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Yass Water Treatment Plant Upgrade - Detailed Business Case

May 2024

Project Background

Project Name Yass Water Treatment Plant Upgrade

Project Date and Version 2 May 2024 Version D

Project Location Yass

Lead Agency Yass Valley Council

Other Organisations Beca Hunter H2O Pty Ltd

Document History and Status

Revision history

Revision	Report Status	Prepared by	Reviewed by	Approved by	Issue Date
A	Draft for stakeholder comment	M Dawson (Beca Hunter H2O)	D Perry (Beca Hunter H2O)		7 Nov 2023
B	Business Case for YVC Approval	M Dawson	DPE Water, NSW Health PHU and NSW Health Water Unit		17 Nov 2023
C	Business Case for Assurance	K Kugaprasatham (YVC)	M Dawson	YVC	20 Dec 2023
D	Final Business Case	M Dawson	K Kugaprasatham	YVC	2 May 2024

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Executive Summary

This detailed business case for the Yass Water Treatment Plant Upgrade Project provides a clear rationale for government action. The need for additional infrastructure to deliver good quality drinking water for the community of Yass was identified in the Integrated Water Cycle Management Strategy Plan (2008) with the Yass Water Treatment Plant (WTP) being scheduled for upgrade in 2020/2021. Investing in the WTP upgrade enables and unlocks opportunities for accelerated provision of new housing into Yass Valley, helping alleviate a chronic shortage issue facing New South Wales and Australia.

The Yass WTP upgrade aims to address several problems. The key issues are:

- Poor water quality deterring housing investment and development
- Raw water quality during extreme weather events
- Ageing treatment assets reaching the end of their serviceable life
- Consumer dissatisfaction with discolouration and scaling
- Increasing level of treatment performance to meet new Health Based Targets (HBT) requirements of the Australian Drinking Water Guidelines (ADWG)
- Inadequate treatment process redundancy and address the issues related to absence of redundancy and maintenance window as the demand increases
- Climate change impacts due to increase in intensity and frequency.

The Business Case presents the project background, a description of the problem, the objective of the intervention, as well as policy and strategic alignment. A high-level benefits assessment is included of how the WTP investment enables housing provision acceleration. A cost-benefit analysis of four options for the upgrade was conducted. Options considered ranged from no upgrade to a full plant upgrade with membrane softening.

Following cost-benefit analysis of two shortlisted options, Option 3 and Option 4, it was determined that Option 4, the optimisation of the existing WTP, is the preferred choice. This decision was based on its higher NPV and BCR, as well as the results of sensitivity testing. The main difference between the two options is the benefits and costs associated with hardness reduction. Option 4 is the superior solution because it allows for future implementation of water softening that will incur significant costs until such time uncertainties surrounding the community's willingness to pay for water softening and authority approvals for disposal of water softening residuals are resolved.

Stakeholders at DPE Water also support the selection of Option 4, as it avoids the premature replacement of treatment assets. Furthermore, Option 4 has a significantly lower capital cost and more favourable operating costs compared to Option 3. Results of the cost estimation and economic evaluation are shown in Table E-1.

Table E-1: Cost estimation and economic evaluation of short listed options

PARAMETER	Option 3	Option 4
COST ESTIMATE		
CONSTRUCTION BASE ESTIMATE ($M)	$32.0	$22.2
YVC PROJECT MANAGEMENT COSTS ($M)	$2.36	$1.96
ESTIMATED PROJECT BASE COST ($M)	$34.4	$24.1
ESTIMATED P50 PROJECT COST ($M)	$42.7	$31.2
ESTIMATED P90 PROJECT COST ($M)	$48.2	$35.9
ECONOMIC EVALUATION		
TOTAL DISCOUNTED COSTS ($M)	$52.3	$40.8
TOTAL DISCOUNTED BENEFITS ($M)	$67.0	$55.6
NPV (30 year at DF of 5%)	$14.8	$14.8
BENEFIT TO COST RATIO	1.28	1.36

The required funding commitments identified in the Business Case are $6.6M from the Housing Acceleration Fund (HAF) and $10.5M from the NSW Government Election Commitment Ad Hoc Fund. Another $3.05M from the NSW Government Election Commitment Ad Hoc Fund will be used for improvements to the town water reticulation system however that work is not described in this Business Case. NSW Health have committed 0.97M for upgrade of fluoridation system, and the Total committed funding is $18.1M. Yass Valley Council will provide debt or equity for the remainder of the project costs by Council Resolution in May 2024.

Commercial analysis indicated that the market has sufficient capability and capacity to undertake the project and a number of experienced and competent Principal Contractors in NSW and Victoria will be interested given the project value and location. An Expression of Interest process will be used to establish a prequalified panel of contractors. An Early Tenderer Involvement process will be used to provide tenderers with the opportunity to raise commercial and technical risks and opportunities with Council. A select Tender process will be used and tenders will be evaluated using cost and non-cost factors.

Project delivery is provided by YVC who will appoint a Project Director and Project Manager. The NSW Department of Planning and Environment Water Group will perform a technical review role as part of the NSW Local Government Act Section 60 approval process. YVC will engage a third party Owners Engineer for technical support and assistance throughout the procurement, design, construction and commissioning of the upgrade.

The Statutory Planning Framework identifies YVC as the determining authority for the proposal under Section 5 or the EP&A Act 1997 and the program recognises key milestone leading to engagement of a Constructor in 2025.

The FBC provides a holistic analysis of the problems faced by the community and details how options for upgrading the water treatment will address these issues. The Case for Change is strong and a thorough options development and evaluation process has been undertaken over several years in consultation with stakeholders at DPE and NSW Health. Multi-criteria, economic and financial analysis has identified Option 4 as the preferred option with a BCR 1.36. YVC has the commercial, management and community engagement plans and strategies in place to ensure success in delivery of the upgrade.

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1 THE CASE FOR CHANGE

1.1 Purpose

The purpose of the Yass WTP Upgrade Business Case is to identify the best possible activity that meets the long-term needs of the community and stakeholder requirements. This covers both 'big picture' housing and economy considerations and drivers, and specific water quality and reliability issues. The business case considers community benefits and welfare, deliverability, and whole-of-life considerations. It allows for the identification of technical options for the works that have been thoroughly considered, and for the evaluation of these options against financial and non-financial issues.

The Business Case revisits and confirms the case for change, identifies the preferred option, identifies potential sources of funding and undertakes a financial appraisal for the two shortlisted options.

The Stage 2 Detailed Business Case seeks the final funding for the design and construction of the upgrade. Construction of the upgrade will be based on the identified preferred option, the high level concept design and a Reference Design that will be prepared in 2024. A Constructor will be engaged in FY2025 to complete the design and construction of the Upgrade of Yass WTP.

1.2 Precis

The poor-quality water, sourced from the Yass River, and the various hazards and challenges associated with treating this water highlights that the Yass WTP is aging and cannot treat the water to current and any future standards and international guidelines. Indeed, the Yass WTP was constructed in 1938 and augmented in 1990. The capacity and performance assessment, summarised in this document, explains that many of the buildings, structures and equipment have passed the typical service design life and do not meet WHS standards and require replacement.

Effects of current poor water quality and reliability of supply are identified from community feedback and research on regional economies as having wide reaching negative effects. It factors into decisions to live or invest in Yass Valley. Evidence indicates that tackling water quality will support acceleration of housing provision in line with New South Wales government policy objectives.

Investment in Yass Valley water treatment aligns with objectives of the government's Housing Acceleration Fund (HAF) program. This is to:

1. Increase housing supply in high demand areas by prioritising infrastructure projects in growth areas and providing for critical enabling infrastructure such as transport, water and community infrastructure. Yass Valley's proximity to Canberra, and wider NSW aligns with this.
2. Accelerate housing supply by providing critical infrastructure to growth areas, giving developers confidence to proceed with housing developments and confidence for Council's to accelerating development approvals.
3. Support community resilience for growth through the provision of enabling infrastructure that enables the development of planned, appropriately serviced and accessible communities.
4. Facilitating sustainable urban growth and in-sequence development to ensure that funding is directed in areas of greatest need and aligned to current plans and strategies. Yass Valley

Settlement Strategy (2019) identified Yass and Murrumbateman as the growth centres is Yass Valley.

The current water treatment unit processes are not designed to meet the target treated water quality, evidenced by the Wormald design targeted a filtered water turbidity of <1 NTU which is significantly higher than the Australian Drinking Water Guidelines target of <0.2NTU. Likewise, the typical raw water turbidity used for the design was 140 NTU while the actual raw water turbidity has exceeded 2000 NTU at times. The typical performance of the dissolved air flotation (DAF) clarifier is below the design standard of 3 NTU due to the raw water treatability, coagulant dosing and mixing, dispersion valve performance, and DAF float stability and removal rate.

The electrical and control systems are over 30 years old with fixed flow rates and basic automation whilst the main switchboard arrangement and location does not comply with current standards. Similarly, the chemical systems are aging with numerous non-compliances with existing WHS Regulations and Australian Standards.

Such design failures can be catastrophic to the day to day operations of the WTP, especially, one that is required to treat raw water as volatile in quality and characteristics as that sourced from the Yass River.

A clear rationale for government action was identified as the need for additional infrastructure to deliver good quality drinking water for the community of Yass in the IWCM Strategy Plan (2008). The IWCM Strategy Plan (2008) stated that the Yass WTP is scheduled for an upgrade in 2020/2021.

The IWCM Strategy Plan (2008) not only highlighted Council's promise to its community, but it also documented the dissatisfaction felt by the residents of Yass over the years due to their inability to drink good quality water that not only looks good, but tastes and smells good. It is well documented in reports by City Water Technology (2014) and Public Works Advisory (2016) that the residents of Yass are dissatisfied with the quality of water provided to them and struggle with the idea that the neighbouring city of Canberra can experience good quality water, whilst it is located 61 km (approximately 60 minutes) south of Yass.

The struggle between achieving "good quality" water for a growing regional town such as Yass compared to Canberra highlights the need for government funding to regional communities that have suffered historically and are required to travel almost an hour to access water from Canberra to experience what is a necessity – good quality drinking water.

Poor quality water in Yass impacts future development and growth for the community as it tarnishes the reputation of the entire township. The Council itself is met with negativity and hostility as it is, at times, is unable to meet the community needs and expectations with the existing water treatment plant.

The struggle for the Yass community further emphasises the need for change with new infrastructure so that the maximum social welfare for value for money is achieved.

1.3 Background

Water Supply Scheme

Yass is a town in the Southern Tablelands region of NSW, approximately 250 km south-west of Sydney and 55 km north-west of Canberra.

The villages of Bowning and Binalong villages are supplied with water through a rising main connected to the Yass reticulated water supply. Murrumbateman village is supplied with water

through a rising main connected to the Yass reticulated water supply since May 2021. According to census data, the population of Yass Valley in 2021 was 17,281[1].

The Yass Dam is an on-river storage on the Yass River and acts as the main source of Yass Water Supply System. The Yass Water Treatment Plant (WTP) is located at 24 Cooks Hill Road and is owned and operated by Yass Valley Council (YVC). The WTP, first constructed in 1938, was replaced and modernised in 1990, and treats water from the Yass Dam. Raw water is currently treated by coagulation and flocculation, dissolved air flotation (DAF), gravity filtration, chlorination and fluoridation.

Water Treatment Plant Description

The current Yass WTP was constructed in 1990 by Wormald Engineering under the supervision of the NSW Department of Public Works.

The single process train consists of dissolved air flotation (Purac, Sweden) and rapid deep sand filtration plant. The plant was designed to treat a flow of 165 L/s or 13 ML/d over 24 hours and to achieve the treated water quality targets shown in Table 1-1.

Table 1-1: : Yass WTP - 1990 design parameters

Parameter	Value
Flow	
Design flow	165 L/s
Design flow	13 ML/d over 24 hours
Raw Water Quality	
Turbidity (min/ave/max)	0.95/ 4.4/ 140 NTU
Apparent Colour (min/ave/max)	15/ 22/ 570 HU
pH	7.4
Chloride	100 mg/L
Alkalinity	30/ 184/ 277 mg/L as $CaCO_3$
Total Hardness	70/ 320/ 377 mg/L as $CaCO_3$
Floated Water Quality	
Turbidity (max)	3 NTU

[1] 2021 Yass Valley, Census All persons QuickStats | Australian Bureau of Statistics (abs.gov.au)

Parameter	Value
Treated Water Quality	
Turbidity	1 NTU
Apparent Colour	10 HU
pH	<8.2
Iron	0.1 mg/L
Free Available Chlorine after 30 min	0.5 mg/L
Odour and Taste	Unobjectionable

The WTP comprises of the following process and assets:

- Raw water pump station drawing from Yass Dam (2 off)
- Three stage flocculation (one train)
- Dissolved air flotation, including float removal, sludge removal and recycle/saturation system (one unit)
- Rapid gravity mono media sand filtration (4 filters)
- Clear water tank (300kL)
- Clear Water pumps (2 off)
- Clear water reservoirs (2 off), 2.70 ML
- Sludge lagoons (2 off)
- Powdered activated carbon storage and dosing system
- Liquid alum storage and dosing system
- Polymer batching and dosing system
- Soda ash storage and dosing system
- Chlorine gas storage and dosing system
- Sodium silicofluoride storage and dosing system.
- Bubble plume aeration of Yass Dam (added in the 2022 Stage 1 Upgrade)
- Potassium permanganate batching and dosing (added in the 2022 Stage 1 Upgrade)

1.4 Project Team and Stakeholders

1.4.1 YVC Project Team

The key YVC personnel are presented in Table 1-2.

Table 1-2: YVC team for the Yass WTP Upgrade project

Name	Role
Chris Berry	Chief Executive Officer
Nathan Cooke	Director Infrastructure and Assets
Kuga Kugaprasatham	Manager Water and Wastewater
Aaron Shepherd	Coordinator, Water and Wastewater
Ron Butt	Senior WTP Technician
Alex Scorgie	Supervisor, Water

1.4.2 Key Project Stakeholders

The key project stakeholders are presented in Table 1-3.

Table 1-3: Key stakeholders of the Yass WTP Upgrade project

Organisation name	Role
Yass Valley Council	The owner and operator of the Yass water supply system, responsible for planning, funding, delivering and managing the Yass WTP upgrade project. Engages with the community, regulators, contractors and consultants throughout the project lifecycle.
YVC Residents and Water Supply Customers	The consumers play a crucial role in the upgrade of the Yass Water Treatment Plant (WTP). The upgrade project aims to improve the quality of water supplied to the community and ensure that it meets the Australian Drinking Water Guidelines. Yass Valley Council residents and ratepayers are important stakeholders in the upgrade of the Yass WTP, as their feedback and financial contributions are taken into consideration in the decision-making process. Out of 15,000 rate payers in the LGA, some 7,200 are supplied with water and are the asset owners who will pay for the upgrade. In 2023, Council reached out to 3,395 customers served by the Yass WTP through a comprehensive survey. The results of this survey

Organisation name	Role
	helped the council in choosing the option that best reflects their customers' wants and needs within the Yass Valley.
NSW Department of Planning and Environment - Water	Provides regulatory guidance and assurance frameworks for local water utilities and helps with the application process for water treatment works approvals. DPE Water also provides technical assistance and support throughout the upgrade process.
NSW Health Local Health Unit and NSW Health Water Units	The regulator of drinking water quality and public health protection in NSW, ensuring that the Yass WTP upgrade project complies with the Australian Drinking Water Guidelines and the Public Health Act 2010. Provides advice, feedback and approval for the water quality management plan and the commissioning plan for the upgraded plant.
Beca HunterH2O	The engineering consultant appointed by YVC to prepare the business case, detailed design and tender documentation for the Yass WTP upgrade project. Provides technical expertise, options analysis, cost estimation, risk management and stakeholder consultation services.
NSW Department of Planning and Environment	The administrators of the Housing Acceleration Fund and the NSW Government Election Commitment Ad Hoc Fund, which provide funding support for the Yass WTP upgrade project are separate teams based within DPE. These teams have ensured that the project aligns with the NSW Government's strategic objectives and priorities for regional growth and water security. Reviewed and approved the funding deed and the election funding commitment and monitored the project compliance with the funding conditions and milestones.
Water Infrastructure NSW	The NSW Government agency that provides funding and strategic guidance for the delivery of water infrastructure projects in regional NSW, including the Yass WTP upgrade project. Reviews and approves the business case and monitors the project progress and performance.
NSW Environment Protection Authority	The regulator of environmental impacts and licenced activities in NSW, ensuring that the Yass WTP upgrade project complies with the Protection of the Environment Operations Act 1997 and the conditions of the environmental protection licence. Provides approval for the Environmental Assessment and the regulates treatment residual disposal from the WTP.

The key stakeholders have been informed about the project and have attended or been informed of the following meetings and workshops:

- Project Risk Management Workshop (Nov 2019)

- Options Value Management Workshop (Nov 2019)
- Options Assessment Workshop (Mar 2020)
- Concept Value Management Workshop (June 2020)
- Steering Committee Meetings (monthly May 2023 – April 2024)
- Option Identification Workshop (June 2023)
- Benefits Realisation and Risk Workshop (August 2023)
- Option Assessment Workshop (September 2023)
- Option 4 Value Management and Development (October 2023)

1.5 Previous studies

Yass WTP has had several assessments completed; these are:

- Yass WTP Audit Report – completed 19 September 2014 by City Water Technology Pty Ltd (CWT)
- Yass Water Treatment Plant Water Quality Improvements Options Study – Completed May 2016 by NSW Public Works.
- WTP Upgrade Options from the Hunter H2O Options Assessment Report (2020) - Extensive options development and assessment leading to identification of a new WTP with lime softening as the preferred upgrade
- Yass WTP Upgrades Options Assessment – completed 13 May 2021 by City Water Technology Pty Ltd (CWT) - assessed the existing plant and recommended a new WTP with membrane softening as the preferred upgrade
- DPE Comments on the CWT Peer review of Hunter H2O's 2020 Options Assessment report
- Yass WTP Stage 1 Upgrade Business Case, July 2021 by Hunter H2O

Yass WTP Audit Report (2014) by City Water Technology Pty Ltd (CWT).

CWT Audit Report outlined the need for a number of process improvements for the following issues:

- High filtered water turbidity
- Fluctuating raw water quality
- High clarified water turbidity
- Improvements to safety and environment
- Ensure integrity of treated water storage tanks and reservoirs
- Maintenance of network chlorine residuals
- High manganese levels in treated water
- Formation of THMs and other chlorinated organics
- Taste/odour and organics removal
- Improvement of documentation
- Improvement of chemical dosing systems
- Filtered water pH target
- Concrete corrosion in filters

Yass Water Treatment Plant Water Quality Improvements Options Study (2016) by NSW Public Works

NSW Public Works Advisory's options report identified two treatment options for comparison, the objectives were to remove hardness, dissolved solids and organic matter. Both treatment trains were considered below:

- Second process train which included Enhanced Coagulation/MIEX, Clarification and Reverse Osmosis.

- Second process train which included Coagulation, Clarification and Nanofiltration/Reverse Osmosis.

The capacity of the above treatment trains was 3 ML/d which would be blended with water from the existing treatment process.

Yass WTP Upgrades Options Assessment (2021) by City Water Technology Pty Ltd (CWT)

CWT Options Assessment was an independent peer review of the proposed preferred option and design basis for a new Yass Water Treatment Plant (WTP) as prepared by Beca HunterH2O.

Variable turbidity, manganese and hardness were identified to be issues for the Yass drinking water supply system and CWT recommended the following treatment process:

- Raw water blending tank (providing at least 15 minutes' contact time for mixing of the raw water with any supernatant stream);
- Oxidation with potassium permanganate and contact tank designed for 15 minutes' effective contact;
- Organics adsorption with PAC and contact tank designed for 30 minutes' effective contact;
- Pre-pH correction (as required, chemical/s to be confirmed by jar testing)
- Coagulation (chemical subject to confirmation by jar testing, likely ferric chloride or ACH);
- Clarification with lamella clarifiers (or solids contact clarifiers);
- Filtration with high-rate dual media filters;
- Manganese oxide coated filter media will be used for residual manganese removal.
- Softening by side stream RO treatment;
- UV irradiation;
- Residual disinfection with chlorine gas;
- Fluoridation with sodium fluoride;
- Post-pH correction (as required, chemical/s to be confirmed by jar testing); and
- Wastewater handling
- Backwash recovery in repurposed existing Clear Water Tank with supernatant return to the raw water
- Blending tank;
- Existing sludge lagoons to be retained and accept clarifier blowdown and settled sludge from filter backwash recovery tank
- The brine waste stream from the RO softening process will be diluted with supernatant from the filter backwash recovery tank and discharged to sewer.
- Chemical waste from periodic RO membrane cleaning will be collected

The NSW Department of Planning and Environment (DPE) responded to CWT Options Assessment with a set of comments which were then passed onto YVC. YVC responses are contained in Appendix D.

Yass WTP Stage 1 Upgrade Business Case and construction (2021-2022)

Addressed ‘urgent’ issues as identified by DPE Water and YVC and developed a business case for critical upgrades being:

- Yass Dam bubble plume aeration
- Electrical and control upgrade of the Raw Water Pump Station
- WTP Urgent Works
- Potassium permanganate building and new batching and dosing system
- New alum dosing system
- Online monitoring of
    - Raw water turbidity
    - Individual Filtered water turbidity
    - Dosed water pH
    - Treated water chlorine
    - New Control and telemetry system for the elements added in Stage 1

2 DESCRIPTION OF PROBLEM

The Yass Water Treatment Plant (WTP) upgrade aims to address several problems. The key issues are:

- **Raw water quality during extreme weather events**. Flooding can introduce high turbidity, colour, suspended solids, pathogens, and contaminants into the raw water source, which can affect the treatment process and the quality of the treated water. Drought and low inflows to the dam affect the quality of the raw water, which can also affect the treatment process and the quality of the treated water.
- **Ageing treatment assets**: The existing treatment assets at the Yass WTP are ageing and may require replacement or upgrading to ensure continued reliable operation.
- **Consumer dissatisfaction with scaling and discolouration**: There have been complaints from consumers about scaling and discolouration of the water supply. The upgrade aims to address these issues and improve the quality of the water supply.
- **Increasing water demand into the future**: As the population grows, there will be an increased demand for water. The upgrade aims to ensure that the Yass WTP can meet this demand and continue to provide a reliable water supply.
- **Increasing level of treatment performance to meet new HBT requirements of the ADWG**: The Australian Drinking Water Guidelines (ADWG) have introduced new Health-Based Targets (HBT) that require a higher level of treatment performance. The upgrade aims to ensure that the Yass WTP can meet these new requirements.
- **Inadequate treatment process redundancy.** The current treatment plant has only one Dissolved Air Flotation (DAF) unit, which means that if the system fails or needs to be taken offline for maintenance, the whole plant will have to shut down. This could compromise the water supply and pose a risk to public health.
- **Climate change impacts**: Climate change can impact raw water quality and increase the frequency and intensity of events such as floods and droughts. The upgrade aims to ensure that the Yass WTP is resilient to these impacts and can continue to provide a reliable water supply.
- **Negative effects on housing investment decisions**: Poor water quality and reliability of supply are identified from community feedback and research on regional economies as having wide reaching negative effects. It factors into decisions to live or invest in Yass Valley. Evidence indicates that tackling water quality will support acceleration of housing provision in line with New South Wales government policy objectives.

2.1 Raw water quality problems and variability

One of the main challenges facing Yass WTP is the ability to reliably and consistently treat raw water from Yass Dam. Dam water exhibits high variability in quality depending on seasonal and climatic conditions. The raw water quality poses significant risks to the health and satisfaction of the

customers, as well as to the performance and reliability of the existing treatment processes and assets. The raw water quality parameters that are of particular concern include turbidity, colour, dissolved organics, iron, manganese, pH, hardness, algal toxins, and taste and odour causing compounds.

The following discussion provides an overview of these water quality challenges and their implications for the WTP upgrade options.

Turbidity is a measure of the cloudiness or suspended solids in water, which can affect the appearance, taste and disinfection efficiency of drinking water. Turbidity in raw water can vary widely depending on rainfall, runoff, and catchment activity. High turbidity levels can also indicate the presence of microbial contaminants such as bacteria, viruses and protozoa, which pose a health risk to consumers. The existing WTP has a design capacity of 13 ML/d and a design raw water turbidity of 140 NTU. However, the WTP often experiences turbidity spikes above this level during high river flow events, which can last for several days or weeks. The existing coagulation, flocculation and dissolved air flotation (DAF) processes are not adequate to cope with such high and variable turbidity levels, resulting in poor clarification and filtration performance, increased chemical consumption and sludge production, and potential breaches of filtered water turbidity targets. The WTP upgrade options aim to improve the turbidity removal efficiency and robustness of the treatment process by adding new or refurbished clarification and filtration units, UV disinfection, and automated control systems.

Pathogens are microorganisms that can cause illness or infection when ingested. They include bacteria, viruses and protozoa, some of which are resistant to chlorine disinfection. The primary source of pathogens in raw water is faecal contamination from human or animal activities in the catchment, such as onsite wastewater management systems, livestock grazing, wildlife and recreational use. The existing WTP draws raw water from an unprotected catchment (Category 4), which means that there is a high likelihood of pathogen occurrence and a high health-based target (HBT) for pathogen removal. The existing WTP relies on chlorine disinfection to achieve the HBTs, but it does not have a reliable method to measure the chlorine contact time (C.t) or the log reduction value (LRV) of pathogens. Moreover, the existing WTP does not have a barrier against chlorine-resistant pathogens such as Cryptosporidium, which can cause severe diarrhoea and dehydration. The WTP upgrade options aim to enhance the pathogen removal and inactivation capabilities of the treatment process by adding UV disinfection, which can achieve 4 log reduction value (LRV) of Cryptosporidium, and by installing contact tanks and instruments and controls to monitor and verify the C.t and LRV of chlorine disinfection.

A rainfall event occurred in February 2020 whereby heavy rainfall in the catchment resulted in water was overtopping Yass Dam. Testing showed that raw water turbidity exceeded 1000 NTU with the Yass WTP struggling to achieve the targeted treated water turbidity. A picture of the raw water is shown above. The raw water sourced from the Yass River highlights the concerns of locals about the poor aesthetic quality of the sourced water. Jar testing with the processes and chemical used at the current WTP did not achieve an acceptable reduction in colour or turbidity and the testing indicated that the plant was unlikely to be able to achieve an acceptable treated water quality on raw waters of a similar nature.

Colour is a measure of the dissolved organic matter (DOM) in water, which can affect the aesthetic quality and disinfection by-product (DBP) formation potential of drinking water. Colour in raw water can vary depending on the type and amount of organic matter in the catchment, such as humic and fulvic acids from decomposing vegetation, algae and cyanobacteria from algal blooms, and organic pollutants from human activities. The existing WTP uses coagulation and DAF to remove colour, but it does not have a reliable method to measure the true colour or the dissolved organic carbon (DOC) of the raw water or the treated water. The WTP upgrade options aim to improve the colour removal efficiency and stability of the treatment process by implementing coagulation pH control which can improve adsorption of dissolved organics onto floc which are removed by clarification and filtration, renewing powdered activated carbon (PAC) adsorption process which can also reduce the taste and odour compounds, and by installing instruments and controls to monitor and optimise the coagulation and PAC dosing.

Iron and manganese are naturally occurring metals in water, which can affect the aesthetic quality and operational performance of drinking water. Iron and manganese in raw water can vary depending on the redox conditions, pH, alkalinity and hardness of the water, as well as the geology and hydrology of the catchment. High levels of iron and manganese can cause staining of plumbing fixtures, laundry and porcelain, metallic taste and odour, and biofilm growth in the distribution system. The actual raw water iron and manganese levels can fluctuate depending on the oxygenation and mixing of the water in the Yass Dam, especially during high river flow or low inflow events. The existing WTP uses dam aeration, potassium permanganate oxidation and chlorine oxidation or coated-media processes to remove iron and manganese. The WTP upgrade options aim to improve the iron and manganese removal efficiency and consistency of the treatment process by adding pH adjustment, providing adequate oxidation time, and by installing instruments and controls to monitor and adjust the potassium permanganate dosing.

Hardness is a measure of the dissolved calcium and magnesium in water, which can affect the aesthetic quality and operational performance of drinking water. Hardness in raw water can vary depending on the geology and hydrology of the catchment, as well as the rainfall and evaporation patterns. High hardness can cause scaling and precipitation of minerals such as calcium carbonate, which can reduce the efficiency and lifespan of the treatment equipment and the distribution pipes. High hardness can also affect the taste, appearance and lathering ability of the water, which can reduce the customer satisfaction and increase the household expenditure on water softening devices or bottled water. The existing WTP has a median raw water hardness of 320 mg/L as CaCO3, which is above the aesthetic guideline value of 200 mg/L as CaCO3 in the ADWG. However, water hardness can range from 70 to 377 mg/L as CaCO3, depending on the river flow and the dam level. The existing WTP does not have a process to reduce the hardness of the raw water or the treated water. The WTP upgrade options aim to provide a hardness reduction capability by adding reverse osmosis (RO) softening, which can also remove dissolved solids, and by installing instruments and controls to monitor and blend the softened and un-softened water.

Algal toxins are substances produced by some species of algae and cyanobacteria, which can affect the health and aesthetic quality of drinking water. Algal toxins in raw water can vary depending on the type and abundance of algae and cyanobacteria in the water, which are influenced by the nutrient levels, temperature, light and mixing conditions in the water. High levels of algal toxins can cause acute or chronic effects on humans and animals, such as skin irritation, gastroenteritis, liver damage and neurological disorders. The existing WTP has detected some potentially toxin-producing algae and cyanobacteria in the raw water from the Yass Dam, but at very low numbers. However, the actual algal toxin levels can increase rapidly during algal blooms, which can occur under favourable environmental conditions. The existing WTP does have processes to adsorb algal toxins (PAC) and to remove intact algal cells (DAF). The WTP upgrade options aim to improve the algal toxin removal and

inactivation capability of the treatment process by adding PAC contacting, improved PAC batching and dosing, and by installing instruments and controls to monitor and respond to algal blooms.

Taste and odour are sensory attributes of water that can affect the aesthetic quality and customer satisfaction of drinking water. Taste and odour in raw water can vary depending on the type and amount of compounds in the water, such as geosmin and 2-methylisoborneol (MIB) from algae and cyanobacteria, volatile organic compounds from natural or anthropogenic sources, and chlorine or chloramines from disinfection. High levels of taste and odour compounds can cause customers to complain, lose confidence or reject the water supply, and resort to alternative sources of water such as bottled water or rainwater tanks. The existing WTP has detected some taste and odour compounds in the raw water from the Yass Dam, especially during high river flow events. However, the actual taste and odour levels can fluctuate depending on the catchment conditions and the dam mixing. The existing WTP does have PAC adsorption which can remove taste and odour compounds from the raw water. The WTP upgrade options aim to improve the taste and odour removal capability of the treatment process by improving the contact time for adsorption, and by installing instruments and controls to monitor and optimise the PAC dosing.

Raw water data from 2020 – 2023 for Yass WTP has been included in Appendix A.

The key observation is that the risk profile is largely unchanged from the raw water analysis conducted in 2020, however, the bubble plume aeration system (operating since December 2022) has improved water quality under conditions of normal or low inflows to the dam but its impact on extended dry periods or during flood events is yet to be observed.

The key raw water quality risks identified from recent analysis are:

- **TSS / Turbidity** – The turbidity is less than 50 NTU 95% of the time and less than 20 NTU 66% of the time. However, rain events result in the turbidity rising above 100 NTU for 1 to 3 days and staying above 50 NTU for 2 to 6 weeks. Hence the biggest challenge is the rapid change in turbidity after an event and managing a high solids load for the following month.
- **Pathogens / Cryptosporidium / Giardia** – The Yass WTP draws from an unprotected catchment (assessed as a Category 4) that contains numerous onsite effluent management systems in proximity to the river and domestic stock animals with direct access to the river. Therefore, microbial pathogens, including chlorine tolerant protozoans, are likely to be present in the raw water.
- **True Colour** – It is estimated that the WTP is challenged with a raw water true colour of 30 to 70 HU for around 8 months of a “typical year”. With the remaining 4 months having an estimated true colour above 100 HU. True colour is lowest following extended dry periods and spikes with rainfall and higher river flows.
- **Dissolved Organics** – From monthly sampling over a year the level of organics is typically 6–11 mg/L but can increase to 15-20 mg/L under conditions of no inflows to the Dam or after large inflow to the dam following these no inflow events. Since operation of the bubble plume aeration system, concentrations have been observed to be on the low end of 6 mg/L during regular conditions but with an uptrend to 11 mg/L. Whether the concentration after a large inflow event returns to 15-20 mg/L or if performance has improved requires to be verified during those events in the future.

- **THMs** - The level of organics, combined with chlorine disinfection and water age in the Yass recirculation network, results in common exceedances of the THM guideline value of the ADWG (250 µg/L) with 10 out of 14 samples greater than 250 µg/L. The consistent exceedance of the ADWG target for THMs, combined with international guidelines being substantially lower that the current Australian guidance, requires consideration in the design to mitigate the current and future risk of THMs.
- **Iron and Manganese** – The median level of total iron and manganese are 1.2 mg/L and 0.19 mg/L respectively. There is event-based presence of 'high' levels of soluble manganese up to and above 0.2 mg/L, well above the aesthetic target (ADWG of < 0.1 mg/L) in the treated water. However, the bubble plume aeration system has indicated there has been some improvement with soluble manganese concentrations consistently below 0.1 mg/L since its operation. Although further monitoring is required to observe concentrations after an extended dry period or during a flood event.
- **pH** - Raw water pH averages 7.6 and typically exceeds 8.0 after 12 months of low river flows with a 95th percentile of 8.2. High pH and concurrent high alkalinity can be problematic in regard to achieving the optimum coagulation pH when using alum as the coagulant.
- **Total hardness** - is strongly influenced by rainfall in the catchment. Following heavy rainfall and significant flows in the river the pH, alkalinity and total hardness all fall rapidly to their respective minimums (around 75 mg/L as $CaCO_3$ for hardness). From this point, Yass Dam offers some buffering, but all three parameters begin to rise once the river returns to a base flow, which is minimal. Total hardness typically exceeds 200 mg/L as $CaCO_3$ following 3-6 months of low river flows. Whether this trend continues since operation of the dam bubble plume aeration system requires further monitoring, particularly during an extended dry period followed by a high rainfall event.
- **Algal toxins** – Potentially toxin producing algae have been detected in the dam in very low numbers.
- **Taste and odour** – Run-off from the Yass River catchment and overflowing of farm dams cause elevated levels of taste and odour (T&O) compounds, geosmin and 2-methylsioborneol (MIB), during a high rainfall event. Geosmin has been measured higher with a peak of 11 ng/L while MIB has peaked at 5 ng/L. Typical geosmin and MIB levels during typical flow conditions are around 1-3 ng/L each and this is what has been observed since after operation of the dam bubble plume aeration system. Further monitoring will assist to determine whether these T&O compounds will return to their historical peak after a high rainfall event.

2.1.1 Effect of bubble plume aeration

The dam bubble plume aeration system has improved the raw water quality since its operation commencing on the 19th of December 2022. The notable improvements are in:

- Lower soluble iron and manganese in raw water to WTP
- Lower organic matter (DOC and UVA) in raw water to WTP
- Reduced taste and odour causing compound concentrations

However, there are only a limited number of samples taken since the aeration system was put into operation. Historically, the wet weather water quality is poor due to run off from farm dams in the catchment which contribute to high turbidity and taste and odour in the raw water. There has been no high rainfall event since the aeration system was in operation and so it is too early to conclude the

effectiveness of bubble plume aeration system to cope with pollutant loads during and after an extreme rainfall event.

Further monitoring and analysis are required to provide indication of how well the raw water risks of elevated soluble manganese, elevated DOC and taste and odours have been mitigated by the aeration system.

2.1.2 High river flow events 2020 – 2023

River flow data downstream of Yass Dam (Station 410026) from 2020 – 2023 was examined to understand high rainfall events affecting raw water quality. The river flow over time compared to raw water turbidity and total hardness is shown in Table 2-1.

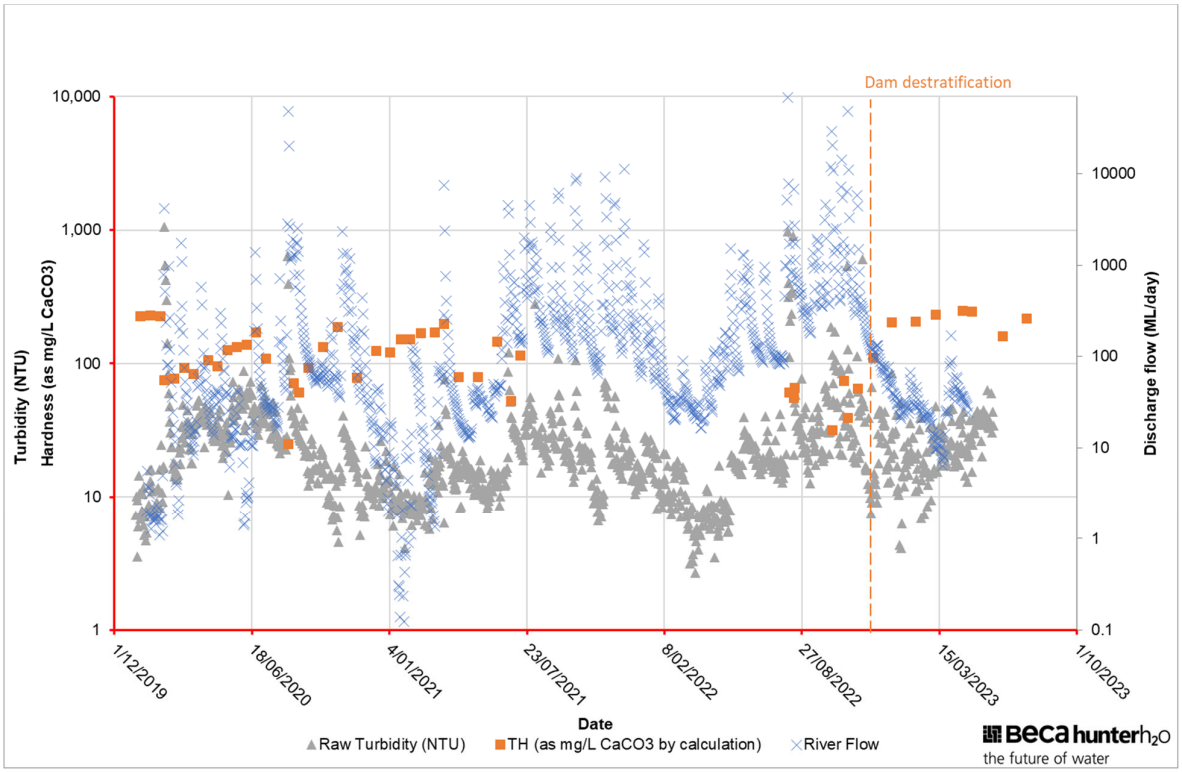


Table 2-1: Raw water flow compared to turbidity and total hardness

It can be observed from Table 2-1 that:

- high river flow correlates well with higher raw water turbidity
- high river flow correlates well with reductions in hardness
- low river flow correlates well with increased hardness
- low river flow correlates well with reduced turbidity however, since commencement of the bubble plume aeration system, the baseline raw water turbidity appears to have increased from <10 NTU to 30-50 NTU

The high flow events between 19/05/2022 – 25/04/2023 is shown in higher resolution in Table 2-2.

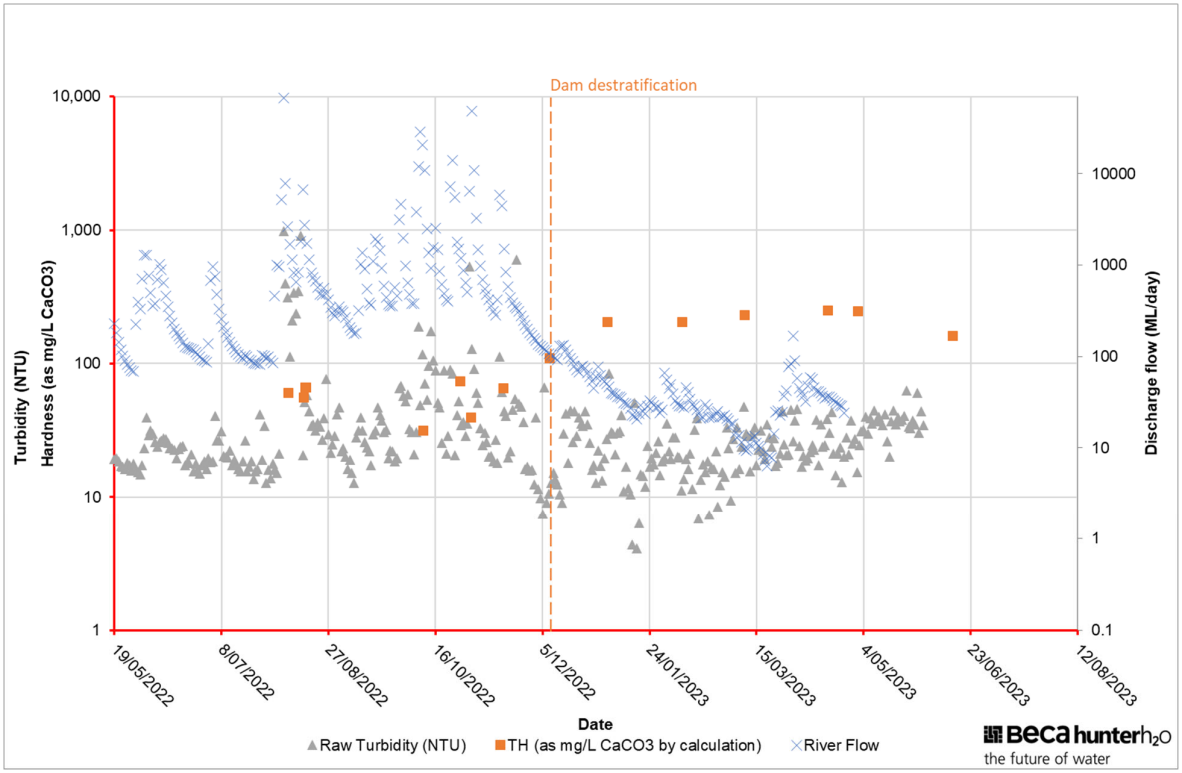


Table 2-2: Raw water flow compared to turbidity and hardness 19/05/2022 - 25/04/2023

A detailed explanation of the historic rainfall events and resulting raw water quality hazards and challenges has been presented whereby it is clearly shown that the community of Yass have struggled for years with poor quality drinking water due to the inability of the Yass WTP to treat the poor quality raw water sourced from the Yass Dam to ADWG.

2.2 An ageing asset - The current treatment plant

The current Yass WTP was constructed in 1990 by Wormald Engineering under the supervision of the NSW Department of Public Works. The process consists of dissolved air flotation (Purac, Sweden) and rapid deep sand filtration plant. The treatment plant was designed to treat a flow of 13 ML/day or 165 L/s over 24 hours to achieve the treated water targets presented in Table 2-3.

Table 2-3: Treated water quality targets

Treated Water Quality Targets	
Turbidity	1 NTU
Apparent Colour	10 HU
pH	<8.2
Iron	0.1 mg/L
Free available chlorine after 30 mins	0.5 mg/L

Treated Water Quality Targets	
Odour and Taste	Unobjectionable

The Yass WTP comprises of the following unit processes:

- Raw water pumping station drawing from Yass Dam
- Three stage flocculation
- Dissolved air flotation, including float removal, sludge removal and recycle/saturation system
- Rapid gravity mono media sand filtration (4 filters)
- Clear water tank (300kL)
- Clear Water pumps (2 off)
- Clear water reservoirs (2 off)
- Sludge lagoons (2 off)
- Powdered activated carbon storage and dosing system
- Potassium permanganate batching and dosing system
- Liquid alum storage and dosing system
- Polymer batching and dosing system
- Soda ash storage and dosing system
- Chlorine gas storage and dosing system and
- Sodium silico-fluoride storage and dosing system.

2020 Review

The 2020 Plant Capacity and Performance Assessment (Appendix C) identified the following issues that require improvement on the current WTP:

1. The current plant is 30 years old, and many assets, systems and processes are at the end of their service life.
2. YVC is planning for the upgrade of the raw water pump to deliver the design flow rate of 165 L/s described in the WTP design documentation. Engineering review has found that the available filter area, filter condition and acceptable filtration rates limit maximum filtration rate to approximately 135 L/s.
3. The WTP electrical and control system is 30 years old, and the technology and assets are at the end of their service life. The plant operates at a fixed flow rate and has a basic automatic operational mode. Changes to the process to deal with changing water quality or plant performance must be manually implemented by operators attending the plant. The main switchboard arrangement and location does not comply with current standards and there are many dilapidated switchgear and control gear assemblies for unit process distributed around the WTP. Upgrade of the electrical and control system, provision of a SCADA system and implementation of automatic, unattended operation of the plant at variable flows, is an essential element of the upgrade of the WTP.

4. There is a single flocculation train comprise 3 stage tapered flocculation. The detention times and mixing regime is more suited to a conventional clarification process and modifications to produce a floc size consistent with clarification using dissolved air flotation should be implemented.

5. There is a single DAF cell (Purac design) with single saturator operating at approximately 500-600 kPa and a recycle rate of 10%. Recycle is taken from the clarified water and can contain solids. The typical performance of the DAF is below the design standard of 3 NTU. This is due to a range of factors including raw water treatability, coagulant dosing and mixing, dispersion valve performance, and DAF float stability and removal rate. Refurbishment of the DAF recycle, saturation and dispersion systems is recommended. Installation of walls around the DAF cell to limit wind effects on the float is also recommended.

6. The WTP design parameters in regard to a design filtered water quality of 1 NTU is inconsistent with current standards for filtered water of <0.2 NTU. Filter renewals consisting of inspection and repair (where necessary) of the filter floor and filter nozzles, renewal of the air scour system, filter media renewal, installation of supports for backwash troughs, renewal of actuated valves, and new instrumentation is required.

7. All chemical systems are largely original with ageing components and numerous non-compliances with existing WHS Regulations and Australian Standards. Replacement of the coagulant system, polymer system, soda ash wet end, PAC system, chlorine system, and fluoridation system is required.

8. Amenities and laboratory facilities are undersized and in poor condition. While the upper floor has under-utilised space, the core activities of the WTP are undertaken on the lower level making this the natural and preferred working area. A new amenities building should be provided that includes separate areas for control and administration, meals and meetings, shower/ toilet, and wet work/ sample analysis.

2023 Review

An asset rating review (Appendix B) undertaken in 2023 found:

Mechanical assets were found to be generally in good to fair condition given their age. Of note, was the limited accessibility to many assets within the main building which presents a safety risk for operation and maintenance activities. Hazards include narrow access and congested areas, low head clearances, and the clear water pumps located within a confined space.

- Approximately 15% of the rated mechanical assets have been assessed as having a rating of poor or very poor.
- Approximately 1% of the rated mechanical assets have been assessed as having a rating of very poor.

Electrical assets were found to be aging, with the site main switchboard (MSB) and satellite switchboards now 33 years in service. The frequency of failures is steady, and repairs are increasingly difficult due to the obsolescence of installed equipment, lack of up to date schematics, lack of spare capacity in switchboards and cableways, and physical access to equipment.

- Approximately 47% of the rated electrical assets have been assessed as having a rating of poor or very poor.

- Approximately 32% of the rated electrical assets have been assessed as having a rating of very poor.

2.3 Consumer Dissatisfaction

The IWCM Strategy Plan (2008) not only highlighted Council's promise to its community, but it also documented the dissatisfaction felt by the residents of Yass regarding their drinking water quality. It is well documented in reports by City Water Technology (2014) and Public Works Advisory (2016) that the residents of Yass are dissatisfied with the quality of water provided to them.

As such, YVC has been receiving an increasing number of water quality complaints from Yass residents over the years during extreme events and it is understood that there is a persistent customer demand for the Council to address the water quality issues.

The water supply customers of Yass have played an important role in providing feedback and insights regarding the Yass Water Treatment Plant (WTP) Upgrade project. In 2023, Yass Valley Council reached out to 3,395 customers in Yass, Murrumbateman, Bowning and Binalong served by the Yass Valley Council Water Treatment Plant through a comprehensive survey (refer Appendix I) designed to gather their valuable insights on their water quality satisfaction and usage habits. The survey covered topics such as water sources, water quality concerns, water usage devices, water bills, and water quality improvements. 3,395 surveys were distributed to customers within the Yass region, and 491 (14.5%) responses were received (refer Appendix I).

Most of the respondents were from South Yass region, making up 57% of the total feedback. North Yass residents contributed 26%, with the remaining respondents from Binalong, Murrumbateman, Bowning and other areas of Yass.

The survey highlighted some key themes and trends:

- Only 15% of respondents drink town water directly from the tap.
- A majority of respondents (85%) do not drink town water,
- Those who do not drink directly from the tap identified alternative sources such as rainwater tanks (53%), bottled water (45%), various filtration methods (7%), and boiled water (1%).
- The most frequently reported concern in response to water quality was taste, with a significant 85% of participants mentioning it. Calcification was noted in 70% of the survey responses, while discolouration and smell were identified as concerns by 64% and 60% of respondents, respectively. Further, 34% were concerned with ruined laundry, and 15% reported a concern for drop in pressure.
- When asked if devices such as household filters for town or drinking water are used, the respondents were almost split at 44% saying 'Yes' and 56% 'No'. Those who did use filters typically replaced their cartridges around 3-4 times per year, with a few replacing them each month. The average cost incurred for each replacement averaged $154 per year, with notable expenses reaching up to $1,600.
- In the case of those relying on rainwater tanks for drinking or cooking, 38% confirmed using household filters while 62% did not. Cartridge replacements amongst these users also occurred around 3-4 times per year, with some respondents replacing them monthly. Only 28% of rainwater tank users additionally boiled their water before consumption.

- On average replacing hot water systems occurred every 10 years; however, there were respondents who replaced their systems as frequently as every 1-2 years, and as infrequently as every 30 years. The cost associated with replacing a hot water system stood at approximately $1,925.
- 67% of respondents expressed concern for discoloured water within the last year (June 2022 – June 2023) and reported that this was experienced roughly 14 times throughout the year. When presented with this problem, 11% of respondents reached out to Council.
- Since March 2023, improvements were reported by 39% of survey respondents. A significant 61% stated they had not seen any improvements, while 29% felt there was a slight change, and only 10% witnessed substantial progress.
- A comparison of water bills across seasons disclosed that the average water bill in winter (June) amounted to approximately $202.39. During the summer months (February), the average water bill increased to around $282.22.
- Many people noted in the feedback that they do not want to pay any extra for clean water usage.

The result of this survey helps the council in choosing the option that best reflects their customers' wants and needs. The findings provided an in-depth understanding of customer concerns, satisfaction levels, and suggestions for improvements, enabling the council to better cater to their needs and enhance their water services.

2.4 Increasing Demand

Another driver for upgrading the Yass WTP is the increasing demand for drinking water due to increased demand for housing in Yass Region. According to the 2016 census data, the population of Yass Valley increased by 10.6% between 2011 and 2016, reaching 16,142 people. According to the 2021 census data, the population of Yass Valley reached 17,281[2], a further 7.1% increase. These trends are expected to continue, as more people choose to live in the regional town for its lifestyle and proximity to Canberra. With the influx of new residents, demand for quality drinking water is also increasing.

The Murrumbidgee Regional Water Strategy (Consultation Draft, Dec 2022) predicts a further 18% increase in the population of the Yass Valley between 2021 and 2041[3].

Housing demand in Yass Region and thus demand for drinking water will exhaust the available capacity of Yass WTP in the next decade (IWCM Draft Issues paper May 2021 and Yass Water Source Strategy, Oct 2022[4]).

[2] 2021 Yass Valley, Census All persons QuickStats | Australian Bureau of Statistics (abs.gov.au)

[3] www.planningportal.nsw.gov.au/populations

[4] https://www.yassvalley.nsw.gov.au/Our-Council/Policies-Plans-and-Reports/Council-Strategies-and-Plans

The increasing demand for drinking water means that the existing WTP will have to operate at higher capacities and with less downtime for maintenance. This will put more pressure on the ageing infrastructure and reduce its reliability and efficiency.

2.5 Health Based Targets

Another driver for upgrading the Yass WTP is the need to comply with the health based targets (HBTs) for drinking water quality, as set by the Australian Drinking Water Guidelines (ADWG) and the National Health and Medical Research Council (NHMRC 2011 and subsequent updates). The HBTs are a risk-based approach to managing drinking water safety, which aim to protect public health from waterborne diseases and contaminants. The HBTs require water suppliers to assess the potential hazards and risks associated with their water sources, treatment processes, and distribution systems, and to implement appropriate preventive measures and corrective actions to minimise or eliminate those risks. The HBTs also set the minimum performance requirements and operational criteria for key treatment barriers, such as filtration, and disinfection.

The WTP does not currently provide the treatment barriers and treatment reliability to supply water to the community. Additional infrastructure is required to improve the quality of treated water and meet the current standards and requirements including the Health Based Targets contained in the ADWGs.

To achieve the required Ct values for different pathogens, the water treatment process must ensure that the chlorine dose is adequate and that the contact time is sufficient. These parameters are influenced by the quality of the filtered water, as well as by the design and operation of the disinfection system. Therefore, the upgrade of Yass WTP will include several improvements to enhance the chlorine disinfection performance, such as:

- - Limiting water turbidity to <1NTU at the point of disinfection,
- - Control and reliability of chlorine dosing
- - Extending the contact time.

A crucial component of the upgrade of Yass WTP is the improvement of the disinfection performance to eliminate or inactivate harmful microorganisms. However, not all pathogens are equally sensitive to chlorine disinfection. Some pathogens, such as Cryptosporidium and Giardia, are protozoan parasites that have a protective cyst or oocyst wall that makes them resistant to chlorine. These pathogens can cause gastrointestinal illnesses, as well as more chronic conditions, such as malnutrition, weight loss, and impaired growth and development. Therefore, it is also vital to achieve the health-based targets for chlorine resistant pathogens, which specify the minimum log removal or inactivation requirements for different levels of protection.

The proposed upgrade allows for installation of UV disinfection to achieve the microbial health-based targets for chlorine resistant pathogens. This requires the use of additional or alternative treatment barriers, such as UV disinfection, which can physically remove or inactivate these cysts or oocysts from the water.

Due to the small volume of the existing Clear Water Tank, and short-circuiting of the existing Clear Water Reservoirs, the contact time (t) cannot be validated. Proposed solutions include construction of a new Clear Water Tank with sufficient volume and modification of the inlet and outlet pipework on the Clear Water Reservoirs to eliminate short-circuiting.

2.6 Inadequate treatment process redundancy

Another driver for the upgrade of Yass WTP is the lack of redundancy in the existing treatment process. Redundancy refers to the ability of a system to continue operating when one or more

components fail or are offline for maintenance. The current treatment plant has only one Dissolved Air Flotation (DAF) unit, which is the primary treatment barrier for removing suspended solids, organic matter, colour, and algae from the raw water. This means that if the DAF system fails or needs to be taken offline for maintenance, the whole plant would have to shut down. This could compromise the water supply and pose a risk to public health. Therefore, it is essential to increase the redundancy of the treatment process by installing additional clarification, which would allow the plant to operate in the event of a failure or outage of one of the units. The proposed additional clarification with Inclined Plate Settling is more effective at treating high turbidity water than the existing DAF. The upgrade will provide operational flexibility and improve the reliability and resilience of the treatment process.

2.7 Consequences of Deferral

The water quality analysis and plant capacity and performance summary highlights that the existing WTP is not capable of treating the full range of water qualities currently experienced in the Yass River, further comprising the water security and potentially water safety of the water supply to Yass. Whilst YVC completed a major capital works project in recent years to secure the supply of water by raising the dam wall, it did not mitigate against the threat of the poor quality raw water sourced from the Yass River or the inability of the WTP to treat the water to ADWG. The inability of the Yass WTP to treat the poor-quality raw water sourced from the Yass River poses a major health risk to the community of Yass as the treated water is not considered “safe” to drink.

Should the Yass WTP Upgrade be deferred, the community of Yass will continue to receive poor quality drinking water that cannot be reliably treated to meet the ADWG. An increasing number of boil water events is likely as the magnitude and frequency of events increase due to climate change, and the WTP is unable to respond to these challenges.

The community will continue to be supplied with poor-quality water which means that negative perceptions of Council will continue and potentially become worse due to a failure to act. Community members will continue to be forced to purchase drinking water or household filters or rainwater tanks with boiling/filters which is a financial burden that comes with environmental impacts associated with the transportation of bottled water and the waste implications of disposal of the packaging.

All current housing growth forecasts scenarios (Government and private sector) anticipate an acceleration of housing demand from the late 2020s. These assume that essential services are available and in place. Moratoriums on growth due to inadequate water quality or supply are not assumed, whereas these remain a risk unless investment in upgrading occurs.

Poor water quality and reliability of supply are identified as having wide reaching negative effects. Deferment of investment in improving water quality for residents in Yass Valley hinders the achievement of the objectives of the government’s Housing Acceleration Fund (HAF) program by diminishing developer’s confidence to proceed with housing developments diminishing confidence for Council’s to accelerate development approvals.

3 OBJECTIVE OF INTERVENTION

The goals and objectives of the Yass WTP Upgrade Project were clarified following the Project Risk Workshop in November 2019. The objectives for the upgrade of Yass WTP were considered again at the Benefits Realisation and Risk Workshop of 7 August 2023.

The stated goals and objectives for the Yass WTP Upgrade are presented below.

3.1 Project Goals

- Improve treated water quality to meet Australian Drinking Water Guidelines (ADWG) and community expectations
- Enhance continuity of water supply and quality
- Ensure WTP has adequate treatment capacity to match the safe yield of Yass Dam
- Enhance flexibility to address potential water quality risks in future; and
- Ensure upgraded WTP asset complies with relevant standards and regulations.

3.2 Project Objectives

- Upgraded WTP supports application of the ADWG Framework for Management of Drinking Water Quality
- Upgraded WTP facilitates the accelerated provision of housing.
- Upgraded WTP complies with relevant standards and regulations.
- Upgraded WTP produces treated water that meets health and aesthetic related target values of the ADWG and community expectations during raw water quality events
- Upgraded WTP enables regular maintenance and inspections within acceptable levels of water supply interruptions
- Upgraded WTP delivered and operated in a manner that builds consumer trust in the safety and quality of drinking water supplied to the community
- The infrastructure proposed is a suitable solution to manage climate change variability projections

3.3 Policy and Strategic Alignment

The YVC and NSW Government Strategic Policies in agreement with the Yass WTP Upgrade Project are presented in Table 3-1.

Table 3-1: YVC and NSW Government strategic Policies and Alignment

Policy	Alignment
Provision of accelerated housing **Housing Acceleration Fund** The NSW Housing Acceleration Fund (HAF) provides grants for critical infrastructure projects which help accelerate the delivery of housing. Projects funded under the HAF include transport,	The upgrade of the Yass WTP Population projections from Government and independent forecasters indicate for the Water Treatment Plant supply area that low growth trajectories are in the order of 1.6% per annum, whereas potential also exists for higher growth scenarios in excess of 2 to 3% growth per annum.

water, wastewater, drainage and community infrastructure. The objectives of the HAF program are: ▪ Increase housing supply in high demand areas by prioritising infrastructure projects in growth areas and providing for critical enabling infrastructure such as transport, water and community infrastructure. ▪ Accelerate housing supply by providing critical infrastructure to growth areas, giving developers confidence to proceed with housing developments and confidence for Council's to accelerating development approvals. ▪ Support community resilience for growth through the provision of enabling infrastructure that enables the development of planned, appropriately serviced and accessible communities. ▪ Facilitating sustainable urban growth and in-sequence development to ensure that funding is directed in areas of greatest need and aligned to current plans and strategies. The program is administered by the Department of Planning and Environment together with Infrastructure NSW and NSW Treasury.	Investment in better water quality is considered a material factor in the ability to track to these higher growth trajectories. Overall Yass Valley growth to around 43,900 by 2056 is indicated, with 12,400 additional people living in the town of Yass. Development is forecast to ultimately see 5,000 new Yass Valley dwellings in NSW commencing with more than 300 dwellings per year from 2032-2047. Surveys of residents and anecdotal feedback from prospective investors into the area indicates that the existing poor water quality factors into decision making. Removing this impediment will support an uplift in attractiveness of the area of new housing provision.
Council's **Integrated Water Cycle Management Strategy Plan 2008** lists the following issues: ▪ Lack of **water storage / Poor security** of existing source ▪ Need for **extension / upgrade of water supply**, sewerage and stormwater to serve existing and future customers ▪ Upgrades to **Yass WTP** scheduled for 2020/2021	The Project directly addresses the issues summarised in the IWCM to upgrade the Yass WTP in 2020 by: ▪ Reducing the occurrence of noncompliance with ADWG by augmenting the unit processes of the Yass WTP to treat raw water sourced from the Yass Dam in agreement to the ADWG ▪ Augmentation of existing WTP capable of treating the raw water, thereby improving water quality and reliability of water supply.
The **Tablelands Regional Community Strategic Plan** for **2016 – 2036** outlines investment in regional and local infrastructure in line with NSW 2021 – the State Government's ten-year investment plan. The following Strategies are stated: ▪ Strategy EN3: Protect and rehabilitate waterways and catchments ▪ Strategy EN4: Maintain a balance between growth, development and environmental protection through sensible planning	The project is heavily relatable to the identified strategies to improve waterways and catchments, supply and security, which is aligned by providing: ▪ Improved the water quality, reliability and security of supply to enable the community to be more liveable and more attractive for tourism and industry etc. ▪ An affordable water supply in terms of both capital and ultimately reducing operational costs; and

▪ Strategy IN5: Ensure high quality water supply options for the towns in the region	▪ A good quality of supply that more reliably meets relevant health standards and reduces risks to non-compliance.
The NSW **Regional Development Framework** is the overarching document that **"***provides a scaffold for better coordination, decision making and effort on the ground*" for coordinating investment throughout regional NSW. The framework highlights the NSW Governments commitment to regional NSW towns and the infrastructure required to support economic growth. Throughout the NSW **Regional Development Framework** document there are many themes, commitments and initiatives which both support regional development, public health and essential services by mentioning: ▪ "We want to ensure that the people of regional NSW have the best access to **essential services** and infrastructure in regional Australia." ▪ "All people in regional NSW should and will have access to **essential services** and infrastructure including hospitals, schools, roads, **water**, police and emergency services. This is our commitment to ensuring that no one in regional NSW should have to choose between where they live and work and having access to the most essential services."	The Project is aligned with the themes, commitments and initiatives by: ▪ Providing regional NSW residents with essential services and infrastructure. This improves: • Public health and wellbeing of the region Yass • Investment and community growth within the Yass by attracting new industries and businesses. • Economic growth by providing good quality essential services.
The **NSW Water Strategy** 2020 is a 20-year, state-wide strategy to improve the security, reliability and quality of the state's water resources over the coming decades. The NSW Water Strategy addresses key challenges and opportunities for water management and service delivery across the state and set the strategic direction for the NSW water sector over the long-term. Twelve new regional water strategies are to be developed to bring together the best and latest climate evidence with a wide range of tools and solutions to plan and manage the water needs in each NSW region over the coming decades. The strategies look out over the next 20 to 40 years and determine how much water a region will need to meet future demand, the challenges and choices involved in meeting those needs and the actions available to manage risks to water availability. The strategies will aim to balance different water needs, inform investment decisions, and deliver the right amount of water, of the right quality for the right purpose at the right times	The Upgrade of the WTP aligns with the strategies objective of "Doing more with less" through the inclusion of non-cost benefits in the option selection process namely; "Improve capacity across NSW to cope with climate variability and change"; and "Invest in appropriate and affordable infrastructure". The proposal aligns with **Priority 6** of the Strategy – "Support resilient, prosperous and liveable cities and towns", in particular **Action 6.2 – Work collaboratively with local water utilities to reduce risks to town water supplies** - DPE has collaborated intensively with Council in development and assessment of the Options considered by the Business Case **Action 6.4 Continue to deliver the NSW Government Election Commitment Ad Hoc Fund**– the NSW Government has committed $13.55 M to the upgrade of the Yass water supply. **6.5 Continue to work with suppliers of drinking water to effectively manage drinking water quality and safety** – the assessment criteria used in the Business Case have been developed in consultation with DPE Water and NSW Health
Murrumbidgee Regional Water Strategy (Consultation Draft, Dec 2022). A long-term regional water strategy is being developed to guide	Investment in the Yass WTP is informed by integrated water cycle management planning and is guided by local water utility strategic planning under the

how the NSW Government can best address the water-related challenges to support a liveable and prosperous Murrumbidgee region. A key challenge that has been identified as "Ensuring resilient water supplies for regional centres, towns and communities in a changing climate". The Plan predicts an 18% increase in the population of the Yass Valley between 2021 and 2041[5]. The Plan sees the potential for supply side restrictions going forward. The ACT and NSW governments have entered a non-binding agreement (re-signed in 2020), through a Memorandum of Understanding for Regional Collaboration, to work together to implement policy and deliver targeted services and economic outcomes for cross border communities. Under the Memorandum of Understanding's Priority Focus Area Plan, a joint water working group is proposed to help facilitate a regional approach to strategic water and land use planning.	*Regulatory and Assurance Framework for Local Water Utilities*. The proposal aligns with the Regional Strategy and provides a more resilient treatment capability in the face of more frequent and extreme events which are driven by climate change. The proposal also strengthens the WTP's ability to provide a high quality supply which supports development and increases in population in Yass Valley.
The Infrastructure NSW **State Infrastructure Strategy Update 2014** identified an NSW Government strategic objective to "*Ensure that **drinking water** and wastewater **services in all regional NSW towns meet contemporary standards"*** In addition, the **State Infrastructure Strategy Update 2014** acknowledges that "*A lack of or inadequate **water supply** and sewerage services are the single most important factors in **protecting public health** and reducing faecal pollution in receiving waters.".*	The Project contributes to the delivery of the objective by: ▪ Using a multi-barrier approach by looking at the catchment/ source to treatment approach to provide a safer drinking water to Yass in accordance with the Australian Drinking Water Guidelines (ADWG) ▪ Planning for the future, including achieving long-term water security, building resilience and redundancy into the water infrastructure in Yass.
The **Economic Development Strategy for Regional NSW** aims to drive economic growth and to deliver a dynamic and globally competitive regional economy. It also focuses on actions to address challenges and opportunities in Regional NSW. The **Economic Development Strategy for Regional NSW** identified goals to enable regional economic development, such as: "*Goal 2: Drive regional employment and regional business growth.*" and "*Goal 3: Invest in economic infrastructure and connectivity.*"	The Project contributes to the delivery of these goals by: ▪ Enabling regional business growth through improvements to water safety and provide potential economic growth as the residents of Yass will no longer be required to purchase and truck water from neighbouring city, Canberra. ▪ Improving State productivity and creating a stronger regional community by enabling economic activity that would otherwise be constrained by a lack of water security and reliability of a safe supply.

[5] www.planningportal.nsw.gov.au/populations

The **Premier** and **State Priorities** identified priorities for safer communities, building infrastructure and encouraging business investment.	The Project contributes to Premier and State Priorities by: ▪ Improving drinking water quality and safety to ensure the safety of the community's health. ▪ Construction of long-term infrastructure assets for the region and local community. ▪ Supporting business by providing a reliable and high-quality water supply that will be a precursor to full proofing future investment.

3.4 Changes to Case for Change

No substantive changes to the case for change have been made from project commencement in terms of considering the business need and objective of the intervention. The need for change was clearly confirmed during the inception/ kick off meeting and developed during the Project Risk Management Workshop with a clear focus on the community needs and expectations with the ultimate goal of achieving good quality water by providing new infrastructure that meets the national and international standards and guidelines. Subsequent to this, in response to the independent business case assurance process, additional focus has been put on the housing acceleration potential of the investment.

Works undertaken in 2021/ 2022 as part of the Yass WTP Stage 1 Upgrade have been considered in the Case for Change and the appropriate technical solutions. Refinements have been made to the problems, benefits, risks by stakeholders identified during the 2023 Project Risk Management Workshop. The updated project problems, benefits and risks have been used to develop and assess the shortlisted options in consultation with stakeholders ensuring full co-operation and transparency between all parties involved.

Providing regional towns essential services and infrastructure to enable economic development and growth is at the forefront of government strategies, policies and initiatives, however events such as the bushfires and COVID-19 pandemic have impacted some priorities to ensure these significant events were dealt with to ensure public safety.

The bushfires which took place in the summer of 2019/2020 had a severe impact on various rural communities of NSW, with NSW government pledging support to ensure these communities can rebuild and prosper.

Furthermore, the outbreak of COVID-19 in 2020 gave rise to major changes to everyday lifestyle to and the NSW Government has worked to ensure all relevant health measures were in place as well as pledging stimulus and relief support to ensure the public safety as well as the impact of the pandemic on economic growth and development. Increases in inflation and interest rates since the onset of the Covid 19 pandemic has impacted on Government budgets and has increased the cost of borrowing.

3.5 Climate Change Risks

Climate change is projected to increase the frequency and intensity of extreme weather events, such as droughts, floods, bushfires, and storms, in the region of Yass. These events pose significant risks to the security and quality of the raw water supply for the WTP, as they can affect the quantity, turbidity, colour, organic matter, pathogens, and contaminants in the source water. These risks can compromise the ability of the existing WTP to meet the current and future drinking water standards and customer expectations, as well as increase the operational and maintenance costs and

environmental impacts of the treatment process. Therefore, climate change risks are a key driver for the upgrade of Yass WTP, as they require a more robust and resilient treatment system that can cope with the variability and uncertainty of the raw water quality and ensure a reliable and safe water supply for the community of Yass.

The raw water quality may deteriorate due to factors such as climate variability, land use changes, and pollution. This will pose more challenges for the water treatment process, as raw water will require more treatment to meet the drinking water standards.

4 COST BENEFIT ANALYSIS

4.1 Stage 1 (Strategic Business Case) Short List Review

The design and business case development of the WTP Upgrade has been funded by the Housing Acceleration Fund (HAF) since February 2019.

Preparation of a Business Case was commenced in 2019. The long list of WTP process options were developed in collaboration with stakeholders by examining the raw water quality hazards as well as site inspections and Hunter H2O experience in similar projects. The Options are generally described as:

- Option 1 – Base Case
- Option 2 – Existing WTP + PAC/Oxidation Tank
- Option 3 – Existing WTP + PAC/Oxidation Tank + Bulk Solids Removal
- Option 4 - Existing WTP + MIEX
- Option 5 – Existing WTP + Lime Clarifier
- Option 6 – Existing WTP + Post filtration side stream NF
- Option 7 – New WTP

The long list of 7 Options were then shortlisted to 4 Options at a workshop with DPIE Water, YVC, NSW Health and consultants in 2020. Four options were shortlisted for further development and assessment. These were:

- Option 1 – Base Case
- Option 3 – Existing WTP + PAC/Oxidation Tank + Bulk Solids Removal
- Option 5 – Existing WTP + Lime Clarifier
- Option 7 – New WTP

Following development and evaluation of the 4 shortlisted options process which involved stakeholders from DPIE Water and NSW Health, a preferred option was identified.

The results of the cost and non-cost assessment and options evaluation show that the highest ranked option was Option 7, the new water treatment plant with lime softening. The second highest ranked option was Option 3, refurbishment of the existing water treatment plant with process enhancement. Lime softening was not included in Option 3.

The estimated project cost for the preferred upgrade was $31.9M (2020) which included a contingency amount of $9.1M.

Council had previously received advice that upgrading of the WTP would involve a capital outlay of approximately $10M. The business case process revealed a larger investment was required to address the identified risks and bring the WTP into compliance. To confirm the justification for the required investment, stakeholders agreed that a peer review of the Options Assessment and preferred option be undertaken. City Water Technologies (CWT) undertook a review of the Hunter H2O assessment and also recommended a new WTP, albeit with inclined plate settlers instead of the clarifiers recommended by Hunter H2O and side-stream membrane softening instead of excess lime softening recommended by Hunter H2O.

The Department of Planning and Environment Water and YVC then discussed further urgent upgrades to be undertaken prior to a decision being made and funding being made available for the new WTP. This constituted the basis for the Stage 1 Upgrade. A Business Case for Stage 1 was prepared and approved in July 2021, and the works were completed in December 2022.

Upon completion of the Stage 1 Upgrade, DPE Water and YVC considered remaining asset and performance risks at the WTP in identifying what further upgrades were required.

4.2 Stage 2 (Detailed Business Case) Shortlist

In March 2023, in consultation with DPE's Housing Acceleration Fund and Infrastructure NSW (Representatives of NSW Treasury) representatives, it was determined that, to ensure a full consideration of financial and non-financial issues were considered, a business case should be prepared to consider the proposed Stage 2 upgrades against the full renewal of the WTP.

The Options considered in this detailed business case have changed somewhat since the 2020 evaluation (refer Appendix E). These changes are in response to the benefits and improvements achieved by the Stage 1 Upgrade investment, recent inclusion of Health Based Targets into the Australian Drinking Water Guidelines and asset condition reviews and inspections undertaken in 2023.

Four upgrade options were developed to cover varying levels of a potential upgrade to Yass WTP from a full plant upgrade, a partial upgrade and no upgrade. The options are:

1. Base case (no upgrade)
2. Risk mitigation upgrade (partial upgrade)
3. WTP augmentation (full plant upgrade)
4. WTP Optimisation

Each option is described in the following Sections of this Business Case. Further detail is contained in the High Level Concept Design which is contained in Appendix F.

The Options developed herein do not include any modification or augmentation of the town water reticulation system.

4.3 Option 1 – Base Case

Option 1 is the base case which reflects the WTP following completion of the Stage 1 Upgrade in December 2022. This option does not address regulatory compliance works or WHS upgrades (e.g., chemical storage and dosing secondary containment). It is therefore not a viable option for the long term plan of the WTP, but it has been prepared for comparison to the other feasible options.

Option 1 retains the treatment process of the existing WTP which consists of the following key process units:

Existing:

- Chemical dosing systems for alum, fluoride, chlorine, polymer, potassium permanganate, soda ash and PAC
- Flocculation tank
- Dissolved air flotation (DAF)
- Media filters
- Clear water tank
- Clear water reservoirs
- Sludge lagoons

Option 1 includes refurbishment of assets in critical condition:

- Renewal of assets awarded low condition ratings from the Yass WTP Upgrade Business Case - M&E Condition Assessment Report (April 2023)
- Minor repairs to the clear water tank and clear water reservoirs within 4 years as detailed in the 2023 inspection report
- Includes filter media replacement of the dual media filters
- Includes renewal of the soda ash batching and dosing systems to maintain operability.

A Process Flow Diagram and site layout are shown in the following figures.

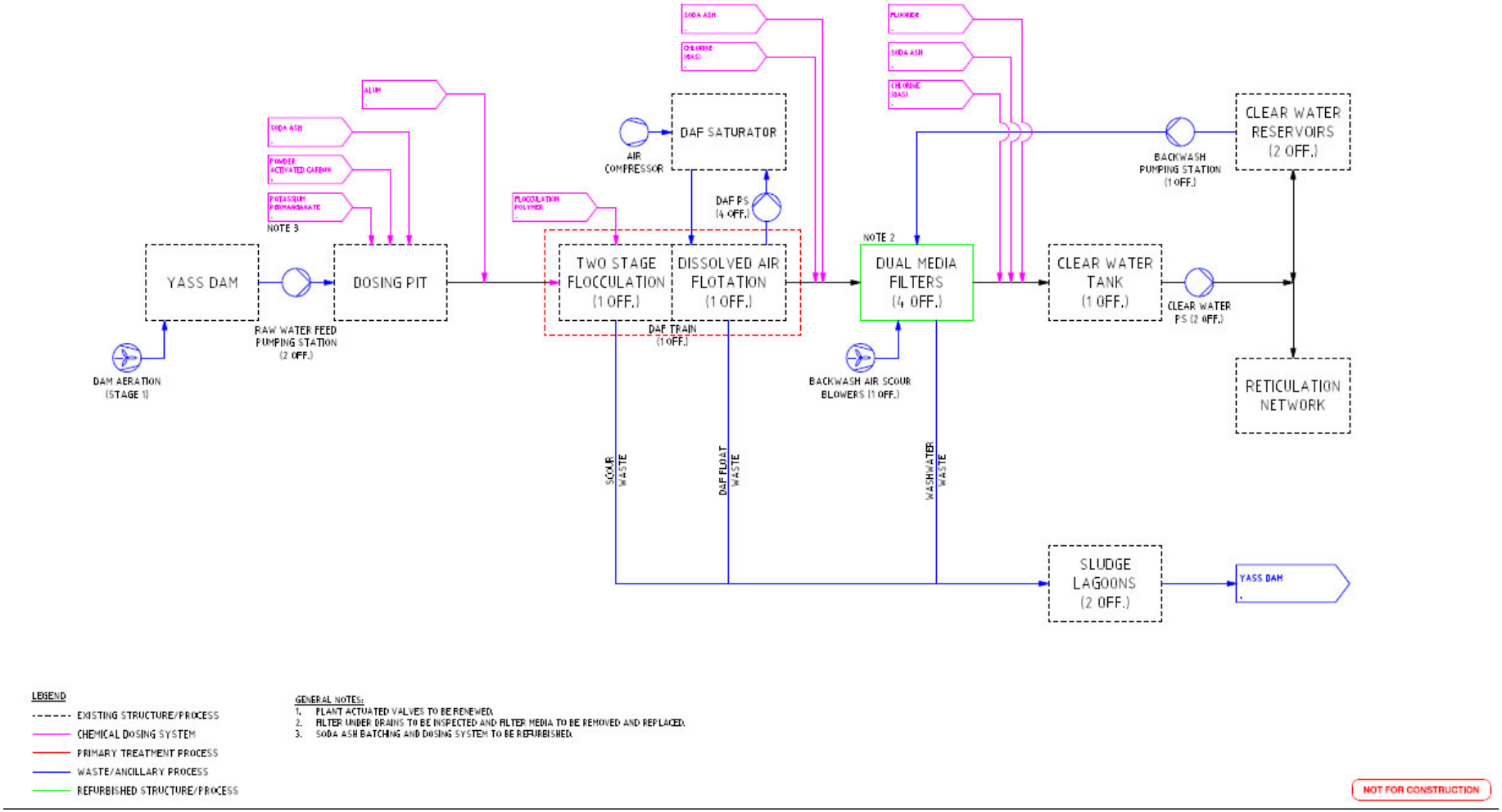


Figure 4-1: Option 1 Process Flow Diagram

Figure 4-2: Option 1 – Existing site layout

4.4 Option 2 – Risk Mitigation Upgrade

Option 2 involves upgrades determined to be of high priority which address water quality and asset risks in the short to medium term and WHS risks. The WTP will expand with new infrastructure mostly constructed on a new land lot at the northern end of the plant. This lot, Lot 1, shown in the registered plan is 8,340 m^2 and belongs to Yass Valley Council as of the 4th of April 2023.

Option 2 consists of the following key process units:

- Existing:
  - Flocculation tank
  - Dissolved air flotation (DAF)
  - Media filters
  - Clear water tank
  - Sludge lagoons
  - Clear water reservoirs (2)
- New:
  - Chemical storage and dosing facility containing chemical dosing systems for alum, sulphuric acid, fluoride, chlorine, polymer, soda ash and PAC
  - Chemical delivery hardstand and heavy vehicle access road
  - UV disinfection
  - Clear water reservoir (1)

Key treatment process augmentation items include:

- The new chemical storage and dosing facility and chemical delivery road will have new chemical systems for:
  - Alum (new bulk storage tank and reuse existing dosing skid)
  - Sulphuric acid (Bullet style IBC based system)
  - Fluoride
  - Chlorine
  - Polymer
  - PAC
  - A new soda ash feeding, batching and dosing system in the existing chemical room. The soda ash silo will be retained.
- Two new blowers for air scouring the dual media filters
- Refurbishment of the existing DAF saturator
- Two new UV disinfection units
- New electrical switchroom with a new permanent backup generator
- New Main Switchboard (MSB) with integrated motor control centre
- New Pole mounted 500kVA transformer
- New PLC control system, telemetry and SCADA system
- A new control and amenities building

- New WTP service water reticulation network and renewal of compressed air distribution piping
- A new 1.5 ML (to be confirmed) Clear Water Reservoir.

Option 2 includes refurbishment of assets in critical condition:

- Renewal of assets awarded low condition ratings from the Yass WTP Upgrade Business Case - M&E Condition Assessment Report (April 2023)
- Minor repairs to the clear water tank and clear water reservoirs within 4 years as detailed in the 2023 inspection report

No definitive position has been reached as to the need for filter media replacement. Investigation undertaken by Hunter H2O in 2020 suggested that media replacement and additional works (as identified by a recommended detailed assessment) would be required. DPE visited site and undertook an inspection in August 2023. YVC then requested water treatment plant design and construction contractors (Water Treatment Australia) to visit site and provide advice on required upgrades. WTA has visited the WTP, but advice regarding required work is not yet available. The filter media was installed in 1990 and is over 30 years old; nominally, media replacement frequency is in the range of 10-25 years. As the WTP Upgrade is intended to provide an asset with a significant extension in asset life it is considered prudent to retain the allowance for filter refurbishment and media replacement in Option 2.

A Process Flow Diagram and site layout are shown in the following figures.

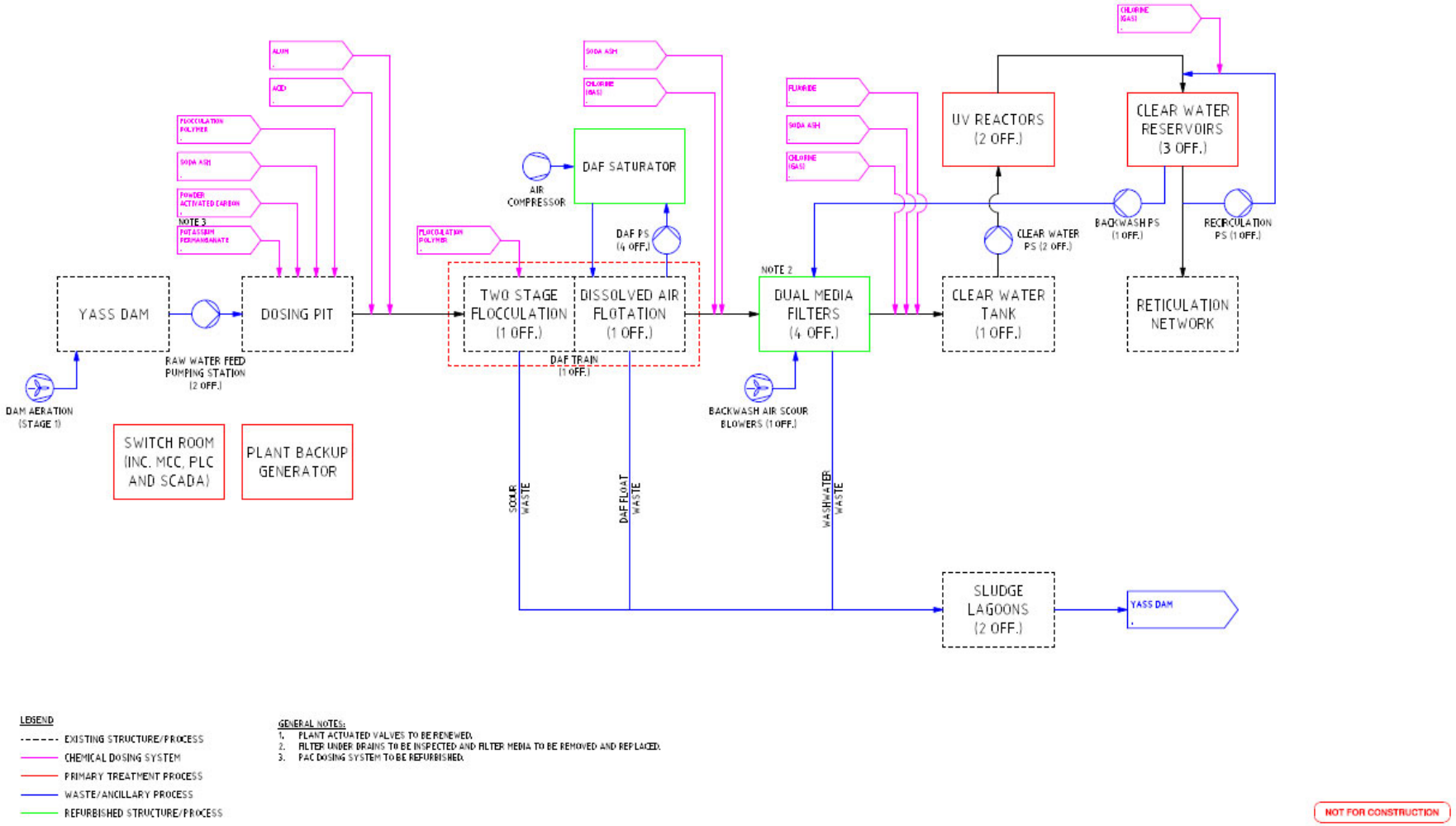


Figure 4-3: Option 2 Process Flow Diagram

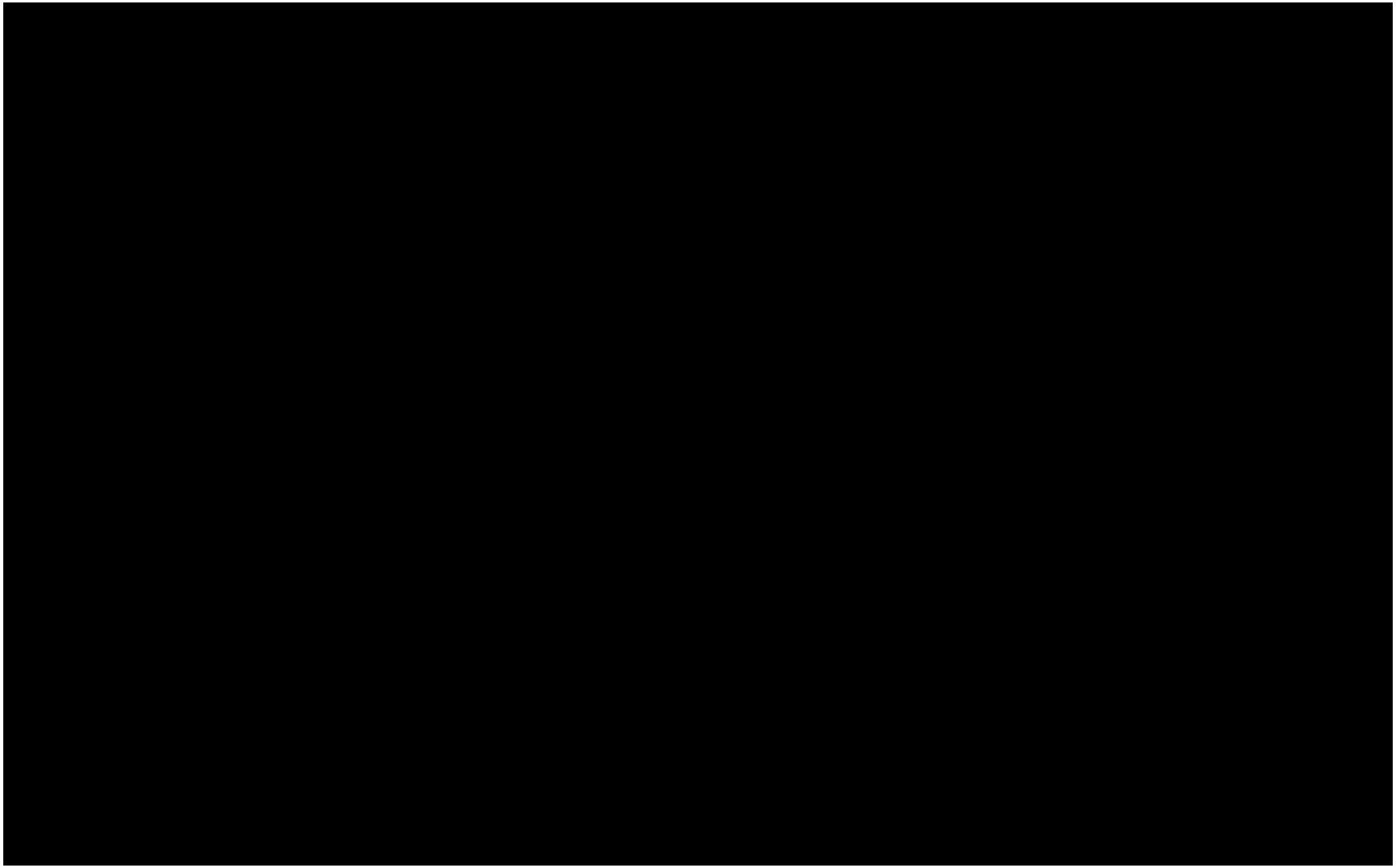


Figure 4-4: Option 2 Site layout

4.5 Option 3 – WTP Augmentation

Option 3 is a new WTP, with reutilisation of the existing Clear Water Storage Tank and Reservoirs to reduce capital expenditure. It adopts a membrane softening process to provide reduction in treated water hardness. Membrane softening is a side-stream process, so that softened and un-softened water is blended to achieve the water quality target.

Option 3 utilises the following treatment process:

- New:
  - Potassium permanganate and PAC contact tank
  - Tapered flocculation followed by two parallel Inclined plate settler (IPS) clarification units
  - Tapered flocculation followed by four Dissolved air flotation on filter (DAFF) units
  - Side stream Reverse osmosis (RO) unit with flow separation and flow blending tanks
  - Clear water tank
  - Treated Water Lift Pump Station
  - Duty/ standby UV disinfection
  - Additional Clear water reservoir (three in total)
  - Backwash recovery tank
  - Supernatant recovery pump station
- Existing:
  - Sludge lagoons

Key plant augmentations include:

- New Electrical and Control system including transformer, switchroom and permanent backup generator
- New Main Switchboard (MSB) with integrated motor control centre
- New Pad mounted Kiosk style 750kVA transformer
- New PLC control system, telemetry and SCADA system
- A new control and amenities building
- A new chemical storage and dosing facility with a new chemical hardstand and chemical detention tank. The facility will have new chemical systems for:
  - Alum (reuse existing dosing skid)
  - Sulphuric acid
  - Fluoride
  - Chlorine
  - Polymer
  - PAC
  - Alkali adjustment (new soda ash or sodium hydroxide system)
  - Potassium permanganate (relocated)
- Two new blowers for air scouring the dual media filters
- New service water reticulation network and compressed air system

- A new 1.5 ML (exact volume to be confirmed) Clear Water Reservoir.

A Process Flow Diagram and site layout are shown in the following figures.

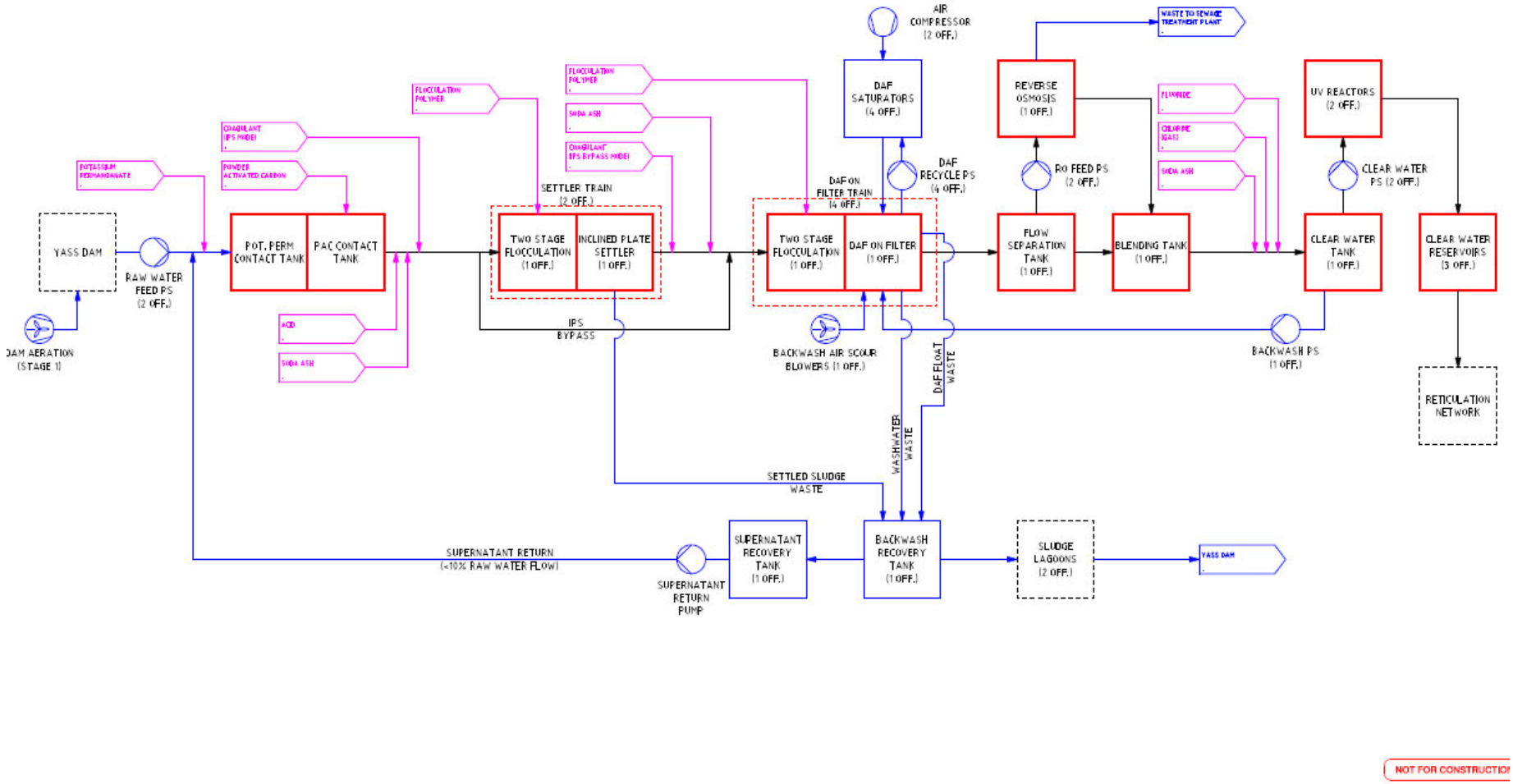


Figure 4-5: Option 3 Process Flow Diagram

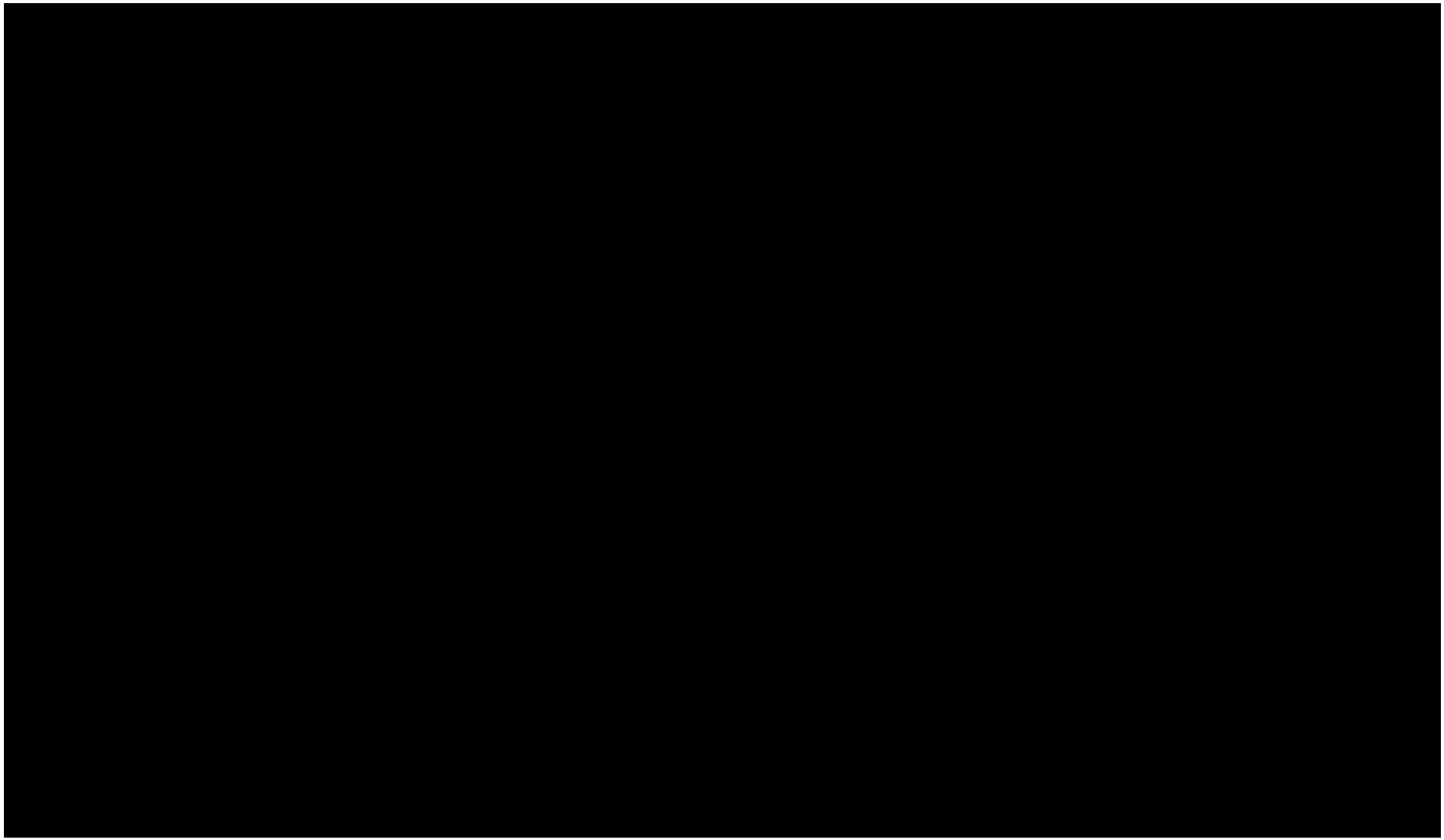


Figure 4-6: Option 3 Site layout

4.6 Option 4 – WTP Optimisation

Option 4 is an augmentation of the existing WTP, with retention of the existing flocculation, dissolved air flotation and filtration systems. The Clear Water Tank is converted to a Backwash Recovery Tank and, while the 1938 WTP is demolished, the third Clear Water Reservoir is not constructed. Softening to provide a reduction in treated water hardness is deferred until a residuals disposal strategy is developed.

Option 4 utilises the following treatment process:

- Existing:
  - Flocculation tank
  - Dissolved air flotation unit
  - 4 dual media filters (mono media replaced with dual media)
  - Potassium permanganate dosing facility
  - PAC dosing facility (building retained, system replaced)
  - Soda ash dosing facility (silo retained, batching and dosing equipment replaced)
  - Clear Water Reservoirs (2)
  - Sludge lagoons
- New:
  - Potassium permanganate and PAC contact tank
  - Inclined plate settler (IPS) clarification unit (1 off) with integral flocculation
  - Clear water tank (~1.2 ML capacity)
  - Clear Water Pump Station
  - Duty/ standby UV disinfection
  - Filter refurbishment, Filter to Waste, Backwash recovery and Supernatant return

Key plant augmentations include:

- New Electrical and Control system including transformer, switchroom and permanent backup generator
- New Main Switchboard (MSB) with integrated motor control centre
- New pole mounted 500kVA transformer
- New PLC control system, telemetry and SCADA system
- A new control and amenities building
- A new chemical storage and dosing facility with a new chemical hardstand and chemical detention tank. The facility will have new chemical systems for:
  - Alum or ACH
  - Sulphuric acid
  - Fluoride
  - Chlorine
  - Polymer
- Two new blowers for air scouring the dual media filters

- New service water reticulation network and compressed air system

Option 4 includes refurbishment of assets in critical condition:

- Renewal of assets awarded low condition ratings from the Yass WTP Upgrade Business Case - M&E Condition Assessment Report (April 2023)
- Minor repairs to the clear water reservoirs within 4 years as detailed in the 2023 inspection report
- Repairs and modifications to the existing 300 kL clear water tank to convert it to backwash recovery tank

No definitive position has been reached as to the need for filter media replacement. Investigation undertaken by Hunter H2O in 2020 suggested that media replacement and additional works (as identified by a recommended detailed assessment) would be required. DPE visited site and undertook an inspection in August 2023. YVC then requested water treatment plant design and construction contractors (Water Treatment Australia) to visit site and provide advice on required upgrades. WTA has visited the WTP but advice is not yet available. The filter media was installed in 1990 and is over 30 years old; nominally media replacement frequency is in the range of 10-25 years. As the WTP Upgrade is intended to provide an asset with a significant extension in asset life it is considered prudent to retain the allowance for filter refurbishment and media replacement in Option 4.

Option 4 includes the demolition of the 1938 WTP which has long been surplus to Council's needs. Part of the building was used for the Yass FM, a community radio station, until 2021. Yass FM has relocated to other premises due to hazards and unsuitability for the occupation of this building. Telecommunications equipment mainly owned by Telstra is located atop the old WTP will be relocated to a new compound at the WTP site. Communication and cooperation for the creation of a new easement for the compound, permitting and approvals and relocation of assets is expected to take several years. Council has commenced negotiations with Telstra regarding relocation and prior to the expiry of lease in August 2028.

Option 4 includes the deferment of installation of a hardness removal/ water softening process at the WTP. There are several reasons for this:

- Willingness to pay – Council will conduct further engagement to understand the community's willingness to pay for construction and operation in addition to the other upgrades
- Technology selection – precipitative softening, ion exchange and membrane softening are all feasible. Further work is required to confirm the appropriate technology considering operability, maintainability and sustainability factors
- Development of a sustainable residual disposal strategy – DPE Water has highlighted that, depending on how much residual is created when softening, the pond at the Yass STP may not have sufficient capacity for extended operation and additional site may be needed. Improved membrane recovery can be achieved with additional capital expense, and this could significantly reduce the amount produced each month. Additionally, Council will consult with NSW EPA regard to sustainable membrane concentrate disposal options.

A Process Flow Diagram and site layout are shown in the following figures.

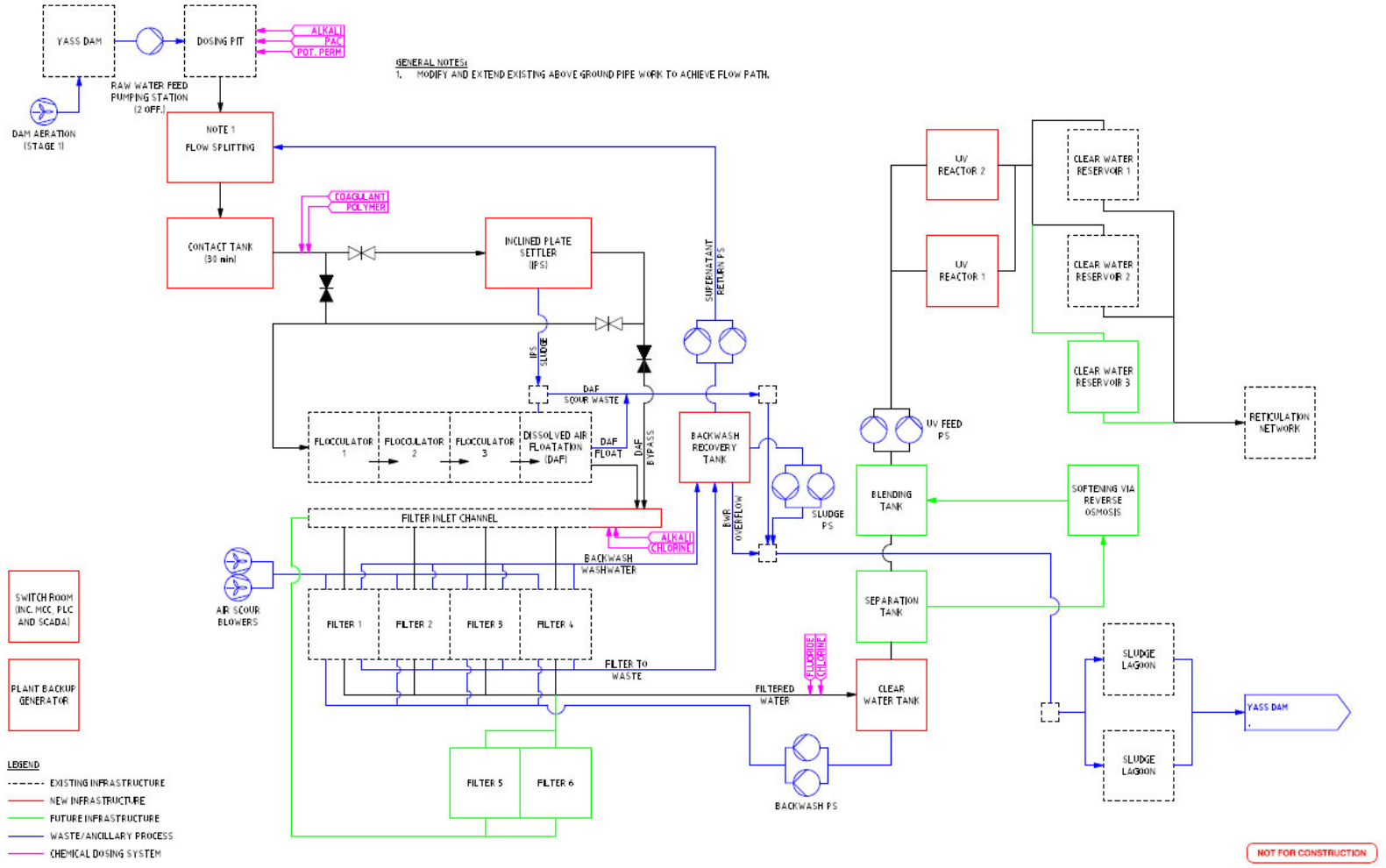


Figure 4-7: Option 4 Process Flow Diagram

Figure 4-8: Option 4 Site layout

4.7 Electrical and Control Upgrades

The below section describes the electrical and control design basis which would be applied commonly to Option 2, 3 and 4. Section 3 of this report can be referred to for details of the existing electrical infrastructure.

The outcome from the Asset Condition Report is that approximately half of the rated electrical assets have been assessed as having a rating of poor or very poor and approximately one third having a rating of very poor.

Key electrical and control features, listed below, are described in the following sections:

- New main switch board with a new permanent backup generator
- Switchboards
- Controllers
- Local Operation Stations
- Cable Reticulation
- Lighting and Power
- Uninterruptible Power Supply
- Fire Detection
- Lightning Protection
- Security
- PLC and SCADA
- Alarm Management

4.7.1 Mains Supply, MSB and Backup Generator

The project works include a provision of new 500 kVA pole mounted transformer (Essential Energy Asset) and Main Switch Board (MSB) to accommodate the increased supply capacity.

Provision shall be made in the MSB for Authority metering equipment connection and Service Protection device requirements as per NSW Service and Installation Rules.

Power factor correction equipment shall be located in the new switch room and meet all statutory requirements. Provision shall be made in for active harmonic filters, the final details to be determined through consultation with Essential Energy.

The MSB shall make provision for motor control hardware to facilitate connection of process drive requirements. The MSB shall include connection to a permanently installed, full demand rated diesel generator with automatic changeover.

The MSB, MCCs, power monitoring and power correction and VSDs shall be housed in a new switchroom.

4.7.2 Switchboards

The new switchboard/s (or motor control centre (MCC)) will satisfy the requirements of the new standard AS6439.1 in terms of construction, segregation and arc flash rating. They will feature Form 4a segregation for larger starters, or the new ‘xbih’ segregation can be employed for the smaller starters. This is provided for both equipment protection and personnel safety. Some chemical system

switchboards could be designed with a lesser degree of segregation, as it would be deemed that the entire system should be isolated prior to any maintenance activities, or when redundant equipment is not required or provided.

The MCC will be housed within a climate controlled switchroom with compliant access and egress and would include spare capacity for future upgrades.

Within the switchroom, larger variable speed drives would be wall mounted. This strategy provides benefits in that greater air flow around the VSD provides improved cooling. It also reduces the size of the required MCC. Furthermore, any major fault of a standalone device should damage that piece of equipment only, leaving the standby VSD and all other equipment within the MCC in operation.

4.7.3 Proprietary Controllers

Certain items of process equipment will feature their own proprietary control panels. These would likely include the following systems:

- Potassium permanganate batching system;
- Polymer batching system;
- PAC dosing system; and
- Fluoride dosing system;
- UV disinfection unit

These systems will feature dedicated panels with local PLC and HMI for visibility and some level of control. They will include a communications link and some hard wired interface to the WTP control system to facilitate the required control and to allow integration into the new WTP SCADA system.

4.7.4 Local Operator Stations

Individual local operator stations will be installed for all stand-alone motors for the purposes of commissioning, maintenance and manual operation. Local operator stations shall include manual start, manual stop, latching stop pushbuttons and in certain cases emergency stop pushbuttons (as required in accordance with a risk assessment to AS4024.1).

Operators shall be able to manually start and stop the pumps in the field once they have been selected to manual control at the switchboard. Manual control of a VSD shall utilise a pre-set speed within the VSD.

4.7.5 Cable Reticulation

As a new location will be provided for the WTP switchboard and due to the age and condition of some of the cabling, all site cabling will be replaced during the upgrade. Consideration will be given to provision of overland cable ladder routes, as opposed to (or to compliment) an underground pit and conduit system. The benefits of this cabling system include ease of installation (if rock is present), alleviates drainage issues and facilitates visual cable checking/prevent rodent damage. An overland system would also assist to avoid clashes with existing or future underground assets.

4.7.6 Lighting

The lighting upgrade or augmentation at Yass WTP would feature high efficiency LED luminaires and located/ mounted in locations that facilitate ease of maintenance, for example wall mounting within

sheds. Where practicable - external fittings will be mounted upon structures, this will reduce the need for lighting poles. Where poles are required, they will utilise swing poles to facilitate ease of access.

The approach to external lighting design is to be minimalistic and generally to provide safe passage for YVC staff and to illuminate relevant process equipment. External lighting will have the ability to be switched via the PLC/SCADA or by motion detectors.

4.7.7 Uninterruptible Power Supply (UPS)

In any upgraded design, a suitably rated UPS would provide a reliable and isolated power supply to PLC, SCADA, remote communications equipment and instrumentation. It is noted that the current communications cabinet features a dedicated UPS, therefore it would be carried through to any programmed or scheduled upgrade.

4.7.8 Fire Detection

A smoke detection system will be provided to monitor the site switchroom (as a minimum). In addition to the switchboard detection, point smoke and thermal detectors can be installed within each building and concealed roof or floor spaces.

4.7.9 Lightning Protection

Historical evidence of strikes at Yass WTP, along with a Lightning Risk Assessment in accordance with AS/NZS 1768 will determine if any new WTP buildings and structures will be required to be protected against lightning.

Any external communication link between buildings would be achieved via fibre optic to minimise damage from lightning, due to transfer potential hazards.

The following items will also be fitted with surge protection devices:

- Switchboards on the incoming supply side
- LV and ELV distribution boards
- Signals from instruments external to buildings
- Telephone lines

4.7.10 Provisions for Installation of PV System

Provisions will be made in the MCC for integration of a grid-feed renewable energy system incorporating roof top photovoltaic (PV) arrays on suitable structures including the control and amenities building, chemical buildings and on new water tanks.

4.7.11 CCTV Monitoring of Facilities

A closed circuit TV system will be provided. Five or six cameras will be located at strategic locations. Cameras will be high resolution colour with tilt, pan and zoom capability. A controller/ video recorder and monitor will be located in the control room. Remote access over Council's WAN will be provided.

4.7.12 Control System PLC

The new centralised CPU PLC rack (make TBC) will be located within a dedicated compartment of the main MCC and be responsible for the control and automation of the entire WTP. Depending on the chosen WTP process option, the layout of the site will likely lend itself to the inclusion of a number of

remote (RIO) racks, this approach will minimise field cabling and also reduce congestion in the Main PLC compartment. Fibre optic cabling shall be utilised for all runs external to a building.

The PLC shall communicate with the SCADA via over an Ethernet connection utilising the PLC proprietary network protocol of the chosen PLC.

4.7.13 SCADA system

[redacted]

4.7.14 Alarm Management

[redacted]

4.7.15 Asset Identification

An important aspect of the electrical, control, safety and asset management systems is the accurate tagging or labelling of equipment. A tagging convention will be developed for physical implementation across all field equipment, switchgear and for use within the WTP control system.

5 VALUE FOR MONEY ASSESSMENT

5.1 Multicriteria Analysis Framework

A multi criteria analysis (MCA) framework was used to assess suitability of each of the shortlisted option to meet the upgrade objectives which includes a criterion for the contribution of each option to housing provision acceleration. The MCA evaluation was based on a number of key assessment criteria which are project specific and reflect the project objectives and important issues that need to be addressed through the decision-making process.

The MCA criteria and weightings were developed in conjunction with key stakeholders. The four options were then scored against the criteria and weighted to come up with an overall score for each.

A summary of the MCA evaluation showing the evaluation criteria and scores can be found in Appendix G.

5.1.1 Non-Cost Evaluation

The Criteria and weightings used in the Stage 1 Business Case were reviewed by stakeholders as part of the Benefits Realisation and Risk Workshop. Stage 2 Non-cost criteria and weightings are shown in Table 5-1.

Table 5-1: Non-Cost Criteria and Weighting

Benefit	WEIGHT
Application of ADWG	***50%***
Achieves CCPs for Chlorine Sensitive Pathogens (viruses, bacteria, amoeba) during raw water quality events	
Achieves CCPs for Chlorine Resistant Pathogens (Cryptosporidium) during raw water quality events	
Provides the tools, systems and personnel to effectively monitor and verify the production of safe drinking water	
Minimises source water or treatment related taste and odour complaints	
Minimises source water or treatment related staining or discolouration complaints	
Minimises source water or treatment related scaling, lathering or staining complaints	
Construction, Operation and Maintenance	***25%***
Minimises Construction related process disruption or reduction in treatment capacity	
Provides full redundancy of critical process units and systems to meet operational and water quality requirements	
Ready availability of personnel, spares or tools needed to ensure WTP availability	
Social, Environmental and Legal	***25%***
Supports acceleration of housing provision in Yass Valley	
Improves consumer trust in the safety and quality of drinking water during operation	

Benefit	WEIGHT
Reuses existing structures and assets	
Can comply with new EPL conditions regarding reduced sludge lagoon discharge (volume and mass) to Yass Dam	
The infrastructure proposed is a suitable solution to manage climate change variability projections	
Eliminates WHS and public safety risk associated with treatment chemical receival, storage, dosing and waste disposal	

Non-cost scoring undertaken by YVC, NSW Health and DPE Water was used to evaluate the options. Results are shown in Table 5-2.

Table 5-2: Non Cost Evaluation Scores

	Benefit	Opt 1	Opt 2	Opt 3	Opt 4	Comments
Supports application of the ADWG Framework for Management of Drinking Water Quality	**Achieves CCPs for Chlorine Sensitive Pathogens (viruses, bacteria, amoeba) during raw water quality events**	0.0	3.0	5.0	5.0	Option 2 lacks FTW and has limited ability to adjust/ control/ monitor the filtered water pH, Cl2 or turb levels and so process upsets can quickly result in issuance of a boiled water event. Opt 3 and 4 provides FTW while Opt 4 has the existing filters. Opt 4 will have a dedicated C.t zone in the new CWT.
	Achieves CCPs for Chlorine Resistant Pathogens (Cryptosporidium) during raw water quality events	0.0	4.0	5.0	5.0	Option 2 lacks FTW and has limited ability to adjust/ control/ monitor the filtered water pH, Cl2 or turb levels and so process upsets can quickly result in issuance of a boil water alert. Option 3 and 4 have FTW and duty standby UV disinfection
	Provides the tools, systems and personnel to effectively monitor and verify the production of safe drinking water	1.0	3.0	4.0	4.0	Opt 4 has the 3 clarification barriers and the filtration step as per Opt 3
	Minimises source water or treatment related taste and odour complaints received by YVC	2.0	3.5	5.0	5.0	Option 3 and 4 provide contact time for adsorption. Option 1 and 2 have only in dam aeration and minimal contact time. Dam aeration effective but Raw Water Events will change WQ characteristics quickly
	Minimises source water or treatment related staining or discolouration complaints received by YVC	2.0	3.5	5.0	5.0	Option 3 and 4 provide contact time for oxidation and pH adjustment. Option 1 and 2 have minimal contact time/ pH control. Dam aeration compressor is duty only. Raw Water Events will change WQ characteristics quickly

	Benefit	Opt 1	Opt 2	Opt 3	Opt 4	Comments
Construction, Operation and Maintenance	**Minimises source water or treatment related scaling, lathering or staining complaints received by YVC**	0.0	0.0	5.0	0.0	Membrane softening (Opt 3) is flexible. Sized for maintaining <200 mg/L of CaCO3 with RW up to 350 mg/L CaCO3. RO unit is ~ 6ML/d as a single pass (75% recovery) and permeate quality of 50 mg/L CaCO3. Could be staged RO rollout in line with WTP production. Softening is deferred for Option 4 subject to technology selection and development of a sustainable residuals management strategy
	Minimises Construction related process disruption or reduction in treatment capacity	5.0	2.0	4.5	2.0	Option 1 has some disruptions (filter refurbishment, soda ash wet end replacement). Option 2 and 4 requires reconnection of all equipment to new power and control system with many interfacing risks and need to sequence the cut-over process. Option 3 allows sequencing and cut over to be performed in a systematic and efficient way. Option 4 requires cutting into the raw water line for feeds to and from the contact tank/ IPS and also modification of the filter inlet race.
	Provides full redundancy of critical process units and systems to meet operational and water quality requirements	1.0	2.0	4.5	4.5	Option 1 has status quo with limited redundancy. Opt 2 has redundant chemical dosing pumps, UV reactors and filters (unavailability would downrate WTP). Option 3 provides redundancy across critical equipment and process units (failure of IPS or DAF filter would result in some downrating). Option 4 has redundancy of clarification units. Existing flocculators and DAF cannot be bypassed without sending raw water directly to CWT. Only existing filters can be by-passed and clarified water wasted to adjust flocculation-clarification process. Once filter is on-line water will be in the CWT & CWR. Out of specification water from filters cannot be wasted without overflowing and pumping out the CWT (send to sludge lagoons)

	Benefit	Opt 1	Opt 2	Opt 3	Opt 4	Comments
	Ready availability of personnel, spares or tools needed to ensure WTP availability	3.0	3.0	3.0	3.0	Relates to organisational resourcing and spares inventory which is not directly influenced by which Option is selected. However full automation and new assets generally require less resourcing than aging assets with limited redundancy
Social, Environmental and Legal	**Improves consumer trust in the safety and quality of drinking water during Operation**	0.0	3.0	4.5	4.0	This is beyond what has been achieved by Stage 1 Upgrade. Option 1 taken as a failure by Council. Option 2 will address many operational issues but will not address the raw water quality challenges during events and create an impression of "nothing has been done" should there be a boil water alert due to a raw water quality event. Option 3 has all of the benefits sought and includes hardness removal. Option 4 has many features that will guarantee acceptable water quality during events, but softening has been deferred unit technology/ environmental issues can be resolved.
	Supports acceleration of housing provision in Yass Valley	0	2.0	4.0	4.0	Option 1 does not support accelerated housing provision as the future state is unchanged compared to the current state. Option 2 provides some improvement in the future state in regard to community confidence and reputation of the Yass water supply. Option 3 and Option 4 provide improvements to water quality and reliability and directly address reputation and confidence issues.
	Reuses existing structures and assets	5.0	5.0	2.0	5.0	Option 1 = all reused Option 2 replaces control and amenities and builds new chlorine, PAC, and switchroom and reuses most of existing plant. Option 3 replaces almost all plant and repurposes CWT, Filter gallery. Option 4 reuses most of existing plant.

Benefit	Opt 1	Opt 2	Opt 3	Opt 4	Comments
Can comply with new EPL conditions regarding reduced sludge lagoon discharge (volume and mass) to Yass Dam	1.0	1.0	4.0	4.0	Backwash water recovery with env discharge possible during extreme rainfall events where rainfall on sludge lagoons leads to discharge.
The infrastructure proposed is a suitable solution to manage climate change variability projections	0.0	1.0	4.0	4.0	Option 1 and 2 provide minimal capability to achieve objective. Option 4 is superior to Option 3 as the expensive softening process is deferred until customer demand, suitable technology, and sustainable residuals management can be achieved.
Eliminates WHS and public safety risk associated with treatment chemical receival, storage, dosing and waste disposal	0.0	4.0	5.0	5.0	Option 1 has no improvements to chemical systems or secondary containment. Option 1 and 2 reuses existing dosing lines and dosing points, some with minimal secondary containment. Options 3 and 4 have new chemical systems, new secondary containment, new chemical dosing lines with secondary containment and protected dosing points.

Results of the evaluation are shown graphically in Figure 5-1. Option 3 scored highest on evaluation of the non-cost benefits provided by each option.

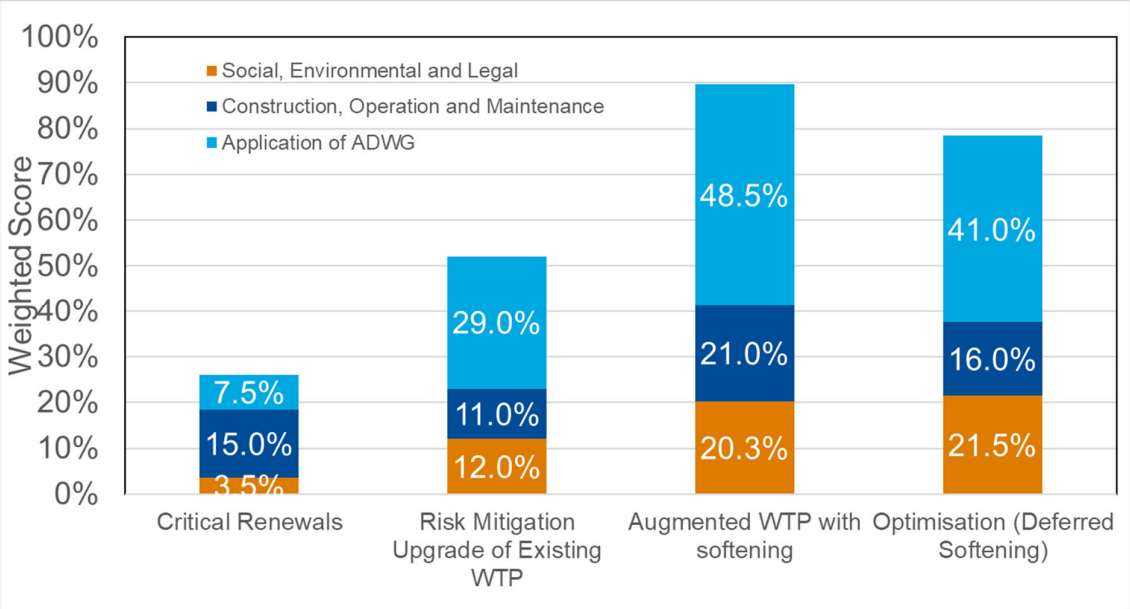


Figure 5-1: Non Cost Scoring Results

Sensitivity testing was undertaken using:

- YVC scores
- Average of YVC, NSW Health and Department of Planning and Environment Water scores
- Criteria Weighting developed at the Benefits Realisation Workshop
- Priority criteria as identified by poll at the Options Evaluation Workshop.

Results are shown in Table 5-3. Sensitivity testing of non-cost scores indicates that Option 3 is preferred although a Scenario of targeted weighting and averaged scores resulted in very little difference between Options 3 and 4.

Table 5-3: Non-cost sensitivity testing

Non-cost Scores	Workshop 1 Weights and YVC Scores	Workshop 1 Weights and Averaged Scores	Workshop 2 Weights and YVC Scores	Workshop 2 Weights and Averaged Scores	Average Non Cost Score
Option 3	89%	84%	93%	95%	90%
Option 4	79%	83%	81%	85%	82%
Rank 1	Option 3	Equal	Option 3	Option 3	Option 3

Subsequent to the September 2023 Options Evaluation workshop, the non-cost assessment was adjusted to consider the accelerated provision of housing as a key objective. Option 1 was assessed by YVC as having non benefit in this regard whole Option 2 had a minor improvement. Options 3 and 4 scored similarly. Overall, the adjustments had no impact on ranking.

5.1.2 Cost Estimation

Cost estimates for the Yass WTP upgrade were developed in June 2023 using a line item bill of quantities and a factor based contingency to achieve a risk-based cost estimate for the project.

Detailed quantities have been extracted from the high level concept design of the proposed upgrade. Costs have been developed using the following primarily first principle methods and the following sources:

- Rawlinson's Construction Handbook 2022 and other first principle estimating tools
- Supplier quotes sourced specifically for the proposed upgrade and this estimate
- Known contract rates and quotes from previous relevant water plant construction projects
- Rates from independent estimator and contractor databases.

Where appropriate, Building Price Indices have been applied to bring rates in line with financially current values.

The cost estimates for total project costs for each option are shown in Table 5-4. Detailed breakdowns are contained in Appendix H 1.

Table 5-4: Option Cost Estimates

OPTION COST SUMMARY	Option 1	Option 2	Option 3	Option 4
CONSTRUCTION BASE ESTIMATE ($M)	$1.2	$16.1	$32.0	$22.2
YVC PROJECT MANAGEMENT COSTS ($M)	$0.06	$1.25	$2.36	$1.96
ESTIMATED PROJECT BASE COST ($M)	$1.3	$17.4	$34.4	$24.1
ESTIMATE P50 PROJECT COST ($M)	$1.5	$22.4	$42.7	$31.2
ESTIMATED P90 PROJECT COST ($M)	$1.7	$25.7	$48.2	$35.9

5.1.3 Cost Weighting and Cost Scores

Net Present Value was used as criteria for assessing the impact of project cost on the options evaluation.

As each of the Options provide different levels of benefits, raw cost estimates were normalised using the non-cost benefits score to derive the Benefit Normalised Score. Benefit Normalised Score is the

ratio of Cost to Benefits achieved ($/ %) and indicates the relative efficiency of achieving the desired project benefits from a unit of investment.

Weighted price score is the weighted Benefit Normalised score less the minimum normalised score divided by the range of scores to give a result between 0 and 1. The Weighted cost scores for each option are shown in Table 5-5.

Table 5-5: Weighted Cost Scores

CRITERIA	WEIGHT	Option 1	Option 2	Option 3	Option 4
Benefit Normalised NPV (30yr@ 7% DF)	100%	0.0%	99.9%	90.5%	100.0%
TOTALS	**100%**	0.0%	99.9%	90.5%	100.0%

The assessment eliminates Option 1 as it was the lowest Benefits Normalised Cost score. Options 2 and 4 have the highest overall Benefits Normalised Cost scores being equal to 100% within the accuracy of the assessment.

5.1.4 Multicriteria Assessment

Results of the multicriteria analysis indicate that Option 3 and Option 4 have the highest overall combination of cost and non-cost scores being equal to ~90% within the accuracy of the assessment.

Table 5-6: MCA Evaluation Results

MCA ANALYSIS - WEIGHTED BENEFITS AND COSTS		Option 1	Option 2	Option 3	Option 4
CRITERIA	**WEIGHT**		**WEIGHTED SCORES**		
Non-Cost	50%	14.3%	27.0%	44.5%	39.5%
Benefit Normalised NPV	50%	0.0%	50.0%	45.2%	50.0%
TOTAL	100%	14.3%	77.0%	89.7%	89.5%
OVERALL RANKING		**4**	**3**	**1**	**2**

The range of multi-criteria scores for the four options is from 14% to 90%. The highest scoring option is Option 3, with a score of 89.7%. However, the second highest scoring option, Option 4, has a score of 89.5%, which is only 0.2% lower than Option 3. Therefore, these two options are considered to be equal within the accuracy of the evaluation.

To identify the preferred option among Option 3 and Option 4, alternate means of analysis were used as presented below, including:

- Conducting a cost-benefit analysis for each option
- Consulting with the stakeholders and experts to elicit their preferences and opinions
- Assessing the risks and uncertainties associated with each option
- Financial analysis to confirm affordability

5.2 Stage 2 CBA

The preceding analysis indicates that Option 1 and Option perform poorly and stakeholders concluded that Option 3 and Option 4 were both viable propositions. The Multi Criteria Analysis was unable to distinguish between Option 3 and Option 4 as to which should be preferred.

A Cost Benefit Analysis (CBA) has been undertaken of the Water Treatment Plant options to compare the economic benefits generated by Option 3 and Option 4 to select the preferred option. Benefits and costs are in real terms; a real discount rate has been applied to reflect the long-term social opportunity cost of capital.

A section is also included on Cost Benefit considerations of wider economic benefits. This reflects the investment seeking funding support from the Housing Acceleration Fund, with Cost Benefit consideration needed of wider economic benefits.

5.2.1 Assumptions

The economics modelling approach is compliant with the Infrastructure Australia (IA) Assessment Framework as well as the NSW Government Election Commitment Ad Hoc Fund Guidelines.

Table 5-7 outlines key assumptions and parameters applied within modelling calculations.

Table 5-7: CBA Assumptions for the Water Treatment Plant

Element	Value	Unit	Notes / Source
Economic Factors			
Price base	FY2022	date	The analysis has been undertaken in real, FY2023 dollars.
Analysis Period	30	years	IA Assessment Framework
Escalation factors	Where inputs were not in the price base year, the parameter was escalated to FY2023.	%	ABS CPI Sydney (Index Numbers; All groups CPI; Sydney; A2325806K)
Project Timeline Inputs			
Capital costs start date	1 July 2025	date	YVC
Construction end date	30 June 2028	months	YVC

Element	Value	Unit	Notes / Source
Operations start date	1 Jan 2024	date	Brownfield upgrade
Discount rate			
Discount rate	5%	%	TPG23-08

5.3 Options

The MCA considered whole of life cost estimates, constructability, operability, sustainability, future proofing, and overall delivery risk. Option 3 and Option 4 were identified as the two preferred options.

5.3.1 Option 3

Option 3 is a new WTP, with reutilisation of the existing Clear Water Tank and Reservoirs to reduce capital expenditure. It adopts a membrane softening process to provide reduction in treated water hardness. Membrane softening is a side-stream process, so that softened and un-softened water is blended to achieve the water quality target.

5.3.2 Option 4

Option 4 is an augmentation of the existing WTP, with retention of the existing flocculation and dissolved air flotation. Filtration systems are renewed and the media replaced. The Clear Water Tank is converted to a Backwash Recovery Tank and, while the 1938 WTP is demolished, the third Clear Water Reservoir is not constructed. Softening to provide a reduction in treated water hardness is deferred until an acceptable treatment process and residuals disposal strategy is developed.

5.3.3 Capital Costs

A summary of capital costs is shown below in Table 5-4.

Table 5-8: Option Project Cost Estimates

OPTION COST SUMMARY	Option 3	Option 4
CONSTRUCTION BASE ESTIMATE ($M)	$32.0	$22.2
YVC PROJECT MANAGEMENT COSTS ($M)	$2.36	$1.96
ESTIMATED PROJECT BASE COST ($M)	$34.4	$24.1
ESTIMATED P50 PROJECT COST ($M)	$42.7	$31.2
ESTIMATED P90 PROJECT COST ($M)	$48.2	$35.9

5.3.4 Operating and Maintenance Costs

The operating (opex) cost profile has been assumed to increase with the projected population growth and the resulting incoming flow. Opex and maintenance costs as provided are inclusive of the following items:

Operational costs

- Power
- Chemicals
- Labour
- Overheads
- Service Contract (for Membrane Softening system)

Maintenance costs

- Maintenance Costs for retained assets after the WTP upgrade, 1.75% p.a.
- Buildings/Civil 0.50% p.a.
- EI&C 2.00% p.a.
- Pipelines 0.25% p.a.
- Mechanical 2.00% p.a.
- ICT/SCADA 0.25% p.a.

Major Maintenance

- Sludge Lagoon desludging
- RO membrane replacement (for Membrane Softening system)
- Compressor replacement
- RO Concentrate disposal (for Membrane Softening system)
- UV lamp replacement

Asset Renewal and Replacement

- Control System Refit

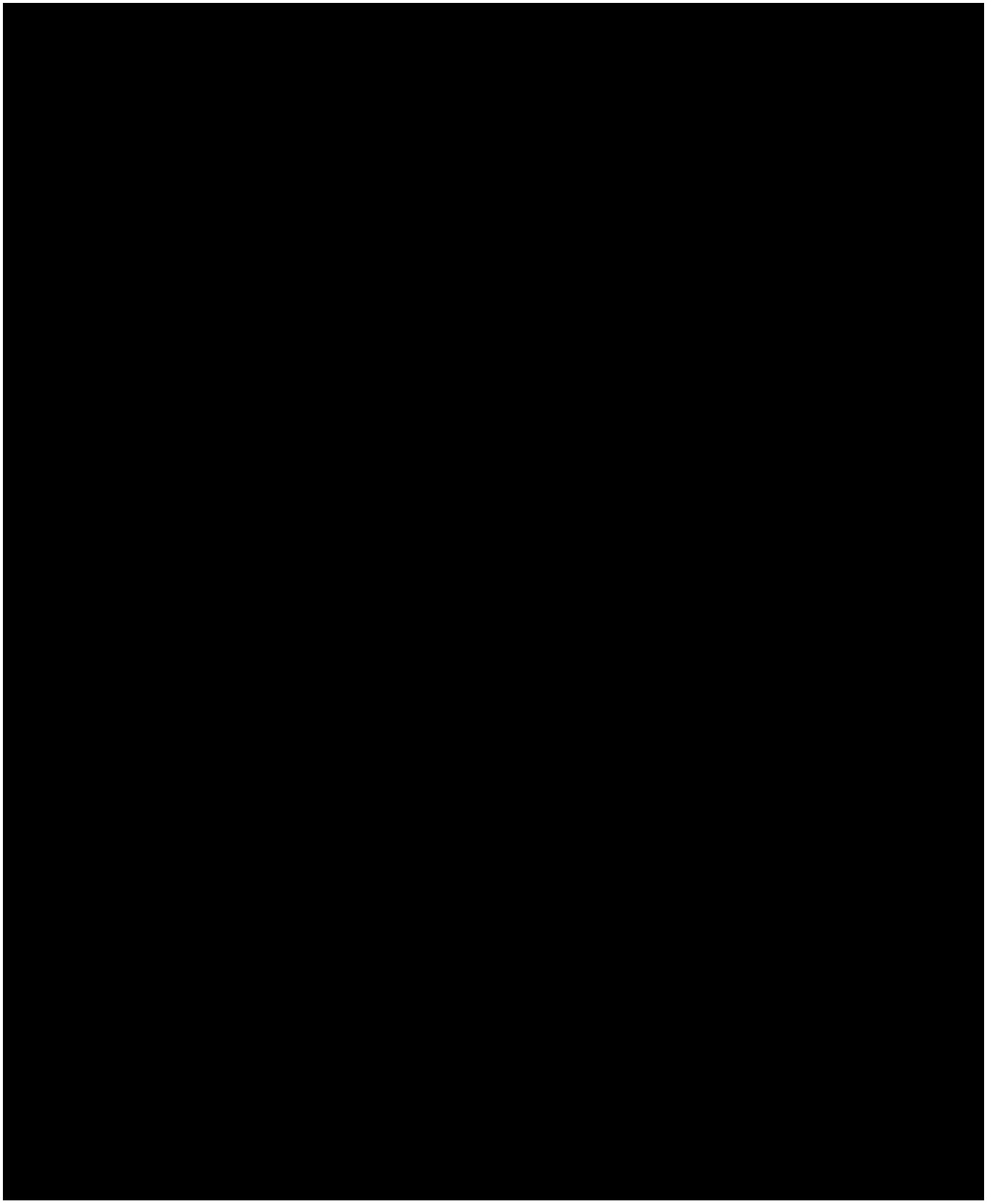
5.3.5 Project Benefits – Water Treatment Plant

The following table summarises the project impacts assessed as part of this economic analysis. A broader assessment of housing and wider community benefits and costs is provided at the conclusion of this report section.

Water Treatment Plan specific benefits are made up of two main benefit groups:

- Failure scenarios: As the current WTP cannot adequately treat high turbidity events, it presents risks around plant failure.
- Downstream benefits: These are the impacts on the wider community that are associated with operating the plant at its current capacity.

Table 5-9: Water Treatment Plant CBA Benefits



Benefit	Description
Failure Scenarios	
Reduced YVC Time responding to complaints, WQ issues, operator callouts, regulator liaison	This benefit captures the reduction in time YVC personnel spend responding to complaints, dealing with water quality issues, increased operator calls outs and liaison with regulators.
Reduced Mains Flushing	This benefit captures the expected reduction in man hours, plant usage and water losses for reducing the amount of mains flushing undertaken by YVC following boiled water or WQ events.
Downstream benefits	
Social Cost of Water Borne Disease	Avoided costs due to water borne disease. Applied to Option 2, 3 and 4 with inclusion of compliant chlorine contact control and UV disinfection. Avoided cost of water borne disease was estimated based on CBA toolkit which utilises the findings of Evaluation of the Country Towns Water Supply and Sewerage Program (2016). A 2015 Trade & Investment Cost-Benefit (CBA) Analysis study found that the total avoided cost in NSW from reduced gastroenteritis cases was estimated to be $957 per case in 2013-14 prices [6]. This cost per case, multiplied by the reduction in cases/person per year, yields the estimated reduced cost per person. Thus, the benefit associated with improved water and sewerage systems (solely from reduced cases of gastroenteritis) would be a reduction in total costs of $303 per head of population covered by each project. A copy of the CBA is contained in Appendix N.
Reduced Community Use of POE/POU Filtration	This benefit captures the reduction in point of entry (POE) or point of use (POU) filters in the community in town water or rainwater tanks
Reduced Community Bottled Water Use	This benefit captures the reduction in bottled water usage in the community
Reduced Hot Water Service Replacement due to calcification	This benefit captures the reduction in hot water service replacement with the implementation of hardness reduction to < the ADWG guideline value
Reduced Small Appliance Replacement due to calcification	This benefit captures the reduction in small appliance replacement with the implementation of hardness reduction to < the ADWG guideline value
Reduced Ruined Laundry Disbenefit	This benefit captures the reduction in community cost associated with ruined laundry associated with elevated soluble manganese concentration in the town water supply

A one-off benefit for the Capital Subsidy for the new Fluoridation plant from NSW Health has been claimed in Year 2.

5.4 Housing and Wider Economic Benefits

Cost Benefit considerations of wider economic benefits are described. By their nature they are all considered downstream benefits from the primary benefits set out in the preceding section.

As Yass Valley's housing market and economy is intertwined with that of Canberra and wider regional New South Wales, reliance is placed on qualitative assessment where quantitative data is not readily available.

5.4.1 Population Growth Targets

Population projections from Government and independent forecasters indicate for the Water Treatment Plant supply area that low growth trajectories are in the order of 1.6% per annum, whereas potential also exists for higher growth scenarios in excess of 2 to 3% growth per annum.

Investment in better Yass Valley water quality is considered a material factor in the ability to track to these higher growth trajectories. Doing so releases a range of associated benefits.

While locational and other factors are in play, parts of Yass Valley within the Water Treatment Plan supply area (and therefore suffering from effects of poor water quality) are shown to been growing more slowly than the averages for Regional NSW[7] (Yass & District 0.6% in the last year and Murrumbateman & District 0.9% compared to Regional NSW averages of more than 1%).

Overall Yass Valley growth to around 43,900 by 2056 is indicated, with 12,400 additional people living in the town of Yass. Development is forecast to ultimately see 5,000 new Yass Valley dwellings in NSW commencing with more than 300 dwellings per year from 2032-2047.

Forecast dwellings and development

Yass Valley	2021		2036		Change between 2021 and 2036	
Area	Number	%	Number	%	Number	%
Yass Valley	**6,809**	**100.0**	**10,405**	**100.0**	**+3,596**	**+52.8**
ACT peri-urban area	810	11.9	2,226	21.4	+1,416	+174.8
Bowning-Bookham-Rural West	807	11.8	910	8.7	+103	+12.8
Gundaroo & District	458	6.7	663	6.4	+205	+44.8
Murrumbateman & District	1,463	21.5	2,334	22.4	+871	+59.5
Yass & District	3,271	48.0	4,272	41.1	+1,001	+30.6

Source: Population and household forecasts, 2021 to 2036, prepared by .id (informed decisions), March 2023.

[6] *NSW Trade & Investment (2014) Country Towns Water Supply and Sewerage Program, Cost-Benefit Analysis of Unfunded Backlog Projects, Unpublished, October 2014*

In terms of housing supply within the Water Treatment Plant supply area, to 2036 higher housing development scenarios (to which that the water quality upgrade will contribute to) exceed the base case lower growth scenario by an average of 45 additional dwellings per annum.

Surveys of residents and anecdotal feedback from prospective investors into the area indicates that the existing poor water quality factors into decision making. Removing this impediment will support an uplift in attractiveness of the area of new housing provision.

All current forecasters scenarios (Government and private sector) anticipate an acceleration of housing demand from the late 2020s. These assume that essential services are available and in place. Moratoriums on growth due to inadequate water quality or supply are not assumed, whereas these remain a risk unless investment in upgrading occurs.

Quantification of how influential water quality is on the housing investment decision making process is limited[8] [9] and not easily quantifiable, however clear indications exist that it is a factor.

Releasing benefits of new housing availability earlier are discussed in the following sections, along with qualitative assessments of how improvement of water quality and reliable supply might influence this.

Housing acceleration related benefits that are supported by improved water quality and reliability are considered across seven benefit groups:

5.4.2 Avoided costs and cost savings

Expected reductions in public and private expenditure directly attributable to the Water Treatment Plant investment are set out in the prior CBA section.

Improved quality and reliability of water have additional consequential cost savings or avoidance related benefits. These arise from enabling higher Yass Valley economic growth trajectory than the base case scenario.

Hastened uplift in economic activity includes effects of accelerated housing supply. Economic theory on agglomeration effects suggests a consequence of faster growth in economic critical mass and activity in Yass Valley will be a lessening to some degree of the need for outward commuting for employment. These travel cost savings and travel risk exposure reductions can be quantified as follows. Over 4900 working residents currently regularly travel outside Yass Valley to work[10] (55%). Attributing a 1% shift in commuting patterns due to an acceleration of opportunities available in Yass Valley (enabled by water quality improvements) produces an annual $800,000 benefit across this commuter group, and unquantified safety and efficiency impacts into wider transport networks. Assuming circa 1 hour travel each way (with the bulk of commutes to Canberra) every 1% reduction in commuting demand (circa 49 workers) will produce in the order of $800,000 of savings or avoided costs on an annual ongoing basis[11].

5.4.3 Government revenue

This benefit focuses on incremental extra revenue to the NSW Government resulting from the Water Treatment Plan initiative that would not be realised in the base case.

Extra revenue is raised from non-NSW parties locating in the Water Treatment Plant supply area sooner and in greater numbers than would otherwise occur. As migration into Yass Valley will continue to be the primary driver of population and housing demand over future forecast periods[12], and with more than half inward migration comes from outside NSW, being able to strengthen the relative attractiveness of areas within the Water Treatment Plant supply area can make a material difference.

Of the estimated 20 dwellings per annum average uplift from base case to the high growth scenario for the WTP supply area this would equate to 150 dwellings over 15 years identifiable as non-NSW parties locating into the area. Indicate revenue for NSW Government would exceed $3.0m (transfer taxes) and circa $1m in additional rate income for Council.

5.4.4 Consumer surplus

When a consumer receives a good or service at a lower price than the maximum they are willing to pay. Availability and quality of water are a service that may increase consumer surplus. This benefit will manifest in prices paid for real estate in Yass Valley townships serviced by the upgraded Water Treatment Plant as they become relatively more attractive.

While no firm quantification of the dollar values is attempted given complexities of housing markets (e.g., relative value to Canberra and other larger centres) with median house prices in Yass NSW at $732,500 (April 2023-March 24) attributing a 1% uplift in value to improved water quality would result in a $7325 lift in overall value per property. This equates to $2.2m over 15 years for the acceleration of 300 properties constructed. If the water quality induced uplift was ascribed to the whole housing market within the Water Treatment Plant catchment this would equate to circa $34m ($7325 uplift x 4731 total existing catchment housing).

5.4.5 Producer surplus

This benefit reflects when the price that a producer receives for a good or service is greater than the cost of production. In the case of housing acceleration, the additional support to the local construction market through demand for new housing is considered likely to generate a producer surplus. Quantification of this has not been attempted.

5.4.6 Labour surplus

This benefit reflects when a worker's actual wages are greater than the minimum, they are willing to accept to do the job (i.e., their reservation wage).

An increase in Yass Valley employment opportunities arises from improved attractiveness as a business location and community to live in (as influenced by increased water quality and reliability). In turn this enables a consequential strengthening of the local employment market and wage pool available in Yass Valley. A labour surplus is considered likely to be a byproduct of the above dynamics as local workers value the advantages of access to local jobs.

5.4.7 Benefits to the broader community

Benefits of the Water Treatment Plant that flow to the community as a whole rather than to the users of the services only are identifiable in the form of accelerated strengthening of the employment and economy relative to the base case scenario.

5.4.8 Residual value

The Water Treatment Plant assets will still have value at the end of the CBA analysis period. The design life of the Yass Valley Water Treatment Plant extends beyond the 30 year CBA analysis period.

5.5 Summary Results

Table 5-10 below summarises the CBA of Options 3 and 4 using a central social discount rate of 5% as mandated by TPG23-08 NSW Government Guide to Cost-Benefit Analysis.

Further details are contained in Appendix H 2- Net Present Value Worksheets.

Table 5-10: Option 3 and 4 Summary Table (PV, $ millions)

Item	Summary ($, thousands)	
	Option 3	**Option 4**
Costs (discounted)		
P50 Project Cost	$39,282	$28,552
Operational and Maintenance Costs	$12,473	$11,710
Benefits (discounted)		
Fluoridation Capital Subsidy	$924	$924
Avoided Social Cost of Water Borne Disease	$41,190	$41,190
Reduced time responding to complaints, WQ issues, operator callouts, regulator liaison	$179	$134
Reduced Use of Household POE/POU Filtration	$4,126	$4,126
Reduced Bottled Water Use	$15,797	$11,848
Reduced community cost for replacement of HWS affected by scale	$4,549	$0
Reduced community cost for replacement of small appliances affected by scale	$4,094	$0
Reduced Mains Flushing	$596	$596
Reduced Ruined Laundry Disbenefit	$2,431	$2,431
Total (discounted)		
Total Costs	$52,256	$40,761
Total Benefits	$67,058	$55,569
Analysis		
Net Present Value (5% d.f)	$14,803	$14,835
BCR	1.28	1.36

5.6 Findings

Over the 30-year appraisal period, Option 4 provided a total benefit value of $40.8 million against a total P50 cost of $31.2 M million, resulting in a BCR of 1.36 and an NPV of $14.8 million.

These results should not be taken as an isolated assessment and should be read in conjunction with the case for change outlined in Section 2 to gain a full appreciation of the benefits gained through the upgrade of Yass WTP.

5.7 Sensitivity Analysis

CBAs are required to include sensitivity analysis that shows the impact on the BCR and NPV of each option when assumptions or parameters are adjusted, to plausible alternative values, to reflect key risks and uncertainties.

Sensitivity testing was undertaken on key assumptions and inputs to reflect the inherent uncertainty associated with the Project and future conditions. This testing included:

- Delays in undertaking the upgrade. A three year delay with and associated capital cost escalation of in nominal costs of 3% was used to investigate the impact in a delay in project due to obtaining regulatory, funding or environmental approvals,
- Capital cost overrun of 10% of the P50 cost estimate
- Discount rate sensitivity test at 3 and 7 per cent as mandated in TPG23-08 NSW Government Guide to Cost-Benefit Analysis

The table below summarises the sensitivity analysis tests undertaken.

Table 5-11: Water Treatment Plant CBA Sensitivity Results

	Option 3		Option 4	
SENSITIVITY	**NPV**	**BCR**	**NPV**	**BCR**
3% Discount Rate	$30.42 M	1.53	$27.48 M	1.61
7% Discount Rate	$4.17 M	1.09	$6.21 M	1.17
5% Discount Rate with 3 Year delay and 3% Escalation	$13.56 M	1.33	$11.46 M	1.34
P50 Capital Cost +10%	$10.58 M	1.19	$11.68 M	1.27

5.8 Economic Analysis Report

Using the information above the results of the economic analysis is shown in Table 5-12.

Table 5-12: Water Treatment Plant CBA Summary

Item	Description	
Project Description	Major upgrade of water treatment facility	
Physical Location.	24 Cooks Hill Road Yass NSW	
Project Context:	The Yass Water Treatment Plant is passed its service life and is need of renewals to meet contemporary requirements. Episodic climate and weather events create situations where the WTP is unable to adequately produce drinking water of acceptable quality. Ongoing performance issues have resulted in a deterioration of consumer trust in the local water utility and could result in below target housing growth and economic development in the LGA.	
Benefits Expected	Compliance with NHMRC Australian Drinking Water Guidelines Compliance with relevant legislation, codes of practice and standards Achieves resilience and reliability Facilitates the acceleration provision of housing Improves customer satisfaction and trust in Council	
Economic Analysis		
Option	**Option 3**	**Option 4 (Preferred Option)**
Project Description and Objectives	Construction of new water treatment plant on land adjacent to existing	Optimisation and renewal of existing plant with construction of new systems
Life	30 years	30 years
Central discount Factor	5%	5%
NPV	$14.8 M	$14.8 M
NPV per $ of Capital Outlay	0.35	0.48
BCR	1.28	1.36
IRR	7.6%	8.2%
Present Value of Costs	$52.3 M	$40/8 M
Sensitivity Analysis		
3% Discount rate BCR	1.53	1.61
7% Discount rate BCR	1.09	1.17
Capital cost + 10% BCR	1.19	1.27
3 Year Delay with 3% escalation BCR	1.33	1.34
Special Considerations	Benefit of reestablishing conditions that enable accelerated provision of housing have not been quantified but are material to the decision to provide the requested funding for the upgrade of the WTP.	

5.9 Reasons for Preferring Option 4

After conducting a cost-benefit analysis on two shortlisted options, Option 3 and Option 4, it was determined that Option 4, the optimisation of the existing WTP, is the preferred choice.

This decision was based on its higher NPV and BCR, as well as the results of sensitivity testing.

Option 4 is seen as the superior solution because it

- reuses existing asset which reduces costs and environmental impacts associated with construction of new process tanks and filters,
- addresses uncertainties surrounding water softening and the disposal of water softening residuals by deferring or avoiding these costs until there is a demonstrated community willingness to pay for capital and operating costs associated with softening

Stakeholders at DPE Water also support the selection of Option 4, as it avoids the premature replacement of treatment assets. Furthermore, Option 4 has a significantly lower capital cost and more favourable operating costs compared to Option 3.

6 FINANCIAL ANALYSIS

6.1 Introduction

Water supply and sewerage businesses are characterised by large variations in annual expenditure as capital assets are progressively purchased, maintained, rehabilitated and replaced. The long life cycle of these assets inevitably means that most water utilities will need to go through cycles of funds accumulation, spending and debt servicing.

The primary objective of financial planning is to model the costs of each of the preferred service options and to determine appropriate funding strategies to ensure that the services remain affordable in the long term. From the customer's perspective, it is important that the cost of service is kept as stable as possible. If the cost of service is consistent (in real terms) over the life cycle of the asset base, both current and future customers are treated in an equitable manner.

A financial appraisal has been undertaken and the quantum of levies required by the various upgrade options at household level has been determined by YVC[13]. As such, the financial appraisal is focused on determining:

- The aggregate annual revenue requirement for YVC to ensure the plant can operate sustainably and without further cash injection throughout its life. The revenue requirement will be used to inform the determination of levies to be charged to ratepayers, which is a separate exercise from this business case, and
- The sustainability of YVC's proposed financing mix for the WTP, including quantifying the equity contribution required from YVC.

The WTP Upgrade options have been financially modelled considering capital and operating costs, and funding for the new assets in consideration of Council's capital works program. The financial report is available in Appendix J and includes further detail on all assumptions and inputs into FINMOD, along with the sensitivity analysis completed.

[13] *Public Works is preparing a FINMOD update for Council's water and sewer funds as part of YVC's IWCM update process.*

[redacted]

6.3 Assumptions

6.3.1 Financial assumptions

[redacted]

[redacted]

6.3.2 Funding for the Upgrade

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]

6.3.3 Growth Forecasts

[redacted]

6.3.4 Revenue assumptions

[redacted]

[redacted]	[redacted]	[redacted]
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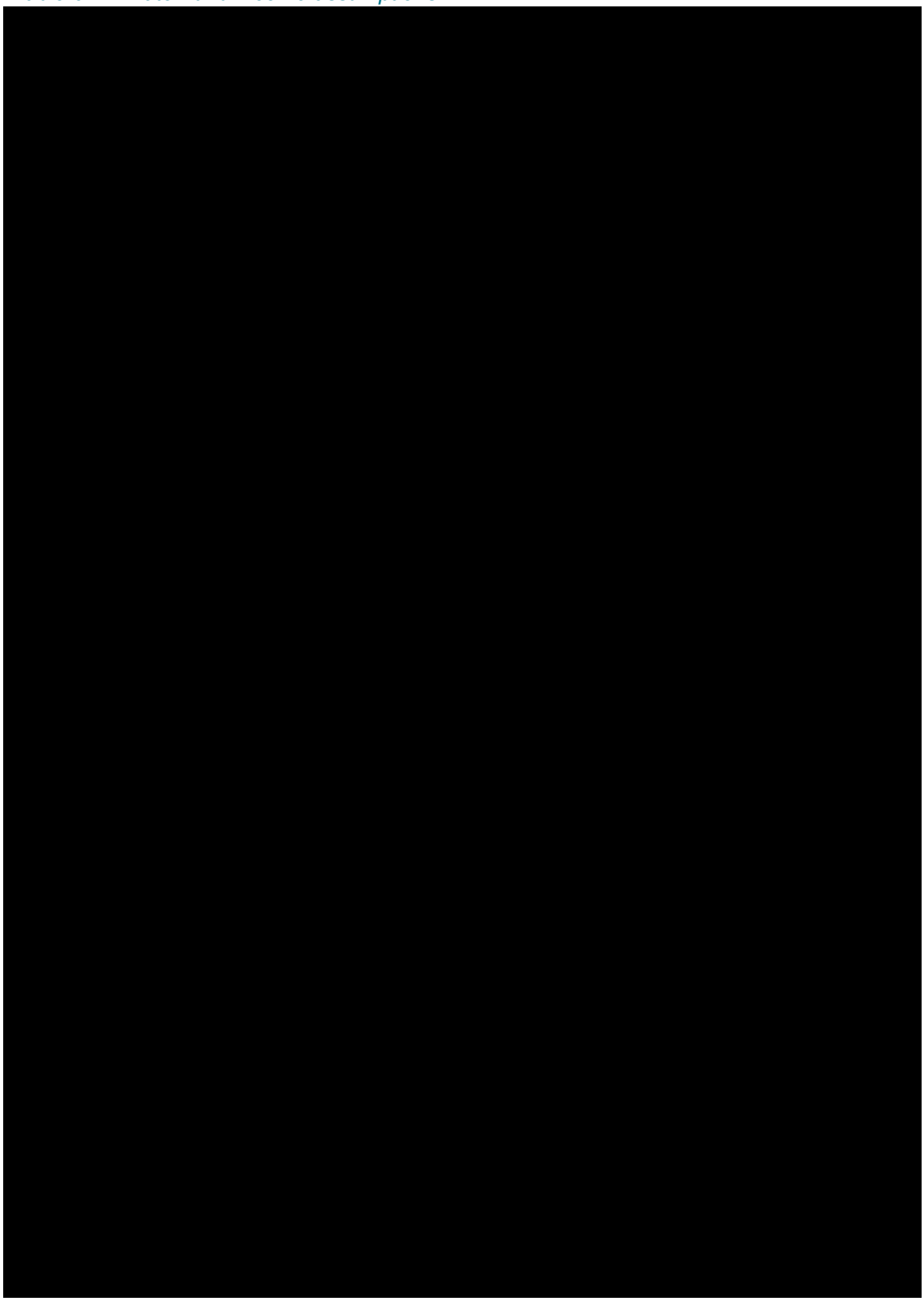
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[14] [redacted]

6.3.5 YVC Income Assumptions

[redacted].

Table 6-4: Water fund income assumptions



6.3.6 Loans Assumptions

[redacted]

Figure 6-1: Forecast YVC required borrowing for each upgrade option

6.3.7 Capital Works

[redacted]

Table 6-5: WTP Upgrade Capital Works Plan

[redacted]

6.3.8 Water Supply Renewals

[redacted]

6.3.9 Operating and Maintenance /costs

[redacted]

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[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

6.4 Financial Summary

[redacted]

[redacted]

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

The staging of new borrowings by YVC to fund each option is shown in Figure 6.2..

[redacted]

Figure 6-2: Comparison of new loans (all options)

[redacted]

Figure 6-3: TRB Comparison- all options

Table 6-8: Option 3 and 4 – required borrowings and impact on TRB

Figure 6-4: YVC Water fund – forecast total capital works, annual O&M costs, total loan repayments and cash reserves (2023 – 2052)

6.4.1 Sensitivity analysis

2.

Table 6-9: Sensitivity of capital costs and borrowings,

[redacted]

Table 6-10: Sensitivity of TRB forecasts

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Table 6-11: Option 4- Financial evaluation with sensitivity

[redacted]

[16] https://water.dpie.nsw.gov.au/local-water-utilities/local-water-utility-performance

Figure 6-5: Option 4 - TRB Sensitivity Results

6.5 Conclusion

A financial analysis of the Yass WTP Upgrade project was conducted as part of a program of works for water projects being completed by the Council in the next 5 years, totalling an estimated investment of $39 million.

A summary of the projects in the program is below which has been included to show what projects are in the water program and their relative influence on affordability. As it can be seen, the Yass WTP project has a large influence on total program cost, Total Residential Bill (TRB) and borrowing requirements. As such, funding is essential to allow YVC mitigate the risks associated with this project.

Table 6-12: Water Program of Works ($'000)

	2023/24	2024/25	2025/26	2026/27	2027/28
Yass WTP Upgrade	-	$500	$16,862	$18,524	$50
Yass Reticulation Upgrade	$200	$950	$950	$900	

The impact of completing this project at the forecast costs as presented in this business case, is in-line with YVC's projections and can be sustainably met, subject to the award of grant funding under Housing Acceleration Fund and the Election Commitment Ad hoc Fund, as defined within this document.

Council has recently had these projects assessed by NSW Public Works for affordability, using FINMOD, and has confirmed that these projects are affordable, based on predicted grant funding and are in-line with the long-term financial strategy.

Information related to affordability for the program is shown in Figure 6-6, where TRB and loan requirements have increased by $300 and $20M respectively to fund the water program.

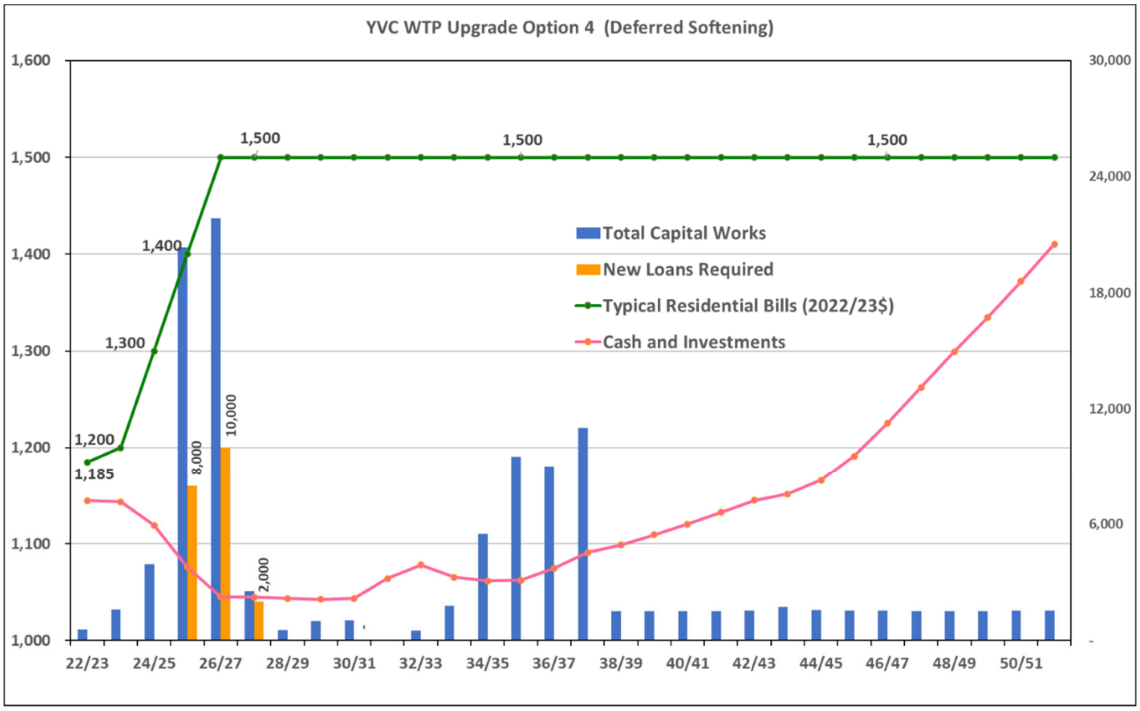

Figure 6-6: Water Fund Option 4 – WTP Upgrade (Deferred Softening Base Case)

The chart shows that the TRB increases to meet the capital, operating and financial expenses of the water program. Grant funding totals $17.1M. Net borrowings of $20M are shown in green. Council's cash and investments initially decline but recover after 2030/31 and are forecast to have a surplus of $20.5 M after 30 years.

The analysis has been centred around developing an understanding of the whole-of-life costs of the Yass WTP, including their quantum and timing. These costs include upfront capital costs, ongoing operating and maintenance costs, and borrowing costs.

Income and revenue streams have been considered and the required increase in revenue from water service fees and usage charges to cover the whole-of-life costs has been calculated.

The impact of completing this project at the forecast costs as presented in this business case, is in-line with YVC's projections and can be sustainably met, subject to the award of grant funding under the NSW Government Election Commitment Ad Hoc Fund, as defined within this document.

With the funding from NSW Government Election Commitment Ad Hoc Fund, the TRB for residents of Yass remains one of the highest in the state. Additional funding is being sought by Council to increase the affordability of the upgrade.

6.6 Preferred option

The results of CBA (option with the highest BCR and NPV) and Financial Analysis (option with the lowest impact on TRB and lowest required new borrowings) identified Option 4 – WTP Optimisation as the preferred option.

The funding requirements identified in the Business Case are:

- HAF $6.6 M
- NSW Government Election Commitment Ad Hoc Fund $10.5M
- NSW Health Fluoridation Capital Subsidy $0.97M

YVC will source additional grant funding or provide debt or equity for the remainder of the project costs.

6.7 Financial Impact Statement

No Financial Impact Statement is required as the ETC of the project is less than $100M and has been assessed as Tier 3 project (referenceTPG22-04, Table 1)

7 COMMERCIAL ANALYSIS

7.1 Current Situation and Business Need

The upgrade project will involve the design, construction, and commissioning of new and upgraded facilities and equipment at the WTP site, as well as the integration of the new systems with the existing ones. The design, construction and commissioning of the WTP upgrade is expected to take approximately two years with a commencement date in 2025.

The WTP upgrade project is a complex and multidisciplinary undertaking that requires external support from competent and experienced engineering companies. For projects of this scale, YVC engages financial, planning and engineering professionals in addition to YVC staff. YVC managed large infrastructure projects such as raising of the Yass Dam (2010-2013) at a cost of $22 million and Yass to Murrumbateman Water Transfer Project (2019-2021) at a cost of $14 million. The WTP upgrade project is technically more complex and is much higher in value. YVC is also planning the upgrade of the Yass Sewage Treatment Plant which will require similar types of involvement and supervision.

YVC will be responsible for:

- Finding a suitable and qualified engineering partner that can meet the technical and engineering requirements, as well as the contractual and financial expectations of YVC.
- Negotiating a fair and balanced contract that allocates the risks and responsibilities appropriately between YVC and the engineering partner and provides incentives for achieving the desired project outcomes and performance standards.
- Managing the project scope, schedule, budget, and quality effectively, and ensuring that any changes or variations are properly evaluated and approved.
- Coordinating and communicating with multiple stakeholders, such as the regulators, the community, the contractor, the suppliers, YVC personnel, and addressing any issues or concerns that may arise during the project implementation.
- Mitigating the potential impacts of the project on the environment, the public health and safety, and the existing water supply and distribution systems, and complying with all the relevant laws and regulations.
- Ensuring that the Constructor delivers the design, construction, and commissioning services in accordance with the agreed specifications and standards, and that the new and upgraded facilities and equipment are integrated seamlessly with the existing ones.
- Verifying and validating the performance and functionality of the new and upgraded WTP and obtaining the necessary approvals and certifications from the regulators and other authorities before putting it into operation.
- Transferring the knowledge and skills from the engineering partner to YVC staff and providing adequate training and support for the operation and maintenance of the new and upgraded WTP.

Therefore, the current situation and business need for YVC is to procure a suitable engineering partner that can deliver the WTP upgrade project on time, within budget, and to the required quality

and performance standards. This will enable YVC to fulfil its obligation to provide essential water and wastewater services to its community and stakeholders.

The engineering partner should have relevant expertise and experience in water treatment plant design and construction, as well as familiarity with the local conditions and regulations. The engineering partner should also be able to work collaboratively and effectively with YVC and other stakeholders, and deliver the project outcomes within the agreed scope, schedule, budget, and quality parameters.

YVC is also planning the upgrade of the Yass Sewage Treatment Plant (STP), which will require similar types and levels of support from an engineering partner. The STP upgrade project is expected to commence after the completion of the WTP upgrade project. The STP upgrade project will also involve the design, construction, and commissioning of new and upgraded facilities and equipment at the STP site, as well as the integration of the new systems with the existing ones.

7.2 Contract Type

The contract systems listed in the NSW Government *Contracts used for construction projects* (NSW Government, July 2008) plus Early Contractor Involvement were used as a starting point for developing the procurement strategy for the WTP Upgrade. The contract systems listed in the document are as follows:

- Construct Only;
- Design Develop & Construct;
- Construction Management;
- Design Novate & Construct;
- Design & Construct;
- Design Construct & Maintain;
- Guaranteed Maximum Price;
- Managing Contractor;
- Alliance (Pure, Competitive, Contracted);
- Commercial Development / Private Public Partnership;
- Early Contractor Involvement (ECI).

A Commercial Development (i.e., Private Public Partnership) and Project Alliance were ruled out as being incompatible with the requirements of the Local Government Act.

In addition, although the work under the contract would be on an operating WTP site with substantial interface with the plant, the risk profile was not considered to be so high as to warrant the adoption of those other contract systems which were developed to manage high and uncertain risks. On that basis Guaranteed Maximum Price, Managing Contractor and Early Contractor Involvement contract systems were eliminated from further consideration.

The remaining contract systems are Design and Construct (D&C), Design Development and Construct (DD&C) and Construct Only.

Given the need to provide tenderers some flexibility and to encourage innovation and cost effective solutions, the most appropriate contract systems are:

- Design & Construct; and

- Design Development & Construct.

A straight Design and Construct Contract is not considered suitable due to the complexity of the project and Council's detailed requirements. It is suggested that Council must maintain a high but not necessarily total level of control over the design to ensure project objectives are met and operation of the WTP is not impacted by the upgrade. Therefore, a Design Development & Construct contract will be developed.

7.3 Market Analysis

Council is generally satisfied that the market has sufficient capability and capacity to undertake the project irrespective of the preferred procurement strategy.

The proposed work incorporates many features of a new build plus the refurbishment of the existing filters and renewal of the DAF system. A number of similar WTP new builds and upgrades have been delivered in NSW in recent years.

Based on currently known project risks, the proposed upgrade is within the capability of the market to deliver, and the project is considered likely to attract interest from tier two contractors.

The Principal Contractor will need to form subcontracts with companies to provide electrical design and construction, process and mechanical design and construction, civil design and construction, systems design and integration, equipment supply, for example:

- CNF and Associates
- Electrical Design and Construction
- Trility
- Safe Group
- Alliance Automation
- Aquatec Maxcon
- Water Treatment Australia
- Xylem

It is expected that a number of experienced and competent Principal Contractors in NSW and Victoria who have worked with these suppliers on previous projects will be interested given the project value and location, for example:

- Gongues Construction PL
- Guidera O'Connor
- Haslen Constructions
- Laurie Curran Water
- Leed Engineering and Construction
- York Construction

7.4 Technical Requirements

Technical requirements for the upgrade will be set out in the Reference Design and the Technical Specifications. These documents and drawings will form the Preliminary Design referenced by the Contract.

The Preliminary Design will include:

- Process and Instrumentation Drawings
- Architectural Drawings
- Mechanical Drawings
- Electrical Drawings
- Civil Drawings

Technical Specifications will include:

- General Specification
- Process and Mechanical Specification
- Functional Specification
- Electrical and Automation Specification
- Civil Specification

7.5 Risk Allocation

Generally, risks will be allocated to the Contractor in the first instance. Site information will be “For Information” rather than “For Reliance” and the Principal will rely on the Contractor as an expert designer and constructor in regard to construction and performance of the Works.

The risk allocation may be negotiated between the Principal and Tenderers prior to award of contract. Risk headings to be discussed include:

Site conditions.

The Principal Contractor will be provided with the following documents or information:

- A geotechnical investigation including bore log analysis.
- A Review of Environmental Factors (undertaken in 2020 and updated during preparation of the Reference Design).
- A detailed electrical and mechanical asset rating report prepared in 2023.
- Survey plan of the site.
- Detailed plans of the existing assets.

Technology Selection

Only equipment or processes successfully deployed on the east coast of Australia will be permitted for incorporation into the Works.

Suppliers must provide evidence of the ability of the offered clarification unit to treat high (>1000 NTU) waters and achieve <5NTU for equipment to be accepted for the works.

Performance

Process performance requirements will be stated in the Specifications together with the design raw water envelope and the treated water quality requirements. Industry standard requirements for the various unit processes will be set out in the Specifications.

Timing

Contract duration will be set during preparation of the Procurement Plan.

Liquidated Damages will be included in the Contract.

Service Interruptions

The Technical Specification will state the maximum interruption time, as well as requirements for prior notification of interruption, planning, fallback measures and risk management.

7.6 Procurement and Delivery Strategy

The key features of the procurement strategy are:

- The project will be delivered using a Design Development and Construct contract using a Principal Contractor
- New South Wales Government GC21 General Conditions of Contract will be used for the contract
- A Reference Design and Specification will be prepared to document the project technical requirements and facilitate review by DPE Water as part of the Section 60 approval process
- Council will invite open Expressions of Interest for the purpose of establishing a list of three prequalified tenderers (plus a reserve) who will be invited to tender for the contract.
- The prequalified tenderers will participate in an Early Tender Involvement process consisting of a small number of briefing workshops to ensure appropriate allocation of risk (technical and commercial) and address constructability issues.
- Tenders for the contract will be evaluated based on price and non-price evaluation criteria.
- Contract and Construction supervision by YVC with support from an organisation contracted to provide these services using AS4122.

It is proposed that a Procurement Workshop will be held in mid 2024 to review the procurement strategy and commence the procurement process. The Workshop will review the project constraints, drivers and major risks which may influence the procurement strategy. The Workshop will commission and endorse the requirements and timing of the following:

- Procurement Plan terms of reference
- Development and implementation of a Probity Plan
- Confirmation of form of contract
- Results of Market Sounding
- Expressions of Interest release timing, scope and returnable requirements.
- Early Tenderer Involvement with discussion and negotiation regarding design requirements, risk allocation and contract terms
- Submission of Priced Tenders

7.6.1 Tendering System

Council's procurement system follows the requirements of the NSW Local Government Act (1993), Local Government (General) Regulation 2005 and associated tendering guidelines (NSW Division of Local Government, 2009).

The Regulation identifies the tendering methods that Council can use. Council may undertake open tendering through public advertisement. Council may also invite selective tenders either by advertising for expressions of interest or by inviting tenders from a pre-prepared list of recognised contractors.

The EOI process can be used establish a prequalified panel of contractors with appropriate capacity and capability and the required insurances.

The EOI process provides market efficiency in terms the tender evaluation process for a project of this nature. An Early Tenderer Involvement (ETI) process can be used to confirm acceptability of contract conditions and to inform tenders of key project features and risks.

Open Expressions of Interest will be invited with the objective of creating a prequalified panel of competent contractors who will tender for the Design Develop and Construct contract. Evaluation of EOIs will be based on non-price criteria.

It is proposed that the prequalified panel will include up to four contractors with one reserve who can be included in the prequalified panel if one of the original tenderers withdraws.

To ensure appropriate risk allocation and improved contract pricing, a "light" ETI process will be developed. The ETI process will provide tenderers with the opportunity to review the proposed contract commercial conditions and preliminary design and attend a site briefing workshop to better understand the risk allocation prior to inviting tenders. The ETI process has the potential to reduce the potential for qualifications to tenders thus reducing the tender evaluation period.

After completion of the ETI, Council will request tenders from the short-listed EOI respondents. Tender evaluation will be based on cost and non-cost factors.

Following finalisation of commercial and technical matters, and in consultation with DPE Water, Council will award a Contract for the Yass WTP Upgrade.

7.7 Statutory and Planning Framework

An assessment of the environmental impacts of the proposed activity has been undertaken against the applicable planning framework and legislation. The key documents reviewed include:

- Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)
- Environmental Planning and Assessment Act 1979 (NSW)
- Environmental Planning and Assessment Regulation 2021 (NSW)
- Biodiversity Conservation Act 2016 (NSW)
- Fisheries Management Act 1994 (NSW)
- State Environmental Planning Policy (Transport and Infrastructure) 2021

The Environmental Planning and Assessment Act 1979 (EP&A Act) regulates development carried out across the State through two primary mechanisms:

- Part 4: Development Applications; or
- Part 5: Activity Approvals.

Overall, the assessment concludes that the proposed activity can be undertaken as development permitted without consent under Part 5 of the EP&A Act, and the environmental impacts can be managed through appropriate mitigation measures. Further details of the legislative assessments have been provided in the sections below.

The relevant considerations under the EP&A Act are as follows:

- Section 5.5(1) of the EP&A Act requires a determining authority to 'examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity'. An REF must be prepared to address the provisions of Section 5.5(1) of the EP&A Act.
- Section 5.5(3) of the EP&A Act is not applicable as the site is not identified as a wilderness area (within the meaning of the Wilderness Act 1987). ▪
- Section 5.6 of the EP&A Act relates to the requirement to address the provisions of the EP&A Regulation. This will be addressed in a Review of Environmental Factors which will be prepared in parallel with the Reference Design for the Upgrade.
- Section 5.7 of the EP&A Act requires an Environmental Impact Statement (EIS) to be prepared if the proposed activity is 'a prescribed activity, an activity of a prescribed kind or an activity that is likely to significantly affect the environment'.

Public Works Advisory's 2019 REF identified the applicable environmental planning instrument for the proposal as the *State Environmental Planning Policy (Infrastructure) 2007* (SEPP(Infrastructure) 2007). Clause 125(3A) of SEPP(Infrastructure) 2007 which allowed development for the purpose of water treatment facilities to be carried out by or on behalf of a public authority without consent on land within a RU1 Primary Production land zoning.

The proposal as it stood in 2019 is similar to that envisaged for the preferred Option in scale and location and would meet the requirements of clause 125(3A). With the T&I SEPP 2021 now in force, the proposal must be assessed against the new provisions.

Division 24 Sect 2.159 (4) of the Transport and Infrastructure SEPP (2021), identifies Development permitted without consent as:

- *Development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in a prescribed zone.*
- Where Section 2.158 defines Prescribed Land as *any of the following land use zones or a land use zone that is equivalent to any of those zones—*
    - *(a) RU1 Primary Production,*
    - *(b) RU2 Rural Landscape,*
    - *(c) RU4 Primary Production Small Lots,*

- *(c1) B7 Business Park, but only for the Port Stephens local government area,*
- *(c1) E4 General Industrial,*
- *(c2) E5 Heavy Industrial,*
- *(d) IN1 General Industrial,*
- *(e) IN3 Heavy Industrial,*
- *(f) SP1 Special Activities,*
- *(g) SP2 Infrastructure.*

- *Under the Yass Valley Local Environment Plan (LEP) 2013, the land area upon which the proposed WTP upgrade site is located is zoned RU1 – Primary Production.*

Therefore, the proposal does not require development consent from the applicable local Council under Part 4 of the EP&A Act . The proposal is instead captured under Part 5 of the Act, which relates to works prescribed by an environmental planning instrument as 'development without consent' when carried out by or on behalf of a public authority.

The definition of a public authority is defined under the EP&A Act as: Public authority means:

(a) A public or local authority constituted by or under an Act, or

(b) A Public Service agency, or

(c) A statutory body representing the Crown, or

(d) A Public Service senior executive within the meaning of the Government Sector Employment Act 2013, or

(e) A statutory State-owned corporation (and its subsidiaries) within the meaning of the State Owned Corporations Act 1989, or

(f) A chief executive officer of a corporation or subsidiary referred to in paragraph (e), or

(g) A person prescribed by the regulations for the purposes of this definition.

Yass Valley Council is a public authority constituted by or under an Act and so a "public authority" as defined in section 1.4 of the EP&A Act. YVC is both the Proponent and the determining authority for the proposal for the purposes of Division 5.1 of the EP&A Act.

8 MANAGEMENT ANALYSIS

8.1 Project Governance

YVC's Manager Water and Wastewater is responsible for the delivery of water and sewer services including operation and maintenance of the Yass WTP and management of the Yass Water Fund. The Manager holds the role of Project Sponsor. As Project Sponsor, the Manager Water and Sewerage is responsible for directing the scope and requirements of the project and approving acceptance of assets within this area.

A Project Management Committee will provide oversight of the project including reviewing progress, project issues and changes.

Project delivery is provided by YVC who will appoint a Project Director and Project Manager for project delivery.

YVC will engage several consultants to assist in delivering the project. These engagements include:

- An Owner's Engineering consultant to prepare the procurement plan, complete the Yass WTP upgrade preliminary design and specifications, Expression of Interest documents, Request for Tender Documents and will provide, technical input during design, construction and commissioning,
- A consultant to prepare a Review of Environmental Factors,
- A consultant to assist with community engagement.

The Proponent recognises that the project options have been developed to a strategic/schematic level which may impact on the design and cost certainty. A Reference Design, REF and Technical Specification will be prepared in 2024 and YVC will commission a detailed cost estimate review prior to procurement of design and construction contractors to ensure the robustness of the base costs and contingency. The results of this cost review will be considered by the Project Steering Committee prior to commencing the Request for Tender process.

YVC will ultimately engage a competent contractor for Yass WTP upgrade design and construction.

The NSW Department of Planning and Environment Water Group will perform a technical review role as part of the NSW Local Government Act Section 60 approval process.

Project roles and responsibilities are further detailed in Table 8-1

Table 8-1: Project roles and responsibilities

Role	Personnel	Responsibilities
Yass Valley Council	Councillors (via Council Meeting)	▪ Approve budget and funding ▪ Approve engagement of service providers (consultants / contractors) engaged by tender ▪ Approval of dealings in land

Role	Personnel	Responsibilities
Project Management Committee (PMC)	Council Executive	▪ Reviewing and approving project deliverables where required by the Project Framework ▪ Approve project budget allocation ▪ Approve gateway and hold point release recommendations ▪ Point of escalation for matters raised by Project Director ▪ Resolve issues outside the Project Director's delegated authority
YVC Project Sponsor	Manager – Water and Wastewater	▪ Endorsing the project scope definition ▪ Endorsing changes to the project scope ▪ Endorsing the Basis of Design ▪ Reviewing deliverables ▪ Liaising with regulators ▪ Approving asset acceptance process (for assets within their control)
YVC Project Director	Director Infrastructure and Assets	▪ Overseeing delivery of the Project ▪ Monitoring project performance ▪ Establish project delivery structure and strategy ▪ Establish project goals and KPIs ▪ Facilitate gateway and hold point reviews and recommend release ▪ Approve communications with external stakeholders and community ▪ Approve project expenditures and cash flow ▪ Approve changes to delivery strategy / approach, scope, schedule, budget ▪ Ensure project controls are implemented and maintained (time, cost, quality, risk) ▪ Approve acceptance of project deliverables (on recommendation by Project Manager) ▪ Point of escalation for matters raised by Project Manager ▪ Resolve issues outside the Project Manager's delegated authority
Project Manager	YVC Manager Water and Wastewater	▪ Delivering the project in accordance with the requirements of the Project Framework and the Project Management Plan ▪ Focal point of all communication ▪ Ensuring that the Project Sponsor, Project Director and PMC are consulted in accordance with the requirements of the Project Framework ▪ Prepare risk-based project budgets and submit for review and approval ▪ Procure service providers as needed ▪ Administer service provider contracts ▪ Ensure service providers comply with Council policies (including Environment, QA, WHS, Sustainability, Procurement) ▪ Undertake audits and reviews in compliance with approved assurance plans ▪ Approve tender evaluation reports and prepare report to Council for resolution ▪ Plan, coordinate, oversee service provider inputs (timetable, cashflow, outputs etc)

Role	Personnel	Responsibilities
		▪ Prepare, implement and manage the approved risk management plan ▪ Oversee (as needed) third party technical reviews ▪ Review and recommend endorsement (acceptance) of project outputs ▪ Monitor and report project progress performance to the Project Director ▪ Prepare regular reports to funding agencies as required ▪ Prepare gateway and hold point release documents ▪ Prepare regulator approval applications / documents ▪ Oversee / coordinate sustainability reviews ▪ Oversee / coordinate stakeholder and community engagement ▪ Ensure project achieves appropriate sustainability outcomes ▪ Ensure project outputs comply with approved objectives and KPIs ▪ Tracking benefits and realisation
Key YVC Project Support Staff	Infrastructure Assets Water and Wastewater WHS Finance Media and Communications	▪ Providing speciality support to the team ▪ Reviewing and advising on Design ▪ Reviewing and advising on assets acceptance process ▪ Reviewing and advising on proposed changes in scope ▪ Providing advice from the IWCM to support the project Business Case ▪ Assisting with the provision of information to support the sustainability ratings
Procurement Support, Design, Technical Construction Input and Commissioning	Engineering Consultancy acting as Owner's Engineer	Design consulting services including: ▪ Reference Design ▪ Technical Specifications ▪ Contract documents ▪ EOI and Tender Period Services ▪ Review Contractor's Design ▪ Construction Phase Services ▪ Commissioning support ▪ Training ▪ Defect management
Independent Technical Review	NSW DPE, Water	▪ Review Contractor's Design ▪ NSW Section 60 approval
Community Engagement Consultant	YVC Engagement Team assisted by Third Party	▪ Undertake community engagement activities as directed by the Project Manager ▪ Maintain complaints register ▪ Maintain project website ▪ Provide customer service first point of enquiry ▪ Prepare and assist in implementing the Stakeholder and Community Engagement Plan

Role	Personnel	Responsibilities
		▪ Provide progress reports as directed by the Project Manager
Contractor	TBA	▪ Design Development and Construction of the works ▪ Provide progress reports as directed by the Project Manager ▪ Commissioning, Proving, Training and Documentation

A Project organisation chart is presented below depicting formal lines of communication, as described in Table 8-1.

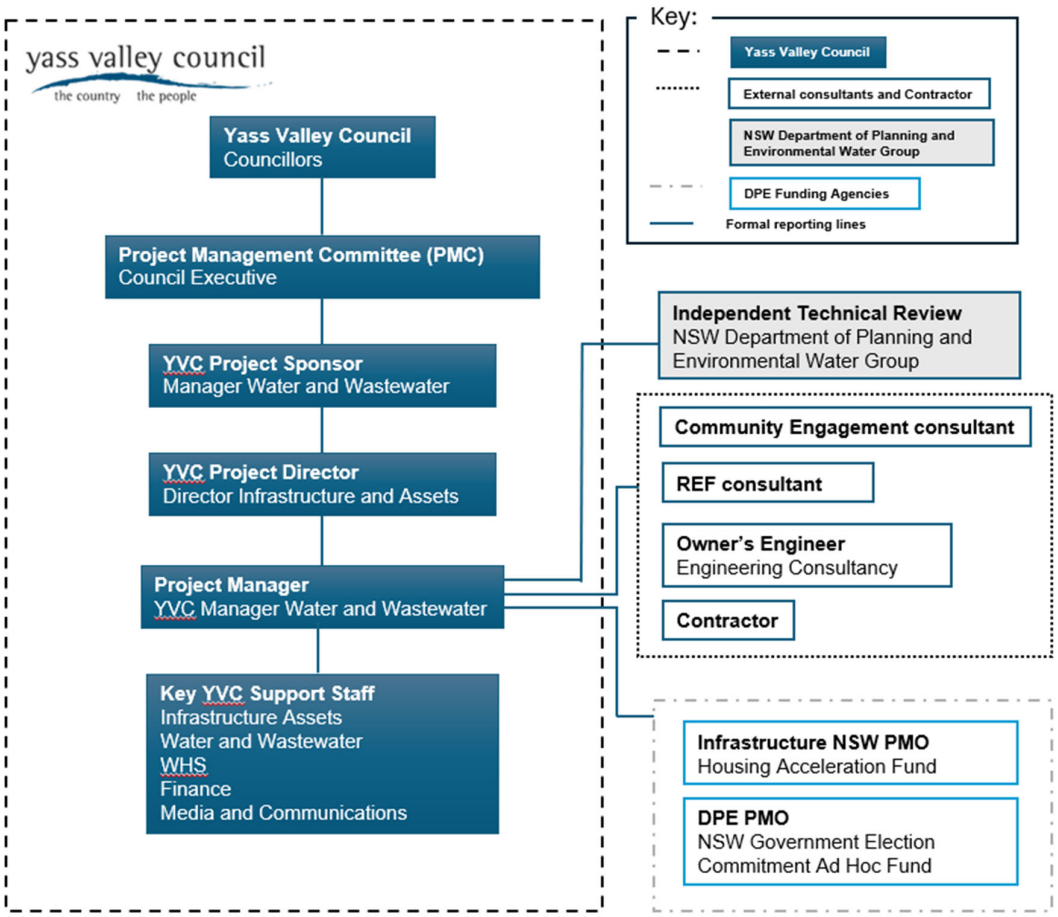

Figure 8-1: Project Organisational Chart

8.2 Project Reporting

Project reporting to funding agencies will be undertaken by YVC's Project Manager.

Under the terms of deeds of agreement with DPE under the Housing Acceleration Fund, YVC reports monthly project progress to the Infrastructure NSW Project Management Office (PMO) via an online portal. All project change requests, including scope, time, and budget, must be lodged with the INSW PMO via the online portal.

For funding provided under the NSW Government Election Commitment Ad Hoc Fund, YVC expect to be required to provide a quarterly progress report to the DPE PMO which includes:

- identification of any major scope changes
- a cost progress update for the phase of funding received:
  - actuals and forecast compared to funding approved
  - draw down on contingency and total contingency remaining
- any known change in total estimated cost of the project
- a schedule progress update showing progress against key milestones (whole of project lifecycle)
- top 10 risks and issues for the project.

Suggested meeting and reporting is presented below

Meeting / Report	Attendees / reviewers	Frequency
Report	PM prepares project progress to the Infrastructure NSW PMO via an online portal	Monthly
Report	PM prepares project progress to DPE PMO	Quarterly
Yass Valley Councilors meeting	List here as appropriate	Bi-monthly
PMC Executive meeting	List here as appropriate	As required?
Internal Project Management meeting	PM, PD, Key YVC team	Fortnightly
Owner's Engineer and YVC PM meeting	Owner's Engineer and YVC PM	Fortnightly
Community Meetings	YVC PM, community representatives, community engagement consultant	As described in stakeholder management plan

More information on project specific reporting requirements will be provided during the finalisation of the funding agreement.

8.3 Project Management Strategy

Project delivery is provided by YVC who will appoint a Project Director and Project Manager for project delivery.

YVC will also engage a competent contractor for Yass WTP upgrade construction.

The NSW Department of Planning and Environment Water Group will perform a technical review role as part of the NSW Local Government Act Section 60 approval process.

YVC with engage a third party Owners Engineer for technical support and assistance throughout the procurement, design, construction and commissioning of the upgrade.

8.3.1 Project Activities

A table of the procurement, construction and completion activities is shown in Table 8-2. Activities and dates will be reviewed and revised during preparation of the Procurement Plan.

A copy of the Gantt Chart is contained in Appendix K.

Table 8-2: Project Activity Timeline

Task Name	Duration	Start	Finish
Assurance and Approval of Business Case	110 days	Mon 15/01/24	Fri 14/06/24
Engage Owner's Engineer	20 days	Mon 26/02/24	Fri 22/03/24
Develop Procurement Plan	22 days	Mon 25/03/24	Tue 23/04/24
Prepare Reference Design and REF	190 days	Mon 25/03/24	Fri 13/12/24
Expression of Interest Process	67 days	Wed 24/04/24	Thu 25/07/24
Early Tenderer Involvement Process	35 days	Mon 16/12/24	Fri 31/01/25
Tendering, Negotiations and Award	110 days	Mon 3/02/25	Fri 4/07/25
Construction	540 days	Mon 7/07/25	Fri 30/07/27
Handover of Main Plant	10 days	Mon 15/02/27	Fri 26/02/27
Project Completion			Mon 2/08/27

8.4 Project Program

Major project milestones are shown in Table 8-3. Milestone Dates will be reviewed and revised during preparation of the Procurement Plan.

Table 8-3: Project milestones

Project Milestones	Target Completion Date
Business Case Approval	June 2024
Funding Deed Executed	Jun 2024
Reference Design, REF and Specification	Nov 2024
Approvals (Section 60 and Part 5 EP&A Act)	Dec 2024
EOI/ ETI Complete	Feb 2025
Tender Closing Date	Apr 2025
Award	July 2025
Contractor's Design	Sep 2025

Project Milestones	Target Completion Date
Construction Completed	Jul 2027
Commissioning	Feb 2027
Handover (Main Plant)	Feb 2027
Post Completion (CWT Conversions etc)	July 2027

8.4.1 Dependencies and Approval Requirements impacting the program

Section 60

The program is dependent on the stated timing of the Business Assurance process and subsequent Ministerial approval. Extended negotiations on Deed milestones of conditions may impact the project schedule.

The Reference Design and Specification must be reviewed and approved as required by Section 60 of the Local Government Act 1990. The minimum review period set by the Department of Planning and Environment is 60 days. Perceived shortcomings in the documentation, or requests for provision of additional information will extend the duration of this process beyond that which has been allowed for in the program.

Section 60 approval is conditional and any changes to the approved reference design must be reviewed and approved by DPE Water. If an alternative is offered by the contract and accepted by YVC, a DPE review is required. The program allows 30 days for this process.

Review of Environmental Factors

A 2019 assessment of the environmental impacts of the proposed activity has been undertaken against the applicable planning framework and legislation. The proposed upgrade is similar in scale, components and location to that considered in the 2019 assessment.

The 2019 assessment concluded that the proposed activity could be undertaken as development permitted without consent under Part 5 of the EP&A Act, and the environmental impacts could be managed through appropriate mitigation measures.

In 2022, The Transport and Infrastructure SEPP came into force. Division 24 Sect 2.159 (4) of the T&I SEPP (2021), identifies Development permitted without consent as:

- *Development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in a prescribed zone.*

Under the Yass Valley Local Environment Plan (LEP) 2013, the land area upon which the proposed WTP upgrade site is located is zoned RU1 – Primary Production which is a “Prescribed Zone” for the purposed on Division 24.

Therefore, the upgrade of the Yass WTP does not require development consent from Council under Part 4 of the EP&A Act . The proposal is instead captured under Part 5 of the Act, which relates to works prescribed by an environmental planning instrument as ‘development without consent’ when carried out by or on behalf of a public authority.

Yass Valley Council is a public authority constituted by or under an Act and so a “public authority” as defined in section 1.4 of the EP&A Act. YVC is both the Proponent and the determining authority for the proposal for the purposes of Division 5.1 of the EP&A Act.

A new REF will be prepared ion 2024 in parallel with preparation of the Reference Design. Consultation with parties providing concurrence will occur in June – October 2024 with finalisation of the REF due by November 2024.

8.5 Resourcing arrangements

The design and construction of the Yass WTP upgrade will be undertaken by a Principal Contractor. YVC’s Water team will manage the construction phase with contract management and technical support from consultants. YVC’s Operations team will continue to operate the existing WTP throughout construction and will participate in training and commissioning of the new facility.

YVC will engage several consultants to assist in delivering the project. These engagements include:

- Owner’s Engineer to complete the Yass WTP upgrade preliminary design and specifications and will provide approvals, technical input during design, construction and commissioning,
- Contract administration and construction supervision will be provided by third parties engaged by YVC.
- A consultant will assist YVC with community engagement.

YVC’s resource plan for the construction and commissioning phase is summarised in Table 8-4.

Table 8-4: Construction phase resource plan

Role	Tasks	Resource	Timing
Project Management	Project management Project reporting Consultant contract administration Coordination with Regulators Coordination of stakeholder and community engagement Coordination with internal QPRC functions	YVC Project Manager	Duration of construction
Principal’s Senior Executive	Input to GC21 contract requirements as required	YVC Director Infrastructure and Assets	Duration of construction
Principal’s Approved Person (PAP)	Contract management – management of the GC21 contract on behalf of the Principal.	YVC and consultant resources	Duration of construction

Role	Tasks	Resource	Timing
	Manage communications, RFI, meetings, issuing instructions, release of hold points GC21 monthly meeting and minutes Assessment of payment claims etc. Progress reporting		
Project/Contract Administration Support	Administration Record keeping	YVC and consultant resources	Duration of construction
Site Engineer	Assist PAP	YVC and consultant resources	Duration of construction
Site Surveillance	Site surveillance and records	YVC and consultant resources	Duration of construction
Survey	Record construction progress Review of Contractor survey submissions Input to works as executed documentation	Consultant / Subcontractor	Duration of construction
Existing WTP Operations Liaison	Coordinate interface with existing operation Site access to existing STP Interruptions to service Input to selected RFI Review of cut-over plans / commissioning Coordination of attendance of operator training Preparation for asset handover to operations team	YVC Operations	Duration of construction
Owner's Engineer	Review tender design Review Contractor's Design Attend workshops Site liaison with YVC contract management Verification that construction conforms to the design Change management Respond to contractor RFI	[redacted]	Duration of Design and construction

Role	Tasks	Resource	Timing
	Clarifications / advice Attend GC21 monthly meetings Visual records / dilapidation Review of shop drawings Witness hold-point inspections Factory acceptance testing Site acceptance testing WAC – As built drawings		
Testing and Commissioning Decommissioning of existing WTP	Prepare commissioning plan Witness the testing and pre-commissioning by Contractor Facilitate proof of performance testing Assist in process optimisation Oversight of decommissioning of the WTP Training	Beca Hunter H2O commissioning team YVC operations staff Contractor resources (leading hand, mechanical, electrical, automation)	Testing and pre-commissioning during construction Commissioning (3-4 month cut-over, commissioning & proof of performance period)

8.6 Change Management

The major changes associated with the project and their management controls are presented in Table 8-5.

Table 8-5: Change elements and management controls

Change Element	Management Controls	Responsible Role
New WTP processes, operation, maintenance and control software	Involvement of operation team in design Plain English functional description Operator training Prepare operation and maintenance manual Engage designer/commissioning team to provide post-handover support	Project Manager
Changes to environmental protection license (EPL) discharge limits, sampling and reporting requirements	Engagement with the EPA to confirm requirements Operator training	Project Manager
Changes to landscape	Include obligations and management practices in OEMP Prepare landscape management plan	Project Manager

Change Element	Management Controls	Responsible Role
	Operator training	
Impacts to YVC's water fund	Develop a business case Undertake a financial analysis to determine the impact of the project on the water fund and the need to increase water rates Incorporate the funding model into the IWCM Plan	Project Manager
Decommissioning of redundant parts of the existing WTP	Develop a decommissioning plan Involve the operational team in development of the decommissioning plan Briefing between the decommissioning team and the operational team on the plan Coordinate between the decommissioning team and operational team	Project Manager
Changes to land boundaries	Liaise with all impacted stakeholders/adjoining landowners to understand their needs Update YVC's records Include any new assets in asset register Include new assets in maintenance schedules Brief operational team on new boundaries and assets	Project Manager
Changes to access roads	Liaise with all impacted stakeholders/adjoining landowners to understand their needs in design development Communicate with stakeholders on implementation timeline and impacts Provide as constructed assert data to the road authority	Project Manager
Changes to site access and security	Liaise with stakeholders who require access to the site to understand their needs during design Operator training Brief other stakeholders who require access on the new protocols/systems including: • Fire and Rescue NSW • State Emergency Service • Essential Energy • NSW Police	Project Manager
Changes to workplace	Involvement of operations team, asset management, field maintenance team and engineering team in preparation of the design to understand needs Operator training	Project Manager

Change Element	Management Controls	Responsible Role
Changes to power supply	Involvement of operational team in preparation of the design Engagement with Essential Energy to confirm requirements Operator training Provision of as constructed asset data to Essential Energy Engagement of suitably qualified maintenance contractors	Project Manager
Changes to waste disposal and recycling	Involvement of operational team, waste team in preparation of the waste and recycling plan Operator training Advise existing waste contractors of changes Engage new waste contractors if required	Project Manager
Changes to operational and maintenance supply needs	Involvement of operational team in preparation of the design Operator training Advise existing supply and maintenance contractors of changes to delivery and maintenance requirements Engage new supply and maintenance contractors if required	Project Manager
Change to YVC assets	Engage with assets team during the design to document asset requirements in contract documentation Provide record of new, decommissioned and altered	Project Manager

8.7 Community Engagement

This Communication and Engagement Strategy (the 'Strategy') has been prepared for Yass Valley Council (YVC, the Council) to provide a framework for communication and engagement activities to support the successful delivery of the Yass Water Treatment Plant Upgrade (Yass WTP). The Strategy will address:

- Communication and engagement objectives
- Communication and engagement approach, tools, and action plan
- Key messages
- Stakeholder analysis
- Roles and responsibilities
- Monitoring, reporting and evaluation.

The Strategy will be used to support Council in facilitating and managing communication and engagement activities. It is a working document and should be updated in response to community and stakeholder feedback and/or changes to the Project plan or scope.

The Strategy provides the approach for communication and community engagement to be undertaken to support the business case application related community education and acceptance, business case approval, funding and approvals, design, construction, commissioning, operational testing, and "go-live" activities to be delivered for the Yass WTP.

The approach recognises the importance of tailoring communication to the project context and needs of identified stakeholder groups, with an aim for transparency about both positive and challenging aspects of the project. This will include the aspect of upgrade funding implications on the community. Key aspects of the project will be considered and coordinated when scheduling the project's communication and engagement activities.

Communication objectives have been developed to form the foundation for effective communication for the commissioning of the infrastructure delivered by the Yass WTP.

The eight objectives as listed below, articulate the benefits from the delivery of the project and will be used as the foundation to design key messaging with the purpose to deliver tailored communication, that engages and connects with stakeholders.

	Communication Objectives
1	Inform and engage with communities on the benefits and the timing of the Yass WTP and how it strategically aligns with various Council and NSW Government policies.
2	Engaging to address the impacts of, and options for, the community paying for the WTP upgrade.
3	Increase and improve education in the community on how water supply is managed within the Yass River, the key challenges, and how this will enhance the quality, continuity, and resilience of supply of drinking water.
4	Seek to identify where the chosen approaches, opportunities, and issues affecting the community can be worked through in a constructive and proactive manner.
5	Develop communication that is clear, concise, planned and tailored to the audience.
6	Use a range of digital and traditional tools to communicate and engagement with community.
7	Provide methods for community to provide feedback; and to understand how their feedback will be addressed.

8.7.1 Key messages

Key messaging has been developed to frame future communication and engagement activities. They are the baseline information that the community and the business should be aware of and are aligned to the communication objectives listed in Table 3. These messages are the 'go-to' for introductory

paragraphs in correspondence, opening lines of conversations, the first few slides in presentations and any media articles.

Consultation with key stakeholder groups and approvals will be adhered to prior to any communication being disseminated. Having a consistent narrative across stakeholder groups will help to shape the story and community adoption of the Yass WTP Upgrade project.

Overarching benefits to the community and the surrounding region for key messaging include:

- Improved attractiveness and ability for new housing and business investment to choose to be in Yass Valley due to improved water quality and reliability.
- Improve treated water quality to meet Australian Drinking Water Guidelines (ADWG) and community expectations.
- Enhance continuity of water supply and quality and ensure the WTP has adequate redundancy to match water supply service levels.
- Enhance flexibility to address potential water quality risks in future and ensure the upgraded WTP complies with relevant standards and regulations.
- Improve resilience to climate change variability in the water supply by upgrading the WTP to manage impacts on raw water quality during extreme weather events.

A copy of the Strategy is contained in Appendix O.

8.8 Benefits Realisation Plan

YVC has prepared a Benefits Management Plan (BMP) that is consistent with the NSW Government Benefits Realisation Management Framework (2018) and supplements the Project Business Case. The BMP outlines the governance structure, benefits and plan to manage, report on and evaluate benefits.

The Benefits Realisation Management Plan guides the water treatment plant upgrade process, focusing on enhancing drinking water quality management. It also acknowledges the contribution to and importance of contributing to acceleration of housing provision in Yass Valley. It involves stakeholder identification, clear objectives, and defining benefits related to health and aesthetics. The upgraded plant aims to achieve compliance with the Australian Drinking Water Guidelines, improve pathogen removal, reduce taste and odour issues, and address safety concerns related to chemical storage and handling. By ensuring stakeholder engagement and adherence to regulations, the upgraded plant can provide safe and high-quality drinking water for the community. A copy of the BMP is contained in Appendix L.

The key project benefits and dis-benefits have been incorporated onto a Benefits Register and include:

Benefits:

- Contribute to acceleration of housing provision in Yass Valley
- Support Application of the Australian Drinking Water Guidelines

- Provides treatment and monitoring to demonstrate management of chlorine sensitive/resistant pathogens (viruses, bacteria, amoeba) during raw water quality events
- Achieves CCPs for Chlorine Resistant Pathogens (Cryptosporidium) during raw water quality events
- Safely manages cyanobacterial toxins
- Provides the tools, systems and personnel to effectively monitor and verify the production of safe drinking water
- Minimises source water or treatment related taste and odour complaints received by YVC
- Minimises source water or treatment related staining or discolouration complaints received by YVC
- Minimises source water or treatment related scaling, lathering or staining complaints received by YVC

- Construction, Operation and Maintenance
  - Minimises Construction related process disruption or reduction in treatment capacity
  - Provides full redundancy of critical process units and systems to meet operational and water quality requirements
- Social, Environmental and Legal
  - Improves consumer trust in the safety and quality of drinking water during Operation
  - Reuses existing structures and assets
  - Can comply with new EPL conditions regarding reduced sludge lagoon discharge (volume and mass) to Yass Dam
  - The infrastructure proposed is a suitable solution to manage climate change variability projections
  - Eliminates WHS and public safety risk associated with treatment chemical receival, storage, dosing and waste disposal

The Project Manager will monitor the implementation of the BMP as the project progresses. Tracking of benefits realisation progress will be recorded by the Project manager in the Benefits Register.

The Project Manager will report on implementation of the BMP as part of the monthly project reporting.

The BMP will be reviewed:

- With any review of the Project Management Plan and/or risk management plan
- Following any changes to the project scope
- when preparing Project Evaluation Reports

8.9 Risk Management Strategy

A project risk register has been maintained since 2019. A copy of the Project Risk Register is contained in Appendix M.

The risk register includes the following key elements:

- risk ID (this is a unique identifier)
- entry date (into risk register)
- risk category
- description of the risk
- risk assessment information, such as:
    - the worst-case consequence, likelihood, and risk level:
    - the current controls and their effectiveness
    - the current consequence likelihood and risk level
    - whether the risk is acceptable or tolerable
    - additional treatments if the risk is not acceptable or tolerable
    - the residual risk level once additional treatments have been implemented
- risk owner – who is responsible for managing the risk
- monitoring information – how and when the risk and its controls will be reviewed and reported
- the date the risk register was last updated

The risk register has been updated at key stages of the project. The most recent update was in September 2023 where the top five project risks were identified by the Steering Committee.

The Risk Register will be reviewed and updated during preparation of the Procurement Plan and will remain a living document throughout the project. Risk arising during preparation of the Reference Design, Early Tenderer Involvement, Contract Negotiations, Contractor Monitoring and Reporting, Contractor Design and Safety in Design activities will all feed into the Risk Register.

8.10 Project Evaluation Plan

The Project Evaluation Plan will assess how effectively the project achieved its objectives. Both evaluation of the process and evaluation of the outcomes achieved by reference to the Benefits realization Plan.

It is noted that changes in water quality sought by the upgrade may not be immediately experiences by consumers due to time for water to change over in the large reticulation system and the impact of the poor condition of the town water mains on consumer experiences. Also, one of the key project benefits sought is to improve consumer trust in the Council's ability to provide a safe and palatable water supply. Changes in community attitudes and sentiment will take time to be observed.

Similarly, the ability of improved water quality and reduction in frequency of poor water quality evnts to translate into medium or high housing development forecasts will take several years to become apparent.

The evaluation plan considers both processes and outcomes.

Process evaluation

Evaluation of how the project was delivered, including efficiency, quality, and customer satisfaction. GC21 includes a Contractor Performance evaluation and reporting system which will be implemented during the project and a performance report completed at the project's end by the Project Manager. Parameters to be evaluated include:

- Cost Management
- Time Management
- Standard of Work
- Outcomes of external audits
- Personnel
- Subcontractor performance
- Contract administration
- Claims
- Co-operative relations
- Design
- WH&S
- Reliability of Operation
- Environmental Management
- Community Relations

Outcome evaluation

The Evaluation will determine whether the project caused demonstrable effects. Based on an assessment 2 years after handover, the Project Manager will:

- Review and report on housing development applications in consultation with the relevant YVC officer,
- consult with operators and maintenance personnel,
- seek information from community liaison officers of Council, and
- commission annual consumer satisfaction surveys.

Appendix A. Raw Water Quality

Appendix B. WTP Performance Review and Asset Rating (2023)

Appendix C. WTP Capacity Assessment (2020)

Appendix D. YVC Response to DPIE Comments on CWT report

Appendix E. Options Identification Meeting Minutes

Appendix F. High Level Concept Design

Appendix G. Multicriteria Analysis

Appendix H. 1- Cost Estimation

Appendix H. 2 – Economic Analysis

Appendix I. Customer Survey (2023)

Appendix J. Financial Analysis

Appendix K. Project Program

Appendix L. Benefits Realisation

Appendix M. Project Risk Register

Appendix N. Extract from Country Towns Water Supply and Sewerage Program - Cost-Benefit Analysis of Unfunded Backlog Projects

Appendix O. Community Engagement Strategy