To:	Kuga Kugaprasatham Manager Water and Wastewater Yass Valley Council	From:	Mark Dawson Principal Process Engineer Beca HunterH2O
Copy to:	Nathan Cooke Director Yass Valley Council	Date:	2 April 2024
Subject:	**Yass WTP Upgrade Business Case – Benefits and Risk Workshop Minutes**		

Contents

1 Introduction 1
2 Objectives of the Workshop 1
3 Background 2
4 Problem Definition 5
4.1 2020 WTP Review 5
4.2 2023 Mechanical and Electrical Asset Rating 6
4.3 Stage 1 Upgrade Performance Review 7
4.4 WTP Performance Review 9
5 Options Identification 9
6 Benefits Realisation Management Framework 11
6.1 Benefits Realisation Strategy 11
6.2 Stakeholders 11
6.3 Benefits Analysis 12
7 Attachments 15

1 Introduction

A Benefits and Risk Workshop was held on 7 August 2023 to:

- Outline the non-financial assessment framework that will be utilised in determining the most appropriate upgrade pathway for Yass WTP
- Provide stakeholders with information relating to risks and benefits associated with the three options being considered

2 Objectives of the Workshop

- Consider the benefits within the context of the BRMF
- Conduct Risk assessment of the project within the context of IOS31000

It is worth noting that this was NOT an options analysis workshop but the outcomes of this workshop were used to differentiate BETWEEN the options being considered.

Workshop Agenda

Topic	Start Date/Time	Finish Date/Time
Welcome, Introductions and Working Agreement	9:30	9:45
Benefits Realisation Framework and the Yass Business Case • Background • Stakeholders • Objectives • Benefits	9:45	10:30
Break	10:30	10:40
Benefits Analysis • Map Benefits to Objectives • Business Problems review • Three Column Analysis	10:40	12:20
Outcome Wrap Up	12:20	12:30
Lunch	12:30	1:00
Risks • Review existing risk profile • Identification of new Risks	1:00	2:00
Break	2:00	2:10
Risks • Consolidation • Prioritisation • *(We will link treatment back to benefits post workshop and update the RR)*	2:10	2:50
Wrap Up	2:50	3:00

3 Attendees

YVC

Nathan Cooke <ncooke@yass.nsw.gov.au>;

Kuga Kugaprasatham <KKugaprasatham@yass.nsw.gov.au>;

NSW Health

Tabitha Holliday (Murrumbidgee LHD) <Tabitha.Holliday@health.nsw.gov.au>;

DPE Water

Bill Ho <bill.ho@dpie.nsw.gov.au>;

Michael Holmes Michael.Holmes@dpie.nsw.gov.au

Andrew Sloan <andrew.sloan@dpie.nsw.gov.au>;

DPE (HAF/ INSW)

Alan Ngo <Alan.Ngo@planning.nsw.gov.au>;

ishara.warakagoda@dpie.nsw.gov.au;

Carla Antunes <Carla.Antunes@dpie.nsw.gov.au>

BecaHunter H2O

Mark Dawson mark.dawson@beca.com

Jo Preston <Jo.Preston@beca.com>;

4 Background

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.

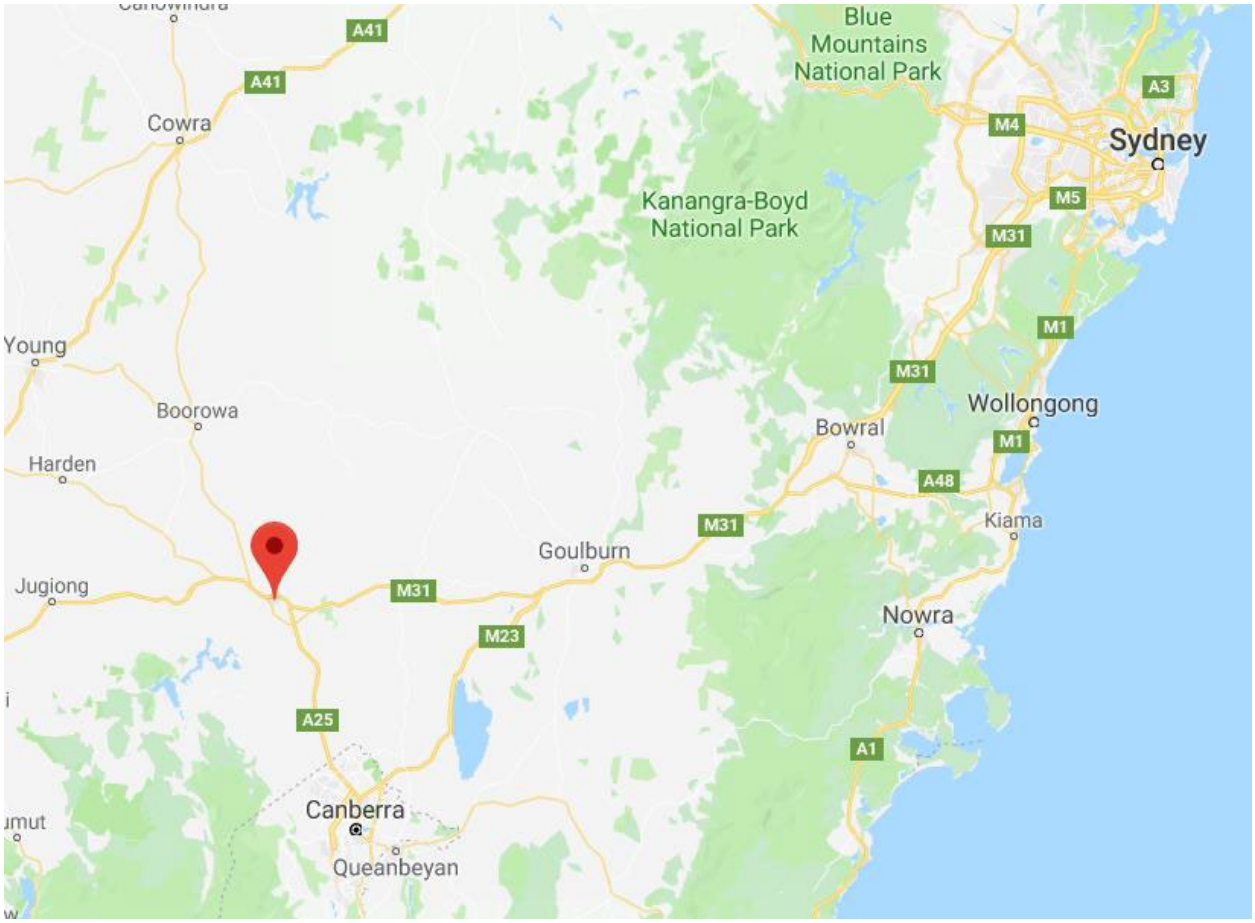


Figure 3-1: Location map for Yass, NSW (Google maps)

The Yass Dam is an on-river storage on the Yass River and acts as the main source of Yass Water Supply System.

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.

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 augmented 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. The WTP has a stated capacity of 13 ML/day. Figure 3-2 shows the location of the Yass WTP relative to Yass Dam.

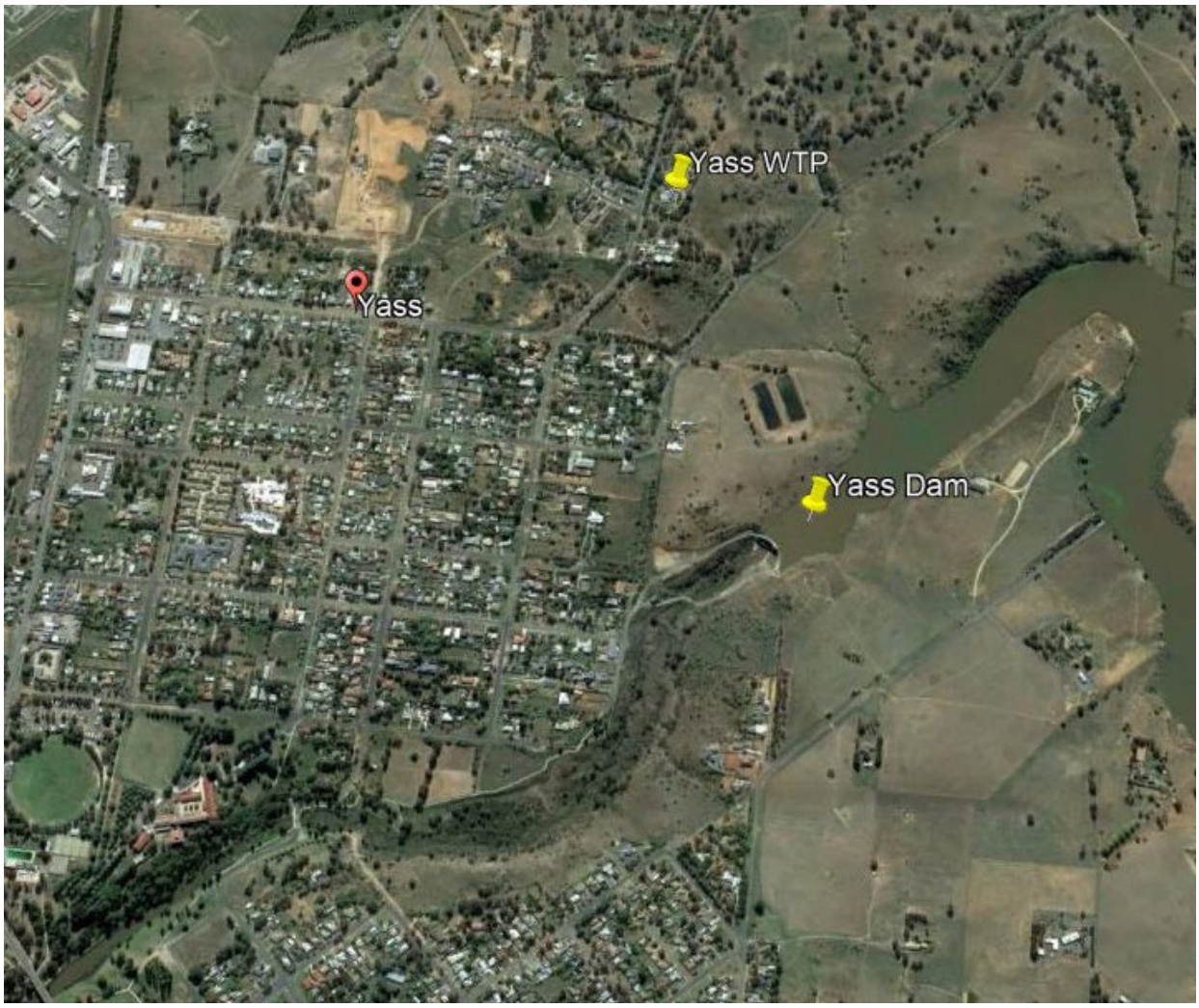


Figure 3-2: Location of Yass WTP and Yass Dam

The raw water in Yass has historically been associated with high hardness which results in poor palatability, and discolouration of the drinking water due to iron and manganese[1]. It is also understood that recent analysis has indicated that the raw water also has had high total dissolved solids, and colour (organic matter). Presence of these materials in the Yass water supply can be attributed to the geology, hydrology and anthropogenic activities within the Yass River catchment. The quality of water in the Yass River has been deteriorating and the trend may continue in future.

The Integrated Water Cycle Management (IWCM) Strategy Plan (2008) and subsequent reports by City Water Technology (2014) and Public Works Advisory (2016) indicated that a large number of Yass residents are dissatisfied with the water quality and the concentrations of total dissolved solids (TDS) and total hardness which frequently exceed the aesthetic guideline value contained in the 2016 Australian Drinking Water Guidelines (ADWG). The 2008 IWCM highlighted that the Yass WTP upgrade contemplates the addition of a softening process in order to combat the hardness issues. The automation of the existing (manual) Powdered Activated Carbon (PAC) dosing system to address taste and odour was also considered.

YVC has been receiving an increasing number of water quality complaints from Yass residents during extreme events and it is understood that there is a persistent customer demand for the Council to address the water quality issues. Additional infrastructure is required in order to improve the potable water quality.

[1] Public Works Advisory (2019) Yass Water Treatment Plant Upgrade Review of Environmental Factors. Report ISR18152

Beca Hunter H2O have considered the options previously considered and consulted with YVC and DPE Water regarding the previously completed options reports and agree on preferred unit operations for the augmentation of Yass WTP. Recent relevant reports and documents and decisions considered include:

- 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 Upgrade "CWT Preferred Design" as detailed in City Water Technologies (CWT) 2021 report (Peer Review of Options Assessment Report)
  - CWT undertook a review of the Hunter H2O assessment and recommended a new WTP with inclined plate settlers instream of the clarifiers recommended by Hunter H2O and side-stream membrane softening instead of excess lime softening recommended by Hunter H2O.
- DPE Comments on the CWT Peer review of Hunter H2O's 2020 Options Assessment report

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, and the works were completed in 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. This is detailed in *Risk Mitigation measures proposed for Stage 2* as outlined in YVC's correspondence of (12 Dec 2022).

In consultation with DPE's Housing Acceleration Fund and Safe and Secure Water Fund representatives, it was determined that, to ensure a full consideration of financial and non-financial issues were considered, a business should be prepared to consider the proposed Stage 2 upgrades against the full renewal of the WTP.

The Business Case is to be completed and submitted for DPE Assurance check by the end of 2023.

5 Problem Definition

5.1 2020 WTP Review

An assessment of the existing WTP undertaken by Hunter H2O in 2019 concluded:

- The current plant is 30 years old, and many assets, systems and processes are at the end of their service life.
- YVC is planning for the upgrade of the raw water pump station (RWPS) to ensure that the pumps can deliver the design flow rate of 165 L/s described in the WTP design documentation. Our review has found that the available filter area, filter condition and acceptable filtration rates limit maximum filtration rate to approximately 135 L/s.
- 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 considered to be an essential element of the upgrade of the WTP.
- There is a single flocculation train comprise 2 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.
- 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.

- 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 refurbishment consisting of inspection and repair (where necessary) of the filter floor and filter nozzles, upgrade of the air scour system, filter media replacement, installation of supports for backwash troughs, renewal of actuated valves, and new instrumentation is required.
- 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, and renewal of the chlorine system is required.
- 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.

A Raw Water Quality Risk Assessment conducted in 2019 identified the following hazards:

- Suspended solids (turbidity)
- Pathogens
- True colour and organics (TOC and DOC)
- Metals including iron, total and dissolved and manganese, total and dissolved
- Variable and high pH, alkalinity and total hardness
- Taste and odour
- Algae, algal toxins and taste and odour

5.2 2023 Mechanical and Electrical Asset Rating

An assessment of electrical and mechanical assets at the WTP was undertaken to inform the business case in terms of required replacement and renewals, and to inform YVC and Constructors who may be ungagged to undertake the WTP upgrade as to the suitability of assets for continued service.

In April 2023, mechanical and electrical assets (i.e. pumps, valves, fans, compressors, switchboards, motors, actuators and instruments) were assigned an Asset Condition Rating Scale of 1-5 based on a visual inspection and discussion with operations personnel. Items were assessed based on factors such as age, corrosion, leakage, vibration, noise and maintainability.

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 34 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.

The results of the asset rating was used in developing the scope of works for Options 1 and 2. A summary of the rating assessment recommended actions is presented in Table 4-1.

Table 4-1: Summary of WTP asset rating (April 2023)

No.	Recommendation
1	Provide a WTP control system (PLC and SCADA) to replaced failing and failed relay based control system
2	Schedule replacement main switchboard and local control panels, including provision of a dedicated switchroom
3	Fit RCD protection to all Building Services circuits.
4	Provide more accurate electromagnetic flow meters that would report to a WTP control system and be monitored by SCADA.
5	Program the replacement of actuators and position indicator switches across the WTP with priority given to the actuated valves controlling filter operation and backwashing
6	Provide the following instruments: ▪ Alum storage level ▪ Chlorine drum weight sensors Fluoride concentration analyser
7	Consider the following additional water quality instrumentation: ▪ Dosed water ORP ▪ Clear Water pH ▪ Fluoride concentration *Note - representative samples for treated water chlorine and fluoride must be obtained from the CWRs as the clear water tank is too turbulent*
8	Install machine guarding compliant to AS4024.1 on the flocculator drives and the clear water pump shaft couplings.
9	Conduct annual drain and inspection of the DAF tank and scraper system.
10	Undertake 5 yearly replacements of the DAF tank scraper cable and skimmer wipers.
11	Renew the DAF saturator level control system including inlet and outlet control valves and level and pressure sensing.
12	Renew the DAF recycle pumps within the next 10 years.
13	Renew the air scour blower and add an acoustic enclosure and soft start control within the next 5 years.
14	Configured the two Clear Water Reservoirs to have separate inlet and outlet pipework to prevent short circuiting.
15	Renew the soda ash batching, and dosing equipment and associated pipework is required within the next 5 years.
16	Replace the soda ash silo dust extractor. (Council is actioning this as of June 2023)
17	Renew the polymer batching, and dosing equipment and associated pipework within the next 5 years.
18	Seal the alum storage bund to provide a liquid retaining function. Ensure bunding complies with AS3780
19	Remove and dispose of the existing fluoridation equipment and decontaminate the fluoride room. Future uses for the room should be considered.
20	Construct a new purpose built fluoridation facility conforming to the relevant Act, Regulation and Code of Practise.
21	Review the compliance of the chlorination room and chlorination system against AS2927:2019 and rectify all deficiencies.
22	Consider the removal of the redundant SCA6 to improve access to the air compressors and air dryer.
23	Replace the service water pipe network.

5.3 Stage 1 Upgrade Performance Review

The Stage 1 Upgrade included:

- Raw water Pump Station upgrade including new switchboard, telemetry and control, connection point for back up diesel generator, installation of variable speed drives, WHS and compliance improvements, and minor building renewals.
- Bubble plume aeration system for Yass Dam including variable speed compressor in the raw water pump station, air supply line to the dam, and a 110 m air diffuser in the dam.
- WTP Urgent works which included:
    - New potassium permanganate dosing facility
    - New alum dosing equipment
    - Water quality instrumentation (dosed water pH, individual filtered water turbidity, treated water chlorine) and new control and telemetry systems

An assessment of the improvements achieved by the Stage 1 Upgrade is included in the following sections.

5.3.1 Yass Dam Bubble Plume Aeration

The Yass Dam Bubble Plume Aeration System comprises a 55 kW oil free low pressure screw compressor supplying up to 180 L/s of air to the dam. Air is introduced at depth using a 110m long HDPE diffuser laid along the path of the original streambed. The system is operated intermittently (several times per day). The compressor is currently (winter) operating at 70% of its rated output and is achieving > 6mg/L of DO at the bottom of the storage as measured by weekly manual sampling.

Based on information to date, the dam bubble plume aeration system has reduced a number of previously identified raw water quality risks since it commenced operation on the 19th of December 2022. The notable improvements are in:

- Lower soluble iron and manganese
- Lower organic matter (DOC and UVA)
- 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 and so the confidence in these conclusions is low until further monitoring and analysis can 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.

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 has been 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.

In the first 7 months of operation of the dam aeration system, improvement has been observed in reducing concentrations of soluble iron and manganese, DOC and taste and odour (MIB and geosmin):

- Soluble iron – reduced significantly from an average of 0.5 mg/L to 0.02 mg/L in August 2023
- Soluble manganese – reduced 100 times from an average of 0.1 mg/L to 0.001 mg/L in August 2023
- DOC – reduced by half from an average of 22 mg/L to 11 mg/L in August 2023
- Taste and odour – reduced significantly from an average of 4 and 5 mg/L for MIB and geosmin to <1 mg/L for both in August 2023

5.3.2 Raw Water Pump Station Upgrade

The upgrade of the Raw Water Pump Station (RWPS) has allowed operators to remotely change the raw water flow, start and stop the pumps, and acknowledge alarms and reset faults.

The upgrade of the RWPS has allowed operation of the WTP at a reduced flow rate of approximately 120 L/s. This reduces the loading rates on the dissolved air flotation unit and the filters which has is beneficial in terms of filtered water quality.

While the minimum flow that the pumps can achieve is less than 100 L/s, operation at <110L/s results in the water level in the DAF tank to fall to a level such that the float removal system becomes inoperable. Therefore the minimum raw water flow for the WTP is approximately 115 L/s.

The new power and control system includes switchboard and VSD capacity for upgrading of the raw water pump capacity (if needed)

Compliance, WHS and building condition improvements have also been achieved.

5.4 WTP Performance Review

Stage 1 delivered a number of improvements or augmentation control and monitoring capabilities including:

- Flow paced, automatic batching and flow paced dosing of potassium permanganate
- Flow paced dosing of alum
- Coagulation pH monitoring and alarming
- Individual filtered water turbidity monitoring and alarming
- Treated water chlorin monitoring and alarming

Water quality data (treated water and process reports) supplied by YVC was analysed to assess the plant performance since 2020.

5.4.1 Filtered water

Some improvement in filtered water turbidity has been observed following the Stage 1 upgrades with fewer spikes above 1 NTU. The additional filtered water monitoring after each individual filter has provided insight into the true filtration performance.

Before the Stage 1 upgrades (December and January 2023), individual filter turbidites would average 0.3 NTU and often spike to 1 NTU over the course of a day. Recent data from the end of May 2023 indicates that individual filter performance has improved with an average of 0.1 – 0.2 NTU and no spikes above 0.3 NTU. When filter performance is examined over a 24 hour period, higher filtered water turbidity is seen during pump starts. Frequent pump starts and stops causing higher levels of turbidity remains an issue, however the high turbidity spikes are lower now at 0.3 NTU instead of > 1 NTU.

Yass WTP's filtered water CCP target limit is <0.5 NTU but it is to be noted that the ADWG has a filtered water target of <0.2 NTU which should be considered as the target in the long term plan of the plant.

The online pH sensor has proven useful in pH monitoring but the plant is unable to achieve a reliable coagulation pH due to the lack of automatic pH control.

The treated water chlorine residual has fallen under 0.5 mg/L, which is Yass WTP CCP critical limit for low chlorine residual on numerous occasions. However, modification of the inlet/outlet arrangement would allow a more consistent free chlorine residual to be achieved.

6 Options Identification

To date, the *Yass WTP Business Case Options Identification Memorandum* has been submitted and workshop held to review and agree on the scope of each of the three options be developed and assessed. Option 2 and Option 3 were revised with agreement of stakeholders during the review workshop. Actions arising from the workshop are presented below.

Table 5-1: Options Identification Workshop Action Summary

Item	Minutes of Discussion	Status
1	DPE Water requires calibration and service of the filter turbidity analysers.	YVC to action
2	Raw water flow is currently around 120 L/s. Raw water pumps cannot drop below 110 L/s or the DAF water level drops below sludge skimmer level and the floated sludge cannot be removed.	Key hydraulic constraint with existing DAF noted.
3	Rearranging the clear water reservoirs inlet-outlet pipework to prevent short circuiting is agreed to by all attendees.	Noted and scope updated

4	Agreed by stakeholders that UV disinfection is required in Options 2 and 3 if NSW Health confirms it is Category 4 catchment. NSW Health advised that it is likely to be Category 4 until the model is finalised.	Noted and scope updated
5	Agreed by DPE Water that if UV disinfection is required then two (duty/standby) UV units are required in Options 2 and 3.	Noted and scope updated
6	The cost of demolition of the de-commissioned part of the WTP to be included in both Options 2 and Option 3.	YVC has obtained an estimate of $310K for demolition. This price includes a provisional sum of $15,000 for asbestos. Estimate excludes "backfilling of tank hole." Therefore the cost of backfilling and compaction for construction of CWRs needs to be added
7	Assume filter media replacement in Options 1 and 2 following filter inspection due to its age. This is subject to further investigation.	Media replacement and minor upgrades as per 2020 report to be included in Options 2 and 3. Investigation on hold
8	DPE Water advises that RO or IX waste to sewer is not a viable solution and that an evaporation pond is preferred. The size of the pond is likely to be large.	Single pass PO system could produce up to 1.6 ML/d at full load. Evaporation pond not likely to be feasible solution during winter months.
9	In Option 3, agreed by all stakeholders that RO membrane softening will be included. Membrane reject and cleaning chemicals waste to be pumped to a new sludge lagoon constructed at the sewage treatment plant. New pump station and pipeline will be required too.	Pumped discharge to STP where a redundant maturation pond could be utilised to be considered.
10	Some upgrade works are to be prioritised immediately and therefore performed earlier than the business case. These works include: ▪ Filter inspection report "15 Point Check" ▪ Formalising backwashing operational procedure with manual backwashing ▪ Review pH alarm limits and response procedures to low coagulation pH. This requires calibration of the pH sensor.	Investigation on hold

The three Options as agreed by stakeholders are:

- Option 1 – Basic Renewals
- Option 2 – Risk Mitigation
- Option 3 – WTP Augmentation

The assessment of these Options will be undertaken in September 2023.

Note that following the initial MCA, an additional Option, Option 4 – WTP Optimisation, was developed and included in the MCA and subject to economic and financial analysis.

7 Benefits Realisation Management Framework

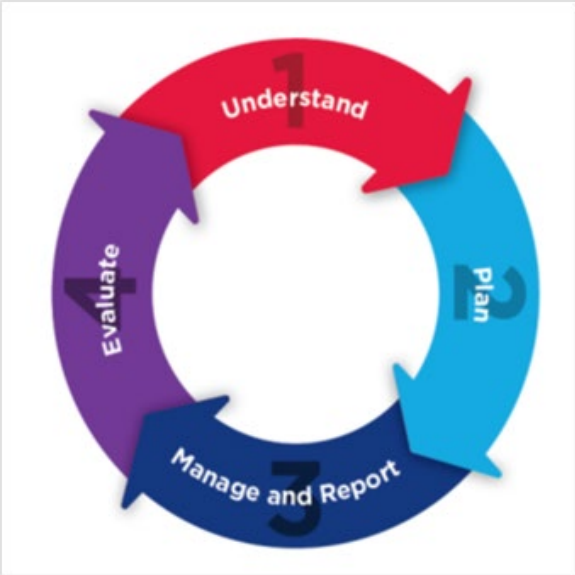
The Framework is aimed at those who are interested in benefits realisation within NSW Government agencies, enabling them to adapt and tailor the guidance to their specific needs. ("Benefits Realisation Management Framework - NSW Government")

The purpose of the Framework is to provide:

- A framework of best practice principles and concepts drawn from latest experiences and proven practice in setting up and managing programs that is transferable across NSW Government agencies
- a standard approach for benefits realisation management for anyone not familiar with the subject matter
- consistent terminology and benefits categorisation

Challenges encountered in benefits realisation, include:

- ill-defined benefits
- unclear program objectives
- unclear strategic goals
- benefit measures data is unavailable or inaccurate
- unclear benefits ownership.



7.1 Benefits Realisation Strategy

For the purpose of the Yass WTP Upgrade Business Case, we will adopt Phase 1 and parts of Phase 2 to:

- Articulate the vision/objectives/key principles
- Identify key stakeholders
- Identify benefits with stakeholders
- Map the outcomes and benefits with stakeholders
- Obtain sponsorship buy in and ownership of benefits
- Develop a benefits realisation strategy

7.2 Stakeholders

The stakeholder relevant to the upgrade of Yass WTP are shown in Table 6-1.

Table 6-1: Stakeholders

Stakeholder Group	Involvement/ Consultation
NSW Local Health Unit	Involved in Project Steering Group, Project Workshops and Business Case Review
NSW Health – Water Unit	Involved in Project Steering Group, Project Workshops and Risk Reviews
Department of Planning and Environment	Involved in Project Steering Group, Project Workshops and Business Case Review
Department of Planning and Environment - Water	Involved in Project Sterring Group, Project Workshops and Technical Review
Yass Valley Council - Officers	Involved in Project Sterring Group, Project Workshops, Technical and Risk Reviews and preparation of the Business Case
Yass Valley Council Councillors	Briefed by YVC Officers on progress of the business case, and associated technical and project delivery risks

7.3 Benefits Analysis

Benefits are the specific outcomes where accountability can be assigned, and measurement defined. Benefits are used for defining and declaring success of the investment in upgrading the Yass WTP. Benefits are the net positive changes resulting from outcomes and it is considered essential that we understand the outcomes before we can define and declare them as benefits.

Benefits can be classified into the following types:

- Financial – benefits that can be quantified and valued in financial terms e.g. cost savings, revenue generation
- Non-financial – benefits that can be quantified in non-financial terms or qualitative terms e.g. user satisfaction, performance measures.

7.3.1 Identify benefits

Non-cost assessment criteria that used for the 2023 analysis were developed from the 2020 Multicriteria Analysis, the results of the Workshop and subsequent inclusion of an objective for accelerated provision of housing. For the 2023 Business Case, the non-financial benefits shown in Table 6-3 are proposed as they map clearly to project objectives.

Table 6-2: 2023 Business Case Non-financial Benefits

Category	Benefit
Supports application of the ADWG Framework for Management of Drinking Water Quality – Health related targets	1. Achieves Health Based Targets (HBTs) for Chlorine Sensitive Pathogens (viruses, bacteria, amoeba) with sufficient Chlorine Contact Time
	2. Achieves Health Based Targets (HBTs) for Chlorine Resistant Pathogens (Cryptosporidium)
	3. Eliminates WHS and public safety risk associated with treatment chemical receival, storage, dosing and waste disposal
	4. Reduces treated water chlorine demand thereby reducing THM formation potential
	5. Effectively manages the risk of cyanobacterial toxins through intact cell removal, metabolite removal or prevention of accumulation in recycle streams
Supports application of the ADWG Framework for Management of Drinking Water Quality – Aesthetic related targets	6. Minimises source water or treatment related taste and odour complaints received by YVC
	7. Minimises source water or treatment related staining or discolouration complaints received by YVC
	8. Minimises source water or treatment related scaling, lathering or staining complaints received by YVC
Construction, Operation and Maintenance	9. Minimises Construction relation process disruption or reduction in treatment capacity
	10. Provides the necessary capability to respond to raw water quality events without increased operational attendance or external operations support.
	11. Provides full redundancy of critical process units and systems to meet operational and water quality requirements
	12. Readily availability of Personnel, spares or tools needed to ensure WTP availability
Social, Environmental and Legal	13. Housing provision acceleration via increased attractiveness from better water quality*
	14. Provides local employment and local purchasing during Construction and Operation.
	15. Improves consumer trust in the safety and quality of drinking water during Operation
	16. Reduces the generation of GHGs
	17. Reuses existing structures and assets
	* 2024 additional factor added post workshop

7.3.2 Benefits Mapping

Benefit to objectives mapping was confirmed as part of the Workshop. Mapping is contained in Attachment B.

7.3.3 3 Column analysis

The Stage 1 Upgrade added the Yass Dam Bubble Plume Aeration System, Upgraded the Raw Water Pump Station, and added a number of features to the WTP. We have stated the known remaining problems at the WTP using information from the 2023 performance review and asset rating reports, as well as regulatory notices and directions received by YVC.

The problems and analysis of what has to change or stop to obtain those benefits is captured in the three column analysis contained in Attachment C.

During the workshop we reviewed the problems and proposed changes and together identify what benefits are being achieved. This was used to identify the Benefits sought in the Multicriteria Analysis process.

Contact

Mark Dawson

Principal Process Engineer

+61 2 4941 4912

Mark.Dawson@hunterh2o.com.au

8 Attachments

- B – Benefits Map
- C – 3 Column Analysis

Attachment B

Table 8-1: Benefits Map

Benefit/ Objectives	Treated water quality must meet health criteria in ADWG	Treated water quality to meet aesthetic criteria in ADWG and community expectations	Enable regular maintenance and inspections within acceptable levels of water supply interruptions	Upgrade simplifies potential treatment process upgrades	Upgraded WTP to match current design capacity of 13ML/day	Upgraded WTP assets to comply with relevant standards and regulations.
Achieves Health Based Targets (HBTs) for Chlorine Sensitive Pathogens (viruses, bacteria, amoeba) with sufficient Chlorine Contact Time	✓					✓
Achieves Health Based Targets (HBTs) for Chlorine Resistant Pathogens (Cryptosporidium)	✓					✓
Eliminates WHS and public safety risk associated with treatment chemical receival, storage, dosing and waste disposal				✓		✓
Reduces treated water chlorine demand thereby reducing THM formation potential	✓					

Benefit/ Objectives	Treated water quality must meet health criteria in ADWG	Treated water quality to meet aesthetic criteria in ADWG and community expectations	Enable regular maintenance and inspections within acceptable levels of water supply interruptions	Upgrade simplifies potential treatment process upgrades	Upgraded WTP to match current design capacity of 13ML/day	Upgraded WTP assets to comply with relevant standards and regulations.
Effectively manages the risk of cyanobacterial toxins through intact cell removal, metabolite removal or prevention of accumulation in recycle streams	✓					
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		✓				
Minimises Construction relation process disruption or reduction in treatment capacity			✓	✓		
Provides the necessary capability to respond to raw water quality events without increased	✓					

Benefit/ Objectives	Treated water quality must meet health criteria in ADWG	Treated water quality to meet aesthetic criteria in ADWG and community expectations	Enable regular maintenance and inspections within acceptable levels of water supply interruptions	Upgrade simplifies potential treatment process upgrades	Upgraded WTP to match current design capacity of 13ML/day	Upgraded WTP assets to comply with relevant standards and regulations.
operational attendance or external operations support.						
Provides full redundancy of critical process units and systems to meet operational and water quality requirements			✓			
Readily availability of Personnel, spares or tools needed to ensure WTP availability			✓			
Housing provision acceleration via increased attractiveness from better water quality						✓
Provides local employment and local purchasing during Construction and Operation.						
Improves consumer trust in the safety and quality of drinking water during Operation	✓	✓				✓
Reduces the generation of GHGs						
Reuses existing structures and assets						

Benefit/ Objectives	Treated water quality must meet health criteria in ADWG	Treated water quality to meet aesthetic criteria in ADWG and community expectations	Enable regular maintenance and inspections within acceptable levels of water supply interruptions	Upgrade simplifies potential treatment process upgrades	Upgraded WTP to match current design capacity of 13ML/day	Upgraded WTP assets to comply with relevant standards and regulations.
Mapping Score	**6**	**4**	**3**	**2**	**0**	**5**

Attachment C – 3 Column Analysis

Table 8-2: Three Column Analysis

Current problems	+	What has to change?	+	What must be stopped?	=	Benefits
1. Existing Yass WTP electrical and control systems are aged and must be replaced with equipment and systems meeting accepted standards		1. Replace electrical and control systems with backup power supply		1. Non-compliant or inadequate a. Power fail protection b. Arc flash protection c. Power monitoring d. Segregation e. Switchroom ingress/ egress f. Switchboard access g. Spare capacity h. Documentation		1. Are a. 10 b. 11 c. 12 d. 14
2. Existing Yass WTP chemical receival, storage and dosing systems are not to accepted or required standards		2. Provide compliant chemical receival, storage and dosing systems a. Delivery hardstand b. Chemical building c. Alum d. Polymer e. Chlorine f. Fluoride g. Sulphuric acid h. Soda ash/ caustic soda i. PAC		2. Non-compliant or poor a. Delivery vehicle access b. Secondary containment c. Asset condition d. Operability e. Process control		2. Are a. 3 b. 10 c. 11 d. 12
3. Existing Yass WTP plant and equipment is ageing and access for day to day operation and maintenance activities is not to accepted standards		3. Refer Mechanical Asset Rating Report, including a. New air scour blower with modern acoustic protected unit b. Replace actuated valves across WTP		3. Poor a. Valve operation b. Maintenance access c. Machine guarding d. Occupational noise levels e. Process performance		3. Are a. 3 b. 10 c. 12 d. 14

Current problems	+	What has to change?	+	What must be stopped?	=	Benefits
		c. Overhaul DAF saturator peripherals d. Machine guarding				
4. Existing Yass WTP cannot disinfect treated water to achieve the Health Based Target (HBT) for chlorine contact time (C.t) contained in the ADWG		4. Modify existing common inlet and outlet to have separate inlet (retain existing outlet)		4. Bypassing CWRs		4. Are a. 1 b. 14
5. Existing Clear Water Reservoirs have a small capacity and even short periods of WTP unavailability result in, depending on the circumstances, issuance of a boil water notice or cessation of supply to the community		5. Additional CWR with changes to outlet pipework between reservoirs and trunk main at Orion St. Allow for level of one CWR to be drawn down for filter backwashing whilst other reservoirs provide system pressure and maintain continuity of supply		5. CWR level <70%		5. Are a. 2 b. 9 c. 10 d. 11 e. 14
6. Existing Yass WTP cannot treat the raw water sourced from the Yass Dam to achieve the Health Based Target (HBT) for cryptosporidium contained in the ADWG		6. Install duty and standby UV disinfection system to achieve the Log reduction value (LRV) set by the NSW Health Risk tool		6. Non-compliant treated water quality		6. Are a. 2 b. 10 c. 11 d. 14
7. Existing Yass WTP cannot treat the flood affected raw water sourced from the Yass Dam to the health and aesthetic guideline values of the ADWG		7. Provide process units and systems to respond to challenges when they arise a. Automatic coagulant dose proportional to raw water turbidity b. Filter renewal with media replacement		7. Ineffective a. Chemical dose rate adjustment when raw water conditions change rapidly or when plan is unattended b. Uncontrolled coagulation pH		7. Are a. 1 b. 2 c. 5 d. 6 e. 7

Current problems	+	What has to change?	+	What must be stopped?	=	Benefits
		c. Flow paced chemical systems, some with feedback control d. Coagulation pH control using either sulphuric acid or an alkali, as appropriate e. Bulk solids removal for situation when solids load exceeds capacity of the existing DAF and sludge/ float removal system f. Automatic filter backwashing system g. Automated polymer batching system h. Automated PAC batching system		c. Clarification unit redundancy d. Manual filter backwashing e. Manual chemical system batching		
8. Existing Yass WTP control room and amenities areas are aged, cramped and situated close to electrical switchboards and chemical systems which creates WHS issues. Inadequate space is available for day to day activities and for document storage, meetings, training, or meals.		8. New amenities and control building		8. Operations, maintenance, contractors, visitors sharing one toilet. No meals room, no supervisor office space, no document room, no storage space		8. Are a. 10 b. 11 c. 14

Current problems	+	What has to change?	+	What must be stopped?	=	Benefits
9. Existing Yass WTP has a single DAF unit meaning unscheduled maintenance results in plant unavailability and scheduled maintenance must be planned and undertaken to minimise unavailability.		9. Either a. Scheduled maintenance and spares inventory to be in place to prevent unscheduled outages b. Parallel clarifier/ DAF units for process redundancy		9. Unscheduled plant outage for repairs/ maintenance of critical unit processes		9. Are a. 10 b. 11 c. 12
10. Existing Yass WTP cannot treat the drought affected raw water sourced from the Yass Dam to the hardness aesthetic guideline value of the ADWG (200 mg/L as $CaCO_3$)		10. Side stream membrane softening process (reverse osmosis) with pumped transfer of reject and cleaning chemicals to a new offsite lagoon (at STP)		10.		10. Are: a. 8 b. 14
11. Responding to critical housing demand shortfalls in NSW / ACT is hindered by poor water quality making new Yass Valley development less attractive		11. Improve WTP water quality to remove impediment and support acceleration of new housing provision		11. Poor water quality and reliability		11. Acceleration in housing provision with accompanying wider economy benefits