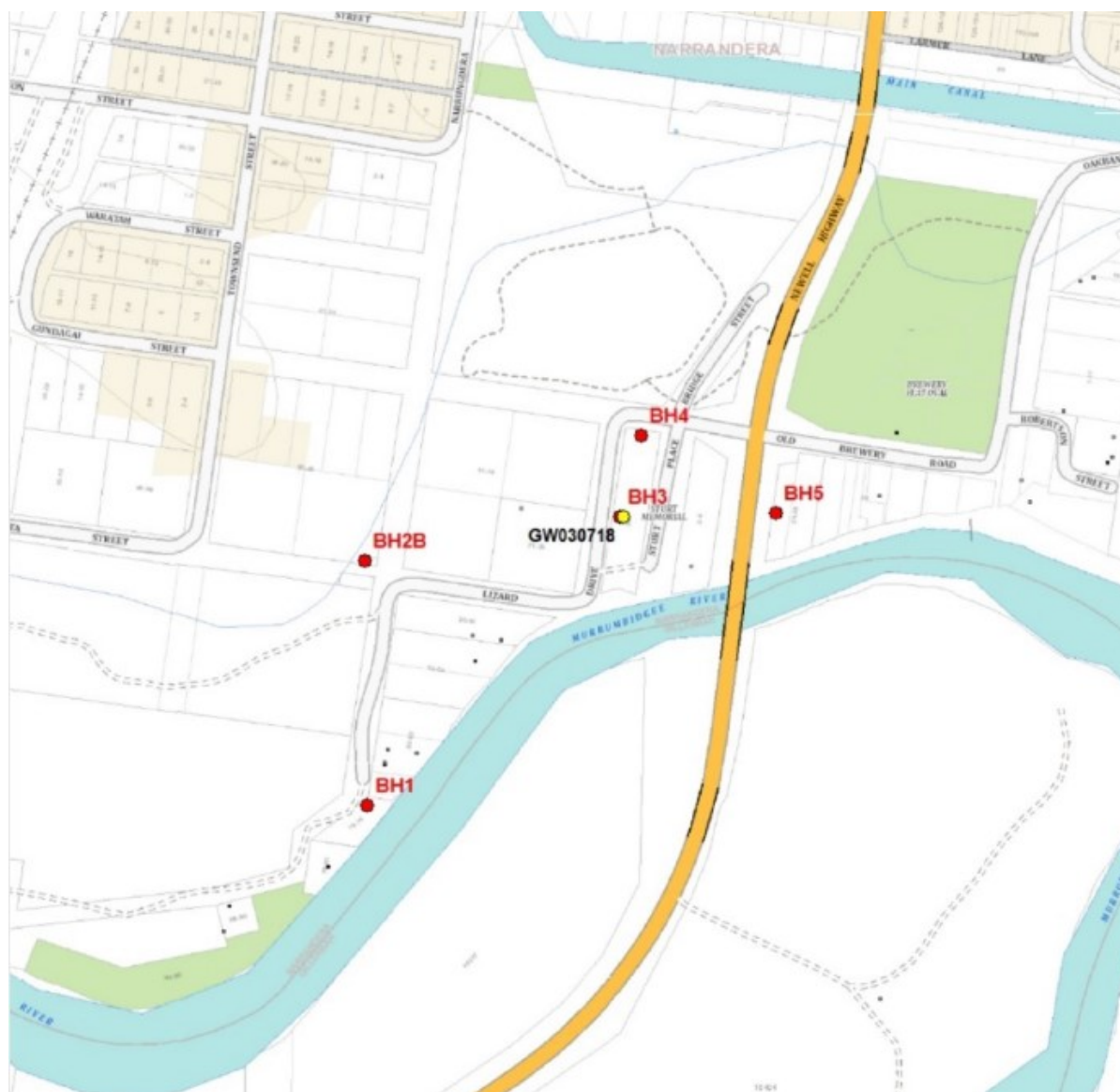


Figure 1-1: Borefield Location and Setting (C. M. Jewell & Associates Pty Ltd, May 2022)

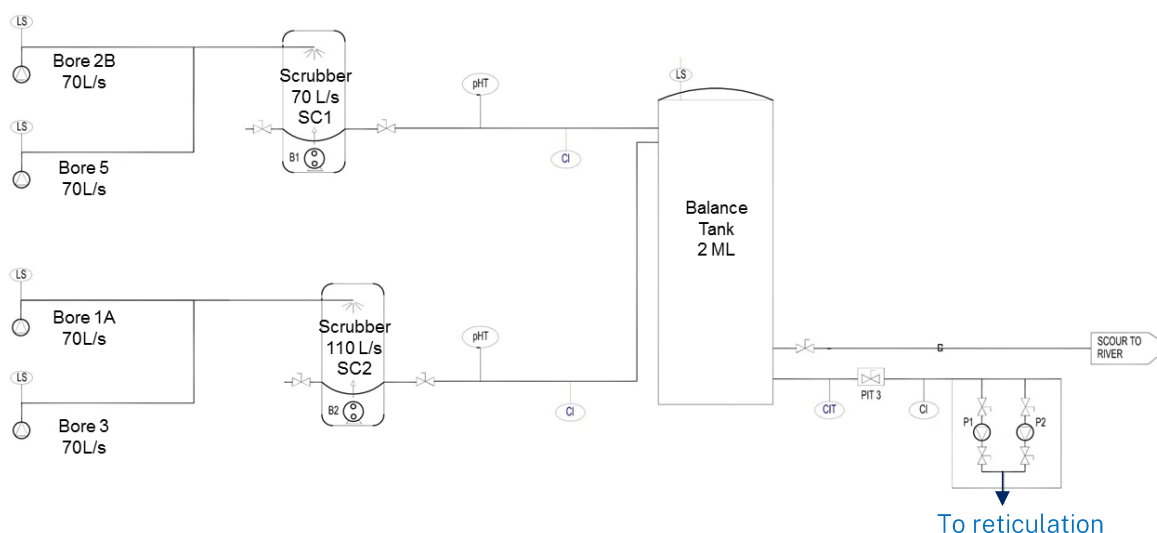
The existing treatment process at Narrandera WTP is discussed below.

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Raw water is taken from four (4) bores (bores 1, 2B, 3, and 5). Bore 4 is used for non-potable use and is blended with recycled water without any treatment. Bores 2B and 5 are combined and aerated via a packed aeration tower (Aeration Tank #1) to remove hydrogen sulphide and oxidise dissolved iron and manganese into particulate form. Bores 1 and 3 are combined and feed to a second packed aeration tower (Aeration Tank #2) similarly to the other process. The towers are rated for 70 L/s and 110 L/s. Chlorine is dosed after aeration and after the balance tank. There is an additional chlorine booster station after the Dalgetty St low level reservoirs. Aerated water is stored in a 2 ML balance tank before being pumped into the distribution system via clear water pumps. The clear water pumps are rated to pump 160 to 250 L/s. They are fixed speed pumps with manual flow control by throttling the discharge. The following Figure 1-2 provides a process flow diagram of the current treatment arrangement.



**Figure 1-2: Current treatment arrangement at Narrandera**

The distribution system has three reservoir zones which are isolated to prevent recirculation of the supply. There are five reservoirs including the balance tank, details of which are provided in Table 1-1.

**Table 1-1: Narrandera WS reservoirs (Source: IWCM)**

Name	Units	Capacity (ML)
Balance Tank	1	2.0
Gordon St reservoir	1	4.5
Dalgetty St low level reservoirs	2	1.0
Dalgetty St high level reservoir	1	7.5
Pine Hill reservoir	4	0.4
<b>Total reservoir capacity</b>		<b>15.4</b>



The following Figure 1-3 shows the distribution system at Narrandera.

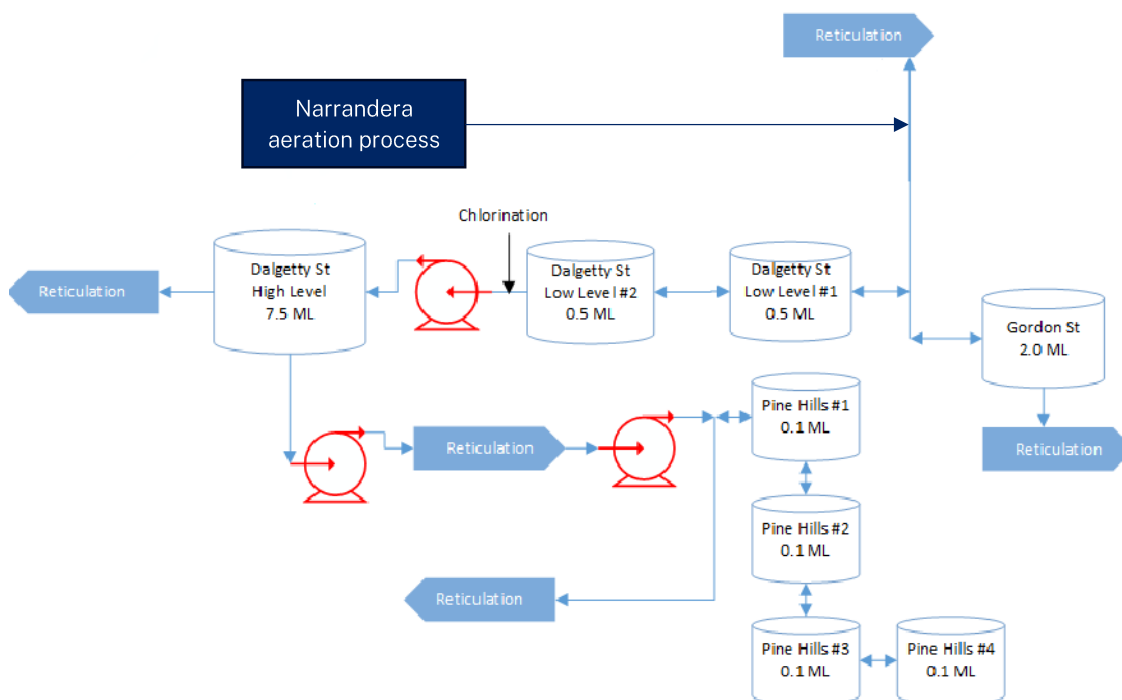


Figure 1-3: Distribution system at Narrandera (CWT, 2017)

## 1.2 Water quality issues

### 1.2.1 Discoloured water

There have been numerous customer complaints in the past of discoloured water caused by iron and manganese in Narrandera in the water supply. Both iron and manganese are present in bore water at concentrations that exceed the Australian Drinking Water Guideline aesthetic limits of 0.3 mg/L and 0.1 mg/L respectively.

The existing treatment does not remove iron or manganese, operators have limited control of iron and manganese by management of bore flows and bore selection. More explanation of iron and manganese in bore water is provided in Section 4.1.2.

Iron and manganese discolouration events in the distribution can occur even when concentrations in treated water are less than ADWG limits. Oxidised iron and manganese can accumulate in low flow regions of the distribution system including tanks and pipe dead ends. Sediments can be re-suspended causing customer complaints when flow reversals or flow increases occur. In order to prevent these events, many treatment plants are operated to produce treated water with manganese concentration <0.05 mg/L or less. In addition, regular cleaning of tanks and low flow pipes is undertaken.



### 1.2.2 Taste and odour

There have also been numerous complaints from the customers regarding taste and odour Narrandera. Taste and odours are a major factor in customer perception of drinking water quality. Taste and odours in drinking water can originate from a wide variety of factors. More details about taste and odours in drinking water is discussed in Section 4.

Identification of the causes of taste and odour complaints is a key aim of this investigation and this report and will provide essential information that can be used to scope the design of the new Narrandera WTP.

### 1.2.3 Contamination of bores

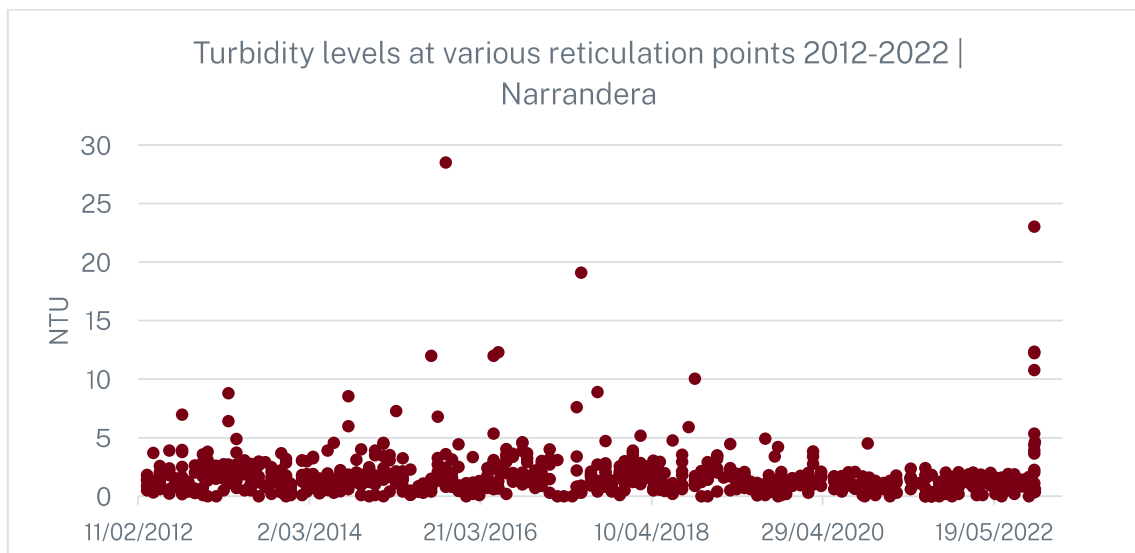
Floods in 2022 identified an issue where the aquifer was contaminated at all locations with E-coli, turbidity and dissolved organic carbon (DOC). Council had placed boil water alert for several weeks and the chlorine demand was higher than usual.

Council advised that their bores are secure but there are approx. 40 private bores (where some bores may not be sealed) which Council believes may cause the contamination of the aquifer.

This issue has not been identified earlier and there is a need for the new treatment plant to remove turbidity and DOC when treating bore water.

### 1.2.4 Poor quality water

As seen from the below Figure 1-4, the turbidity at the reticulation has gone above 1NTU many times during the period 2012-2022. Higher levels of turbidity can lead to many issues such as discoloured water, fluctuating chlorine decaying and potentially unhealthy water for drinking.



**Figure 1-4: Turbidity levels at various reticulation points 2012-2022 | Narrandera**

Further water quality of the distribution system is discussed in Section 4.

## 1.3 Previous work

Narrandera Shire Council has commissioned a range of water quality related reports including:

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- Investigation into Bore Water Treatment Methods by Ecowise Environmental (June 2005)
- Jar Testing Report by GHD (October 2014)
- Narrandera Water Treatment Plant Audit Report by City Water Technology (February 2015)
- Narrandera Water Treatment Plant Review by City Water Technology (April 2017)
- Hydrogeological Assessment for the Narrandera Borefield undertaken by C. M. Jewell & Associates Pty Ltd in 2022.

Relevant key findings from the above reports will be included in this report.

#### 1.4 Purpose/aims of this report

The aims of this report are to:

- Review the historical water quality information from each bore and Murrumbidgee River.
- Review customer issues with the current system.
- Review findings from the Jar Testing report,
- Review findings from the NSC taste testing report.
- Identify water quality hazards in bore and river water.
- Review Health based targets (HBT) catchment category for the Murrumbidgee and bores at Narrandera.
- Brief about the new Narrandera WTP.
- Provide comments of key water quality issues and potential remediation actions.

Findings from this report will be used to develop the design of the new Narrandera WTP for the Scoping Study report.

#### 1.5 Methodology

##### 1.5.1 Jar testing

This report includes details of jar testing undertaken to simulate treatment options at Narrandera including treatment of:

- Murrumbidgee River water.
- Murrumbidgee River and bore water in a 50/50 blend.
- Bore water and bore water.

Jar testing results will provide raw water treatability data that can be used in subsequent Scoping, Options and Concept design reports.

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**1.5.2 Review of bore water quality**

Water quality from individual bores will also be reviewed to develop a raw water quality design envelope for the new treatment plant.

This will include health-based targets assessment of the bores.

**1.5.3 Review Murrumbidgee River water quality**

Water quality from Murrumbidgee River will also be reviewed to develop a raw water quality design envelope for the new treatment plant.

This will include health-based targets assessment of the river catchment.

**1.5.4 Treated water requirements**

The final treatment requirements as per the ADWG will be discussed.

**2. New Narrandera WTP**

Narrandera Shire Council is planning for a new water treatment plant at Narrandera. Currently bore water is used as the raw water source. Council confirmed that the new treatment plant would be designed to treat Murrumbidgee River water as the preferred source (Minutes SSWP243 - Narrandera Shire Council - IWCM Strategy - project update, 12 August 2024). Bore water would be used as an alternative when required. For example, in the event of source water quality deterioration e.g. high turbidity following floods or algal blooms or if the river was in drought. The new Narrandera WTP is required to be robust and flexible in design to treat different raw water sources such as river water only, river and bore water in a shandy mix and bore water only.

**3. Details of the bores**

The Table 3-1 provides a summary of the bores located at Narrandera. There are 5 production bores. Bore BH4 is used only for non-potable application. Bore 2A which has been abandoned in 1997.



Table 3-1: Narrandera Bore Construction Details (C. M. Jewell & Associates Pty Ltd, May 2022)

Bore No.	Water NSW Ref.	Date Drilled	Total Depth (m)	Casing Diameter (mm)	Screened Intervals (m below GL)	Screen Aperture / Diameter (mm)	Notes
BH1	Previous GW030676	7/2016	82.1	400 (PVC)	69.1.0-79.0	1.0 / 400	Current bore not in Water NSW or NGIS databases. Construction details from CCTV inspection.
		10/1974	111.4	406	78.9-88.5 100.5-109.8	3.81 / 412 3 / 305	Drilled depth 138.7m
BH2B	GW416587	02/2013	109.3	315 (PVC)	80.3-86.2 99.1-109.3	1.5 / 315 1.5 / 315	Construction details from CCTV inspection.
	Previous GW401477	Previous 05/1995	85.5	406	62.0-71.0 75.0-85.0	3 / 305 3 / 305	Decommissioned 05/2018.
	GW030723	08/1977					
	GW030717	03/1977					
BH3	GW030724	11/1977	103.7	406 (SS)	55.1.0-58.4	3.0 / 406	Bore has been relined with spiral weld stainless steel pipe and wire-wrap screen. Screen depths from CCTV Original depth 107 m  Previous 30718 now a monitoring bore
					74.0-77.0	3.0 / 406	
96.1-99.9	3.0 / 406						
101.0-103.7	3.0 / 406						
BH4	GW403580	05/2006	90.1	355 (SS)	49.0-57.0	1.6 / 355	Upper two screens now blanked off by swaged liner.
					64.0-76.0	1.6 / 355	
					77.9-80.8	1.4 / 355	
					82.8-90.1	1.6 / 355	
BH5	GW416586	10/2013	87.0	315	62.0-85.0	1.5 / 315	Drilled depth 101.0m

The bores are located on the northern side of the river, south of the town. They are completed in the Mid-Murrumbidgee Alluvium and have depths of between 90 m and 121 m. Bore draw water from two aquifers Cowra (shallow) and Lachlan (deep). (C. M. Jewell & Associates Pty Ltd, May 2022).

Cowra aquifer source water mainly from leakage from Murrumbidgee River, overbank and tributary flood events and rainfall while Lachlan formation, which is at lower elevation than Cowra source the water mainly from vertical leakage from the Cowra aquifer.

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Figure 3-1: Images of bores (CWT, Narrandera Water Treatment Plant Audit Report, 2015)





## 4. Review of Water Quality

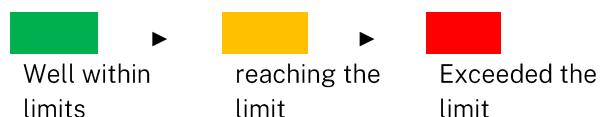
The following raw water sources will be used at the new Narrandera water treatment plant.

- Bore water as a single source.
- River water quality as a single source.
- Bore and river water as a blend.

### 4.1 Bore water quality

Table 4-1: Raw water quality of different bores | ALS laboratory | May 2023

Parameters	Unit	ADWG		Bore #1				Bore #2B				Bore #3				Bore #4				Bore #5			
		Health	Aesthetic	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile
pH	pH Unit		6.5-8.5	7.7	7.6	7.7	7.7	7.8	7.6	8.0	8.0	7.9	7.8	8.1	8.1	8.2	8.2	8.2	8.2	8.0	7.9	8.0	8.0
Total Dissolved Solids	mg/L		600	201	153	249	244	486	443	528	524	567	513	621	616	420	398	442	440	377	373	380	380
Turbidity	NTU		5	3.3	3.1	3.5	3.5	0.8	0.6	0.9	0.9	4.1	2.1	6.0	5.8	1.3	1.1	1.5	1.5	16.2	14.0	18.3	18.1
Total Hardness as CaCO3	mg/L		200	92	90	94	94	148	146	150	150	185	174	196	195	214	200	228	227	244	238	249	248
Chloride	mg/L		250	44	23	66	64	207	206	208	208	227	198	256	253	128	120	136	135	132	131	133	133
Total Alkalinity as CaCO3	mg/L			86	81	90	90	122	119	125	125	121	116	126	126	166	162	169	169	128	127	128	128
Dissolved Iron	mg/L		0.3	0.08	0.05	0.10	0.10	0.03	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.01	0.04	0.04	0.03	0.00	0.05	0.05
Iron	mg/L		0.3	0.63	0.54	0.71	0.70	0.08	0.06	0.10	0.10	0.80	0.65	0.94	0.93	0.25	0.22	0.27	0.27	1.40	1.17	1.62	1.60
Sodium	mg/L		180	37	21	53	51	163	155	170	169	145	177	175	91	91	92	92	49	47	51	51	
Dissolved Manganese	µg/L	500	100	78	64	92	91	10	8	11	11	45	37	52	51	29	27	31	31	151	136	165	164
Manganese	µg/L	500	100	80	66	94	93	10	8	12	12	46	38	53	53	29	26	31	31	157	144	170	169



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Table 4-2: Raw water quality of different bores | From IWCM | Oct/Nov 2018

Parameters	Unit	ADWG		Bore #1				Bore #2B				Bore #3				Bore #4				Bore #5			
		Health	Aesthetic	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile	Mean	Min	Max	95th %tile
Dissolved Iron	mg/L		0.3	0.77	0.53	1.00	0.98	0.10	0.02	0.24	0.22	0.23	0.21	0.25	0.25	0.09	0.03	0.15	0.14	0.50	0.15	0.71	0.70
Iron	mg/L		0.3	0.75	0.50	1.00	0.98	0.18	0.16	0.21	0.21	0.31	0.28	0.35	0.34	0.22	0.21	0.23	0.23	0.54	0.16	0.73	0.73
Dissolved Manganese	µg/L	500	100	0.14	0.11	0.17	0.17	0.02	0.02	0.02	0.02	0.05	0.03	0.07	0.07	0.04	0.03	0.05	0.05	0.07	0.06	0.08	0.08
Manganese	µg/L	500	100	0.00	0.00	0.00	0.00	0.07	0.02	0.16	0.11	0.03	0.02	0.04	0.04					0.13	0.09	0.16	0.16

Further bore water quality results are attached in Appendices.

4.1.1 Iron and manganese in bore water

Iron and manganese are usually present in groundwater as dissolved minerals or associated with other components. Because ground waters are not readily exposed to the air, they have little or no input of oxygen, and any dissolved oxygen initially present is consumed by organisms and by reactions with compounds in the water. In these anoxic (anaerobic) or ‘reducing’ conditions, iron, manganese and other metals are often dissolved from rocks and soil in the aquifer. Groundwater may therefore contain high levels of dissolved iron and/or manganese.

Iron and manganese if present in treated water causes many problems like colour and taste, clothes staining and encouraging bacterial growth in water distribution networks which affect the pipes transfer efficiency. The ADWG aesthetic limits for iron and manganese are 0.3 mg/l and 0.1 mg/l, respectively. Soluble iron and manganese must be oxidised to insoluble form to be removed by clarification and filtration. Iron can be readily oxidised by air, chlorine and permanganate. Manganese can be oxidised using chlorine at pH > 8.0 using extended contact times and by permanganate within a few minutes contact. Iron and manganese can accumulate as biofilms and deposits in the distribution system. Accumulation can lead to discolouration/dirty water events and customer complaints when changes to flow occur caused by increased flow and flow reversals occur. Many treatment plants target treated water iron and manganese concentrations lower than the ADWG aesthetic limit, for example iron < 0.1 mg/L and manganese < 0.05 mg/L to minimise risk of discolouration events. Network flushing/swabbing and tank cleaning is also undertaken as required.

4.1.2 Comments about the bore water quality

Iron levels are generally high in all the 5 bores considered and exceed the ADWG limits apart from Bore #2B. However, Bore #2B has elevated levels of TDS, chlorides and sodium. High dissolved solids can cause taste and odour issues as well as discolours water.

In general, all the bores do not have manganese at a level to be concerned.

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Bore #5 has high level of turbidity, hardness while Bore #3 has a high level of TDS and chlorides.

**4.2 Murrumbidgee River water quality**

Narrandera water supply currently does not extract water from the Murrumbidgee River even though NSC has the license to extract. The river license information is shown in the following Table 4-3.

**Table 4-3: Water access license for Murrumbidgee River at Narrandera (IWCM)**

WAL	Water Sharing Plan	Water source	Entitlement (ML/annum)	Purpose	Location
6460	Murrumbidgee regulated river water source	Murrumbidgee regulated river water source	2,000	Town water supply	Lot 1, Section 81, DP758757

According to the IWCM Issues Paper, the dry year annual extraction forecast for 2048 is 1,744ML. Therefore, the river entitlement can fulfill the Narrandera town demand 100%.

There are limited water quality data available for the Murrumbidgee River at Narrandera.

Narrandera is located on the Murrumbidgee River approximately 100 km downstream of the regional centre of Wagga Wagga. Therefore, this report includes raw water quality data for Murrumbidgee River at Wagga Wagga received from Riverina Water which is summarised in Table 4-4. Samples were taken at monthly intervals (approximately) for a 13-year period which included drought and flood conditions. This is to compare with the limited water quality data available for Murrumbidgee River at Narrandera.

**Table 4-4: Water quality | Murrumbidgee River at Wagga | 2011-2024**

	Mean	Minimum	Maximum	95th %tile	ADWG
Colour (PCU)	83	3	700	264	15
Turbidity (NTU)	17	0.42	114	51	5
pH	7.2	6.0	7.9	7.7	6.5-8.5
Alkalinity (mg/L)	52	10	110	80	
Iron (mg/L)	0.3	0.03	1.2	0.4	0.3
Mn (mg/L)	0.04	0.001	0.24	0.08	0.1
Ca Hard (mg/L)	31	15	60	45	
Hardness (mg/L)	62	20	105	90	60-200
F- (mg/L)	0.12	0.04	0.85	0.16	1.5
Chlorides (mg/L)	21	5.0	80	40	250
TDS (mg/L)	87	17	404	137	600

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Cond. (mg/L)	166	35	806	270	
Sulphate (mg/L)	3.78	0	8	8	250
UVA 254nm (filter)	0.15	0.08	0.17	0.17	
E.Coli	48	29	51	51	
Coliforms	182	74	201	201	

Table 4-5 shows the water quality data extracted from the jar testing report undertaken by MJM Environmental Pty Ltd. The water has been sourced from Murrumbidgee River at Narrandera.

**Table 4-5: Summary of Murrumbidgee River water quality data at Narrandera 2023-24 | ALS**

Test	Units	ADWG	Mean	Min	Max	95th %tile
Alkalinity, Total as CaCO3	mg/L		52	36	83	80.9
Aluminium (acid extractable)	mg/L		1	0.12	1.73	1.49
Calcium (dissolved)	mg/L		8	4.94	13.1	12.92
Colour - Apparent	Colour Units		23	13	33	31.25
Colour - true	Colour Units	15	9	5	22	19.9
Total Hardness as CaCO3	mg/L	60-200	41	24	72	68.1
Iron (acid extractable)	mg/L		1	0.06	1.14	1.005
Iron (dissolved)	mg/L	0.3	0	0.01	1.29	1.044
Magnesium (dissolved)	mg/L		5	2.96	9.58	8.743
Manganese (acid extractable)	mg/L		0	0.002	0.063	0.0588
Manganese (dissolved)	mg/L	0.1	0	0.001	0.021	0.0189
pH	pH units	6.5-8.5	7	6.4	8.2	8.02
Total Dissolved Solids	mg/L	600	76	11	161	140.3
Turbidity	NTU	5	21	1	50	45.5
UV Absorbance	AU		0	0.043	0.157	0.157
UV Transmission	%		77	53	90	89.75

Table 4-6 below summarise the algae results noted during the jar testing exercise.



**Table 4-6: Algae recorded during Jar Testing in November 2023 at Murrumbidgee River**

Parameter	Result
Total Cyanophyta (cells/mL)	16/11/2023: 867
	18/11/2023: 1,190
	20/11/2023: 319
	21/11/2023: 1,710
Total Cyanophyta Biovolume (mm <sup>3</sup> /L)	16/11/2023: 0.0876
	18/11/2023: 0.0029
	20/11/2023: 0.0008
	21/11/2023: 0.0031
Total Algae (cells/mL)	16/11/2023: 3,700
	18/11/2023: 8,500
	20/11/2023: 821
	21/11/2023: 5,300

Further water quality results are attached in Appendices.

**4.2.1 Comments about the river water quality**

Table 4-7 presents water data for the Murrumbidgee at Wagga. The maximum turbidity and colour were 100NTU and 700PCU respectively. It is assumed that similar high turbidity and colour will also be found at Narrandera following rain events

The following Table 4-7 discuss some of the key parameters of the river water quality.

**Table 4-7: Key water quality parameters | River water (Copy words from executive summary for the table)**

Parameter	Comments
Alkalinity	There is no guideline value given in ADWG for alkalinity. The river water is low in alkalinity. Alkalinity is required for coagulation, pH stability and to prevent corrosion.
Hardness	ADWG describes harness and effects of it as follows. <ul style="list-style-type: none"> <li>• &lt;60 mg/L as CaCO<sub>3</sub> soft but possibly corrosive</li> <li>• 60–200 mg/L as CaCO<sub>3</sub> good quality</li> <li>• 200–500 mg/L as CaCO<sub>3</sub> increasing scaling problems</li> <li>• &gt;500 mg/L as CaCO<sub>3</sub> severe scaling</li> </ul> Therefore, the river water most times appears to be soft in nature.



Parameter	Comments
TDS	<p>There is no health guideline value is provided for total dissolved solids (TDS) in ADWG, as there are no health effects directly attributable to TDS. However, for good palatability total dissolved solids in drinking water should not exceed 600 mg/L.</p> <p>For Murrumbidgee River, TDS levels are very low hence can lead to corrosive water. Usually, surface water does not contain high levels of TDS compared to bore water.</p>
pH	pH ranges from 6.0 to 7.0.
True colour	<p>Colour is due mainly to the presence of dissolved organic matter including humic and fulvic acids, which originate from soil and decaying vegetable matter.</p> <p>The dissolution of metals in pipes and fittings can also discolour drinking water. Badly corroded iron pipes can produce a brownish colour whereas corrosion of copper pipes can produce a blue-green colouration on sanitary ware and a faint blue colour in water in extreme cases. The condition of household pipes can also significantly influence water colour. In bore water, 'red water' is a frequent problem, caused by the oxidation of iron. In addition, a black discolouration in reservoirs and distribution systems can result from the action of bacteria on dissolved manganese to produce insoluble oxides.</p> <p>Based on aesthetic considerations in ADWG, true colour in drinking water should not exceed 15 HU. Upstream of Murrumbidgee River at Narrandera, the true colour recorded very high values up to a maximum of 700PCU. Coagulation can remove the colour of water.</p>
Turbidity	<p>Turbidity is a measure of the light-scattering property of water caused by the presence of fine suspended matter such as clay, silt, plankton and other microscopic organisms. The degree of scattering depends on the amount, size and composition of the suspended matter. At low levels, turbidity can only be detected by instruments, but at higher levels the water has a "muddy" or "milky" appearance clearly visible to the naked eye.</p> <p>In the Murrumbidgee River water, it has recorded turbidity up to 114NTU at Wagga and 52NTU at Narrandera. Coagulation followed by filtration can easily remove turbidity in water.</p>



Parameter	Comments
Iron	<p>Iron occurs commonly in soil and rocks as the oxide, sulphide and carbonate minerals. In water, it is present in oxidised forms as ferric [Iron(III)] or ferrous [Iron(II)] compounds.</p> <p>Based on aesthetic considerations, the concentration of iron in drinking water should not exceed 0.3 mg/L. Iron salts can be effectively removed by the standard water treatment processes of coagulation followed by filtration.</p> <p>Murrumbidgee River water recorded iron levels up to 1.3mg/L.</p>
Manganese	<p>Based on aesthetic considerations, the concentration of manganese in drinking water should not exceed 0.1 mg/L, measured at the customer’s tap. ADWG has noted that “the aesthetic guideline of 0.1 mg/L at the customer’s tap is based on practical experience and has been reported by utilities to be acceptable to customers. The discretionary target of 0.01 mg/L at the treatment plant is also based on experience; that although manganese accumulates in distribution systems, a plant producing 0.01 mg/L generally does not generate customer complaints, while a concentration of 0.02 mg/L or more tends to lead to various problems.</p> <p>Manganese recorded in Murrumbidgee River at Wagga suggest that 95% of the time it is below 0.1mg/L and occasionally it can go over. The highest recorded was 0.24mg/L. Manganese concentrations can be lowered by converting soluble forms to insoluble precipitates, followed by filtration.</p>
UV transmissivity (UVT)	<p>UVT is the measure of the fraction of incident Ultraviolet light (UV) transmitted through a material (e.g. water), usually expressed as a percentage. Higher the percentage, the clearer the water is.</p> <p>UVT is important when designing the UV system. It helps to determine the appropriate number of lamps, power consumption, additional features etc., which is required to ensure the desired purity of the water. In this way, the optimal operating cost can be achieved, while living up to the defined disinfection requirements.</p> <p>For Murrumbidgee River, it has recorded a min UVT of 53% and mean UVT of 77%.</p>



Parameter	Comments
Algae (Cyanobacteria)	<p>Cyanobacteria can produce taste and odour compounds (MIB and geosmin) as well as toxins.</p> <p>Jar testing was undertaken when low number of non-toxin/taste and odour producing cyanobacteria were present in the Murrumbidgee River. Repeat testing is required when cyanobacteria are present higher numbers. Extracellular toxins and taste can be removed by powdered activated carbon (PAC) and chlorination.</p> <p>Algal cells can be removed by coagulation, clarification and filtration. Extracellular taste and odour compounds can be removed using activated carbon.</p>

### 4.3 Narrandera distribution system water quality

The Figure 4-1 to 4-6 are plotted using NSW Health drinking water data.

The Figures 4-1 and 4-2 plotted to show free chlorine residual (FCR) at two reticulation points from 2012-2022. The two points were selected to represent dead ends and the longest from the reservoir. 6 samples were collected each year. It is evident that the FCR varies considerably even at the same sample point over a year.

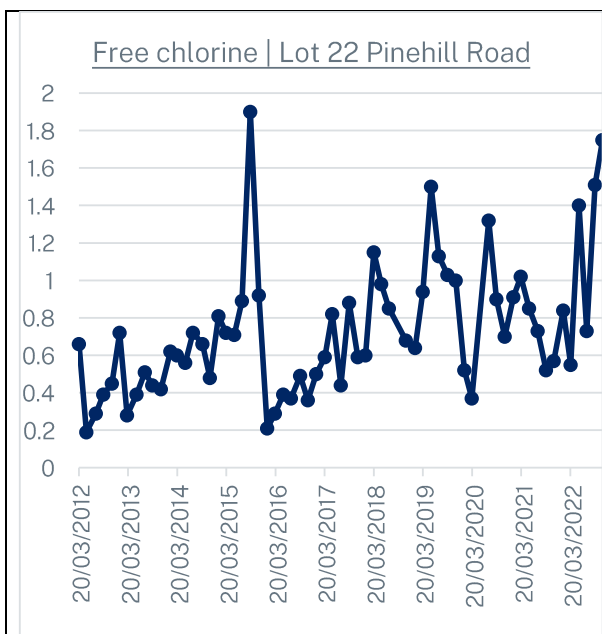


Figure 4-1: Free cl2 recorded at Lot 22 Pinehill Road 2012-2022 (Source: NSW Health)

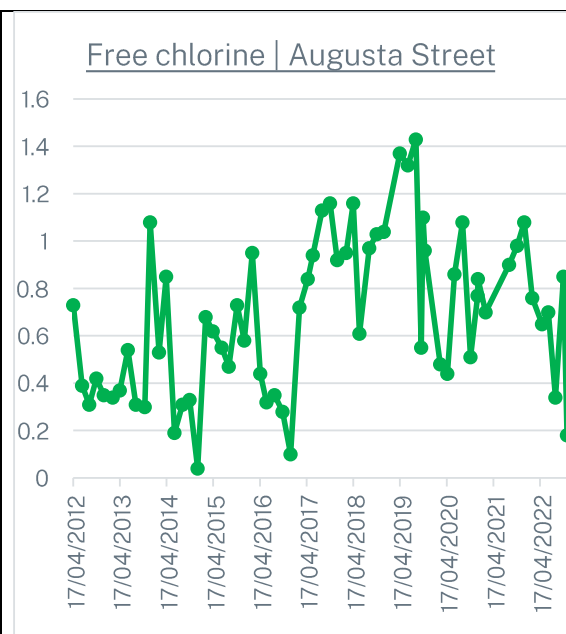
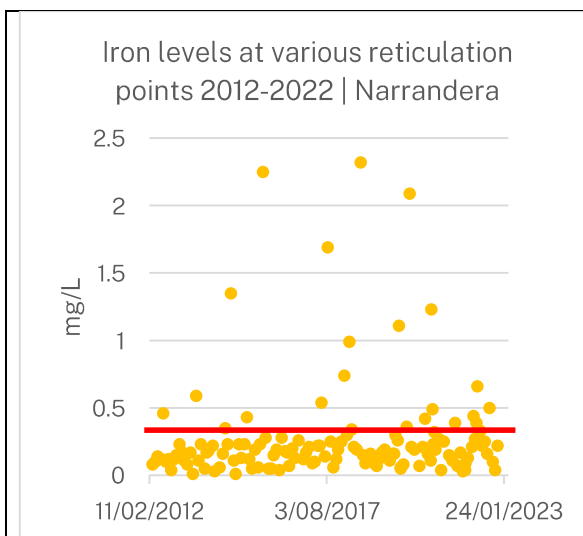


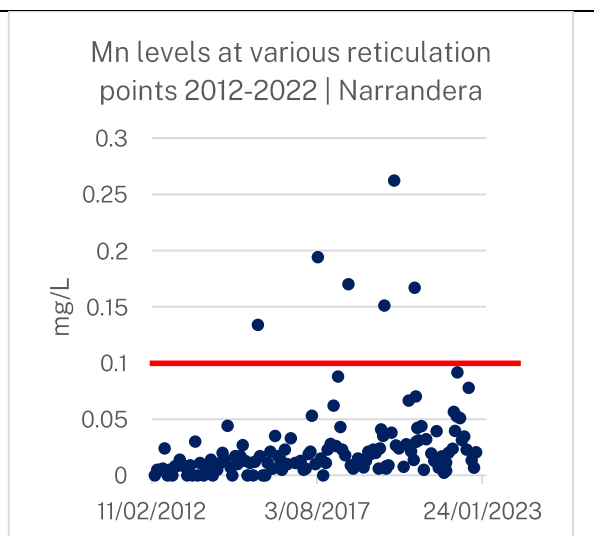
Figure 4-2: Free cl2 recorded at Augusta Street 2012-2022 (Source: NSW Health)

The following Figures 4-3 to 4-6 are plotted covering all the reticulation sampling points across Narrandera reticulation from 2012-2022.

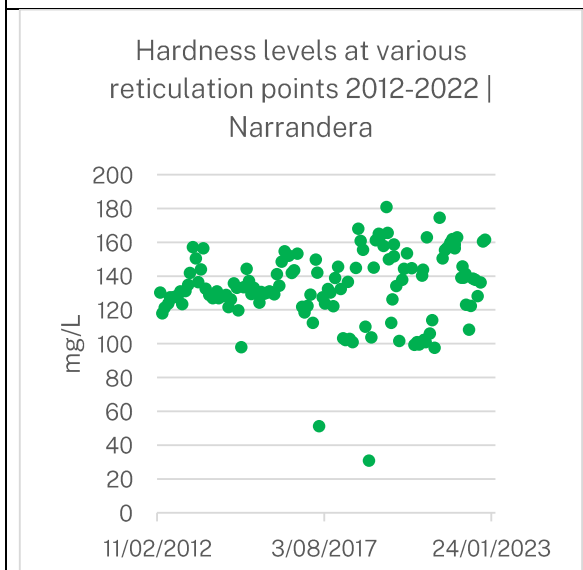




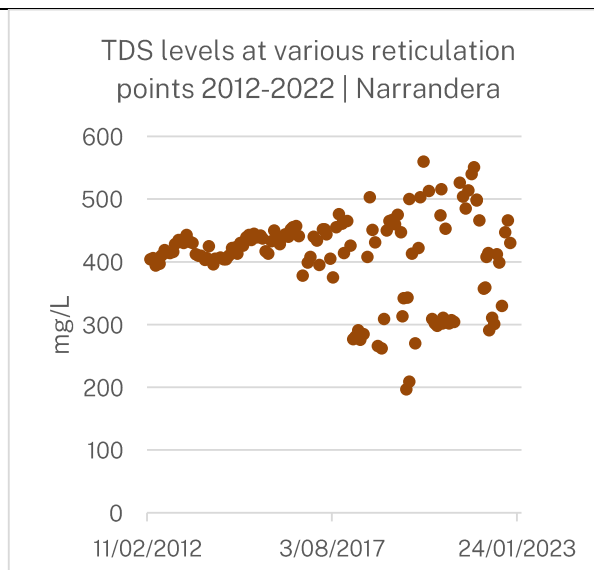
**Figure 4-3: Iron levels at various reticulation points 2012-2022 | Narrandera**



**Figure 4-4: Manganese levels at various reticulation points 2012-2022 | Narrandera**



**Figure 4-5: Total Hardness levels at various reticulation points 2012-2022 | Narrandera**



**Figure 4-6: TDS levels at various reticulation points 2012-2022 | Narrandera**

**4.3.1 Comments about the reticulation water quality**

Figure 4-1 and Figure 4-2 present trends in chlorine residual at two locations in the Narrandera distribution system, considerable variation in free chlorine concentration can be seen at both locations.

Ideally, the chlorine concentration would be stable to meet the target chlorine concentration selected by Council. Variable chlorine residual concentration at the customer tap leads to customer dissatisfaction.

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It can be seen from Figure 4-3 and 4-3, the iron and manganese levels in the water supplied to customers exceeds the ADWG Aesthetic limits for number of occasions.

As discussed earlier in the report, the turbidity levels in the reticulation water are high reaching 30NTU (Figure 1-4) at times.

All the above indicates the quality supplied to customer for existing system is not satisfactory and further demonstrates the need for the new Narrandera WTP.

**4.4 HBT assessment for bore and river water**

NSW Health assesses catchments used for drinking water on behalf of local water utilities to allow treatment health-based target (HBT) be identified for pathogens. NSW Public Works has requested Narrandera Shire Council to obtain HBT assessment of bore and river catchments at Narrandera. HBT assessment of bore and river catchments is essential to scope treatment requirements for the new Narrandera WTP.

Table 4-8 presents log removal targets (LRV) for various source water categories (NHMRC, Version 3.7 Updated January 2022).

**Table 4-8: Treatment targets for protozoa, bacteria and viruses given the source water type and E. coli results (NHMRC, 2011).**

Source water category (assessment)	Indicative source water type (vulnerability classification)	Maximum or 95 <sup>th</sup> percentile <sup>(1)</sup> E. coli results from raw water monitoring (number/100 mL) (band allocation)	LRV target to achieve 1x10 <sup>-6</sup> DALYs per person per year <sup>(2)</sup>		
			Protozoa	Virus	Bacteria
Category 1	Surface water or groundwater under the influence of surface water, which is fully protected. or Secure groundwater	<20 (E. coli band 1)	0	0 <sup>(3)</sup>	4.0
Category 2	Surface water, or groundwater under the influence of surface water with moderate levels of protection	20 to 2,000 (E. coli band 2) <sup>(4)</sup>	3.0	4.0	4.0
Category 3	Surface water, or groundwater under the influence of surface water with poor levels of protection		4.0	5.0	5.0
Category 4	Unprotected surface water or groundwater under the influence of surface water that is unprotected	>2,000 to 20,000 (E. coli band 3)	5.0	6.0	6.0

**4.4.1 River water HBT**

Until confirmed by NSW Health, it is assumed that the river and aquifer catchments are category 4 requiring 5.0 LRV for protozoa, 6.0 LRV for bacteria and 6.0 LRV for viruses.



#### 4.5 Treated water requirements

The new water treatment plant needs to be designed to produce treated water to meet or better the current Australian Drinking Water Guidelines. In particular, the water quality requirements in Table 4-6 will be satisfied.

**Table 4-9: Desirable treated water quality requirements**

Parameter	Target
True Colour	≤ 5 Hazen Units
Turbidity	≤ 0.2NTU 100% of the time ≤ 0.1NTU 90% of the time
pH	7.2 to 8.2
Total Iron	≤ 0.1 mg/L
Total Manganese	≤ 0.02mg/L
Free Chlorine	Between 0.5 and 1.5mg/L after 30 minutes contact time in the clearwater tank
Taste and Odour	Unobjectionable
Total Aluminium	< 0.1mg/L
Protozoa <i>Cryptosporidium</i> and <i>Giardia</i>	Minimum five log removal or inactivation
Total Trihalomethanes (THMs)	Total THMs formed, with at least 2 mg/L of free residual chlorine remaining after 48 hours in a controlled environment, not to exceed the ADWG limit of 0.25 mg/L.
Fluoride	1mg/L (± 0.05mg/L)
Disinfection by-products	Should not exceed current ADWG level
<i>E. coli</i> and Faecal Coliforms	0 counts/100mL

### 5. Taste and odour issues at Narrandera

There have been numerous complaints of taste and odour from the customers in the past about Narrandera drinking water.

#### 5.1 Causes of taste and odour in drinking water

Tastes and odours in drinking water can be caused by a wide range of factors including:

- Natural products in water used for abstraction.
- Chemicals formed during water treatment, storage or distribution.

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- Ingress of materials into distribution systems that either react with compounds in the water or cause tastes or odours themselves.

The identification of unpleasant taste and odour in drinking water stands as a primary cause for consumer grievances directed at water providers. Certain chemical impurities possess exceedingly low thresholds for taste and odour detection, prompting consumers to discern them even at minimal concentrations. Yet, while the actual health hazards linked to many taste and odour occurrences may be negligible, consumers often interpret the detection of off-taste or odour as indicative of toxicity concerns. Given that the taste, odour, and appearance of drinking water serve as consumers' primary yardstick for assessing its quality, it's reasonable to anticipate that unfamiliar or disagreeable tastes and odours instil a perception of health risk. (Rogers, 2001).

Whilst water quality as measured by the parametric standards defined in the ADWG guidelines and most water supplies provides drinking water conformance to this guideline. However, the consumer will generally judge the acceptability and safety of drinking water purely on the basis of the aesthetic quality of what is drawn from the tap.

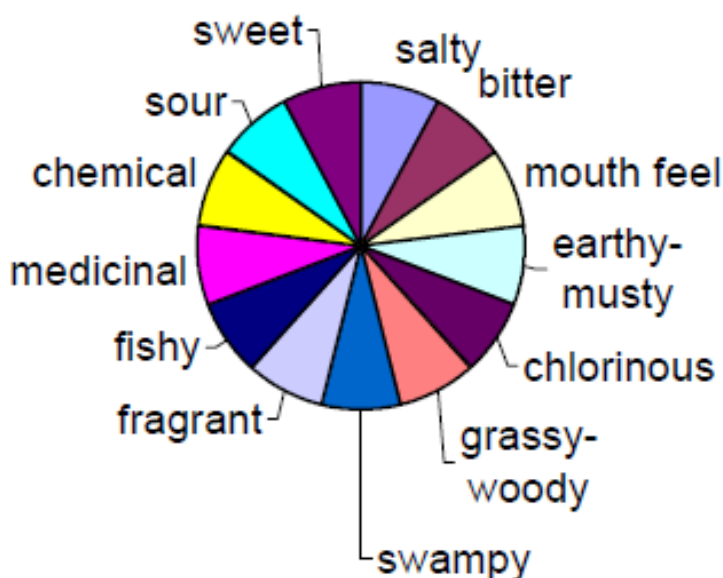


Figure 5-1 Drinking water flavour wheel (Rogers, 2001)

**5.2 Possible Causes of taste and odour at Narrandera**

Bore water:

From the known raw water quality parameters and typical bore characteristics, the following declarations can be made.

- High iron and manganese can cause metallic taste in water.
- High TDS levels can cause salty taste due to sodium and chloride.
- Presence of hydrogen sulphide can lead to rotten egg/ swampy odours. Hydrogen sulphide reacts with chlorine making chlorine residual control difficult. Changes in

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chlorine residual can lead to customer dissatisfaction with the taste and odour of drinking water.

Distribution system

Hydrogen Sulphide can be removed from water using air stripping technology. Most common applications in water treatment use a simple air stripper. However, to effectively remove hydrogen sulphide from water by stripping, water pH should be lowered to 6.0 to convert the soluble sulphide ion to the dissolved gas, hydrogen sulphide. If the raw water hydrogen sulphide is not properly removed, the remaining hydrogen sulphide will react with dosed chlorine making chlorine residual control difficult. There is limited hydrogen sulphide removal using the existing stripping process at Narrandera given the lack of pH correction and this may in part explain the poor control of chlorine shown in Figure 4-1 and 4-2.

Chlorine oxidises soluble Iron and Manganese to particulate forms, which intern can lead to dirty/discoloured water at customer tap, visually unappealing appearance high turbidity and particles.

## 6. Taste testing conducted by NSC

NSC conducted a customer water tasting event in December 2023. A total of 57 participants submitted their feedback after tasting 3 samples of drinking water (NSC 2023 need to reference report).

Three different water samples were presented for the participants to taste.

- Sample one was treated water sourced from Grong Grong, which is looked after by Glenfield's Water.
- Sample two was prepared using laboratory jar testing methodology (described in section 7.0) to simulate a filtered sample specific to a future filtration plant. This was a 50/50 shandy of the coagulated, clarified and filtered river water and filtered bore water. The shandy was dosed with hypochlorite to simulate disinfection using chlorine and the chlorine residual was allowed to dissipate.
- Sample three was sourced from the current water supply (tap water).

NSC reported that: 47% of the participants preferred sample two (laboratory simulated treated river water/bore water shandy). The report stated that "the data provides valuable insights that can aid in improving water treatment processes and infrastructure. It reflects the preferences to address concerns related to water quality and assess the impact of different water sources and filtration systems on the community's satisfaction. This information is crucial for Narrandera Shire Council to make informed decisions that align with the needs and expectations of the residents."

The full taste testing report is attached as an appendix.

## 7. Jar testing

Jar testing investigation was undertaken by MJM Environmental Pvt Ltd.

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The following 3 water samples were undertaken for testing. It is noted that only one of the bores was used for the test. Bore 5 was selected as the bore with poorest water quality.

- River water
- River /Bore #5 shandy (50/50)
- Bore #5 water

The test simulated treatment for conventional settling, lagoon sedimentation and dissolved air floatation (DAF).

*River water turbidity and colour used for the jar test was extremely low and jar test results provide little information regarding treatability of Murrumbidgee River water at Narrandera using different treatment processes and coagulants. The jar test should be repeated when the river water contains elevated turbidity and colour and/or algal cells.*

**Summary of jar testing**

Simulated treated water from the jar tests was tested for Trihalomethane Formation Potential (THMFP). THMFP for bore 5 and river water THMFP results were lower than the ADWG guideline limit for THM, was 0.025 mg/L & 0.027mg/L respectively. The ADWG guideline value for THMs is 0.25mg/L. These low THMFP results are explained by the very low DOC concentration (<1mg/L) found in all the samples tested. DOC is the precursor for THMs in chlorinated water.

Full jar testing results can be found in appendices.

## 8. Preliminary Raw water design envelope

A preliminary raw water quality design envelope to be used for the concept design of the new Narrandera WTP is presented in Table 8-1 and 8-2.

**Table 8-1: Narrandera WTP Raw Water Quality Design Envelope for Concept Design (bore water)**

Parameter	Units	Lower	Mean	Upper
Alkalinity as CaCO <sub>3</sub>	mg/L	80	125	200
Calcium as CaCO <sub>3</sub>	mg/L	11	22	36
CCPP as CaCO <sub>3</sub>	mg/L	-9.7	-4.9	3.36
Chloride	mg/L	22	148	308
pH	pH	7.5	7.9	8.5
Sulphate	mg/L	4	25	61
TDS	mg/L	150	410	745
Temperature	°C	3	25	45

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Parameter	Units	Lower	Mean	Upper
TOC	mg/L	1	1	4
Total iron	mg/L	0.06	0.63	2.0
Total manganese	µg/L	8	62	200
True colour	HU	1.0	3.0	5.0
Turbidity	NTU	0.6	5.1	22.0

**Table 8-2: Narrandera WTP Raw Water Quality Design Envelope for Concept Design (Murrumbidgee River)**

Parameter	Units	Lower	Mean	Upper
Alkalinity as CaCO <sub>3</sub>	mg/L	10	52	83
Calcium as CaCO <sub>3</sub>	mg/L	4.94	8	13.1
Chloride	mg/L	5	21	80
pH	pH	6	7	8.2
Sulphate	mg/L	0	3.8	8
TDS	mg/L	11	76	404
Total iron	mg/L	0.01	0.04	1.3
Total manganese	µg/L	0.001	5	9.6
True colour	HU	3	83	700
Turbidity	NTU	0.42	21	114

**9. Recommendations**

- HBT assessment of bore and river catchments is required at Narrandera.
- Additional water sampling and testing including jar tests of the Murrumbidgee River at Narrandera are required when water quality changes (turbidity, colour increases and or the river is subject to algal blooms).

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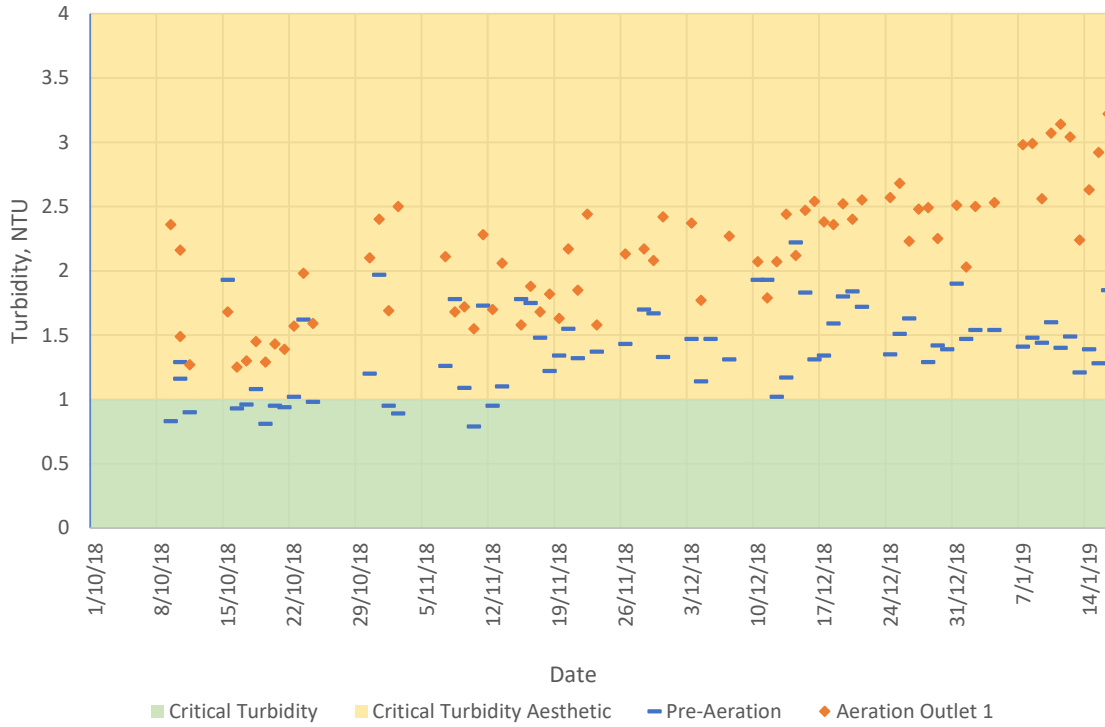
**10. References**

- Investigation into bore water treatment methods by Ecowise Environmental (June 2005).
- Jar Testing report by GHD (October 2014).
- Narrandera water treatment plant audit report by City Water Technology (February 2015).
- Narrandera water treatment plant review by City Water Technology (April 2017).
- Hydrogeological assessment of the Narrandera Borefield by C. M. Jewell & Associates Pty Ltd (May 2022).
- Drinking Water Monitoring Program | water quality test results submitted by NSC.
- Narrandera Shire Council | IWCM Strategy – Options Assessment | Report Number: WSR 18069 (June 2022)
- Water quality test reports in May 2023
- Jar Testing report by MJM (2024).
- Water quality results for bores and Murrumbidgee River supplied by NSC conducted by ALS
- Australian Drinking Water Guidelines 6 (2011) | Version 3.7 Updated January 2022



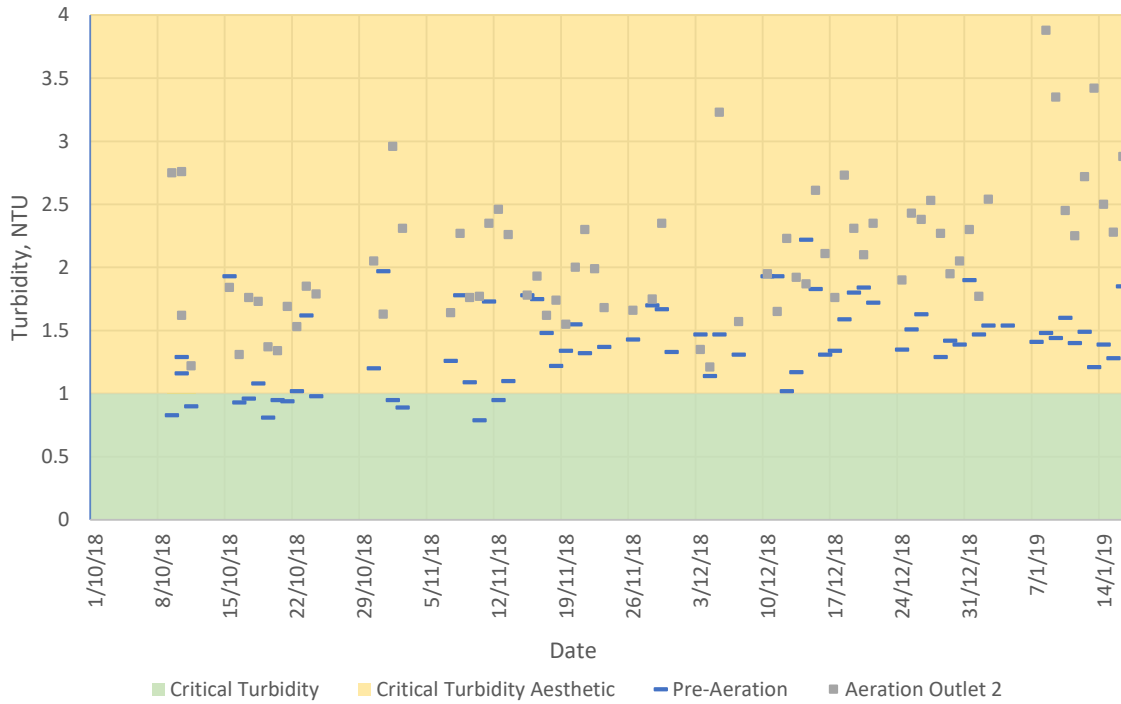


Appendix A Water Quality Data from IWCM Report

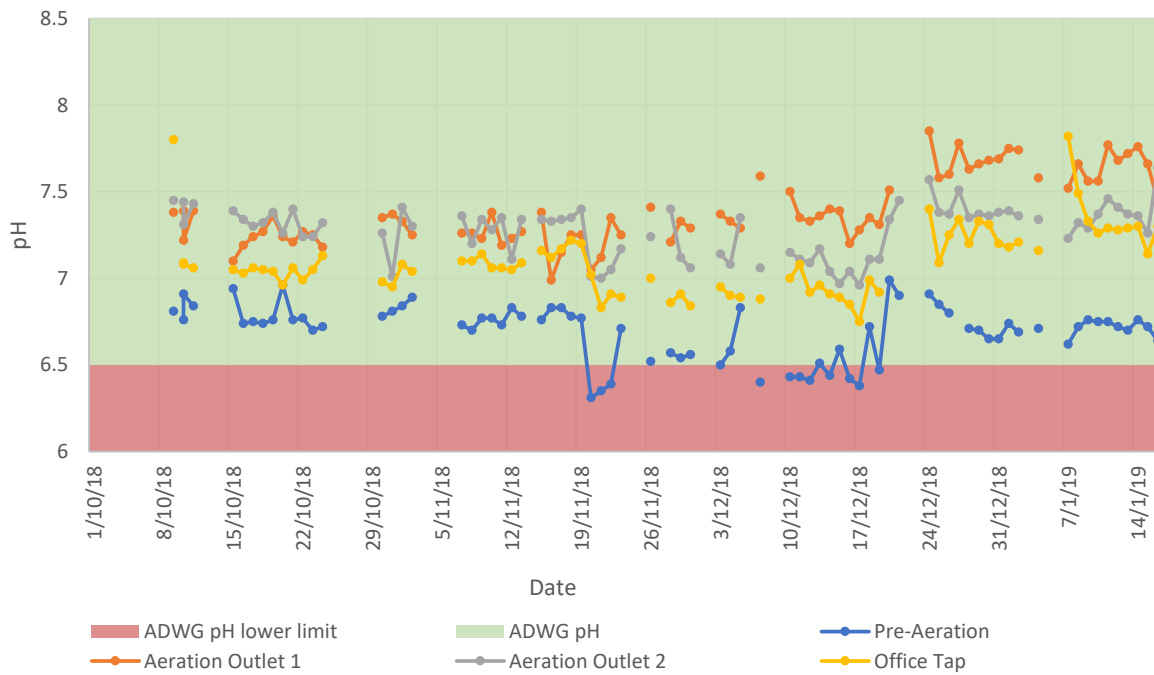


Appendix Figure A-1: **Turbidity of Aerator 1** (Pre-aeration sampling point is on individual bore line)

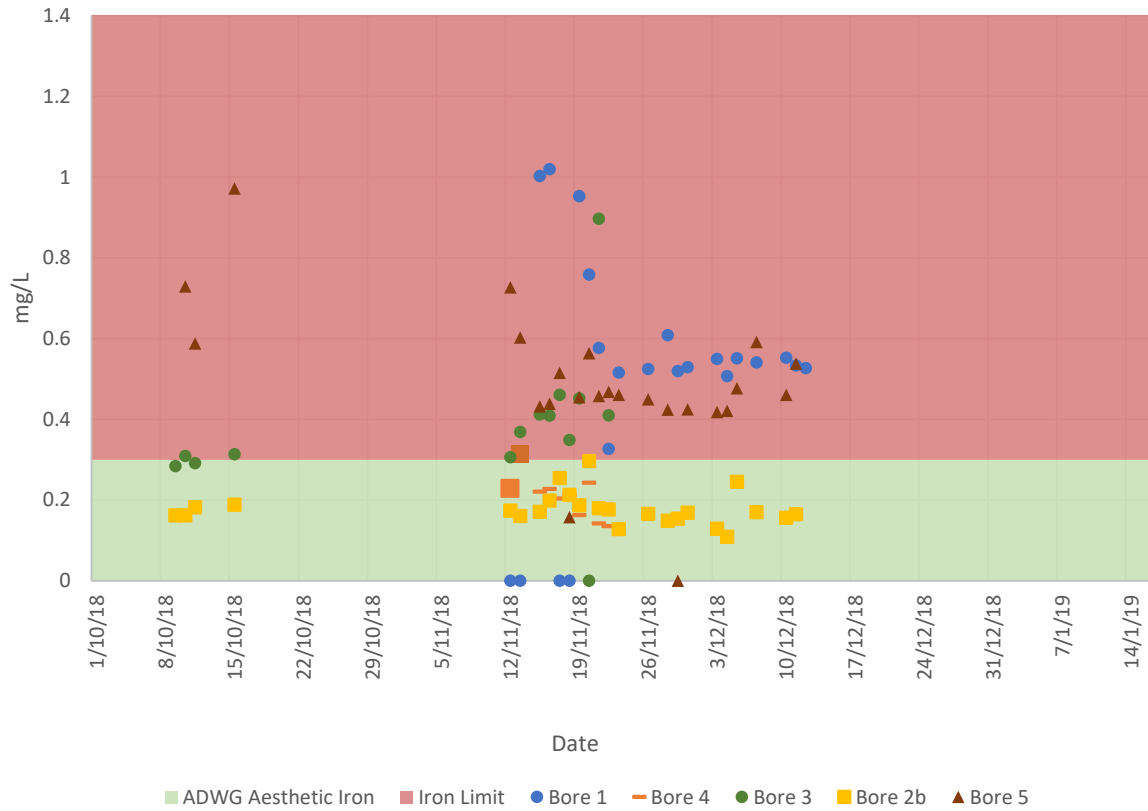
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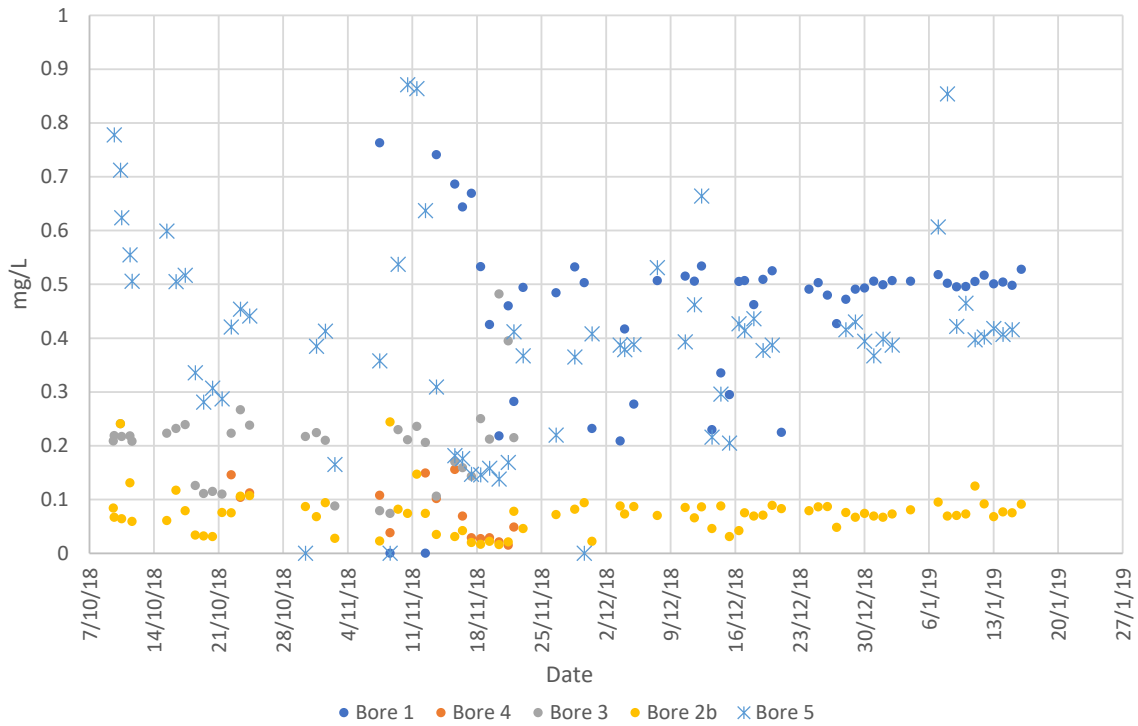
Appendix Figure A-2: Turbidity of Aerator 2 (Pre-aeration sampling point is on common line)



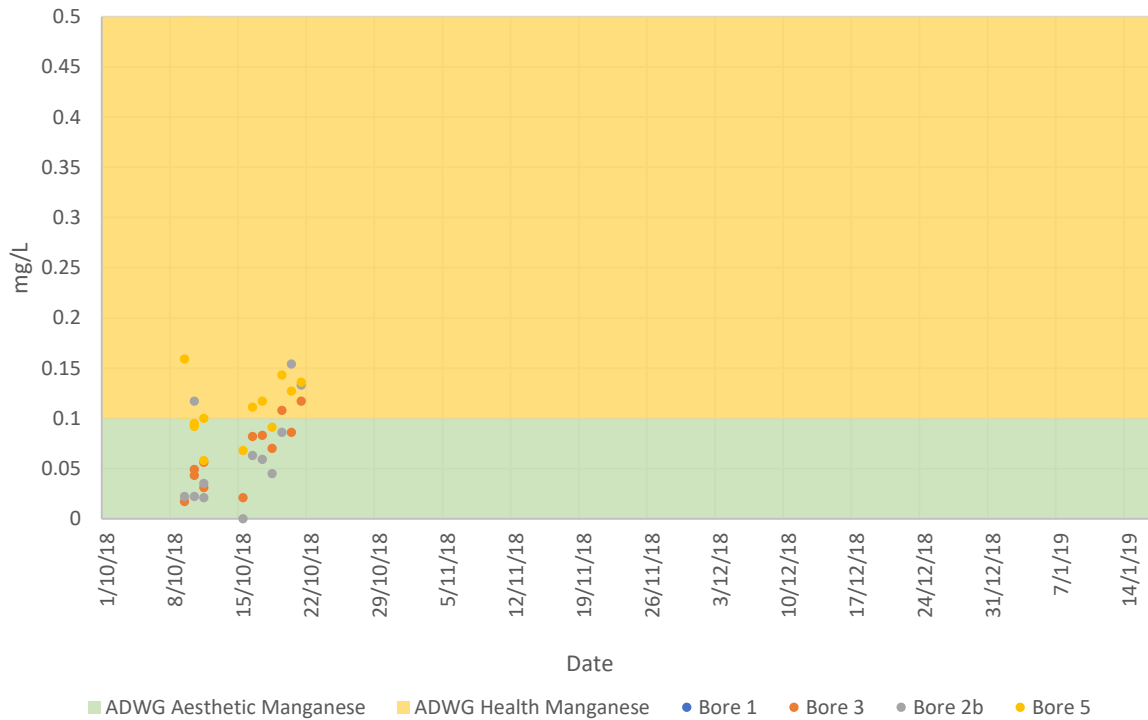
Appendix Figure A-3: pH sampling with time



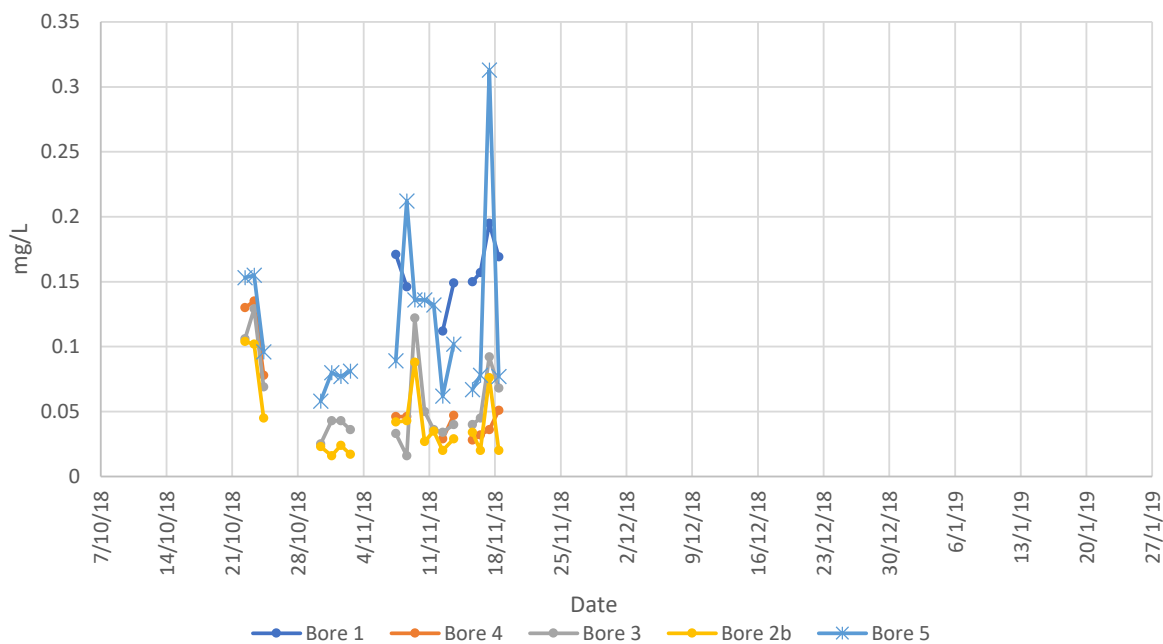
Appendix Figure A-4: Total iron of the bores with time



Appendix Figure A-5: Dissolved iron of the bores with time



Appendix Figure A-6: Total manganese of the bores with time



Appendix Figure A-7: Dissolved Manganese of the bores with time

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## Appendix B Further water quality extracted from various sources for bore water

### Summary of Bore #5 water quality data 2023-24 | ALS

Test	Units	ADWG	Mean	Min	Max	95th %tile
Alkalinity, Total as CaCO3	mg/L		134	131	138	137
Aluminium (acid extractable)	mg/L		0	0.03	0.03	0.03
Calcium (dissolved)	mg/L		24	22	27	26
Colour - Apparent	Colour Units		18	12	22	22
Colour - true	Colour Units	15	10	5	25	22
Total Hardness as CaCO3	mg/L	60-200	194	182	220	215
Iron (acid extractable)	mg/L		1.0	0.4	1.1	1.1
Iron (dissolved)	mg/L	0.3	1	0.2	1.3	1.2
Magnesium (dissolved)	mg/L		33	301	37	36
Manganese (acid extractable)	mg/L		0	0.07	0.15	0.14
Manganese (dissolved)	mg/L	0.1	0	0.001	0.145	0.138
pH	pH units	6.5-8.5	8	6.5	9	8.8
Total Dissolved Solids	mg/L	600	516	437	566	566
Turbidity	NTU	5	28	1	108	90
UV Absorbance	AU		0	0.011	0.022	0.021
UV Transmission	%		96	94	97	97

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Bore water quality parameters | Hydrogeological Assessment by C. M. Jewell

TABLE 4 Summary of Analytical Data																	
Analyte	Date	pH	EC	TDS	HCO <sub>3</sub> <sup>-</sup>	Cl <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	S <sup>2-</sup>	NO <sub>3</sub> <sup>-</sup>	Na	K	Ca	Mg	Fe (dis)	Mn (dis)	As (dis)	CH <sub>4</sub>
Units		units	µS/cm	mg/L	mg/L as CaCO <sub>3</sub>	mg/L	mg/L	mg/L as S	mg/L as N	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L
Bore 1	Apr 2010	7.5	780	440	192	160	37	<0.02	<0.01	-	-	16	20	0.04	0.017	0.001	-
Bore 2B	Oct 2014	7.88	693	450	88	150	27	1.0	<0.01	105	2	15	11	0.14	0.012	<0.001	131
Bore 3	Apr 2010	7.6	780	420	231	150	31	<0.02	<0.01	-	2.8	16	22	0.09	0.031	0.001	-
Bore 4	Mar 2010	7.5	980	530	171	190	23	<0.02	<0.01	-	3.8	40	54	0.52	0.17	<0.001	-
Bore 4	Apr 2013	8.04	777	420	174			<0.1		-	<0.1	34	42	<0.05	0.026	-	-
Bore 5	Oct 2014	7.77	669	435	102	141	7	0.1	<0.01	72	3	21	29	0.93	0.096	<0.001	167
Bore 5	Sept 2015	7.53	654	381	111	105	9	<0.1	0.02	71	3	32	22	0.54	0.058	<0.001	128

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Parameter	Unit	Bore Number			Total range
		1	3	4	
Turbidity	NTU	0.3 - 2.8	0.3 - 2.1	0.1 - 31	0.1 - 31
TDS	mg/L	440	420	590	130 - 590
pH		7.1 - 7.5	6.5 - 7.6	7.1 - 7.5	6.5 - 7.6
Apparent colour	HU	7 - 41	10	4 - 12	1 - 55
Iron soluble	mg/L	0.1 - 0.2	0.3 - 1.4	1.4 - 2.8	0.1 - 5.6
Iron total	mg/L	0.2 - 0.4	0.3 - 1.5	1.5 - 3.1	0.2 - 6.1
Manganese soluble	mg/L	0.02 - 0.08	0.03 - 0.1	0.1 - 0.3	0.02 - 0.6
Manganese total	mg/L	0.05 - 0.1	0.05 - 0.2	0.2 - 0.3	0.05 - 0.7
Conductivity	µS/L	780	780	980	200 - 980
DO	mg/L	4.1	5.5	2.8	2.8 - 4.1
Calcium hardness	mg/L	39	41	100	23 - 100
Total hardness	mg/L	120	130	320	71 - 320



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## Appendix C Further water quality extracted from various sources for river water

### Water quality at Murrumbidgee River | MJM Jar test report | 2023

Raw Water	Units	ADWG	16th of Nov 2023	23rd of Nov 2023
pH	pH unit	6.5-8.5	7.3	8.2
Turbidity	NTU	5	1.0	1.0
True Colour	PCU	15	5	15.0
Apparent Colour	PCU	15	13	26.0
TOC	mg/L		1.8	1.8
DOC	mg/L		0.7	0.7
Alkalinity	mg/L CaCO <sub>3</sub>		44	39
Total Hardness	mg/L CaCO <sub>4</sub>	200	32	25
Total Dissolved Solids	mg/L	600	71	65
Calcium	mg/L		6.51	5.11
Aluminium (total)	mg/L		0.44	0.12
Iron (total)	mg/L	0.3	0.31	0.06
Iron (soluble)	mg/L		0.25	0.01
Manganese (total)	mg/L	0.1	0.012	0.002
Manganese (soluble)	mg/L		0.005	0.001
UVT	%		85	89
UV-254	AU		0.0068	0.05

Turbidity data available for the Murrumbidgee River at Location for the period 2003-2011 and other parameters to 2009-2011 is shown below table and graph from NSWPW archives.

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Alkalinity, turbidity and total hardness data | 2009-2011

Year	Month	Average of Alkalinity mg/l CaC3	Max of Alkalinity mg/l CaC3	Average of Turbidity NTU	Max of Turbidity NTU	Average of Total Hardness mg/l CaCo3	Max of Total Hardness mg/l CaCo3
2009	Jan	33.13	52	32.30	120	27.27	52
	Feb	29.89	35	26.96	39	22.36	28
	Mar	43.58	80	14.03	21	37.23	62
	Apr	69.27	82	13.50	64	66.57	88
	May	41.54	80	7.33	22	42.33	75
	Jun	72.23	112	8.37	15	72.47	86
	Jul	31.00	68	8.07	24	34.50	78
	Sep	45.55	62	23.41	48	46.91	75
	Oct	45.39	72	25.91	53	46.26	75
	Nov	33.33	70	22.93	30	24.43	35
	Dec	30.81	65	17.81	26	23.68	38
	<b>2009 Total</b>		<b>43.93</b>	<b>112</b>	<b>18.81</b>	<b>120</b>	<b>40.53</b>
2010	Jan	40.90	76	22.32	55	30.90	54
	Feb	49.18	85	16.57	64	42.11	80
	Mar	41.81	100	5.48	14	33.65	75
	Apr	84.97	725	16.43	40	63.43	82
	May	68.87	76	24.58	85	70.87	78
	Jun	64.47	82	32.13	150	69.87	95
	Jul	41.23	78	36.39	204	35.68	89
	Aug	19.52	80	22.74	108	22.58	82
	Sep	39.47	70	39.23	104	45.63	88
	Oct	31.90	80	26.81	78.5	33.16	78
	Nov	35.83	58	43.06	208	35.47	56
	Dec	16.52	55	14.37	53	15.94	55

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Year	Month	Average of Alkalinity mg/l CaC3	Max of Alkalinity mg/l CaC3	Average of Turbidity NTU	Max of Turbidity NTU	Average of Total Hardness mg/l CaCo3	Max of Total Hardness mg/l CaCo3
<b>2010 Total</b>		<b>44.39</b>	<b>725</b>	<b>25.00</b>	<b>208</b>	<b>41.47</b>	<b>95</b>
2011	Jan	57.16	76	36.65	56	54.65	72
	Feb	33.71	85	27.89	90	32.18	82
	Mar	61.90	74	43.71	58	61.42	70
	Apr	60.33	85	26.27	42	61.23	85
	May	52.61	74	24.61	90	39.52	70
	Jun	39.77	72	20.73	48	41.73	78
	Jul	45.58	72	31.79	132	37.35	77
	Aug	51.00	71	59.31	430	57.06	78
<b>2011 Total</b>		<b>50.43</b>	<b>85</b>	<b>32.37</b>	<b>430</b>	<b>47.74</b>	<b>85</b>

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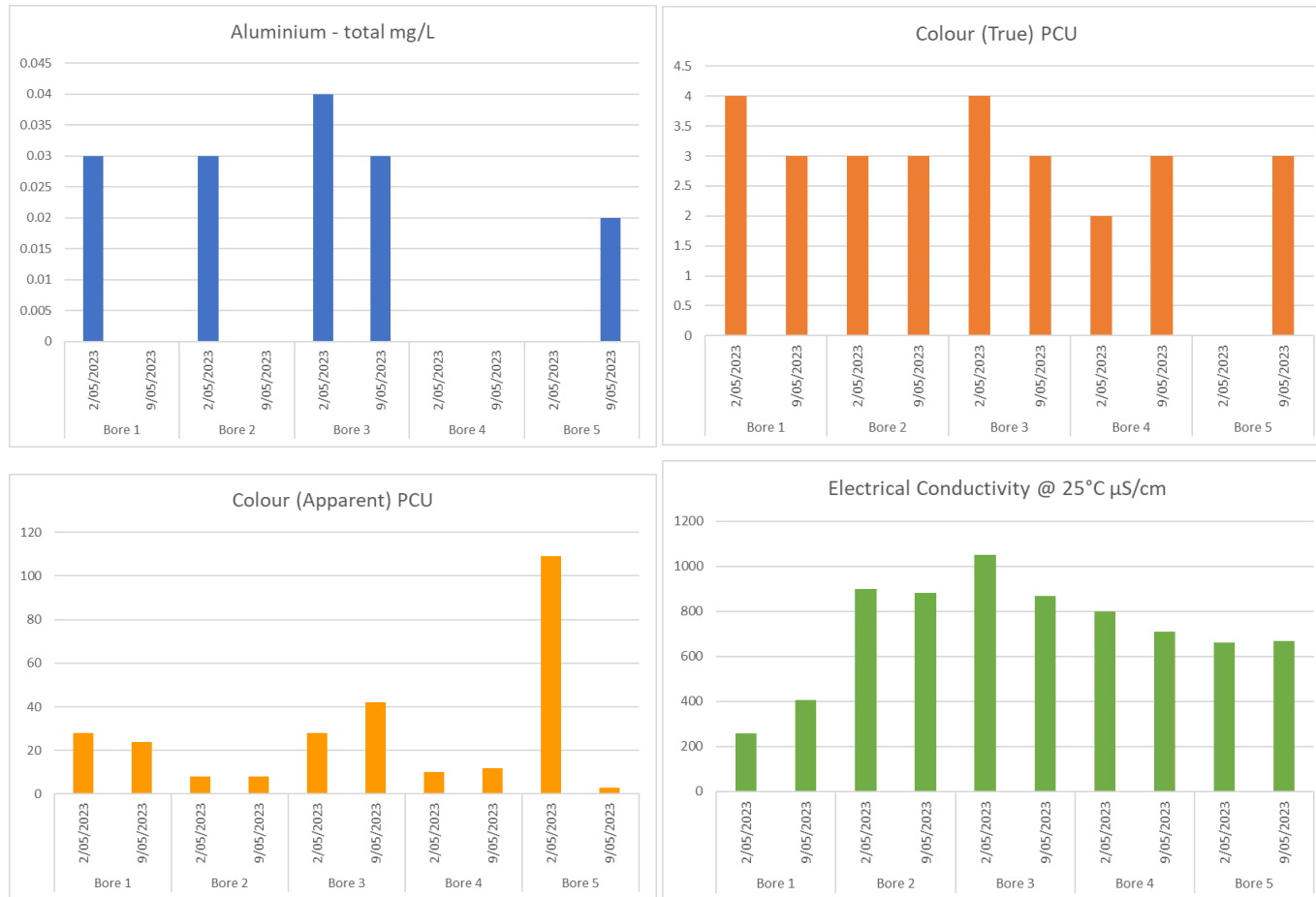
Turbidity recorded in Murrumbidgee River at Wagga Wagga

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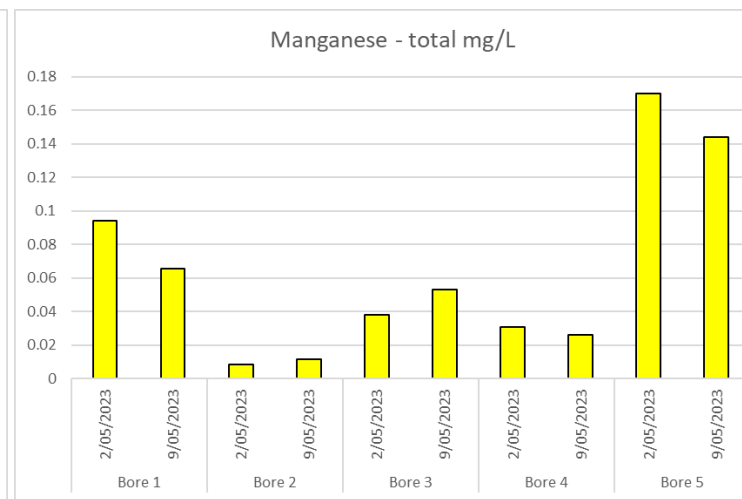
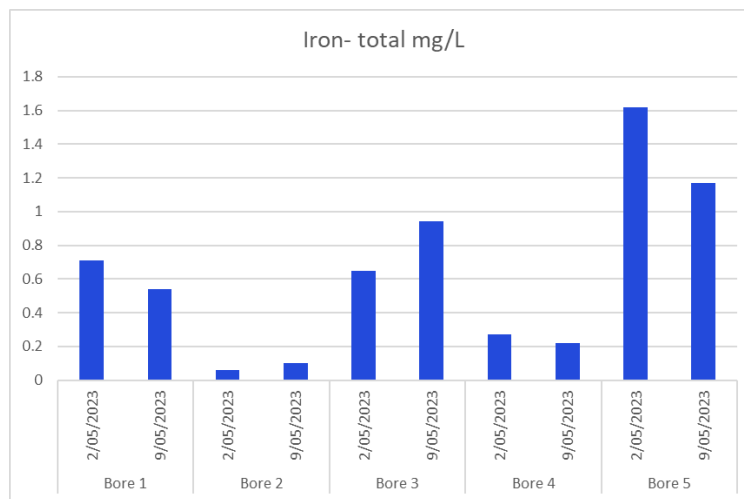
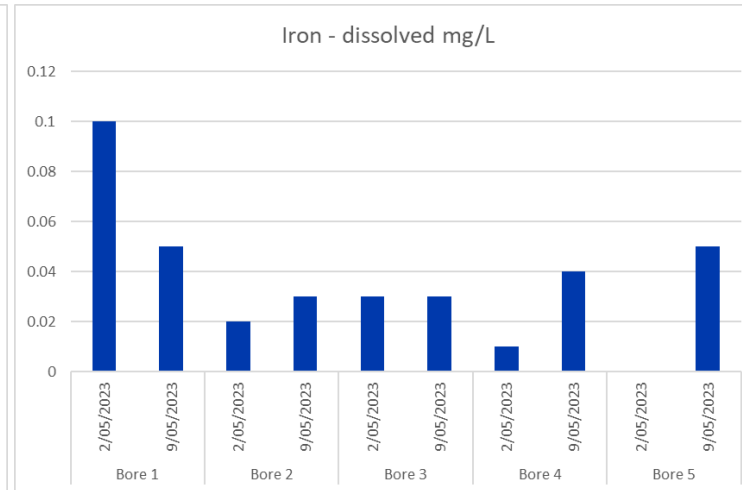
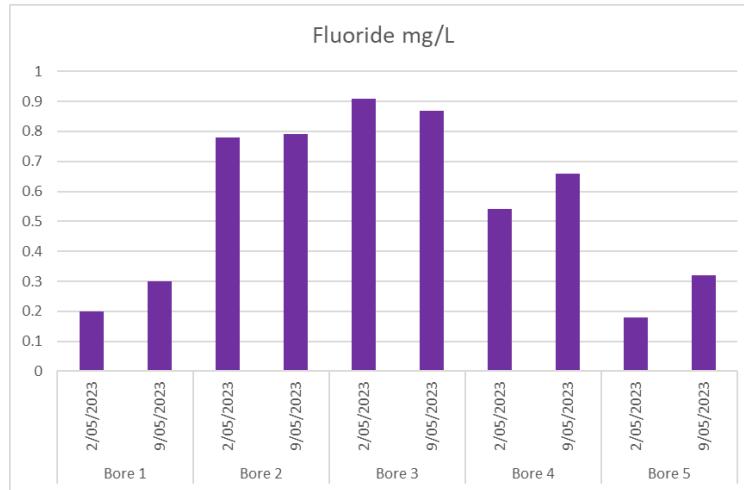


### Appendix D Latest water quality data analysis

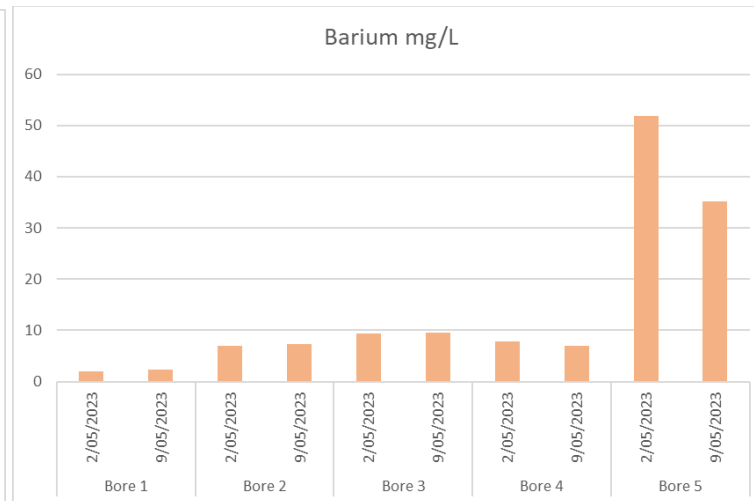
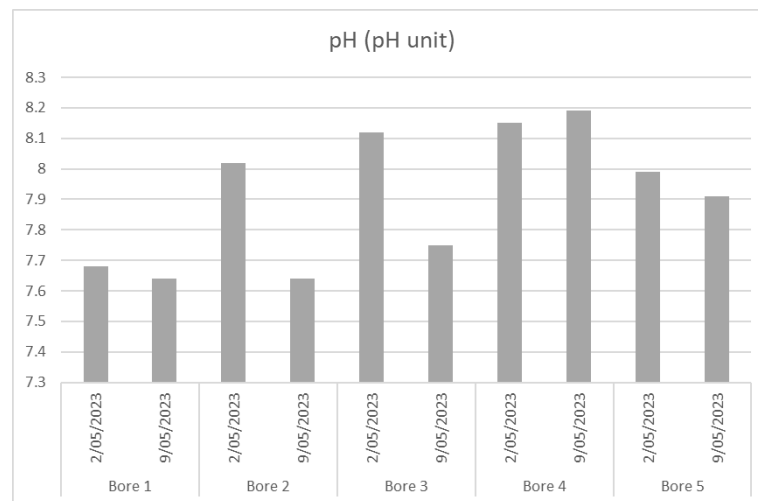
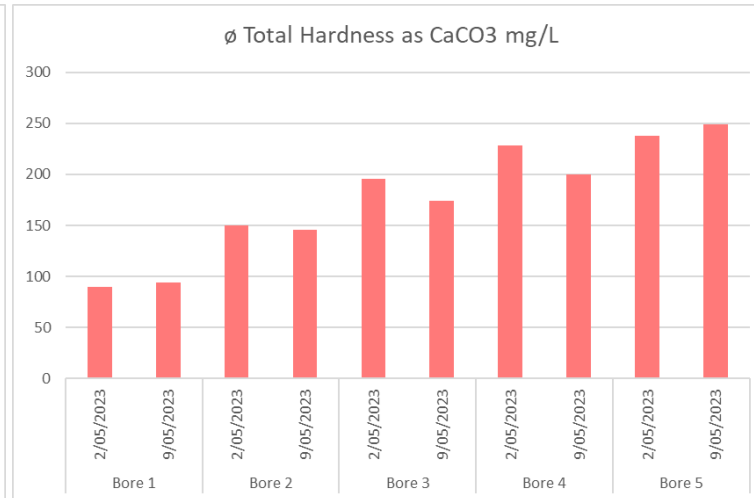
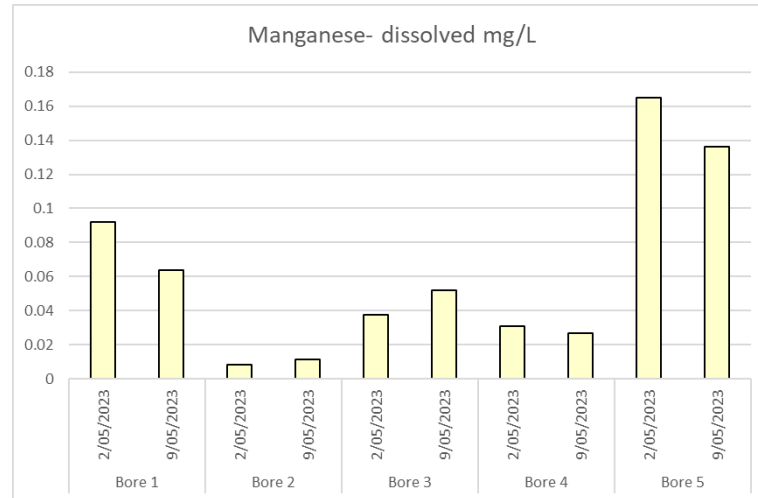
The following graphs were plotted for key water quality parameters using the testing done in May 2023.



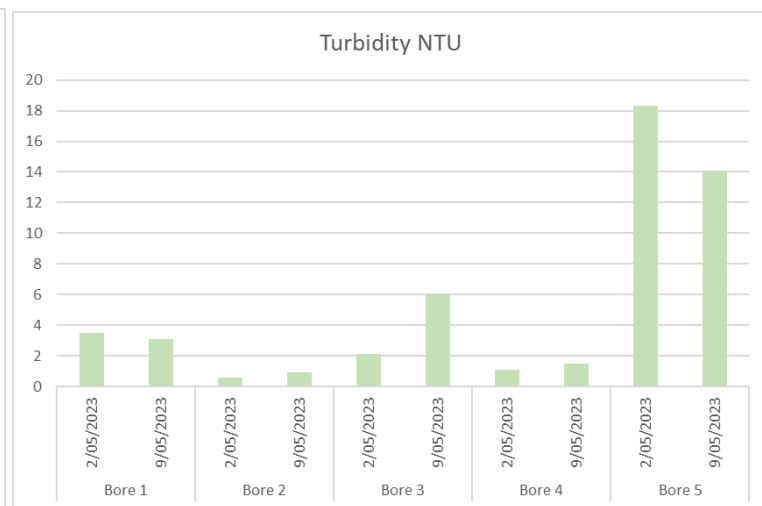
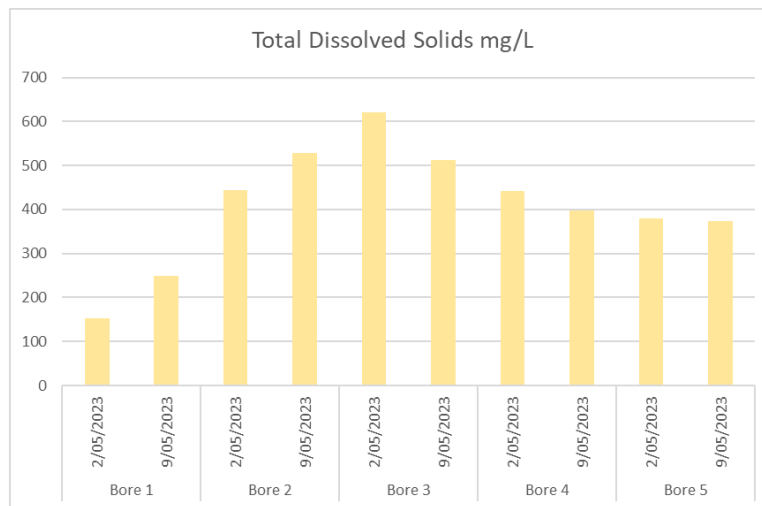
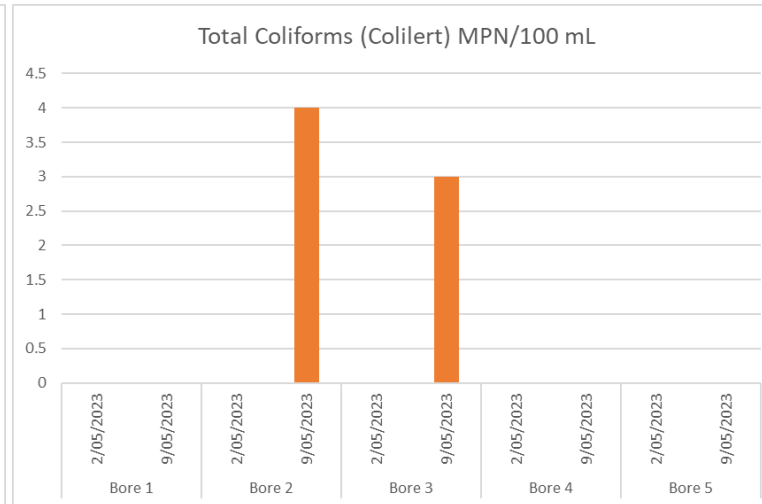
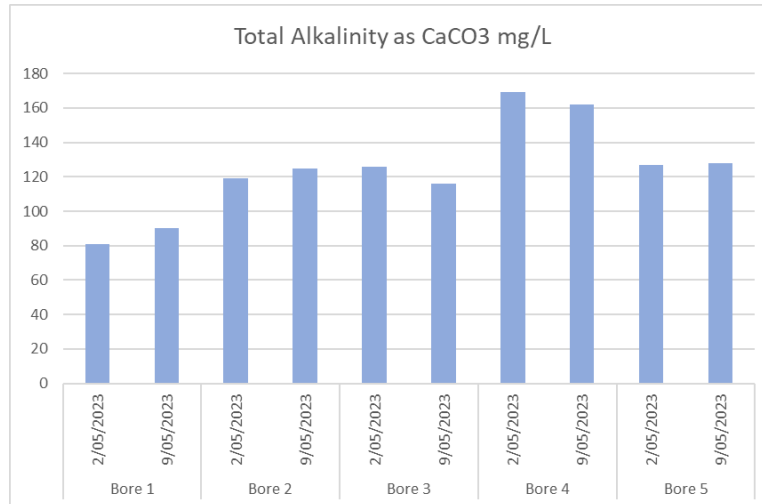
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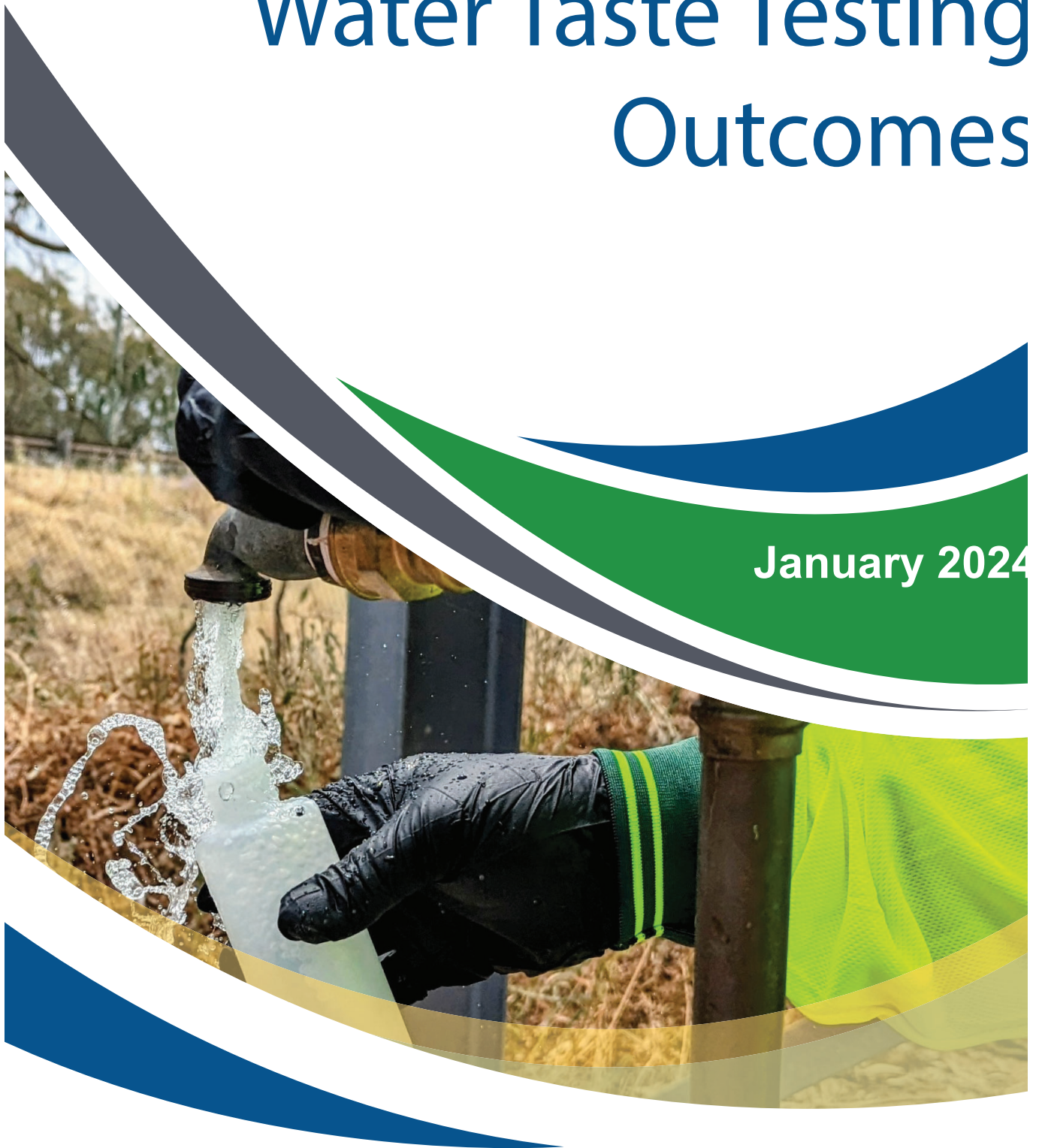
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## Appendix E Taste testing report by NSC

# Water Taste Testing Outcomes

January 2024





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Question 3 – Is the Narrandera township's main-supplied water your only source of water. ....	4
Question 4 – Do you currently use a water filter on the mains supplied water at your residence. ....	4
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## Background

Council has been undertaking an Integrated Water Cycle Management Plan (IWCM) since 2017. In 2019, the first draft Options Assessment was reviewed by the Department of Planning Industry and Environment (DPIE).

Following this review, additional Gap Tasks were identified and proposed by DPIE to improve the quality and scope of the IWCM, with these tasks to be eligible for funding under the Safe and Secure Water funding program.

NSW Public Works was appointed to undertake a scoping study, which began in 2023, under the Safe and Secure Water funding program.

The water taste testing event was organised to gather insights and preferences from participants regarding the quality, taste, and overall satisfaction between three samples of water.

- Sample one was sourced from Grong Grong, which is looked after by Goldenfields Water.
- Sample two was sourced from the scoping study, a filtered sample specific to a future filtration plant.
- Sample three was sourced from the current water supply.

The event aimed to provide valuable data that could aid in improving water treatment processes and infrastructure. Through this initiative, Narrandera Shire Council sought to address concerns related to water quality and to further assess the impact of different water sources and filtration systems on the community's satisfaction. Understanding these preferences is crucial for local authorities and water management organisations to make informed decisions that align with the needs and expectations of the residents.



## Water Taste Testing

Two water taste testing events were held on Friday 15 December 2023.

The first taste testing event was held between 10 am – 2 pm in Keisling Lane, a highly utilised thoroughfare within the main street of Narrandera.

The second event was held between 5.30 pm – 6.30 pm at the Emergency Operations Centre in Twynam Street, this time slot required registration through Eventbrite, with a total of 7 bookings made.

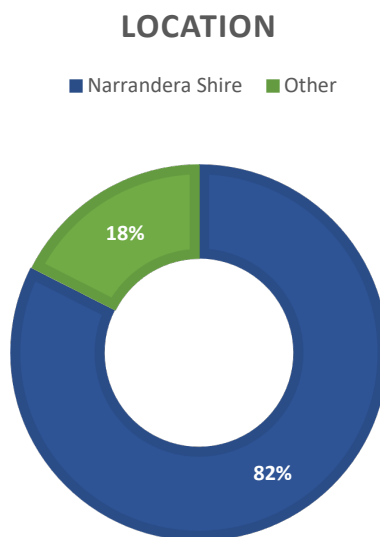
The survey consisted of 9 questions in total below are the outcomes of each question:

### Question 1 – Contact Details.

57 in total completed the water taste testing survey, contact details were provided by each respondent.

### Question 2 – Is your residence in Narrandera.

82% of respondents reside in Narrandera Shire.



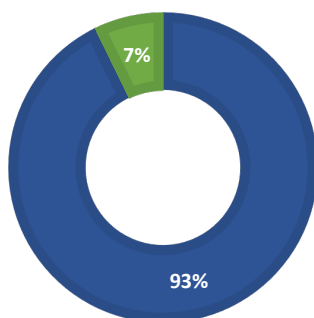


Question 3 – Is the Narrandera township's main-supplied water your only source of water.

93% of respondents have main-supplied water as their only source of water.

### WATER SOURCE

■ Mains-supplied water ■ Other

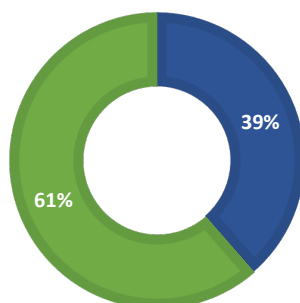


Question 4 – Do you currently use a water filter on the mains supplied water at your residence.

39% currently have a council-supplied filter on their water main.

### UTILISING A COUNCIL SUPPLIED FILTER ON WATER MAIN.

■ Utilising Filter ■ No filter

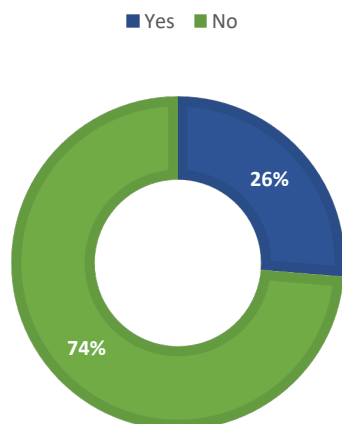




Question 5 – Is the mains-supplied water to your residence discoloured.

26% of respondents intermittently have discoloured water.

**DISCOLOURED WATER**



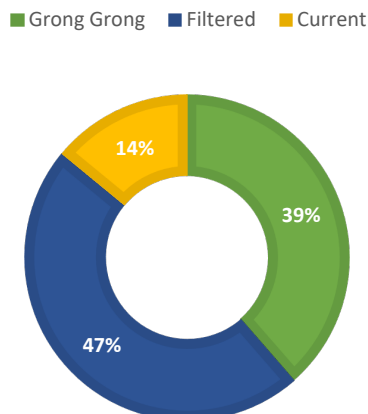
Question 6 – preferred water sample for clarity.

38.6% preferred the clarity of Grong Grong’s water.

47.37% preferred the clarity of the filtered water.

14.04% preferred the clarity of the current water.

**PREFERRED WATER SAMPLE FOR CLARITY**



Question 7 – preferred water sample for taste.

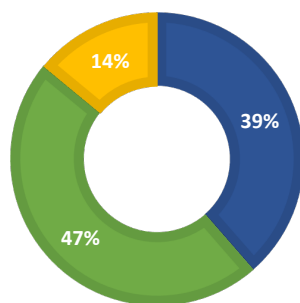
38.6% Prefer the taste of Grong Grong’s water.

47.37% prefer the taste of the filtered water.

14.04% prefer the taste of the current water.

**PREFERED WATER SAMPLE FOR TASTE**

■ Grong Grong ■ Filtered ■ Current



Question 8 – preferred water sample for least odour.

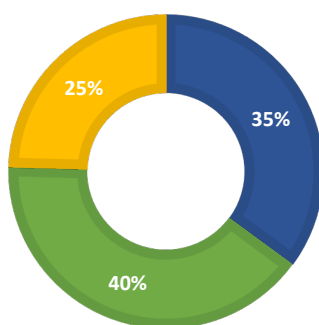
35.09% prefer the odour of Grong Grong’s water.

40.35% prefer the odour of the filtered water.

24.56% prefer the odour of the current water.

**PREFERRED WATER SAMPLE FOR LEAST ODOUR**

■ Grong Grong ■ Filtered ■ Current





**Question 9 – preferred water sample for overall satisfaction.**

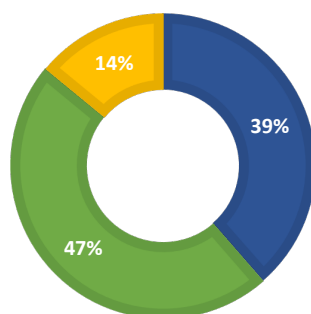
38.06% preferred Grong Grong’s water for overall satisfaction

47.37% preferred the filtered water for overall satisfaction.

14.04% preferred the current water for overall satisfaction.

**PREFERRED WATER SAMPLE FOR OVERALL SATISFACTION**

■ Grong Grong ■ Filtered ■ Current



**Conclusion**

Based on the water taste testing event organised to gather insights and preferences from participants regarding the quality, taste and overall satisfaction of water samples, it was found that the overall satisfaction for the proposed filtered sample was 47%.

This data provides valuable insights that can aid in improving water treatment processes and infrastructure. It reflects the preferences to address concerns related to water quality and assess the impact of different water sources and filtration systems on the community’s satisfaction.


This information is crucial for Narrandera Shire Council to make informed decisions that align with the needs and expectations of the residents.


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## Appendix F Jar testing results by MJM Environmental


Jar Testing Optimum Conditions															
Jar Test No.	Objective	COAGULANT		POLY LT20	COAGULATION			FLOCCULATION							
		Potassium Permanganate mg/L	Alum (liquid) mg/L	mg/L	Rapid Mix Time (min)	Poly Dose Delay (sec)	Rapid Mix Energy (rpm)	Flocculation Time (min)	Flocculation Energy (rpm)						
1	Alum dose optimisation	-	100	-	1	-	160	15	30						
2	LT20 dose optimisation for conventional settling	-	95	0.1	1	20	160	15	30						
3	LT20 dose optimisation for DAFF	-	95	0.1	1	20	160	15	30						
4	LT20 dose optimisation for DAFF	-	80	0.05	1	20	160	15	30						
5	Lagoon clarification with alum and LT20	-	95	-	1	-	160	15	20						
Jar Test No.	Objective	Raw Water													
		Temperature (°C)	pH	Turbidity (NTU)	Apoparent Colour (PCU) (0.45µm)	True Colour (PCU)	TOC (mg/L)	DOC (mg/L)	Al (Total) (mg/L)	Al (Soluble) (mg/L)	Fe (Total) (mg/L)	Fe (Soluble) (mg/L)	Mn (Total) (mg/L)	Mn (Soluble) (mg/L)	
1	Alum dose optimisation	25.5	7.3	2.29	69	13	1.8	0.7	0.12		0.06		0.002		
2	LT20 dose optimisation for conventional settling	25.5	7.3	2.29	69	13	1.8	0.7	0.12		0.06		0.002		
3	LT20 dose optimisation for DAFF	25.5	7.3	2.29	69	13	1.8	0.7	0.12		0.06		0.002		
4	LT20 dose optimisation for DAFF	25.5	7.3	2.29	69	13	1.8	0.7	0.12		0.06		0.002		
5	Lagoon clarification with alum and LT20	25.5	7.3	2.29	69	13	1.8	0.7	0.12		0.06		0.002		
Jar Test No.	Objective	Settled Water/DAF Subnatant	FILTERED WATER QUALITY												
		Turbidity (NTU)	Temperature (°C)	pH	Turbidity (NTU) Final	Apparent Colour (PCU)	TOC (mg/L)	UVT (%)	pH (pH Units)	Al (Total) (mg/L)	Al (Soluble) (mg/L)	Fe (Total) (mg/L)	Fe (Soluble) (mg/L)	Mn (Total) (mg/L)	Mn (Soluble) (mg/L)
1	Alum dose optimisation	2.59			0.16	11	-	-	7.4	-	-	-	-	-	-
2	LT20 dose optimisation for conventional settling	2.94			0.06	13	2	96.2	7.4	< 0.01	-	< 0.05	-	0.002	-
3	LT20 dose optimisation for DAFF	1.86			0.10	6	2	95.8	7.8	< 0.01	-	< 0.05	-	0.002	-
4	LT20 dose optimisation for DAFF	1.12			0.08	11	-	-	7.7	-	-	-	-	-	-
5	Lagoon clarification with alum and LT20	0.32			0.26	0	2	96.3	7.6	0.02	-	< 0.05	-	0.002	-

<b>Project No: 496 2414</b>		496-2414					
<b>Project Title:</b>		NSC WTP Jar Testing					
<b>Sampled by:</b>		NSC					
Water Source:		Murrumbidgee River					
Objective:		Raw water analysis					
<b>Water Quality</b>		<b>Collected by NSC as part of sample collection prior to shipment to MJM Laboratory.</b>					
<b>Raw Water</b>		Sampled by NSC 16th of Nov 2023	Sampled by NSC 23rd of Nov 2023				
pH	pH unit	7.3	8.2				
Turbidity	NTU	1.0	1.0				
True Colour	PCU	5	15.0				
Apparent Colour	PCU	13	26.0				
TOC	mg/L	1.8	1.8				
DOC	mg/L	0.7	0.7				
Alkalinity	mg/L CaCO <sub>3</sub>	44	39				
Total Hardness	mg/L CaCO <sub>3</sub>	32	25				
Total Dissolved Solids	mg/L	71	65				
Calcium	mg/L	6.51	5.11				
Aluminium (total)	mg/L	0.44	0.12				
Iron (total)	mg/L	0.31	0.06				
Iron (soluble)	mg/L	0.25	0.01				
Manganese (total)	mg/L	0.012	0.002				
Manganese (soluble)	mg/L	0.005	0.001				
UVT	%	85	89				
UV-254	AU	0.0068	0.05				
Sample Bottle ID							
<b>Notes:</b>							



Project No: 496 2414	496-2414									
Project Title:	NSC WTP Jar Testing									
Sampled by:	IM									
<b>Jar Test</b>										
Jar Test Number:	2						Date:	29/11/2023		
Water Source:	Murrumbidgee River						Time:			
Objective:	Alum dose optimisation									
Jar Volume	1000 mL									
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator 0.3 mm Size A 0.5 mm Size B 0.75 mm Size C 1.0 mm Size D 1.5 mm Size E 2.25 mm Size F 3.0 mm Size G 4.5 mm
Alum	mg/L		85	90	95	100				
Alum (mL in syringe)	mL		8.5	9	9.5	10				
<b>Mixing</b>										
Rapid Mix Time	min		1	1	1	1				
Rapid Mix Speed	rpm		160	160	160	160				
Poly Added After	sec									
Flocculation Time	min		15	15	15	15				
Flocculation Speed	rpm		30	30	30	30				
Settling time	min		20	20	20	20				
<b>Floc Properties</b>										
Time to Form Floc	min									
Floc Size @ Start of Mixing	(A - G)		A	A	A	A				
Floc Size @ End of Mixing	(A - G)		B	B	B	B				
<b>Water Quality</b>										
<b>Settled Water/ DAF Subnatant</b>										
Turbidity	NTU		2.95	3.23	2.2	2.59				
<b>Filtered Water</b>										
Temperature	°C									
pH	pH unit		7.58	7.43	7.48	7.37				
Turbidity	NTU		0.3	0.26	0.19	0.16				
True Colour	PCU									
Apparent Colour	PCU		16	12	8	11				
TOC	mg/L									
DOC	mg/L									
Suspended Solids	mg/L									
Alkalinity	mg/L CaCO <sub>3</sub>									
Hardness	mg/L CaCO <sub>4</sub>									
Total Suspended Solids	mg/L									
Total Dissolved Solids	mg/L									
Calcium	mg/L									
Chloride	mg/L									
Sulphate	mg/L									
Aluminium (total)	mg/L									
Aluminium (soluble)	mg/L									
Iron (total)	mg/L									
Iron (soluble)	mg/L									
Manganese (total)	mg/L									
Manganese (soluble)	mg/L									
Sample Bottle ID										
<b>Notes:</b>										

Project No: 496 2414	496-2414									
Project Title:	NSC WTP Jar Testing									
Sampled by:	IM									
<b>Jar Test</b>										
Jar Test Number:	3						Date:	30/11/2023		
Water Source:	Murrumbidgee River						Time:			
Objective:	LT20 dose optimisation for Conventional Settling									
Jar Volume	1000 mL									
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator 0.3 mm Size A 0.5 mm Size B 0.75 mm Size C 1.0 mm Size D 1.5 mm Size E 2.25 mm Size F 3.0 mm Size G 4.5 mm
Alum	mg/L		95	95	95	95				
Alum (mL in syringe)	mL		9.5	9.5	9.5	9.5				
LT20	mg/L		0.05	0.1	0.15	0.2				
LT (mL in syringe)	mL		0.5	1	1.5	2				
<b>Mixing</b>										
Rapid Mix Time	min		1	1	1	1				
Rapid Mix Speed	rpm		160	160	160	160				
Poly Added After	sec		20	20	20	20				
Flocculation Time	min		15	15	15	15				
Flocculation Speed	rpm		30	30	30	30				
Settling time	min		20	20	20	20				
<b>Floc Properties</b>										
Time to Form Floc	min									
Floc Size @ Start of Mixing	(A - G)		A	A	A	A				
Floc Size @ End of Mixing	(A - G)		C	C	C	C				
<b>Water Quality</b>										
<b>Settled Water/ DAF Subnatant</b>										
Turbidity	NTU		2.95	2.94	0.12	0.7				
<b>Filtered Water</b>										
Temperature	°C									
pH	pH unit		8	7.43	7.4	7.35				
Turbidity	NTU		0.16	0.06	0.1	0.07				
True Colour	PCU									
Apparent Colour	PCU		15	13	11	7				
TOC	mg/L			2						
DOC	mg/L									
Suspended Solids	mg/L									
Alkalinity	mg/L CaCO <sub>3</sub>			14						
Hardness	mg/L CaCO <sub>4</sub>									
Total Suspended Solids	mg/L									
Total Dissolved Solids	mg/L									
Calcium	mg/L									
Chloride	mg/L									
Sulphate	mg/L									
Aluminium (total)	mg/L			< 0.01						
Aluminium (soluble)	mg/L									
Iron (total)	mg/L			< 0.05						
Iron (soluble)	mg/L									
Manganese (total)	mg/L			0.002						
Manganese (soluble)	mg/L									
UVT	%			96.2						
Sample Bottle ID										
<b>Notes:</b>										

<b>Project No: 496 2414</b>		496-2414									
<b>Project Title:</b>		NSC WTP Jar Testing									
<b>Sampled by:</b>		IM									
<b>Jar Test</b>											
Jar Test Number:		4					Date:		30/11/2023		
Water Source:		Murrumbidgee River					Time:				
Objective:		LT20 dose optimisation for DAFF									
Jar Volume		1000 mL									
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator 0.3 mm Size A 0.5 mm Size B 0.75 mm Size C 1.0 mm Size D 1.5 mm Size E 2.25 mm Size F 3.0 mm Size G 4.5 mm	
Alum		mg/L		95	95	95	95				
Alum (mL in syringe)		mL		8.55	8.55	8.55	8.55				
LT20		mg/L		0	0.1	0.15	0.2				
LT (mL in syringe)		mL		0.45	0.9	1.35	1.8				
<b>Mixing</b>											
Rapid Mix Time		min		1	1	1	1				
Rapid Mix Speed		rpm		160	160	160	160				
Poly Added After		sec		20	20	20	20				
Flocculation Time		min		15	15	15	15				
Flocculation Speed		rpm		30	30	30	30				
DAF time		min		5	5	5	5				
<b>Floc Properties</b>											
Time to Form Floc		min									
Floc Size @ Start of Mixing		(A - G)		A	A	A	A				
Floc Size @ End of Mixing		(A - G)		C	C	C	C				
<b>Water Quality</b>											
<b>Settled Water/ DAF Subnatant</b>											
Turbidity		NTU		4.85	1.86	1.22	1.38				
<b>Filtered Water</b>											
Temperature		°C									
pH		pH unit		7.7	7.78	7.58	7.53				
Turbidity		NTU		0.24	0.1	0.06	0.06				
True Colour		PCU									
Apparent Colour		PCU		14	6	11	15				
TOC		mg/L			2						
DOC		mg/L									
Suspended Solids		mg/L									
Alkalinity		mg/L CaCO <sub>3</sub>			17						
Hardness		mg/L CaCO <sub>4</sub>									
Total Suspended Solids		mg/L									
Total Dissolved Solids		mg/L									
Calcium		mg/L									
Chloride		mg/L									
Sulphate		mg/L									
Aluminium (total)		mg/L			< 0.01						
Aluminium (soluble)		mg/L									
Iron (total)		mg/L			< 0.05						


<b>Project No: 496 2414</b>		496-2414								
<b>Project Title:</b>		NSC WTP Jar Testing								
<b>Sampled by:</b>		IM								
<b>Jar Test</b>										
Jar Test Number:	6						Date:	27/11/2023		
Water Source:	Murrumbidgee River						Time:			
Objective:	LT20 dose optimisation for DAFF									
Jar Volume	1000 mL									
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator 0.3 mm Size A 0.5 mm Size B 0.75 mm Size C 1.0 mm Size D 1.5 mm Size E 2.25 mm Size F 3.0 mm Size G 4.5 mm
Alum	mg/L		80	80	80	80				
Alum (mL in syringe)	mL		7.2	7.2	7.2	7.2				
LT20	mg/L		0.05	0.1	0.15	0.2				
LT (mL in syringe)	mL		0.45	0.9	1.35	1.8				
<b>Mixing</b>										
Rapid Mix Time	min		1	1	1	1				
Rapid Mix Speed	rpm		160	160	160	160				
Poly Added After	sec		20	20	20	20				
Flocculation Time	min		15	15	15	15				
Flocculation Speed	rpm		30	30	30	30				
DAF time	min		5	5	5	5				
<b>Floc Properties</b>										
Time to Form Floc	min									
Floc Size @ Start of Mixing	(A - G)		A	A	A	A				
Floc Size @ End of Mixing	(A - G)		B	C	C	D				
<b>Water Quality</b>										
<b>Settled Water/ DAF Subnatant</b>										
Turbidity	NTU		1.12	1.96	0.84	1.25				
<b>Filtered Water</b>										
Temperature	°C									
pH	pH unit		7.7	7.52	7.46	7.43				
Turbidity	NTU		0.08	0.14	0.18	0.17				
True Colour	PCU									
Apparent Colour	PCU		11	10	11	10				
TOC	mg/L									
DOC	mg/L									
Suspended Solids	mg/L									
Alkalinity	mg/L CaCO <sub>3</sub>									
Hardness	mg/L CaCO <sub>4</sub>									
Total Suspended Solids	mg/L									
Total Dissolved Solids	mg/L									
Calcium	mg/L									
Chloride	mg/L									
Sulphate	mg/L									
Aluminium (total)	mg/L									
Aluminium (soluble)	mg/L									
Iron (total)	mg/L									
Iron (soluble)	mg/L									
Manganese (total)	mg/L									



<b>Project No: 496 2414</b>		496-2414									
<b>Project Title:</b>		NSC WTP Jar Testing									
<b>Sampled by:</b>		IM									
<b>Jar Test</b>											
Jar Test Number:		5					Date:		23/11/2023		
Water Source:		Murrumbidgee River					Time:				
Objective:		Alum and LT20 for Lagoon Clarification									
Jar Volume		1000 mL									
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator	
Alum		mg/L		95	95					0.3 mm	
Alum (mL in syringe)		mL		9.5	9.5					Size A	
LT20		mg/L			0.15					0.5 mm	
LT (mL in syringe)		mL			1.5					Size B	
<b>Mixing</b>											
Rapid Mix Time		min		1	1					0.75 mm	
Rapid Mix Speed		rpm		160	160					Size C	
Poly Added After		sec			20					1.0 mm	
Flocculation Time		min		15	15					Size D	
Flocculation Speed		rpm		30	30					1.5 mm	
Settling time		min		20	20					Size E	
<b>Floc Properties</b>											
Time to Form Floc		min								2.25 mm	
Floc Size @ Start of Mixing		(A - G)								Size F	
Floc Size @ End of Mixing		(A - G)								3.0 mm	
<b>Water Quality</b>											
<b>Settled Water/ DAF Subnatant</b>											
Turbidity		NTU		0.32	0.15					Size G	
<b>Filtered Water</b>											
Temperature		°C									
pH		pH unit		7.7	7.58						
Turbidity		NTU		0.26	0.11						
True Colour		PCU									
Apparent Colour		PCU			0						
TOC		mg/L			2						
DOC		mg/L									
Suspended Solids		mg/L									
Alkalinity		mg/L CaCO <sub>3</sub>									
Hardness		mg/L CaCO <sub>4</sub>									
Total Suspended Solids		mg/L									
Total Dissolved Solids		mg/L									
Calcium		mg/L									
Chloride		mg/L									
Sulphate		mg/L									
Aluminium (total)		mg/L			0.02						
Aluminium (soluble)		mg/L									
Iron (total)		mg/L			< 0.05						
Iron (soluble)		mg/L									
Manganese (total)		mg/L			0.002						
Manganese (soluble)		mg/L									
UVT		%			96.3						
Sample Bottle ID											
<b>Notes:</b>											

496-2414 - NSC WTP Bore 5 Jar Testing Results (2024-02-15)(Draft)

Jar Testing Optimum Conditions Summary															
Jar Test No.	Objective	COAGULANT		POLY LT20	COAGULATION			FLOCCULATION							
		Potassium Permanganate mg/L	Alum (liquid) mg/L	mg/L	Rapid Mix Time (min)	Poly Dose Delay (sec)	Rapid Mix Energy (rpm)	Flocculation Time (min)	Flocculation Energy (rpm)						
1	Potassium Permanganate Oxidation Optimisation	0.75	0	-	1	-	160	15	30						
2	Optimum alum dose not achieved. Results not reported.														
3	Alum dose optimisation for Conventional Clarification	0	80	-	1	-	160	15	20						
4	Alum dose optimisation for DAFF process	0	80	-	1	-	160	15	20						
5	LT20 Dose Optimisation for Conventional Settling	0	80	0.05	1	-	160	15	20						
6	LT20 Dose Optimisation for DAFF	0	80	0.05	1	-	160	15	20						
7	Lagoon Clarification optimisation with LT20 (Note: Jar Test Duplicated)	0	80	0.05	1	-	160	15	20						
Jar Test No.	Objective	Raw Water													
		Temperature	pH	Turbidity	Apparent Colour	True Colour	TOC	DOC	Al (Total)	Al (Soluble)	Fe (Total)	Fe (Soluble)	Mn (Total)	Mn (Soluble)	
		(°C)		(NTU)	(PCU) (0.45µm)	(PCU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
1	Potassium Permanganate Oxidation Optimisation	25.6	7.6	2.49	42	23	-	-	< 0.03	-	0.38	< 0.05	0.12	0.115	
2	Optimum alum dose not achieved. Results not reported.														
3	Alum dose optimisation for Conventional Clarification	25.6	7.6	2.49	42	23	-	-	< 0.03	-	0.38	< 0.05	0.12	0.115	
4	Alum dose optimisation for DAFF process	25.6	7.6	2.49	42	23	-	-	< 0.03	-	0.38	< 0.05	0.12	0.115	
5	LT20 Dose Optimisation for Conventional Settling	25.6	7.6	2.49	42	23	-	-	< 0.03	-	0.38	< 0.05	0.12	0.115	
6	LT20 Dose Optimisation for DAFF	25.6	7.6	2.49	42	23	-	-	< 0.03	-	0.38	< 0.05	0.12	0.115	
7	Lagoon Clarification optimisation with LT20 (Note: Jar Test Duplicated)	25.6	7.6	2.49	42	23	-	-	< 0.03	-	0.38	< 0.05	0.12	0.115	
Jar Test No.	Objective	Settled Water/DAF Subnatant Water Quality	FILTERED WATER QUALITY												
			Turbidity	Temperature	pH	Turbidity	Apparent Colour	Alkalinity	Al (Total)	Al (Soluble)	Fe (Total)	Fe (Soluble)	Mn (Total)	Mn (Soluble)	
			(NTU)	(°C)		(NTU)	(PCU)	(mg/L CaCO <sub>3</sub> )	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
			Final		Final										
1	Potassium Permanganate Oxidation Optimisation	-	25.5	7.57	-	0				< 0.05	< 0.05	0.006	0.006		
2	Optimum alum dose not achieved. Results not reported.														
3	Alum dose optimisation for Conventional Clarification	0.66	25.5	6.9	0.21	0				-	-	-	-		
4	Alum dose optimisation for DAFF process	0.85	25.5	7.41	0.2	0				-	-	-	-		
5	LT20 Dose Optimisation for Conventional Settling	0.61	25.5	7.6	0.07	7				-	-	-	-		
6	LT20 Dose Optimisation for DAFF	1.12	25.5	7.7	0.08	11				-	-	-	-		
7	Lagoon Clarification optimisation with LT20 (Note: Jar Test Duplicated)	0.22	25.5	7.7	0.22	16				-	-	-	-		

<b>Project No: 496 2414</b>		496-2414					
<b>Project Title:</b>		NSC WTP Jar Testing					
<b>Sampled by:</b>		NSC					
Water Source:		Bore 5					
Objective:		Raw water analysis					
<b>Water Quality</b>		<b>Collected by NSC as part of sample collection prior to shipment to MJM Laboratory.</b>					
<b>Raw Water</b>		16 Nov 2023 Sample at 11 am	21 Nov 2023 Sample @ 8:30 am	28 Nov 2023 Sample at 12:30 pm			
pH	pH unit	7.9	9.0	6.5			
Turbidity	NTU	108	< 1.0	16			
True Colour	PCU	< 5	9.0	< 5			
Apparent Colour	PCU	16	12.0	25			
TOC	mg/L	-	-	1.4			
DOC	mg/L	-	-	0.8			
Alkalinity	mg/L CaCO <sub>3</sub>	131	135	138			
Total Hardness	mg/L CaCO <sub>4</sub>	188	186	220			
Total Dissolved Solids	mg/L	550	566	461			
Calcium	mg/L	23.3	22.6	27.2			
Aluminium (total)	mg/L	< 0.03	< 0.03	< 0.03			
Iron (total)	mg/L	0.8	< 0.01	1.09			
Iron (soluble)	mg/L	0.46	< 0.01	1.3			
Manganese (total)	mg/L	0.104	0.073	0.148			
Manganese (soluble)	mg/L	0.102	< 0.01	0.145			
UVT	%	97	97	97			
UV-254	AU	0.013	0.015	0.011			
Sample Bottle ID							
<b>Notes:</b>							







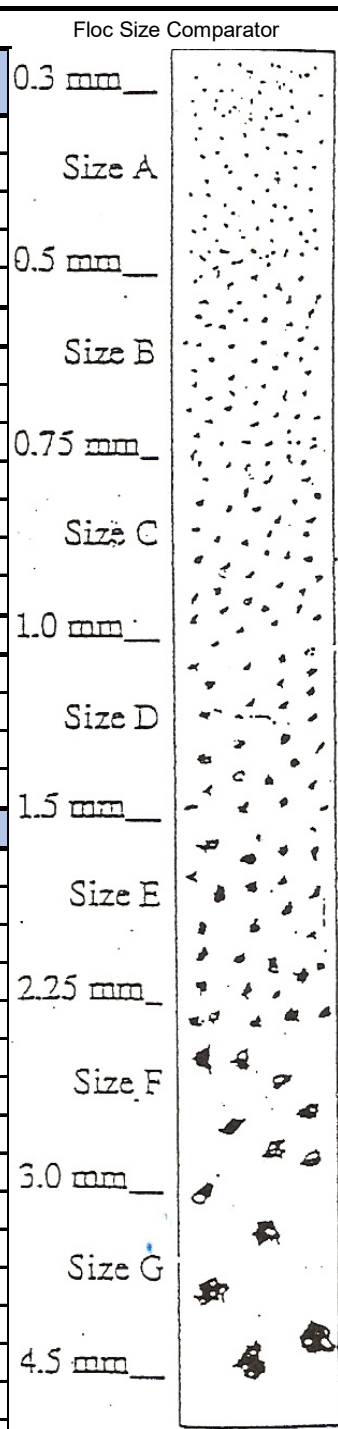
<b>Project No: 496 2414</b>	496-2414									
<b>Project Title:</b>	NSC WTP Jar Testing									
<b>Sampled by:</b>	IM									
<b>Jar Test</b>										
Jar Test Number:	1						Date:	23/11/2023		
Water Source:	Bore 5						Time:			
Objective:	Potassium permanganate oxidation									
Jar Volume	1000 mL									Floc Size Comparator
<b>Chemicals</b>	<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	0.3 mm	
Potassium Permanganate	mg/L		0.25	0.5	0.75	1			Size A	
									0.5 mm	
									Size B	
<b>Mixing</b>										
Rapid Mix Time	min		1	1	1	1			0.75 mm	
Rapid Mix Speed	rpm		160	160	160	160			Size C	
Poly Added After	sec		-	-	-	-			1.0 mm	
Oxidation Time	min		30	30	30	30			Size D	
Mixing Speed	rpm		30	30	30	30			1.5 mm	
									Size E	
<b>Floc Properties</b>										
Time to Form Floc	min								2.25 mm	
Floc Size @ Start of Mixing	(A - G)								Size F	
Floc Size @ End of Mixing	(A - G)								3.0 mm	
									Size G	
<b>Water Quality</b>										
<b>Settled Water</b>										
Turbidity	NTU								4.5 mm	
<b>Filtered Water (Filtered through 0.45µm filter paper)</b>										
Temperature	°C									
pH	pH unit		7.59	7.59	7.57	7.56				
Turbidity	NTU									
True Colour	PCU		0	3	0	0				
Apparent Colour	PCU									
DOC	mg/L									
DOC	mg/L									
Suspended Solids	mg/L									
Alkalinity	mg/L CaCO <sub>3</sub>									
Hardness	mg/L CaCO <sub>4</sub>									
Total Suspended Solids	mg/L									
Total Dissolved Solids	mg/L									
Calcium	mg/L									
Chloride	mg/L									
Sulphate	mg/L									
Aluminium (total)	mg/L									
Aluminium (soluble)	mg/L									
Iron (total)	mg/L	0.38	< 0.05	< 0.05	< 0.05	< 0.05				






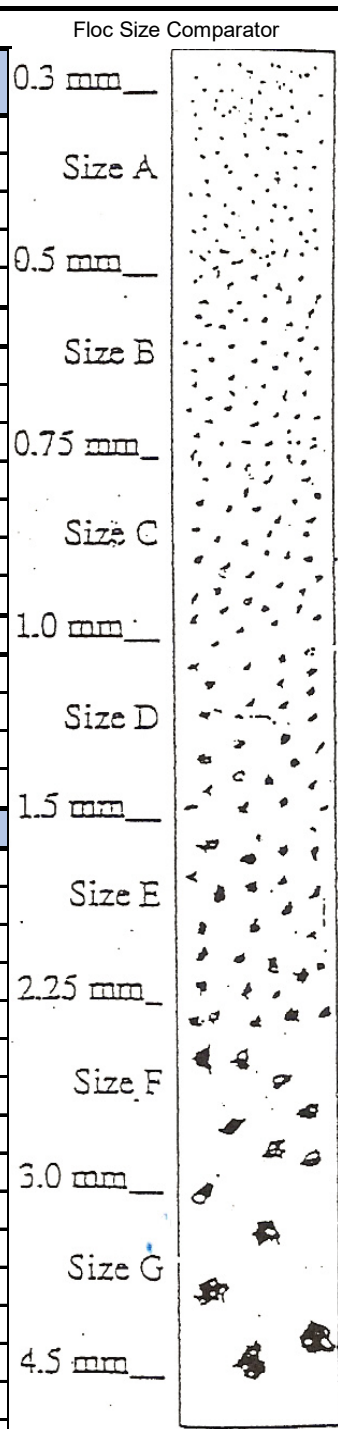
<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:	2						Date:	23/11/2023	
Water Source:	Bore 5						Time:		
Objective:	Alum dose optimisation for conventional clarification								
Jar Volume	1000 mL								
<b>Chemicals</b>	<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator
Alum	mg/L		10	20	30	40			0.3 mm
									Size A
									0.5 mm
									Size B
									0.75 mm
									Size C
									1.0 mm
									Size D
									1.5 mm
									Size E
									2.25 mm
									Size F
									3.0 mm
									Size G
									4.5 mm
<b>Mixing</b>									
Rapid Mix Time	min		1	1	1	1			
Rapid Mix Speed	rpm		160	160	160	160			
Poly Added After	sec								
Flocculation Time	min		15	15	15	15			
Flocculation Speed	rpm		30	30	30	30			
Settling time	min		20	20	20	20			
<b>Floc Properties</b>									
Time to Form Floc	min								
Floc Size @ Start of Mixing	(A - G)		A	A	A	A			
Floc Size @ End of Mixing	(A - G)		B	B	B	B			
<b>Water Quality</b>									
<b>Settled Water</b>									
Turbidity	NTU		3.31	2.37	2.12	1.52			
<b>Filtered Water</b>									
Temperature	°C								
pH	pH unit		8.4	8.5	7.3	7.2			
Turbidity	NTU		1.61	1.6	0.78	0.5			
True Colour	PCU								
Apparent Colour	PCU		14	15	24	15			
TOC	mg/L								
DOC	mg/L								
Suspended Solids	mg/L								
Alkalinity	mg/L CaCO <sub>3</sub>								
Hardness	mg/L CaCO <sub>4</sub>								
Total Suspended Solids	mg/L								
Total Dissolved Solids	mg/L								
Calcium	mg/L								
Chloride	mg/L								
Sulphate	mg/L								
Aluminium (total)	mg/L								
Aluminium (soluble)	mg/L								
Iron (total)	mg/L								
Iron (soluble)	mg/L								
Manganese (total)	mg/L								
Manganese (soluble)	mg/L								
Sample Bottle ID									
<b>Notes:</b>									


<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:	3						Date:	23/11/2023	
Water Source:	Bore 5						Time:		
Objective:	Alum dose optimisation for conventional clarification								
Jar Volume	1000 mL								
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>
Alum	mg/L		60	70	80	90			
<b>Mixing</b>									
Rapid Mix Time	min		1	1	1	1			
Rapid Mix Speed	rpm		160	160	160	160			
Poly Added After	sec								
Flocculation Time	min		15	15	15	15			
Flocculation Speed	rpm		30	30	30	30			
Settling time	min		20	20	20	20			
<b>Floc Properties</b>									
Time to Form Floc	min								
Floc Size @ Start of Mixing	(A - G)								
Floc Size @ End of Mixing	(A - G)								
<b>Water Quality</b>									
<b>Settled Water</b>									
Turbidity	NTU		1.04	1.95	0.66	0.65			
<b>Filtered Water</b>									
Temperature	°C								
pH	pH unit		6.78	6.83	6.9	6.05			
Turbidity	NTU		0.87	0.35	0.21	0.4			
True Colour	PCU								
Apparent Colour	PCU		3	0	0	3			
TOC	mg/L								
DOC	mg/L								
Suspended Solids	mg/L								
Alkalinity	mg/L CaCO <sub>3</sub>								
Hardness	mg/L CaCO <sub>4</sub>								
Total Suspended Solids	mg/L								
Total Dissolved Solids	mg/L								
Calcium	mg/L								
Chloride	mg/L								
Sulphate	mg/L								
Aluminium (total)	mg/L								
Aluminium (soluble)	mg/L								
Iron (total)	mg/L								
Iron (soluble)	mg/L								
Manganese (total)	mg/L								
Manganese (soluble)	mg/L								
Sample Bottle ID									
<b>Notes:</b>									

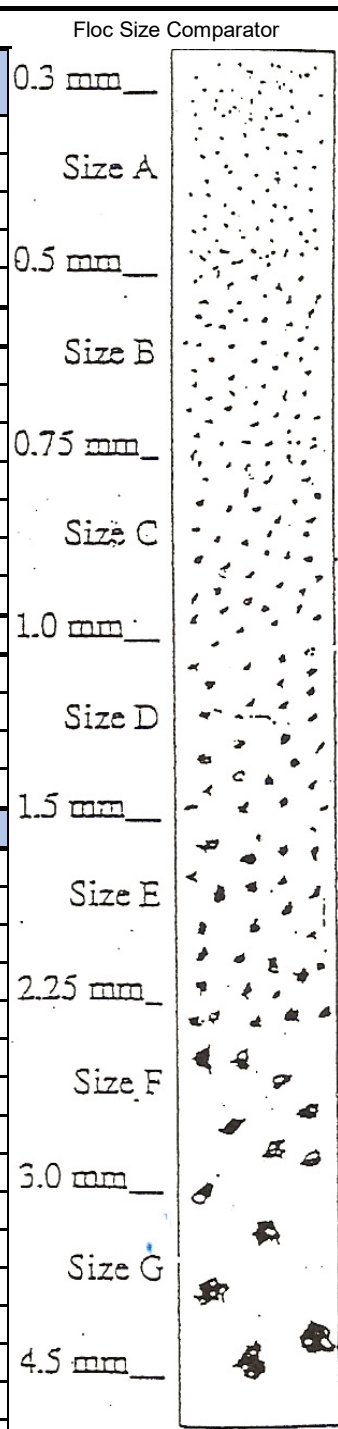





<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:	4						Date:	27/11/2023	
Water Source:	Bore 5						Time:		
Objective:	Alum dose optimisation for DAFF								
Jar Volume	1000 mL								
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>
Alum	mg/L		60	70	80	90			
<b>Mixing</b>									
Rapid Mix Time	min		1	1	1	1			
Rapid Mix Speed	rpm		160	160	160	160			
Poly Added After	sec								
Flocculation Time	min		15	15	15	15			
Flocculation Speed	rpm		30	30	30	30			
Flotation Time	min		5	5	5	5			
<b>Floc Properties</b>									
Time to Form Floc	min								
Floc Size @ Start of Mixing	(A - G)		A	A	A	A			
Floc Size @ End of Mixing	(A - G)								
<b>Water Quality</b>									
<b>DAFF/Settled Water</b>									
Turbidity	NTU		1.95	2.93	0.86	0.98			
<b>Filtered Water</b>									
Temperature	°C								
pH	pH unit		6.28	6.4	6.53	6.6			
Turbidity	NTU		0.67	0.72	0.23	0.76			
True Colour	PCU								
Apparent Colour	PCU		6	2	0	0			
TOC	mg/L								
DOC	mg/L								
Suspended Solids	mg/L								
Alkalinity	mg/L CaCO <sub>3</sub>								
Hardness	mg/L CaCO <sub>4</sub>								
Total Suspended Solids	mg/L								
Total Dissolved Solids	mg/L								
Calcium	mg/L								
Chloride	mg/L								
Sulphate	mg/L								
Aluminium (total)	mg/L								
Aluminium (soluble)	mg/L								
Iron (total)	mg/L								
Iron (soluble)	mg/L								
Manganese (total)	mg/L								
Manganese (soluble)	mg/L								
Sample Bottle ID									
<b>Notes:</b>									




<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:	5						Date:	27/11/2023	
Water Source:	Bore 5						Time:		
Objective:	LT20 dose optimisation for Conventional Settling								
Jar Volume	1000 mL								
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>
Alum	mg/L		80	80	80	80			
LT20	mg/L		0.05	0.1	0.15	0.2			
<b>Mixing</b>									
Rapid Mix Time	min		1	1	1	1			
Rapid Mix Speed	rpm		160	160	160	160			
Poly Added After	sec		20	20	20	20			
Flocculation Time	min		15	15	15	15			
Flocculation Speed	rpm		30	30	30	30			
Settling time	min		20	20	20	20			
<b>Floc Properties</b>									
Time to Form Floc	min								
Floc Size @ Start of Mixing	(A - G)		A	A	A	A			
Floc Size @ End of Mixing	(A - G)		A	B	B	C			
<b>Water Quality</b>									
<b>Settled Water</b>									
Turbidity	NTU		0.61	1.25	0.35	0.86			
<b>Filtered Water</b>									
Temperature	°C								
pH	pH unit		7.6	7.53	7.45	7.41			
Turbidity	NTU		0.07	0.23	0.06	0.2			
True Colour	PCU								
Apparent Colour	PCU		7	13	6	13			
TOC	mg/L								
DOC	mg/L								
Suspended Solids	mg/L								
Alkalinity	mg/L CaCO <sub>3</sub>								
Hardness	mg/L CaCO <sub>4</sub>								
Total Suspended Solids	mg/L								
Total Dissolved Solids	mg/L								
Calcium	mg/L								
Chloride	mg/L								
Sulphate	mg/L								
Aluminium (total)	mg/L								
Aluminium (soluble)	mg/L								
Iron (total)	mg/L								
Iron (soluble)	mg/L								
Manganese (total)	mg/L								
Manganese (soluble)	mg/L								
Sample Bottle ID									
<b>Notes:</b>									



<b>Project No: 496 2414</b>		496-2414									
<b>Project Title:</b>		NSC WTP Jar Testing									
<b>Sampled by:</b>		IM									
<b>Jar Test</b>											
Jar Test Number:		6					Date:		27/11/2023		
Water Source:		Bore 5					Time:				
Objective:		LT20 dose optimisation for DAFF									
Jar Volume		1000 mL								Floc Size Comparator	
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	0.3 mm	
Alum		mg/L		80	80	80	80			Size A	
LT20		mg/L		0.05	0.1	0.15	0.2				
										0.5 mm	
										Size B	
<b>Mixing</b>										0.75 mm	
Rapid Mix Time		min		1	1	1	1			Size C	
Rapid Mix Speed		rpm		160	160	160	160				
Poly Added After		sec		20	20	20	20			Size D	
Flocculation Time		min		15	15	15	15				
Flocculation Speed		rpm		30	30	30	30			Size E	
DAF time		min		5	5	5	5				
										1.0 mm	
<b>Floc Properties</b>										Size F	
Time to Form Floc		min									
Floc Size @ Start of Mixing		(A - G)		A	A	A	A			Size G	
Floc Size @ End of Mixing		(A - G)		B	C	C	D				
										1.5 mm	
<b>Water Quality</b>										Size E	
<b>DAF/Settled Water</b>											
Turbidity		NTU		1.12	1.96	0.84	1.25			Size F	
<b>Filtered Water</b>											
Temperature		°C								Size G	
pH		pH unit		7.7	7.52	7.46	7.43				
Turbidity		NTU		0.08	0.14	0.18	0.2			Size F	
True Colour		PCU									
Apparent Colour		PCU		11	10	11	10			Size G	
TOC		mg/L									
DOC		mg/L								Size F	
Suspended Solids		mg/L									
Alkalinity		mg/L CaCO <sub>3</sub>								Size G	
Hardness		mg/L CaCO <sub>4</sub>									
Total Suspended Solids		mg/L								Size E	
Total Dissolved Solids		mg/L									
Calcium		mg/L								Size F	
Chloride		mg/L									
Sulphate		mg/L								Size G	
Aluminium (total)		mg/L									
Aluminium (soluble)		mg/L								Size F	
Iron (total)		mg/L									
Iron (soluble)		mg/L								Size G	
Manganese (total)		mg/L									




<b>Project No: 496 2414</b>		496-2414									
<b>Project Title:</b>		NSC WTP Jar Testing									
<b>Sampled by:</b>		IM									
<b>Jar Test</b>											
Jar Test Number:		7					Date:		28/11/2023		
Water Source:		Bore 5					Time:				
Objective:		Alum and LT20 optimisation for Lagoon Clarification									
Jar Volume		1000 mL								Floc Size Comparator	
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	0.3 mm	
Alum		mg/L		80	80	80	80			Size A	
Alum (mL in syringe)		mL		8	8	8	8				
LT20		mg/L			0.05		0.05				
LT (mL in syringe)		mL			0.5		0.5				
										0.5 mm	
<b>Mixing</b>										Size B	
Rapid Mix Time		min		1	1	1	1			0.75 mm	
Rapid Mix Speed		rpm		160	160	160	160				
Poly Added After		sec		-	20	-	20			Size C	
Flocculation Time		min		15	15	15	15				
Flocculation Speed		rpm		30	30	30	30			1.0 mm	
Settling time		min		20	20	20	20				
<b>Floc Properties</b>										1.5 mm	
Time to Form Floc		min								Size D	
Floc Size @ Start of Mixing		(A - G)		A	A	A	A				
Floc Size @ End of Mixing		(A - G)		B	B	B	B				
<b>Water Quality</b>										2.25 mm	
<b>Settled Water</b>										Size E	
Turbidity		NTU		0.38	0.38	0.36	0.22				
<b>Filtered Water</b>										Size F	
Temperature		°C									
pH		pH unit		8.04	7.95	7.68	7.66			3.0 mm	
Turbidity		NTU		0.44	0.21	0.53	0.22				
True Colour		PCU								Size G	
Apparent Colour		PCU		18	17	12	16				
TOC		mg/L								4.5 mm	
DOC		mg/L									
Suspended Solids		mg/L									
Alkalinity		mg/L CaCO <sub>3</sub>									
Hardness		mg/L CaCO <sub>4</sub>									
Total Suspended Solids		mg/L									
Total Dissolved Solids		mg/L									
Calcium		mg/L									
Chloride		mg/L									
Sulphate		mg/L									
Aluminium (total)		mg/L									
Aluminium (soluble)		mg/L									
Iron (total)		mg/L									
Iron (soluble)		mg/L									
Manganese (total)		mg/L									


496-2414 - NSC WTP - 50\_50 Blended Water - Jar Testing Results (2024-02-15)(Draft)

Jar Testing Optimum Conditions															
Jar Test No.	Objective	COAGULANT		POLY LT20	COAGULATION			FLOCCULATION							
		Potassium Permanaganate mg/L	Alum (liquid) mg/L	mg/L	Rapid Mix Time (min)	Poly Dose Delay (sec)	Rapid Mix Energy (rpm)	Flocculation Time (min)	Flocculation Energy (rpm)						
1	Alum dose optimisation for Conventional Clarification	-	95	-	1	-	160	20	30						
2	Alum and LT20 dose optimisation for Conventional Clarification	-	95	0.1	1	-	160	15	30						
3	Alum and LT20 Optimisation for DAFF	-	95	0.15	1	20	160	15	30						
4	Process Comparison Jar Test - Please See jar Test 4 for results for each type of process.														
		Raw Water													
		Temperature	pH	Turbidity	Apparent Colour	True Colour	TOC	DOC	Al (Total)	Al (Soluble)	Fe (Total)	Fe (Soluble)	Mn (Total)	Mn (Soluble)	
		(°C)		(NTU)	(PCU)	(PCU)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
1	Alum dose optimisation for Conventional Clarification				(0.45µm)										
2	Alum and LT20 dose optimisation for Conventional Clarification	25	7.6	2.4	12	9			0.03						
3	Alum and LT20 Optimisation for DAFF	25	7.6	2.4	12	9			0.03						
4	Process Comparison Jar Test - Please See jar Test 4 for results for each type of process.	25	7.6	2.4	12	9			0.03						
		FILTERED WATER QUALITY													
		Temperature	pH	Turbidity	Apparent Colour	Alkalinity	Al (Total)	Al (Soluble)	Fe (Total)	Fe (Soluble)	Mn (Total)	Mn (Soluble)			
		(°C)		(NTU)	(PCU)	(mg/L CaCO <sub>3</sub> )	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)			
				Final											
1	Alum dose optimisation for Conventional Clarification	25.2	7.04	0.35	12		-		-		-				
2	Alum and LT20 dose optimisation for Conventional Clarification	25.2	6.9	0.08	5		-		-		-				
3	Alum and LT20 Optimisation for DAFF	25.2	6.8	0.3	8		-		-		-				
4	Process Comparison Jar Test - Please See jar Test 4 for results for each type of process.														



496-2414 - NSC WTP - 50\_50 Blended Water - Jar Testing Results (2024-02-15)(Draft)

<b>Project No: 496 2414</b>		496-2414								
<b>Project Title:</b>		NSC WTP Jar Testing								
<b>Sampled by:</b>		IM								
<b>Jar Test</b>										
Jar Test Number:	1						Date:	4/12/2023		
Water Source:	50/50 Bore 5/River						Time:			
Objective:	Alum dose optimisation for Conventional Clarification									
Jar Volume	1000 mL									
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	Floc Size Comparator 0.3 mm Size A 0.5 mm Size B 0.75 mm Size C 1.0 mm Size D 1.5 mm Size E 2.25 mm Size F 3.0 mm Size G 4.5 mm
Alum	mg/L		80	85	90	95				
Alum (mL in syringe)	mL		8	8.5	9	9.5				
<b>Mixing</b>										
Rapid Mix Time	min		1	1	1	1				
Rapid Mix Speed	rpm		160	160	160	160				
Poly Added After	sec									
Flocculation Time	min		15	15	15	15				
Flocculation Speed	rpm		30	30	30	30				
Settling time	min		20	20	20	20				
<b>Floc Properties</b>										
Time to Form Floc	min									
Floc Size @ Start of Mixing	(A - G)		A	A	A	A				
Floc Size @ End of Mixing	(A - G)		B	B	B	B				
<b>Water Quality</b>										
<b>Settled Water</b>										
Turbidity	NTU		2.01	2.06	2.08	2.38				
<b>Filtered Water</b>										
Temperature	°C									
pH	pH unit		7.12	6.95	7	7.04				
Turbidity	NTU		0.47	0.47	0.46	0.35				
True Colour	PCU									
Apparent Colour	PCU		10	11	13	12				
TOC	mg/L									
DOC	mg/L									
Suspended Solids	mg/L									
Alkalinity	mg/L CaCO <sub>3</sub>									
Hardness	mg/L CaCO <sub>4</sub>									
Total Suspended Solids	mg/L									
Total Dissolved Solids	mg/L									
Calcium	mg/L									
Chloride	mg/L									
Sulphate	mg/L									
Aluminium (total)	mg/L									
Aluminium (soluble)	mg/L									
Iron (total)	mg/L									
Iron (soluble)	mg/L									
Manganese (total)	mg/L									
Manganese (soluble)	mg/L									
Sample Bottle ID										
<b>Notes:</b>										


<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:		2				Date:		4/12/2023	
Water Source:		50/50 Bore 5/River				Time:			
Objective:		Alum and LT20 dose optimisation for Conventional Clarification							
Jar Volume		1000 mL							
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>
Alum		mg/L		95	95	95	95		
Alum (mL in syringe)		mL		9.5	9.5	9.5	9.5		
LT20		mg/L		0.05	0.1	0.15	0.2		
LT (mL in syringe)		mL		0.5	1	1.5	2		
<b>Mixing</b>									
Rapid Mix Time		min		1	1	1	1		
Rapid Mix Speed		rpm		160	160	160	160		
Poly Added After		sec		20	20	20	20		
Flocculation Time		min		15	15	15	15		
Flocculation Speed		rpm		30	30	30	30		
Settling time		min		20	20	20	20		
<b>Floc Properties</b>									
Time to Form Floc		min							
Floc Size @ Start of Mixing		(A - G)							
Floc Size @ End of Mixing		(A - G)							
<b>Water Quality</b>									
<b>Settled Water</b>									
Turbidity		NTU		2.27	1.37	1.44	1.24		
<b>Filtered Water</b>									
Temperature		°C							
pH		pH unit		6.88	6.88	6.86	6.87		
Turbidity		NTU		0.08	0.15	0.16	0.05		
True Colour		PCU							
Apparent Colour		PCU		5	6	10	5		
TOC		mg/L							
DOC		mg/L							
Suspended Solids		mg/L							
Alkalinity		mg/L CaCO <sub>3</sub>							
Hardness		mg/L CaCO <sub>4</sub>							
Total Suspended Solids		mg/L							
Total Dissolved Solids		mg/L							
Calcium		mg/L							
Chloride		mg/L							
Sulphate		mg/L							
Aluminium (total)		mg/L							
Aluminium (soluble)		mg/L							
Iron (total)		mg/L							
Iron (soluble)		mg/L							
Manganese (total)		mg/L							
Manganese (soluble)		mg/L							
Sample Bottle ID									
<b>Notes:</b>									

Floc Size Comparator

- 0.3 mm
- Size A
- 0.5 mm
- Size B
- 0.75 mm
- Size C
- 1.0 mm
- Size D
- 1.5 mm
- Size E
- 2.25 mm
- Size F
- 3.0 mm
- Size G
- 4.5 mm






<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:		3				Date:		11/12/2023	
Water Source:		50/50 Blend				Time:			
Objective:		Alum and LT20 Optimisation for DAFF							
Jar Volume		1000 mL							
<b>Chemicals</b>		<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>
Alum		mg/L		95	95	95	95		
Alum (mL in syringe)		mL		8.55	8.55	8.55	8.55		
LT20		mg/L		0	0.1	0.15	0.2		
LT (mL in syringe)		mL		0.45	0.9	1.35	1.8		
<b>Mixing</b>									
Rapid Mix Time		min		1	1	1	1		
Rapid Mix Speed		rpm		160	160	160	160		
Poly Added After		sec		20	20	20	20		
Flocculation Time		min		15	15	15	15		
Flocculation Speed		rpm		30	30	30	30		
DAF time		min		5	5	5	5		
<b>Floc Properties</b>									
Time to Form Floc		min							
Floc Size @ Start of Mixing		(A - G)		A	A	A	A		
Floc Size @ End of Mixing		(A - G)		C	C	B	C		
<b>Water Quality</b>									
<b>DAFF/Settled Water</b>									
Turbidity		NTU		7.2	1.38	2.3	5.14		
<b>Filtered Water</b>									
Temperature		°C							
pH		pH unit		6.76	6.8	6.81	6.83		
Turbidity		NTU		0.47	0.33	0.3	0.32		
True Colour		PCU							
Apparent Colour		PCU		7	6	8	4		
TOC		mg/L							
DOC		mg/L							
Suspended Solids		mg/L							
Alkalinity		mg/L CaCO <sub>3</sub>							
Hardness		mg/L CaCO <sub>4</sub>							
Total Suspended Solids		mg/L							
Total Dissolved Solids		mg/L							
Calcium		mg/L							
Chloride		mg/L							
Sulphate		mg/L							
Aluminium (total)		mg/L							
Aluminium (soluble)		mg/L							
Iron (total)		mg/L							
Iron (soluble)		mg/L							
Manganese (total)		mg/L							
Manganese (soluble)		mg/L							
Sample Bottle ID									
<b>Notes:</b>									

Floc Size Comparator

- 0.3 mm
- Size A
- 0.5 mm
- Size B
- 0.75 mm
- Size C
- 1.0 mm
- Size D
- 1.5 mm
- Size E
- 2.25 mm
- Size F
- 3.0 mm
- Size G
- 4.5 mm



<b>Project No: 496 2414</b>		496-2414							
<b>Project Title:</b>		NSC WTP Jar Testing							
<b>Sampled by:</b>		IM							
<b>Jar Test</b>									
Jar Test Number:	4						Date:	12/12/2023	
Water Source:	50/50 Bore 5/River						Time:		
Objective:	Process Comparison Jar Test								
Jar Volume	1000 mL		Conventional Clarification		DAFF		Lagoon		Floc Size Comparator 0.3 mm Size A 0.5 mm Size B 0.75 mm Size C 1.0 mm Size D 1.5 mm Size E 2.25 mm Size F 3.0 mm Size G 4.5 mm
<b>Chemicals</b>	<b>Units</b>	<b>Raw</b>	<b>Jar 1</b>	<b>Jar 2</b>	<b>Jar 3</b>	<b>Jar 4</b>	<b>Jar 5</b>	<b>Jar 6</b>	
Alum	mg/L		95	95	95	95			
Alum (mL in syringe)	mL		9.5	8.55	9.5	9.5			
LT20	mg/L		0.05	0.1	0	0.1			
LT (mL in syringe)	mL		0.5	0.9	0	1			
<b>Mixing</b>									
Rapid Mix Time	min		1	1	1	1			
Rapid Mix Speed	rpm		160	160	160	160			
Poly Added After	sec		20	20	-	20			
Oxidation Time	min		30	30	30	30			
Flocculation Speed	rpm		30	30	30	30			
Settling/DAFF time	min		20	5	16	16			
<b>Floc Properties</b>									
Time to Form Floc	min								
Floc Size @ Start of Mixing	(A - G)		A	A	A	A			
Floc Size @ End of Mixing	(A - G)		C	C	C	C			
<b>Water Quality</b>									
<b>DAFF/Settled Water</b>									
Turbidity	NTU		1.65	2.68	0.32	0.22			
<b>Filtered Water</b>									
Temperature	°C								
pH	pH unit		6.88	6.93	7.08	7.12			
Turbidity	NTU		0.08	0.1	0.15	0.13			
True Colour	PCU								
Apparent Colour	PCU		0	0	10	8			
TOC	mg/L			3		1			
DOC	mg/L								
Suspended Solids	mg/L								
Alkalinity	mg/L CaCO <sub>3</sub>			57					
Hardness	mg/L CaCO <sub>4</sub>								
Total Suspended Solids	mg/L								
Total Dissolved Solids	mg/L								
Calcium	mg/L								
Chloride	mg/L								
Sulphate	mg/L								
Aluminium (total)	mg/L		0.02	0.02		0.04			
Aluminium (soluble)	mg/L								
Iron (total)	mg/L		0.05	0.05		0.05			



## Section 7.12 Local Infrastructure Contribution Plan 2025



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## 1. Executive Summary

### 1.1 Purpose and objectives of the Plan

This Plan is the Draft Local Infrastructure Plan for Narrandera Shire Council (Council) and has been put together to meet the requirements of the Environmental Planning and Assessment Act 1979 and the Environmental Planning and Assessment Regulation 2021. It allows Council or an Accredited Certifier to levy contributions from developments to fund public amenities and services.

This Plan aims to ensure that adequate public facilities are available for future developments and to prevent the existing community from bearing the costs associated with these facilities. Additionally, the Plan establishes the administrative framework for the collection, spending, accounting, and review of development contributions in a fair manner. In doing so, it ensures both public and financial accountability.

### 1.2 Nature of future development

Whilst the Local Strategic Planning Statement (LSPS) forecast a decrease in population, this is not considered to be a reflection what is currently happening or expected to occur. Instead, it is anticipated that up to 2035, the population of the Narrandera Shire Council Local Government Area (LGA) will grow by 500 people.

The Narrandera LGA is experiencing a considerable amount of change, with investment into the industrial areas and regional renewable energy projects resulting in the attraction of support industry to the area. Sustained growth in our traditional rural industries such as agriculture and support industries are expected. Local advancements and societal shifts, such as the reticulation of sewer in Barellan and growing industry attraction in Narrandera, are predicted to result in an increase in population of 500 people over the next 10 years.

This future development will require new, extended, or augmented public amenities and services.

### 1.3 Life of the Plan

The Plan covers a 10-year planning period, aligning with Council's 10-year financial plan, and generally fitting in with various NSW State Government and Council strategies. It also falls within the timeframe of residential and employment forecasts used by Council for planning and infrastructure purposes.

The levy payable under this Plan will be indexed from the date of determination until the date of payment of the contribution. Additionally, the development costs used to calculate the levy under this Plan will be indexed from the date of the cost estimate to the date of determination.

### 1.4 Other funding sources

Contributions sought by this Plan may only partially fund infrastructure listed in this Plan. Council will draw upon other funding sources to meet the residual costs to deliver such infrastructure.

### 1.5 Treatment of funds collected prior to the commencement of this Plan

Funds levied and collected under previous Development Contributions Plans will be used to deliver community infrastructure of a similar facility category for which they were originally collected and spent within the same catchment from within which they were levied.

Table 1 Summary of Contribution Rates

Cost of Development	Contribution levy rate %
All development valued up to and including \$100,000	0%
All development valued between \$100,000 to \$200,000	0.5%
All development valued in excess of \$200,000	1%

### 1.6 Works schedule

Contributions sought through this Plan will be used to fund, in part or in full, the public amenities and services set out in the Schedule of Works at **Appendix E**.

### 1.7 Structure of this Plan

- Section 1 – Executive Summary (this section).
- Section 2 – Introduction, identifies the name of the Plan, its commencement date, the purpose, aims and objectives of the Plan, the land and forms of development which the Plan applies and the Plan’s relationship to other plans, reports and policies.
- Section 3 – Administration and Operation of the Plan, outlines the types of public amenities and services addressed by the Plan, describes how and when contributions are to be made and provide details regarding the ongoing management of the Plan.
- Section 4 – Forecast Development and Demand for Infrastructure, outlines the residential and employment generating development forecast to occur during the life of this Plan and the plans, strategies and other documents that have contributed to the works schedule for this Plan.
- Appendix A – Abbreviations and definitions
- Appendix B – Determining the proposed Costs of Development
- Appendix C – Cost Summary Report Templates
- Appendix D – Model Conditions of Consent
- Appendix E – Rollover funds, Catchments and Work Schedules
- Appendix F – Map

## 2. Introduction

This Plan has been prepared to determine the Section 7.12 local infrastructure levy that applies and the public facilities that are to be funded by the levy. [Name of the Plan](#)

This plan is the Draft Narrandera Section 7.12 Local Infrastructure Contributions Plan 2025.

### 2.2 Abbreviations and definitions used in the Plan

The meanings of key words and terms used in this Plan are contained in **Appendix A** Abbreviations and Definitions.

### 2.3 Commencement of the Plan

This Plan has been prepared pursuant to the provisions of the Environmental Planning and Assessment Act 1979 (the Act) and the Environmental Planning and Assessment Regulation 2021 (the Regulation).

- The Plan will be adopted following public exhibition of the draft version of the Plan.
- This plan is anticipated to commence in July 2025.

### 2.4 Purpose and objectives of the Plan

The Plan's purpose and objectives are:

- To authorise the imposition of a condition on certain development consents and complying development certificates requiring the payment of a contribution pursuant to section 7.12 of the Environmental Planning and Assessment Act 1979.
- To assist Council to provide the appropriate public facilities that are required to maintain and enhance amenity and service delivery within the area.
- To ensure that the existing community is not burdened by the provision of public facilities required as a result of future development.
- To publicly identify the purposes for which the levies are required.
- To govern the application of money paid to Council under a condition authorised by this Plan.

### 2.5 Area to which the Plan applies

This Plan applies to the entire Narrandera Shire Council LGA identified in **Appendix F** Map.

### 2.6 Operation period of this Plan

The Plan is intended to cater for a 10-year planning period from 2022 to 2032 with this period generally aligning with the Integrated Planning and Reporting Framework, Long Term Financial Plan and Resourcing Strategy.

The Plan will be monitored and, if necessary, the works schedule may be amended to account for infrastructure works that have been delivered or for which there has been a change in the estimated costs or timing.

In line with Delivery Program, the Plan will be reviewed every four years.



## 2.7 Relationship with other contributions plans

This plan repeals the following contributions plans:

- Narrandera Section 94A Contributions Plan 2014
- Narrandera Shire Council Section 94 Contributions Plan – Pine Hill 1994

Contributions imposed on developments under the above plans and paid to or held by Council will be applied to completing the works shown in **Appendix E**.

## 2.8 Savings and transitional arrangements

There are no savings or transitional provisions under this Plan. That is, if a development application has been made before the commencement of this Plan in relation to land to which this Plan applies and the application has not been finally determined before that commencement, the application shall be determined in accordance with the provisions of this Plan.

If a modification application pursuant to s4.55 or s4.56 of the Act has been made before the commencement of this Plan in relation to land to which this Plan applies and the application has not been finally determined before that commencement, the application must be determined in accordance with the contributions plan that applied at the date that the original development consent was granted.

This Plan does not affect any conditions imposed under a previous plan(s). Any application made under the Act to modify a development consent issued before the commencement date of this Plan will be determined against the plan that applied at the date the consent was originally determined.

### 3. Administration of the Plan

#### 3.1 Development to which this plan applies

This Plan applies to:

- Residential development (excluding single dwellings)
- Subdivisions
- Seniors living (integrated facilities, hostels, and residential care facilities)
- Rural industries, agriculture and agritourism
- Industrial development
- Retail shops, business premises, commercial premises, offices
- Educational establishments
- Tourist and visitor accommodation
- Eco-tourist facilities
- All other development, including renewable energy developments.

Exemptions to this Plan are identified in 3.4.

#### 3.2 Calculating the contributions

The maximum percentage of the proposed cost of carrying out development that may be imposed by a development levy for development is:

*Table 2 - Maximum percentage Levy for Development*

Cost of Development	Contribution levy rate %
All development valued up to and including \$100,000	0%
All development valued between \$100,000 to \$200,000	0.5%
All development valued in excess of \$200,000	1%

The levy will be determined on the basis of the rate as set out in the table above. The levy will be calculated as follows:

$$\text{Levy payable} = \%C \times (\$C - E)$$

Where:

- i. **%C** is the levy rate applicable
- ii. **\$C** is the proposed cost of carrying out the development
- iii. **E** is the exemptions as per Clause 208 of the Environmental Planning and Assessment Regulations 2021.

### 3.3 Calculating the cost of works

The proposed cost of carrying out the development will be determined in accordance with clause 208 of the EP&A Regulation. The procedures set out for submitting a development application (included in this plan) must be followed to enable Council to determine the amount of the levy to be paid.

The proposed cost may be adjusted before payment of a development levy, to reflect annual variations to readily accessible index figures adopted by the Plan between the day on which the proposed cost was determined by the consent authority and the day by which the development levy must be paid.

The genuine estimate of the cost of works must be supplied at the time an application is lodged. When determining the estimated cost of works, applicants must have regard to [Planning Circular PS 21-022 Calculating the genuine estimated cost of development](#).

Consistent with this circular, development applications are to be estimated in accordance with the following:

- for development up to \$100,000, the estimated cost be estimated by the applicant or a suitably qualified person, with the methodology used to calculate that cost submitted with the development application.
- for development between \$500,000 and \$3 million, a suitably qualified person should prepare the cost estimate and submit it, along with the methodology, with the development application.
- for development more than \$3 million, a detailed cost report prepared by a registered quantity surveyor.

Note: A **suitably qualified person** is a builder who is licensed to undertake the proposed works, a registered architect, a qualified and accredited building designer, a registered quantity surveyor, or a person who is licensed and has the relevant qualifications and proven experience in costing of development works at least to a similar scale and type as is proposed.

Cost Summary Report Templates are available in **Appendix C**.

Council may, at the applicant's cost, engage a person referred to in this clause to review a report submitted by an applicant in accordance with clause 2.3.

### 3.4 Exemptions

This plan does not apply to the following types of development:

- Where the proposed cost of carrying out the development is \$100,000 or less
- A single dwelling house
- Dwelling house that replaces an existing dwelling house
- Development ordinarily incidental or ancillary to the use of a dwelling house, such as a swimming pool, garages, sheds, carports, decks and the like
- Alterations, fit outs, or refurbishment of an existing development, where there is no enlargement, expansion, increase in floor area or intensification of the current use (208)(4)(g)
- An application for demolition (where there is no replacement building or development)
- An application by or on behalf of Council for community infrastructure, such as, but not limited to libraries, community facilities, waste management facilities, recreation areas, recreation facilities and carparks

- Development for the sole purpose of adaptive re-use of an item of environmental heritage contained in Council's Heritage Schedule 5.10 in the Narrandera Local Environmental Plan 2013
- Development for the sole purpose of providing affordable housing assessed under the State Environmental Planning Policy (Housing) 2021
- Development that involves the rebuilding or repair of damage resulting from declared natural disasters by the NSW State Government, such as flooding or bushfires
- Not for profit or charity groups – the standard of evidence required is:
  - A Certificate of Registration with the Australian Charities and Not-for-Profit Commission; or
  - A Notice of Endorsement as a Deductible Gift Recipient, issued by the Australian Taxation Office (ATO); or
  - A Notice of Endorsement for Charity Tax Concessions, issued by the ATO.

Council will not provide exemptions to development contributions made under this Plan other than exemptions or discounts outlined above or outlined by a Ministerial direction under Section 7.17 Directions by Minister of the EP&A Act.

Council does not apply discounts to the payment of development contributions unless otherwise stated in this Plan.

### 3.5 Refunding contributions

The EP&A Act and Regulation do not make provision for refunds for contributions and there is no express power for a Council to refund contributions already paid in accordance with a condition of consent. However, Council at its complete discretion, may consider a refund where:

- A consent has been modified under the Act resulting in a reduction of the contributions payable; or
- Contributions have been paid but development has not commenced and will not proceed in accordance with the consent. In this instance, the consent will need to be surrendered in accordance with the provisions of the Act.

In each case, Council will consider refunding contributions if it has not been spent and the refund will not impact on Council's ability to deliver the works outlined in the Works Schedule. The applicant must apply for a refund in writing within 12 months of the payment of the contribution.

### 3.6 Imposing contributions

In accordance with the Act, a development levy under this Plan will be imposed as a condition of development consent, or as a condition on a Complying Development Certificate. Model Conditions of Consent are available in **Appendix D**.

### 3.7 Payment of the contribution

A levy must be paid to Council at the time specified in the condition that imposes the levy. If no such time is specified, the levy must be paid as per the following:

- Development involving building work – prior to the issue of the Construction Certificate
- Complying Development – prior to the issue of the Complying Development Certificate
- In the case of Development Applications where no Construction Certificate or Occupation Certificate is required – prior to the commencement of works or use.

Where an application is dealt with by an Accredited Certifier other than Council, the development consent shall not operate unless the amount required by the consent under this Plan is paid to Council. The amount of any monetary contribution to be paid will be the contribution payable at the time of consent and, depending upon the time of payment, will be subject to reasonable adjustment due to movements in the Consumer Price Index and/or changes to the rates indicated within this Plan.

### 3.8 Indexation of contributions

This Plan authorises Council to undertake these indexed based changes without the necessity of preparing a new or amending the contributions plan. This is to ensure that the value of contributions is not eroded over time by movements in the Consumer Price Index, land value increases, the capital costs of construction of facilities and administration of the Plan, or through changes in the costs of studies to support the Plan.

Contributions required as a condition of development consent will be adjusted at the time of payment using the following formula:

$$\text{CP} = \frac{\text{CDC} \times \text{Current Index}}{\text{Base Index}}$$

Where:

- i. **CP** is the amount of the contribution calculated at the time of payment
- ii. **CDC** is the amount of the original contribution as set out in the development consent
- iii. **Current Index** is the Consumer Price Index  
All Groups Index for Sydney (as currently available from the Australian Bureau of Statistics at the time of payment).
- iv. **Base Index** is the Consumer Price index  
All Groups Index for Sydney which applied at the time of calculation as shown on the development consent.

### 3.9 Construction certificates and the obligations of Accredited Certifiers

In accordance with the Act and the Regulation, a certifying authority must not issue a Construction Certificate or an Occupation Certificate applicable under a development consent unless it has verified that each condition requiring the payment of monetary contributions has been satisfied.

In particular, the certifier must ensure that the applicant provides a receipt(s) confirming that contributions have been fully paid and copies of such receipts must be included with copies of the certified plans provided to Council in accordance with the Regulation. Failure to follow this procedure may render such a certificate invalid.

The only exceptions to the requirement are where a works in-kind, material public benefit, dedication of land or deferred payment arrangement has been agreed by Council. In such cases, Council will issue a letter confirming that an alternative payment method has been agreed with the applicant.

### 3.10 Complying Development and the obligation of Accredited Certifiers

In accordance with the Act, Accredited Certifiers must impose a condition on a Complying Development Certificate requiring monetary contributions in accordance with this Plan for all types of development,

except for those development that are exempt from charges as per clause 3.4 or those listed under clause 208 of the Regulation.

The conditions imposed must be generally consistent with Council's standard condition for Complying Development Certificates (see **Appendix D**) and be strictly in accordance with this Plan. It is the professional responsibility of an Accredited Certifier to inform themselves of any amendments to this Plan (including current indexed rates), to accurately calculate the contribution and to apply the development contributions condition correctly in accordance with Council's current consent condition requirements.

It is also the professional responsibility of an Accredited Certifier to ensure that any applicable monetary contributions have been paid to Council prior to the timings referred to in 3.7.

### 3.11 Pooling of levies

This Plan expressly authorises monetary contributions paid for different purposes to be pooled and applied (progressively or otherwise) for those purposes. The priorities for the expenditure of the levies are shown in the works schedule.

### 3.12 Deferred or periodic payment of levies

Deferred or periodic payments may only be permitted in:

- Circumstances where the applicant can demonstrate to Council that the payment of contributions in accordance with clause 3.7 is unreasonable, and Council accepts deferred or periodic payment; or
- Circumstances where the developer intends to make a contribution by way of works in-kind or land dedication in lieu of a cash contribution in a future stage of the one development and Council and the developer have a legally binding agreement for the provision of the works or dedication; or
- In other circumstances determined to be reasonable by Council; or
- They will not jeopardise the timely provision of works or land identified within the Plan; or
- They will not adversely impact on the cash flow of the Plan.

All requests for deferred or periodic payment of contributions are required to be made in writing and may only be accepted (in writing) where:

- There are valid reasons for the deferral or periodic payment (as outlined above)
- They will not adversely impact on the administration or operation of the Plan
- They will not jeopardise the timely provision of works or land identified within the Plan
- They will not adversely impact on the cash flow of the Plan.

The conditions under which Council may accept payment by way of periodic payment for a staged development are that:

- The instalment be paid before the work commences on the relevant stage of the development
- The amount to be paid at each stage is to be calculated on a pro-rata basis in proportion to the overall development.

Matters that will be considered for deferral requests include:

- The financial position of the contribution scheme,
- The extent of any loan borrowing,
- Future Capital commitments,
- Whether or not infrastructure works essential for the initial development can be deferred,
- Whether or not development/land release can be staged to more appropriately match infrastructure requirements and commitments.
- Under certain circumstances, an applicant may also request in writing, a deferral or variation of the contribution through a Voluntary Planning Agreement (Division 7.1 – Subdivision 2 of the Environmental Planning & Assessment Act 1979).

Should a deferred or periodic payment be accepted by Council, a suitable bank guarantee, to the value of the outstanding contributions is to be lodged.

The conditions under which Council may accept deferred settlement by way of lodgement of a bank guarantee are that:

- The bank guarantee be by an Australian bank for the amount of the total contribution, or the amount of the outstanding contribution, plus an amount equal to twelve months interest,
- The Bank unconditionally pays the guaranteed sum to Council if Council so demands in writing not earlier than 12 months from the provision of the guarantee or completion of the work whichever occurs first,
- The Bank must pay the guaranteed sum without reference to the applicant or landowner or other person who provided the guarantee, and without regard to any dispute, controversy, issue or other matter relating to the development consent or the carrying out of development in accordance with the development consent,
- The Bank's obligations are discharged when payment to Council is made in accordance with this guarantee or when Council notifies the Bank in writing that the guarantee is no longer required.

### 3.13 Alternatives to payment of the levy

If an applicant does not wish to pay the section 7.12 levy applicable to their development, they may offer to enter into a Voluntary Planning Agreement with Council under Section 7.4 of the *Environmental Planning and Assessment Act 1979* in connection with the making of a development application or in an application for a modification.

The applicant's provision under a planning agreement may be additional to or instead of paying a levy in accordance with a condition of development consent authorised by this Plan. This will be a matter of negotiation with Council. The offer to enter into the planning agreement together with the draft agreement should accompany the relevant development application.

Acceptance of an offer to enter into a voluntary planning agreement is at the sole discretion of Council and payment of the section 7.12 levy will be required if Council does not agree to the offer.

### 3.14 Accounting and management of funds

Separate accounting records are maintained for all development contributions made to Council under this Plan and a Development Contributions Register will be maintained by Council in accordance with the Regulation.

Council is also required to publish details of development contributions accounts annually and this is undertaken as part of Council's annual financial reporting cycle.

### 3.15 Treatment of funds received prior to the commencement of this Plan

Funds levied and received under previous plans will be used to deliver public amenities of a similar facility type as the funds were originally received.

Funds levied and received under previous plans will be spent within the same catchment from which they were levied.

### 3.16 Monitoring and review of the Plan and contributions

It is intended that this Plan be monitored and reviewed on a regular basis as it contains forecasts of future development, including likely future population and the likely demands and costs of providing community infrastructure for that population.

The cost of works proposed by the Plan (including land values) may also require review over time if there is a concern that the indexation of costs may not be adequately reflecting actual current costs.

Council's aim is that all forecasts, costs, and assumptions are reviewed and adjustments and/or amendments as appropriate will be made at four-yearly intervals after the date of adoption of this Plan.

The Plan may also be amended to address the matters listed in the Regulation. In particular, the Plan may be amended from time to time to reflect indexation of contributions and the cost of works without the need for public exhibition.



## 4. Forecast development and demand for infrastructure

### 4.1 Local Strategic Planning Statement

The Narrandera Local Strategic Planning Statement (LSPS) was adopted by Council in August 2020. The LSPS planning priorities, strategic directions and actions provide the rationale for land use planning decision making and how land will be used to achieve the community's broader goals.

### 4.2 Forecast development

The Narrandera LGA is experiencing a considerable amount of change, with investment into the industrial areas and regional renewable energy projects attracting support industry to the area. Sustained growth in the traditional rural industries such as agriculture and support industries are expected.

Whilst the LSPS forecast a decrease in population, this is not considered to reflect what is currently happening or anticipated to occur. Local advancements and societal shifts, such as reticulation of sewer in Barellan and industry attraction in Narrandera, are predicted to result in an increase in population of 500 people over the next 10 years. This significant public and private investment in the region is likely to drive population growth and increase the demand for public facilities.

There is also estimated to be an increase in non-residential development over this 10-year period comprising of the creation and development of approximately 85.25 hectares of industrial land, of which 48 hectares has already been sold for development. This future development will require new, extended or augmented public amenities and services.

### 4.3 Demand for public facilities and services

The increased usage of and demand for new transport and social infrastructure as a consequence of the forecast additional development will, in most cases, exceed the capacity of existing public facilities in the LGA. It will therefore be necessary that new and embellished transport and social infrastructure be provided to cater for the anticipated demand of future development.

## 5. References

The following legislation, plans and policies, studies, technical guides, and other information have been used to formulate the contents of the Plan:

- Australian Bureau of Statistics (2016) Census Data
- Environmental Planning & Assessment Act 1979 Environmental Planning & Assessment Regulation 2021
- Infrastructure Contributions Practice Note Review Policy Paper October 2021
- Narrandera Local Housing & Employment Zone Land Strategy 2022
- Narrandera Local Strategic Planning Statement 2020
- Section 7.12 fixed development consent levies Practice Note 2021

## Appendix A - Abbreviations and Definitions

Words and phrases used in this plan have the same meaning as the terms defined the EP&A Act, or the Standard Instrument – Principal Local Environmental Plan (SI LEP).

In this plan, the following words and phrases have the following meanings:

**Accredited Certifier** means a registered certifier are independent regulators of building construction and subdivision work, that are registered and regulated by NSW Fair Trading.

**Act** means the Environmental Planning and Assessment Act 1979.

**affordable housing** means housing for very low income households, low income households or moderate income households, being such households as are prescribed by the regulations or as are provided for in an environmental planning instrument.

**Applicant** means the person(s) or organisation(s) submitting a development application.

**ATO** means the Australian Taxation Office.

**CDC** means complying development certificate.

**Consent authority** has the same meaning as in the EP&A Act but also includes an Accredited Certifier responsible for issuing a complying development certificate.

**Consumer Price Index (CPI)** is a standard measure of price movements published by the Australian Bureau of Statistics.

**Council** means Narrandera Shire Council.

**DCP** means a Development Control Plan adopted by Council under the Act.

**Development** has the meaning under Section 4 of the Act which in relation to land means:

- a. the use of land; and
- b. the subdivision of land; and
- c. the erection of a building; and
- d. the carrying out of a work; and
- e. the demolition of a building or work; and
- f. any other Act, matter or thing that may be controlled by an environmental planning instrument.

**Development consent** means consent under Part 4 of the Act to carry out development and includes, unless expressly excluded, a complying development certificate.

**Development levy** means a levy referred to in the Act, section 7.12.

**Development levy condition** means a condition of development consent, referred to in the Act, section 7.12, requiring the payment of a levy.

**LEP** means a Local Environmental Plan made by the Minister under the Act.

**LGA** means Local Government Area.

**Material public benefit** means a facility or work which is offered by a developer as a finished entity either in return for a reduction in the amount of monetary contributions required for the same category of contribution or as an additional or partial additional benefit under a Planning Agreement;

**Ministerial Direction** means a Direction by the Minister pursuant to Section 7.9 or Section 7.17 of the Act.

**Planning agreement** means a planning agreement referred to in the Act.

**Public infrastructure** means:

- a. public amenities and public services, and
- b. affordable housing, and
- c. transport infrastructure

but does not include water supply or sewerage services.

**Regulation** means the Environmental Planning and Assessment Regulation 2021

## Appendix B - Determining the proposed Cost of Development

### 208 Determination of proposed cost of development—the Act, s 7.12(5)(a)

- (1) The proposed cost of carrying out development must be determined by the consent authority by adding up all the costs and expenses that have been or will be incurred by the applicant in carrying out the development.
- (2) The costs of carrying out development include the costs of, and costs incidental to, the following—
  - a) if the development involves the erection of a building or the carrying out of engineering or construction work—
    - (i) erecting the building or carrying out the work, and
    - (ii) demolition, excavation and site preparation, decontamination or remediation,
  - b) if the development involves a change of use of land—doing anything necessary to enable the use of the land to be changed,
  - c) if the development involves the subdivision of land—preparing, executing and registering—
    - (i) the plan of subdivision, and
    - (ii) the related covenants, easements or other rights.
- (3) In determining the proposed cost, a consent authority may consider an estimate of the proposed cost that is prepared by a person, or a person of a class, approved by the consent authority to provide the estimate.
- (4) The following costs and expenses must not be included in an estimate or determination of the proposed cost—
  - a) the cost of the land on which the development will be carried out,
  - b) the costs of repairs to a building or works on the land that will be kept in connection with the development,
  - c) the costs associated with marketing or financing the development, including interest on loans,
  - d) the costs associated with legal work carried out, or to be carried out, in connection with the development,
  - e) project management costs associated with the development,
  - f) the cost of building insurance for the development,
  - g) the costs of fittings and furnishings, including refitting or refurbishing, associated with the development, except if the development involves an enlargement, expansion or intensification of a current use of land,
  - h) the costs of commercial stock inventory,
  - i) the taxes, levies or charges, excluding GST, paid or payable in connection with the development by or under a law,
  - j) the costs of enabling access by people with disability to the development,
  - k) the costs of energy and water efficiency measures associated with the development,
  - l) the costs of development that is provided as affordable housing,
  - m) the costs of development that is the adaptive reuse of a heritage item.
- (5) The proposed cost may be adjusted before payment of a development levy, as specified in a contributions plan, to reflect quarterly or annual variations to readily accessible index figures

adopted by the plan between the day on which the proposed cost was determined by the consent authority and the day by which the development levy must be paid.

**Example—**

A contributions plan may adopt the Consumer Price Index.

- (6) To avoid doubt, this section does not affect the determination of the fee payable for a development application.

### Appendix C – Cost Summary Report Templates

<b>Cost Summary Report</b>	
Development Cost over \$500,000 and less than \$3,000,000	
	Date
Applicant name	
Proposed development	
Development address	

ANALYSIS OF DEVELOPMENT COSTS	
Demolition and alterations	\$
Engineering and Earthworks	\$
Structure	\$
External walls, windows and doors	\$
Internal walls, screens and doors	\$
Wall finishes	\$
Floor finishes	\$
Ceiling finishes	\$
Lighting	\$
Fittings and equipment	\$
Hydraulic Services	\$
Mechanical Services	\$
Fire Services	\$
Lift Services	\$
External Works	\$
External Services	\$

Landscaping	\$
Other related works	\$
<b>SUB-TOTAL</b>	\$
Consultant fees	\$
Goods & Services Tax	\$
<b>TOTAL DEVELOPMENT COST</b>	\$

I certify that I have:

- Inspected the plans the subject of the application for development consent, complying development or construction certificate.
- Calculated the development costs in accordance with the definition of development costs in clause 208 of the *Environmental Planning & Assessment Regulation 2021*.
- Included GST in the calculation of development cost.

<b>Name</b>	
<b>Signed</b>	
<b>Position &amp; Qualification</b>	
<b>Date</b>	

Note: For development up to \$500,000, the estimated cost must be estimated by the applicant or a suitably qualified person, with the methodology used to calculate that cost submitted with the development application.

Note: For development between \$500,000 and \$3 million, a suitably qualified person must prepare the cost estimate and submit it, along with the methodology, with the development application.

A **suitably qualified person** is: a builder who is licensed to undertake the proposed works, a registered architect, a qualified and accredited building designer, a registered quantity surveyor or a person who is licensed and has the relevant qualifications and proven experience in costing of development works at least to a similar scale and type as is proposed.



<b>Cost Summary Report</b>	
Development Cost more than \$3,000,000	
	<b>Date</b>
<b>Applicant name</b>	
<b>Proposed development</b>	
<b>Development address</b>	

<b>DEVELOPMENT DETAILS</b>			
Gross Floor Area – Commercial	m <sup>2</sup>	Gross Floor Area – Other	m <sup>2</sup>
Gross Floor Area – Residential	m <sup>2</sup>	Total Gross Floor Area	m <sup>2</sup>
Gross Floor Area – Retail	m <sup>2</sup>	Total Site Area	m <sup>2</sup>
Gross Floor Area Car Parking	m <sup>2</sup>	<b>Total car parking spaces</b>	
<b>Total Development Cost</b>	\$		
<b>Total Construction Cost</b>	\$		
<b>Total GST</b>	\$		

<b>ESTIMATE DETAILS</b>			
<b>Professional fees</b>	\$	<b>Excavation</b>	\$
% of Development cost	%	Cost per m <sup>2</sup> of site area	\$ / m <sup>2</sup>
% of Construction cost	%	<b>Car Park</b>	\$
<b>Demolition and site preparation</b>	\$	Cost per m <sup>2</sup> of site area	\$ / m <sup>2</sup>

<b>Cost per m2 – site area</b>	\$ / m2	Cost per space	\$
<b>Construction – Commercial</b>	\$	Fit out – Commercial	\$
<b>Cost per m2 – commercial area</b>	\$ / m2	Cost per m2 – commercial area	\$ / m2
<b>Construction Residential</b>	\$	Fit out – residential	\$
<b>Cost per m2 – residential area</b>	\$ / m2	Cost per m2 – residential area	\$ / m2
<b>Construction – retail</b>	\$	Fit out - retail	\$
<b>Cost per m2 – retail area</b>	\$ / m2	Cost per m2 – retail area	\$ / m2

I certify that I have:

- Inspected the plans the subject of the application for development consent, complying development or construction certificate.
- Prepared and attached an elemental estimate generally prepared in accordance with the Australian Cost Management Manuals from the Australian Institute of Quantity Surveyors (AIQS).
- Calculated the development costs in accordance with the definition of development costs in clause 208 of the Environmental Planning & Assessment Regulation 2021.
- Included GST in the calculation of development cost.
- Measured gross floor areas in accordance with the Method of Measurement of Building Area in the AIQS Cost Management Manual Volume 1, Appendix 2.

<b>Name</b>	
<b>Signed</b>	
<b>Position &amp; Qualification</b>	
<b>Date</b>	

**Note:** For development more than \$3 million, a detailed cost report must prepared by a registered\* quantity surveyor.

\*A member of the Australian Institute of Quantity Surveyors

## Appendix D - Model Conditions of Consent

The following model Conditions of Consent may be used for Development Consents and Complying Development Certificates.

### Model Development Condition of Consent

Pursuant to section 4.17 of the Environmental Planning and Assessment Act 1979, and the Narrandera Section 7.12 Local Infrastructure Contributions Plan 2025 (the Plan), a monetary contribution of \$[insert total amount] must be paid to Council for the purposes of the provision, extension or augmentation of public amenities and services within the [insert catchment] catchment.

The amount to be paid is to be adjusted at the time of the actual payment, in accordance with the Narrandera Section 7.12 Local Infrastructure Contributions Plan 2025. The contribution is to be paid before [insert requirement]. It is the professional responsibility of the Principal Certifying Authority to ensure that the monetary contribution has been paid to Council in accordance with the above timeframe.

Council's Plan may be viewed at <https://www.narrandera.nsw.gov.au> or a copy may be inspected at Council's Offices during normal business hours.

### Model Complying Development Condition

Pursuant to Section 4.28(6) of the Environmental Planning and Assessment Act 1979, and the Narrandera Section 7.12 Local Infrastructure Contributions Plan 2025 (the Plan), a monetary contribution of \$[insert total amount] must be paid to Council for the purposes of the provision, extension or augmentation of public amenities and services within the [insert catchment] catchment.

The amount to be paid is to be adjusted at the time of the actual payment, in accordance with the Narrandera Section 7.12 Local Infrastructure Contributions Plan 2025. The contribution is to be paid before [insert requirement]. It is the professional responsibility of the Principal Certifying Authority to ensure that the monetary contribution has been paid to Council in accordance with the above timeframes.

Council's Plan may be viewed at <https://www.narrandera.nsw.gov.au> or a copy may be inspected at Council's Offices during normal business hours.

## Appendix E – Works Schedule

The table below identifies the projects in which the funds will be partly or wholly used in the future. Note, the timings detailed below are indicative and may vary depending on the availability of grants and other funding streams.

<b>FUTURE PROJECT LIST</b>			
<b>Title</b>	<b>Description/Comments</b>	<b>Estimated Capital Cost</b>	<b>Year of works</b>
<b>Economic grants</b>			
Lake Talbot	Water deepening - physical works	\$2,200,000	2026
<b>Active transport /road safety</b>			
Grong Grong footpaths	Construction of a pedestrian walkway connecting Berrembed/Junee and Narrandera Streets	\$280,000	2027
Larmer St pedestrian bridge	Construction of a pedestrian bridge across the canal on the western end of Larmer Street	\$560,000	2026
Larmer St shared path	Construction of a pedestrian shared path connecting Midgeon and Elizabeth Streets	\$300,000	2027
Old Wagga Road shared path	Construction of a pedestrian shared path on Old Wagga Road connecting the urban area to Rocky Water Holes	\$880,000	2029
<b>General infrastructure</b>			
Narrandera Town entrance statement	Sign, landscaping and water feature on Lot 10 Larmer Street	\$250,000	2025
Public Art	Narrandera, Barellan and Grong Grong	\$300,000	Ongoing
Barellan Toilets	Expand toilets in main street to meet demand from bus groups	\$250,000	2030
Barellan Main St beautification	Undertake an upgrade/ beautification program of the main street areas (landscaping, footpaths, etc)	\$250,000	2025
Barellan Pool	Renewal of the existing 50m pool and filtration system	\$2,500,000	2028
Barellan Pool	Major refurbishment / fitout - changeroom - kiosk	\$350,000	2029
Changing places facility	Adult change facility with hoist and change table (Narrandera and Barellan)	\$250,000 per unit	2031

Lake Talbot Water Park	Stage 3 – upgrade of top amenities, kiosk and extend decking	\$800,000	2032
Maree Bashir Park	Adventure playground (youth)	\$750,000	2030
Maree Bashir Park	Construction of a permanent stage	\$300,000	2032
Henry Mathieson Oval	BBQ shelter, scoreboard and cricket pitch	\$80,000	2028

### Appendix E – Map

The map below identifies the Narrandera Local Government Area to which this Plan applies (see clause 2.5).

