# Yellow Pinch WTP Reference Design Report

Bega Valley Shire Council

28 November 2022

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# Executive Summary

Bega Valley Shire Council (BVSC) are proposing to build a new water treatment plant (WTP) at Yellow Pinch, NSW. The WTP site is located at 43 Red Gum Road, approximately 2 kilometres southeast of the Yellow Pinch Dam, in the Bega Valley Shire in the south coast region of New South Wales (NSW).

The WTP will be located on a previously residential property with the existing structures to be demolished to make way for the WTP infrastructure. Existing pipework runs through the property and will connect the new WTP to the Kiah-Tantawangalo drinking water supply network.

Currently in the Kiah-Tantawangalo network, gas chlorination of raw water is the only means of treating water for the supply of Merimbula, Pambula, Eden, Tura, Wolumla, and Candelo, as well as rural customers connected to the trunk mains. A new WTP is required to provide water security to the region, meet health-based targets and adhere the Australian Drinking Water Guidelines (ADWG), particularly during periods where the raw water supply is impacted by heavy rainfall or other extreme events (e.g., algae blooms, bushfire).

The Yellow Pinch WTP Reference Design was undertaken by GHD in collaboration with Bega Valley Shire Council (BVSC) and the Department for Planning and Environment (DPE) to define the scope of works for the new treatment plant.

The Reference Design provides sufficient information to develop a project cost and seek Design and Construct (D&C) tenders from competent Contractors for the works.

The following key items form part of the Reference Design and scope of works for the D&C tender.

– New Powdered Activated Carbon (PAC) contact tank including connection to existing raw water main from Yellow Pinch Dam
– New 3.4 ML clear water storage (CWS, as 2 No. separate tanks) with relift pumping into the CWS tanks
– New dissolved air floatation and filtration (DAFF) process to treat 17 ML/d over 22 hours per day
– New control and administration building
– New chemical systems in a new chemical building including:
– PAC dosing
– Aluminium sulphate (Alum) dosing (TBC pending jar testing)
– Polymer dosing (filter aid and sludge conditioning)
– Caustic soda dosing (TBC pending jar testing)
– Chlorine dosing
– Fluoride dosing
– Carbon dioxide dosing
– New sludge management system including wash water balance tank, sludge thickener, sludge drying beds and supernatant return pump station
– All pipework, valving and instruments associated with the new WTP
– Electrical supply, automation and SCADA works including:
– Complete new electrical supply system for the WTP, including overhead connection from the existing Essential Energy 11 kV network and new padmount transformer
– New switchboards, motor control centres (MCCs), control panels, distribution boards, process logic controllers (PLCs) etc.
– General power and lighting for the entire site
– New 560 kW solar panel system with battery storage of TBC kWh that enables both export to the grid and standalone operation of the treatment plant
– All site works including earthworks, access roads, stormwater drainage system etc.

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# 1. Introduction

## 1.1 Purpose of this report

The purpose of this report is to document Bega Valley Shire Council's (BVSC) preferred reference design for the new Yellow Pinch Water Treatment Plant (WTP), provide sufficient information for Council to develop a pre-tender project cost estimate (through WT Partnership) and seek Design and Construct (D&C) tenders from competent Contractors for the works.

The key project drivers and objectives for the WTP are as follows:

– Meet future demand in accordance with overall strategy (short and long-term)
– Meet water quality guidelines – health-based targets and the Australian Drinking Water Guidelines (HBTs and ADWG)
– Ensure safety of public and operators
– Meet environmental regulations and minimise disturbance to local community
– Maximise environmental sustainability outcomes
– Easy to operate, i.e. robust processes and low operator attendance
– Easy to maintain, e.g. common plants across region
– Meet budget and timing

## 1.2 Previous reports and workshops

This report outlines the key design considerations, process units and site work requirements for the Reference Design. The report follows on from the Basis of Design phase, where key decisions were agreed between GHD and BVSC. Previous key workshops have included:

– Options Workshop where the main treatment process was selected (dissolved air floatation and filtration, DAFF). For more details, refer to the *Yellow Pinch WTP Options Report* (Appendix D)
– Basis of Design Workshop where the key design parameters were defined and agreed between GHD, Council and the Department of Planning and Environment (DPE). For more details, refer to the *Basis of Design Workshop Minutes* (Appendix A)

## 1.3 Scope and limitations

This report: has been prepared by GHD for Bega Valley Shire Council and may only be used and relied on by Bega Valley Shire Council for the purpose agreed between GHD and Bega Valley Shire Council as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Bega Valley Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.4 of this report and throughout document as relevant). GHD disclaims liability arising from any of the assumptions being incorrect.

## 1.4 Key assumptions

– A plant size of 17 ML/d has been adopted for the Basis of Design and subsequent Reference Design as advised by BVSC. As discussed in the *Yellow Pinch WTP Options Report*, this will enable the Eden WTP to be deferred until nominally 2036.
– Drinking water demand analysis and network considerations were outside GHD's scope at the time of the Basis of Design workshop. GHD has since been engaged in a separate scope of work to undertake a review of BVSC's calculations defining to the upstream and downstream hydraulics to the extent in which they may impact the Yellow Pinch WTP Reference Design.
– Raw water quality envelope is based on data provided by BVSC from 2014-2022 and it is assumed that this is the best available data at the time of preparing this report.

**Accessibility of documents**

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

# 2. Basis of design

A Basis of Design Workshop between GHD, Council and DPE was held on 24 October 2022. In this workshop, the key design parameters were defined and agreed between the stakeholders present and this basis is summarised in the following sections. For more details, refer to the *Basis of Design Workshop Minutes* (Appendix D)

## 2.1 Overall design criteria

Key objectives for the WTP were agreed upon during the Reference Design Basis of Design Workshop held on 24 of October 2022. They are as follows:

– Meet future demand in accordance with overall strategy (short and long-term)
– Meet water quality guidelines (HBTs and ADWG)
– Ensure safety of public and operators
– Meet environmental regulations and minimise disturbance to local community
– Maximise environmental sustainability outcomes
– Easy to operate, i.e., robust processes and low operator attendance
– Easy to maintain, e.g., common plants across region
– Meet budget and timing

These objectives were used in developing the overall design criteria described in the following sections.

## 2.2 Raw water envelope

The design raw water envelope for the Yellow Pinch WTP was developed during the Options phase (refer to the *Yellow Pinch WTP Options Report* for further detail*)*. It assumed that raw water will be sourced from Yellow Pinch Dam, which receives water from Tantawangalo Creek and Bega River groundwater. It is classified as a Category 4 Catchment due to supply from the Bega Borefields which can be affected by surface water flows. This source water vulnerability assessment was undertaken by Council and is a key factor in defining the treatment requirements for pathogen removal at Yellow Pinch WTP.

The raw water quality envelope is summarised in Table 1.

***Table 1 Raw Water Envelope***

| Parameter | Units | Yellow Pinch Dam Data | | | | |
|---|---|---|---|---|---|---|
| | | **Minimum** | **5th %ile** | **Median** | **95th %ile** | **Maximum** |
| Temperature | °C | 9.7 | 10.7 | 18.1 | 23.6 | 25.9 |
| True Colour | Pt-Co | 1.0 | 5.0 | 10.0 | 42.4 | 88.0 |
| UV Transmissivity | % | 49.8 | 52.7 | 85.2 | 90.6 | 99.2 |
| Turbidity | NTU | 0.2 | 0.7 | 1.2 | 4.4 | 22.9 |
| Total Diss Solids | mg/L | 71.0 | 77.0 | 97.5 | 132.5 | 169.0 |
| pH | pH units | 6.9 | 7.1 | 7.7 | 8.1 | 8.5 |
| Alkalinity (CaCO3) | mg/L | 30.0 | 34.0 | 44.0 | 68.5 | 88.0 |
| Total Hardness | mg/L | 23.0 | 26.0 | 34.0 | 50.0 | 53.0 |
| Ca Hardness | mg/L | 12.0 | 13.0 | 20.0 | 40.6 | 43.0 |
| Dissolved Org Carbon | mg/L | 2.0 | 3.0 | 4.0 | 8.0 | 10.0 |
| Total Org Carbon | mg/L | 3.0 | 3.0 | 4.0 | 8.0 | 10.0 |
| Dissolved Oxygen | mg/L | 6.8 | 8.0 | 9.9 | 11.9 | 12.8 |
| Fluoride | mg/L | 0.05 | 0.07 | 0.10 | 0.14 | 0.20 |

| Parameter | Units | Yellow Pinch Dam Data | | | | |
|---|---|---|---|---|---|---|
| Chloride | mg/L | 8.4 | 12.6 | 16.6 | 24.9 | 25.6 |
| Sulphate | mg/L | 0.8 | 1.6 | 2.6 | 14.6 | 14.9 |
| Dissolved Silica | mg/L | 6.4 | 7.2 | 10.5 | 14.0 | 14.6 |
| E. coli | cfu/100mL | 1.0 | 1.0 | 2.0 | 18.2 | 1300 |
| Total Iron | mg/L | 0.02 | 0.04 | 0.09 | 0.37 | 0.63 |
| Total Manganese | mg/L | 0.002 | 0.005 | 0.011 | 0.02 | 0.07 |
| Total Magnesium | mg/L | 3.0 | 3.2 | 3.9 | 5.5 | 6.0 |
| Total Aluminium | mg/L | 0.009 | 0.010 | 0.03 | 0.25 | 0.78 |
| Total Boron | mg/L | 0.01 | 0.01 | 0.01 | 0.02 | 0.06 |
| Total Calcium | mg/L | 5.4 | 5.7 | 7.7 | 12.2 | 13.0 |
| Total Potassium | mg/L | 1.1 | 1.2 | 1.3 | 2.0 | 2.4 |
| Total Sodium | mg/L | 10.6 | 12.2 | 14.8 | 18.6 | 20.0 |
| Total Cobalt | mg/L | 0.0002 | 0.0002 | 0.0003 | 0.0003 | 0.0006 |
| Total Copper | mg/L | 0.001 | 0.001 | 0.002 | 0.011 | 0.020 |
| Total Zinc | mg/L | 0.005 | 0.005 | 0.008 | 0.048 | 0.056 |
| Total Arsenic | mg/L | 0.001 | 0.001 | 0.001 | 0.002 | 0.020 |
| Total Selenium | mg/L | 0.001 | 0.001 | 0.002 | 0.006 | 0.007 |
| Total Barium | mg/L | 0.005 | 0.012 | 0.016 | 0.021 | 0.024 |
| Total Mercury | mg/L | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| Total Lead | mg/L | 0.0002 | 0.0002 | 0.0004 | 0.0004 | 0.0034 |
| Total Nitrogen | mg/L N | 0.06 | 0.14 | 0.21 | 0.46 | 0.60 |
| Nitrate (as N) | mg/L N | 0.002 | 0.003 | 0.02 | 0.19 | 0.23 |
| Nitrite (as N) | mg/L N | 0.002 | 0.002 | 0.004 | 0.016 | 0.019 |
| Ammonia (asN) | mg/L N | 0.002 | 0.004 | 0.02 | 0.07 | 0.12 |
| Total Phosphate (as P) | mg/L P | 0.002 | 0.004 | 0.01 | 0.02 | 0.06 |
| Algal Counts | No/mL | 50 | 157 | 2635 | 52500 | 185000 |
| Cyanophyta | No/mL | 7 | 48 | 1620 | 57250 | 184000 |
| B-G Biovolume | $mm^3/L$ | 0.0001 | 0.0001 | 0.01 | 0.24 | 0.92 |
| Dissolved Iron | mg/L | 0.01 | 0.01 | 0.05 | 0.23 | 0.40 |
| Dissolved Manganese | mg/L | 0.001 | 0.001 | 0.002 | 0.01 | 0.05 |

# 2.3 Plant capacity and storage

## 2.3.1 System demands

A plant size of 17 ML/d will be adopted for the design of the Yellow Pinch WTP. This is based on peak day demands for the Merimbula, Candelo, Wolumla and Eden areas until nominally 2036 as advised by BVSC. From 2036 onwards to 2051, the plant will only be required to supply Merimbula, Candelo and Wolumla.

Table 2 summarises the projected flows to the Tantawangalo-Kiah Water Supply System.

*Table 2 Peak day demand projections for Tantawangalo/Kiah system*

| Peak Day Demand | 2022 | 2036 | 2048 |
|---|---|---|---|
| Total PDD (ML/d) | 15.1 | 16.6 | 18.1 |
| Total PDD excl. Eden (ML/d) | 11.2 | 12.2 | 13.3 |

Further details on the network to be supplied is shown in Figure 1 and Figure 2. This includes the Eden region, shown within the green outline in Figure 2, which is assumed to be supplied in the future by a new WTP.

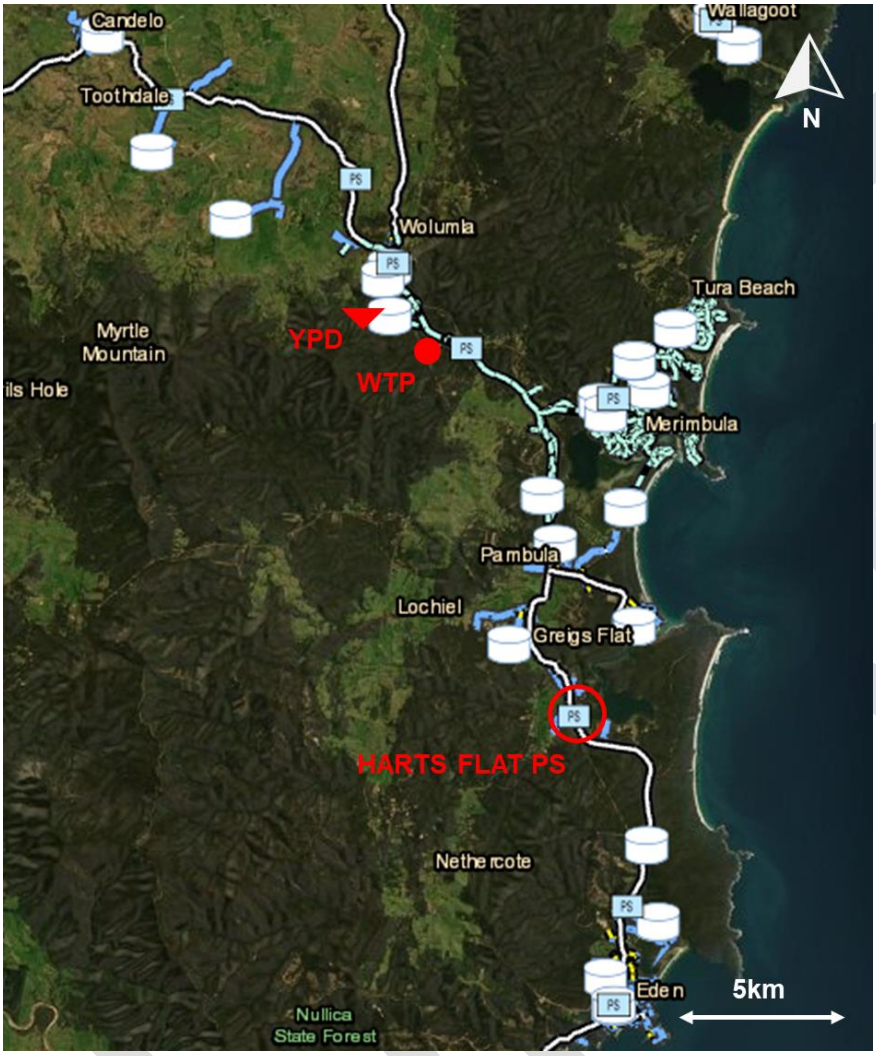



*Figure 1 Aerial map showing approximate locations and extent of the Kiah-Tantawangalo network*

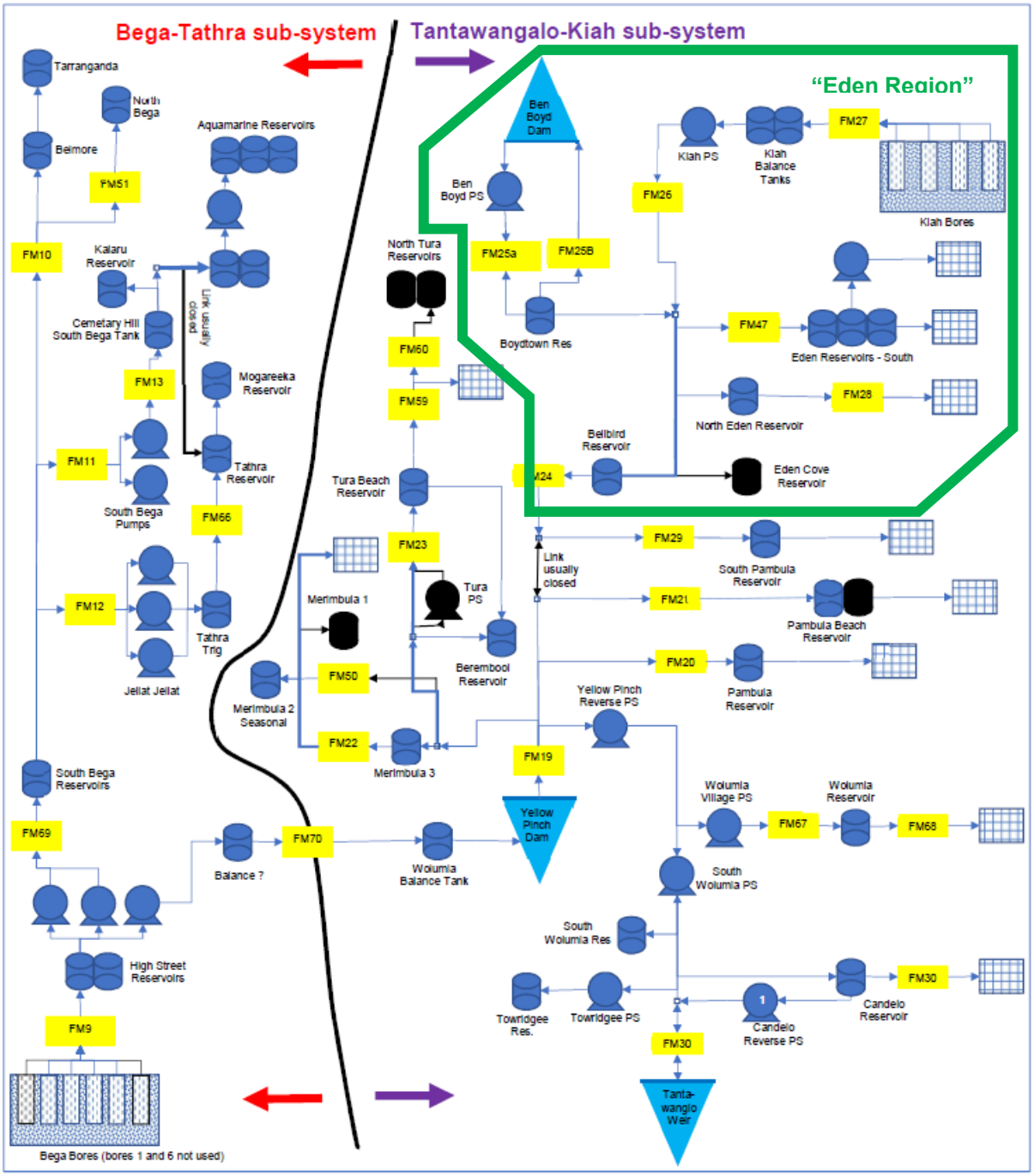



*Figure 2* *Bega Valley Shire drinking water network diagram. The Eden region is indicated within the green outline.*

## 2.3.2 Clear water storage

During a meeting between GHD and BVSC on 26 September 2022, it was agreed that 3.4 ML clear water storage (CWS) will be adopted, based on storage requirements detailed in the *Yellow Pinch WTP Options Report*.

On-site CWS of 3.4 ML is equivalent to around 4 hours of peak day demand (2.8 ML) plus local demands that draw directly from the trunk main (i.e. not connected to a separate storage in the network, nominally 0.6 ML). The reference design will split this storage between two equal sized CWS tanks to allow for:

– Operational flexibility, maintainability and redundancy
– Optimising of the CWS levels to reduce pumping requirements
– Easier constructability on a sloping site
– Chlorine residual control

## 2.4 Treated water targets

The Yellow Pinch WTP will be designed to meet the treated water targets shown in Table 4. These targets were developed to meet health-based targets, Australian Drinking Water Guidelines (ADWG) requirements and aesthetic requirements.

### 2.4.1 Health-based targets

The following table lists the required log removal values (LRVs) to meet the Water Services Association of Australia (WSAA) Health Based Targets (HBTs) required for a Category 4 Catchment. These are the values which have been used to determine the pathogen removal requirements at Yellow Pinch WTP.

***Table 3 Required log removal value (LRV) to meet Health Based Targets (HBTs) as defined by WSAA***

| | Protozoa (*Cryptosporidium*) | Virus | Bacteria |
|---|---|---|---|
| **Log removal value (LRV) required** | 5.5 | 6 | 6 |

### 2.4.2 Australian Drinking Water Guidelines (ADWG)

The ADWG are the basis for the health and aesthetic based treated water quality targets outlined in Table 4.

Based on discussion in the workshop on 8 August 2022, there is a history of customer complaints for colour and taste, and odour in chlorinated water from the Yellow Pinch Dam.

Note: There is a potential risk that further aesthetic issues may result from the corrosion of ageing assets in the network. Investigating or addressing this is beyond the current scope of this project.

### 2.4.3 Treated water quality targets

The treated water targets, incorporating the above listed guidelines, are shown in Table 4. The plant will be designed to meet these under the specified compliance regimes.

*Table 4 Treated Water Targets and Sampling Locations and Frequencies*

| Parameter | Unit | Target Value | % Compliance | Aesthetic / Health | Sample Location | Sampling Frequency |
|---|---|---|---|---|---|---|
| Turbidity after filtration | NTU | 0.15 | 95 | Health & Aesthetic | Individual filter outlet | Continuous |
| | | 0.3 | 100 | Health & Aesthetic | Individual filter outlet | Continuous |
| True Colour | Pt/Co | 5 | 95 | Aesthetic | Filtered water header pipe | Grab Sample |
| pH | | ± 0.2 of set point | 90 | Health | CWT inlet | Continuous |
| pH Set-Point Range | | 7-8 | 100 | Health | | |
| Free Chlorine Residual | mg/L | ± 0.2 of set point | 90 | Health & Aesthetic | CWT inlet | Continuous |
| Free Chlorine Set-Point Range | mg/L | 2-3 | Typical | Health & Aesthetic | At outlet of CWT | |
| Total Aluminium | mg/L | <0.1 | 100 | Aesthetic | CWT inlet | Grab Sample |
| Total Coliforms | No./mL | Nil | 100 | Health | CWT inlet | Grab Sample |
| E. coli | No./mL | Nil | 100 | Health | CWT inlet | Grab Sample |
| Total Iron | mg/L | <0.1 | 95 | Aesthetic | CWT inlet | Grab Sample |
| Total Iron | mg/L | <0.3 | 100 | Aesthetic | CWT inlet | Grab Sample |
| Total Manganese | mg/L | <0.1 | 100 | Aesthetic | CWT inlet | Grab Sample |
| Fluoride | mg/L | 0.95-1.05 | 95 | Health | CWT inlet | Grab Sample |
| Taste and Odour | | Should not be offensive to most people | 100 | Aesthetic | CWT inlet | Grab Sample |
| UV Log reduction value (protozoa) | LRV | >2.5 | 100% | Health | CWT inlet | Grab Sample |
| CCPP | mg/L | >-4 | 100% | | CWT inlet | Grab Sample |

# 2.5 Main process selection

## 2.5.1 MCA Workshop

A non-price Multi Criteria Assessment (MCA) was undertaken by GHD and BVSC during the *Options Workshop* on 8 August 2022. The NSW Department of Planning and Environment (DPE) were provided with the options report and gave feedback where applicable.

The two processes evaluated were:

– Dissolved air floatation and filtration (DAFF) with upstream powdered activated carbon (PAC) dosing, and;
– Membrane Filtration with downstream biological activated carbon (BAC) filters

As discussed in the Options Report (refer Appendix D), raw water entering the Yellow Pinch WTP is likely to contain algae at times and therefore there is a risk of taste and odour (T&O) compounds (e.g., geosmin, MIB), algal metabolites, and algal biomass being present in raw water. The mandatory inclusion of activated carbon in the design is to increase removal of T&O compounds and algal metabolites during algal events. The suitable activated carbon technology paired with DAFF is PAC dosed into the raw water and for membranes it is a BAC filter to polish the membrane permeate.

The MCA categories and weightings were discussed and adjusted during the workshop. Figure 3 summarises the results of the MCA comparison. The final weightings used for the assessment and full results can be found in the Options Report (refer Appendix D).

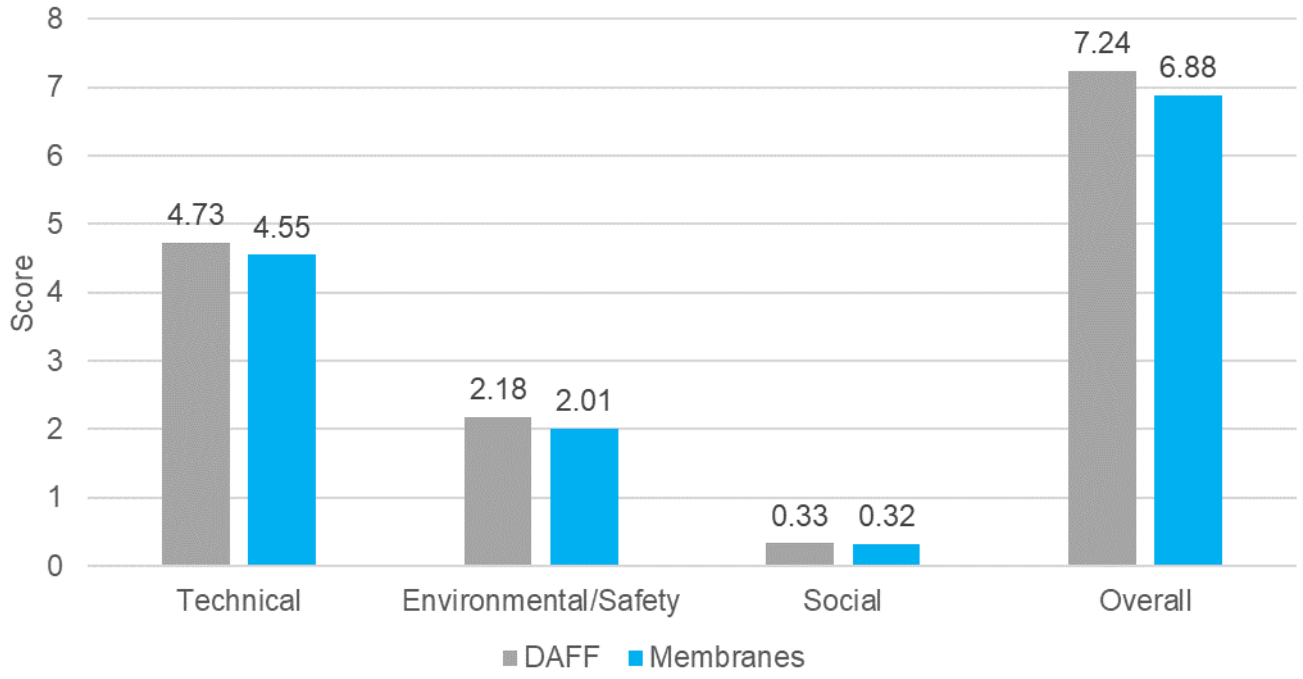



***Figure 3*** ***MCA results grouped as technical, environmental/safety and social scores.***

As shown in Figure 3, DAFF was the preferred main process for the Yellow Pinch WTP with an overall score of 7.24 versus 6.88 for membranes. Therefore, this Reference Design is based on DAFF with PAC dosing, however based on the close scoring, a membrane process is also considered an appropriate option and Council may wish to allow Contractors to offer membrane filtration as an alternative tender design. GHD will prepare suitable datasheets and specifications for a membrane filtration alternative.

## 2.5.2 Residuals management process selection

The residuals for the DAFF process include filter backwash, DAF float and filter to waste. Two key options have been considered to manage these residual streams:

– Sludge drying beds with thickener. These are straight-walled concrete basins which can be constructed above ground or cut into the slope.
– Earthen sludge lagoons which are excavated into the ground and lined with clay.

For this site, the key difference between the two residual management options is that the sludge lagoons require a significantly larger footprint compared to the drying beds due to their sloped earthen wall construction. Based on constrained site and existing ground slope, finding a suitable location for the large footprint required for earthen lagoons would be very challenging and would require excessive excavation and stabilisation of the hillside. Sludge drying beds are smaller in footprint and can be constructed directly adjacent one another with shared vertical walls, or terraced if necessary, therefore they can be more easily accommodated within the available site.

The decision to adopt sludge drying beds for the Yellow Pinch WTP Reference Design was agreed and documented in the Basis of Design workshop (refer Appendix A).

## 2.5.3 Coagulation chemical selection

A coagulant is required for the DAFF process and two chemicals were selected to be compared:

– Aluminium chlorohydrate (ACH)
– Aluminium sulphate (Alum)

Initial jar testing has been undertaken for poor raw water quality conditions (high colour and organics), refer Appendix E. ACH was not available for this initial suite of tests, however Alum was found to be a suitable coagulant based on the jar testing results. Future jar testing and water chemistry RTW modelling (in late 2022 or early 2023) will confirm if ACH is also a suitable coagulant for use at Yellow Pinch, as this chemical is the preferred by Council. This future testing will aim to sample from the Yellow Pinch Dam when the raw water is considered 'normal' (i.e., when the high colour and organics have subsided).

For the purposes of progressing the tender documentation, Alum has been selected as the preferred coagulant, however Council may wish to adopt ACH as preferred following confirmation of its suitability through future jar testing.

### 2.5.4 pH and stabilisation chemical selection

The following pH adjustment and stabilisation chemicals were considered:

– Soda ash
– Caustic soda
– Lime

Caustic soda is tentatively preferred based on the expected reduced CAPEX and improved handleability compared to the other options. This is largely based on the experience at Bega WTP. As for selection of the preferred coagulant chemical, jar testing and RTW modelling will be used to confirm that caustic soda will be suitable for the raw water envelope and process train at Yellow Pinch WTP.

### 2.5.5 Fluoride chemical selection

Several fluoride chemicals were considered for this plant:

– Sodium Fluoride (NaF)
– Hydrofluorosilicic Acid ($H_2SiF_6$) (FSA)
– Sodium Silicofluoride ($Na_2SiF_6$) (SSF)

Based on the relatively large capacity of Yellow Pinch WTP and maintaining consistency with the WTPs at Brogo and Bega, SSF has been selected for the Reference Design.

## 2.6 Water treatment processes

### 2.6.1 Redundancy and asset life

The following redundancy levels shall be specified in the Reference Design:

– Duty only DAFF  for 17 ML/d plant (at least 2 no. DAFF trains)
– Duty/standby for air compressors and all pumps, including dosing pumps
– Duty/standby for UV reactors
– Air scour blower, DAFF saturator, sludge thickener (if required) and chemical tanks: duty only
– All other major mechanical equipment items, valves, flow meters and other pipe fittings: duty only
– All hydraulic elements with capacity at least 15% greater than current maximum design duty

The above redundancy requirements were discussed and agreed during the Yellow Pinch WTP Basis of Design workshop held on 24 October 2022. Full redundancy requirements for each piece of equipment will be outlined in the Technical Specification and Datasheets.

The plant component service life is specified in Table 5.

*Table 5 Design Service Life – Water Treatment Plant Components*

| Assets | Design Asset Life |
|---|---|
| Civil/Structural | 100 years |
| Buildings | 50 years |
| Pavements | 25 years |
| Mechanical | 25 Years |
| Electrical | 25 Years |
| PLC/Instrumentation | 15 Years |

## 2.6.2 Connection to network

Several connections to the existing water distribution network are required for the Yellow Pinch WTP. The assumptions adopted for the Basis of Design are listed in Table 6.

*Table 6 Network Connections Assumptions*

| Network Consideration | Area served | Current Assumption |
|---|---|---|
| Raw Water Feed | N/A | Gravity flow is possible above a nominal 'low level' (TBC) – no need for raw water pump station<br>Note that gravity flow is not possible as the dam approaches bottom water level (BWL) |
| Treated Water to the south | Merimbula, Pambula, Tura, Eden, trunk main customers | Will connect to existing DN450 pipeline |
| | | CWS bottom operating level will gravitate to Merimbula Tank. It is expected that new pump stations will be required to transfer water to Tura and Eden (outside scope of this Reference Design) |
| Treated Water to the north | Wolumla, Candelo, trunk main customers | Will connect to existing DN225 pipeline from WTP, however new section of pipework will be required from Wolumla to Candelo (separate scope of work) |
| | | New pump station required. Provision for pump station to be included in Reference Design on WTP site for space proofing (however D&C for pump station and pipeline is separate scope). |

A review of BVSC's hydraulic calculations and network considerations will be conducted by GHD to confirm the assumptions listed in Table 6. This is part of a separate scope of work and the findings will be included in the Final Reference Design submission.

## 2.6.3 Residuals management

The plant will be designed for the following criteria:

– Zero liquid discharge from plant (no sewer connection)
– Supernatant return flows <10% of raw water inflow at all times
– Supernatant quality
– Turbidity <10 NTU and <10 mg/L suspended solids 100% of the time

– Turbidity <5 NTU and <5 mg/L suspended solids 95% of the time
– Sludge dewatered to achieve dried solids of greater than 30% (in practice this will likely be higher during typical operation)

### 2.6.4 Bunds and overflows

The plant will incorporate the following as a minimum:

– Automatic controls based on level switches in tanks to stop pumps and shut valves
– Valves will be fail safe on power failure
– Emergency overflows from PAC contact tank, process tanks and CWS tank to be directed to a scour dissipation structure prior to being discharged to site stormwater system
– Overflow visible to operators and alarmed
– Chemical delivery bunds shall be sized to comply with NSW EPA Bunding and Spill Management Guidelines and drain to site stormwater system (close valve during delivery)

## 2.7 Building requirements

The following building requirements summarised in Table 7 were agreed during the Reference Design BoD Workshop on 24 October 2022.

***Table 7 Building Requirements for Yellow Pinch WTP***

| Building / Feature | Requirement |
|---|---|
| Control building | Required |
| Electrical switchroom | Required |
| Laboratory | Required (minimum 4m x 4m)<br>Easily accessible from sample points<br>Double wash basin /sinks connected to warm water system to be included |
| Mechanical room | Required |
| Admin (Control/office/Lunchroom) | Required |
| Meeting room | Not required – exclude from Reference Design |
| Toilet and shower | Required with internal access door |
| External walls | Brick or blockwork |
| Internal walls | To meet specified noise limits in specification |
| Air conditioning | Required in electrical and control room and laboratory. |
| Ventilation | Natural and mechanical ventilation in mechanical room. |
| Insulation | Required |
| Gutters/Eaves | Gutters and eaves are required. Gutters to include gutter guard to avoid blocking. |
| Roof design | Suitable for fitting of solar panels (e.g., kliplok or longline profile, refer Section 8) |

## 2.8 REF considerations

Council is conducting a Review of Environmental Factors (REF) separately with this study commencing after the submission of the planning proposal. Some of the key assumptions that may be impacted by the outcomes of the REF are listed in this section, however it is noted that there may be other considerations that arise from the REF study that have not been anticipated at this stage.

## 2.8.1 Bushfire mitigation

The WTP is in a densely vegetated, high-risk bushfire area and therefore the risk mitigation requirements will play a key role in the Yellow Pinch WTP Reference Design. The assumptions below are from the Council Bushfire Report[1] and were confirmed by Council as the basis for the Reference Design.

***Access requirements***

Based on recommendations from the Council Bushfire Report, the primary access road requirements are 5.5 metres width with vertical clearance of 4 metres to ensure safe passing for emergency vehicles and to allow for service vehicle to leave the site safely under bushfire conditions. Allowances could be made for minor variations to this if there are site restrictions with the design process.

***Perimeter road and fire trail requirements***

A secondary access or fire trail was also recommended by Council with a minimum 4 metre width and 4 metre vertical clearance. The same road width and clearance requirements are recommended for the perimeter road which follows the circumference of the asset protection zone (APZ) to allow easy access for firefighting vehicles and personnel. As advised by Council, the perimeter road will be outside of the fenced compound allowing access to surrounding forested bushland vegetation, and within the fence an unobstructed trafficable area clear of combustible vegetation will be maintained where possible.

***Asset protection zone requirements***

The report concludes that an APZ of at least 45 m is required around all critical assets. Critical assets are shown in the table below. Non-critical or non-combustible assets are able to be constructed within the APZ.

*Table 8 Summary of critical and non-critical assets for bushfire APZ purposes*

| Critical (requires >45 m buffer) | Non-critical (may be constructed inside APZ) |
|---|---|
| – All process buildings (admin, control room, electrical switchroom, plant room)<br>– Dissolved air floatation and filtration tanks<br>– Pumps<br>– Chemical storage and dosing sheds<br>– Sludge thickener and supernatant return pump station | – Water tanks (e.g., clear water storage tanks, washwater tank)<br>– Sludge drying beds<br>– Roads/fences/gates |

As shown in Figure 4, there are various habitat features (e.g., hollow bearing trees) present across the site. Some of these features will fall inside the APZ around the plant's critical infrastructure which may necessitate their removal. Council will need to work with the environmental consultant, The Environmental Factor (TEF) and the bushfire experts to identify specific trees which may be retained within an APZ without jeopardising the function of the buffer area.

## 2.8.2 Biodiversity

Council was provided with an ecological constraints map by TEF which highlights areas that contain high value biodiversity on the WTP site (refer Figure 4 below). The design basis will be to avoid the higher value areas where practical, noting that this may not be possible in all cases given that maintaining a buffer around critical assets will require clearing of the majority of the vegetation within the APZ.

In the constraints map shown, Zones 1 and 6 are considered high constraint zones and removing vegetation from these areas will be avoided where practically possible. The moderate constraint zones will also be avoided where possible, noting that clearing much of the red area (Zone 2) will likely be unavoidable due to the proposed sizing of plant assets and the required APZ.

[1] *Bushfire assessment report for a proposed zoning change & proposed construction of water treatment plant at lot 882 DP 789858 43 Red Gum Road Yellow Pinch*. Garry Cooper. Bushfire Planning and Assessment Officer, Bega Valley Shire Council (30 August 2022)

It is noted that the constraints map shown in Figure 4 may need to be updated when cadastral survey confirms the lot boundaries.

***Table 9 Summary of constraint levels for each zone depicted in Figure 4***

| Zone | Constraint Level |
|---|---|
| 1 | High |
| 2 | Moderate |
| 3 | Moderate |
| 4 | Moderate |
| 5 | Low |
| 6 | High |

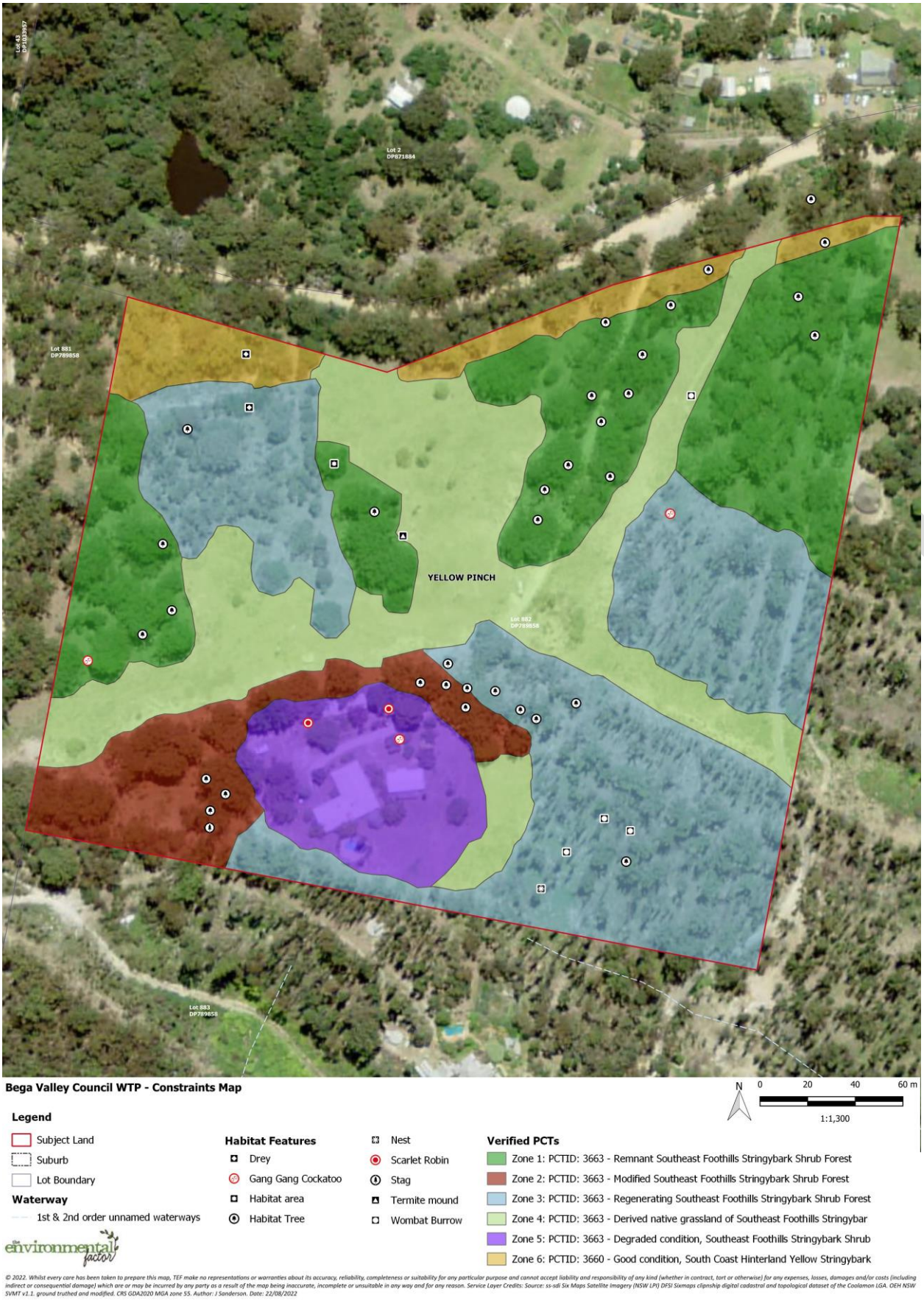



***Figure 4*** ***Yellow Pinch WTP biodiversity constraints map (courtesy of TEF). Note that this map may need to be updated when cadastral survey confirms the lot boundaries.***

### 2.8.3 Noise and visual amenity

As part of the REF, Council will be undertaking a noise and visual amenity assessment. Due to the close proximity of the neighbouring property immediately to the south of the site, this may result in some additional noise attenuation requirements and/or screening at the plant.

The REF will be undertaken after the planning proposal is submitted which precedes submission of the Reference Design, therefore, the detailed design may be informed by the outcomes of the REF. The REF will specify any additional requirements above what has been specified in the Reference Design and Technical Specification and the D&C contractor will need to comply with all requirements of the Technical Specification and REF.

# 3. Water treatment process

## 3.1 Overview of process units

The water treatment process to be adopted for the Yellow Pinch WTP design is summarised below. Details on the process selection and additional background information is contained in the *Yellow Pinch WTP Options Report*.

- Raw water from Yellow Pinch Dam gravitates to the new WTP site located at 43 Red Gum Road. There is an existing pipeline running from the dam through the WTP site. GHD is assisting Council to confirm the suitability of the raw water pipeline for raw water transfer to the new WTP as part of a separate scope of work.
- Powdered Activated Carbon (PAC) dosing to a PAC contact tank at the head of the WTP
- pH correction and addition of coagulant chemical
- Flocculation
- DAFF (combined DAF and filtration)
- UV disinfection
- Treated water relift pumping
- Treated water stabilisation or pH correction
- Chlorination
- Fluoridation
- Treated water storage (3.4 ML)
- Washwater tank and sludge thickener
- Sludge drying beds
- Supernatant return to the head of the plant

## 3.2 Reference design criteria

Table 10 lists the key Reference Design assumptions and criteria for each process unit in the WTP. For additional information, refer to the Datasheets (Appendix C)

***Table 10 Key Reference Design Assumptions and Criteria***

| Process | Parameter |
|---|---|
| Overall treatment plant | |
| Peak daily treated water output Delivered | 17 ML/d |
| Design hours per day of operation | 22 hours |
| Plant turndown | 4:1 |
| DAFF | |
| Number of units | Min 2 No. |
| Flocculation | 2 stage |
| Minimum flocculation time | 10 mins per stage |
| Design DAFF rate[2] (at peak flow, including recycle) | 10 $m^3/m^2/hr$ |
| Design DAFF recycle rate | 5 to 20% of plant flow |
| Number of recycle pumps (duty) | One per train (shared standby) |
| Float removal system | Cutting sprays and hydraulic float removal |
| Access | Trafficable area above platform area including external access stairs |

| Process | Parameter | | |
|---|---|---|---|
| Filter media | Dual media – sand and filter coal | | |
| Filter media L/D | >1300 | | |
| Backwash method | Air scour then water rinse | | |
| Design backwash rate | >55 m/hr | | |
| Design air scour rate | >55 m/hr | | |
| Backwash source | Clear Water Storage | | |
| Washwater Tank | | | |
| Volume basis | Allow for 2 no. backwashes simultaneously | | |
| Volume | 450 kL | | |
| Clear Water Storage Tank | | | |
| Sizing basis | 4 hours at PDD plus additional local demands (Refer Section 2.3.2) | | |
| Number of storages | 2 No. | | |
| Size (total) | 3.4 ML | | |
| Disinfection | | | |
| **Log removal parameters** | **Bacteria** | **Virus** | **Protozoa** |
| LRV required | 6 | 6 | 5.5 |
| LRV claimed | | | |
| DAFF | 2 | 2 | 3.5 |
| UV | | | 2 |
| Chlorine | 4 | 4 | 0 |
| **Total** | **6** | **6** | **5.5** |
| UV Redundancy | N+1 | | |
| Minimum UVT | 80% | | |
| Chlorine disinfection | Chlorine Gas | | |
| Chlorine disinfection C.t. | 15 mg/L.min | | |
| Sludge Drying Beds | | | |
| Sludge loading rate | 44,950 kg/year (conservatively based on Alum and PAC dosing) | | |
| Number of drying beds | Minimum 3 no. | | |
| Minimum drying bed area | 1,800 $m^2$ | | |
| Sludge thickener | 1 No. duty<br>Conventional or lamella plate | | |
| Supernatant return pumps | Duty/standby submersible pumps | | |
| Subnatant return pumps | Duty/Standby | | |
| Underdrains | Required | | |
| Decant structure | Required | | |
| % dry solids at start of drying period | 5% | | |
| Decanted sludge depth | 1 m | | |
| Chemical Building/s | | | |
| Purpose | Area for both chemical storage and dosing systems | | |
| External Walls | | | |

| Process | Parameter |
|---|---|
| Ventilation | Natural and mechanical ventilation |
| Insulation | Required |
| Chemical storage requirement | 14 days at PDD |
| Powdered Activated Carbon | |
| Purpose | Control taste & odour compounds and colour in raw water |
| Contact time | 30 min at PDD |
| Contact tank volume | 450 kL |
| Coagulant | |
| Purpose | Suspended solids removal from raw water |
| Chemical | Aluminium sulphate (alum) – TBC through jar testing |
| Polymer | |
| Purpose | Improved flocculation |
| Design inclusions | Filter aid polymer<br>Sludge thickening polymer |
| pH and alkalinity adjustment | |
| Purpose | pH and alkalinity adjustment |
| Chemical | Caustic soda |
| Fluoridation | |
| Purpose | Public health |
| Chemical | Sodium silicofluoride (SSF) |
| Mechanical/Control Building | |
| Office/control | Included |
| Electrical Room | Included |
| Laboratory | Included |
| Mechanical Room | Included |
| Lunchroom, Toilets | Included |
| Total floor space | 250 $m^2$ (nominal) |
| External Walls | Brick or Blockwork |
| Fire Resistance - Window | Screens |
| Fire Resistance - Doors | Fire rating |
| Noise | Meet EPA rural noise criteria<br>Meet requirements of the REF |
| Air Conditioning | Required in electrical room, office and laboratory. |
| Ventilation | Natural and mechanical ventilation in plant room. |
| Insulation | Required |
| Chemical Building/s | |
| Purpose | Area for both chemical storage and dosing systems |
| External Walls | Brick or Blockwork |
| Ventilation | Natural and mechanical ventilation |
| Insulation | Required |
| Chemical storage requirement | 14 days at PDD |

# 4. Value engineering

## 4.1 DAF and filtration loading rate

Table 11 summarises the Yellow Pinch WTP demands both before and after the proposed Eden WTP is commissioned. The Eden plant will be commissioned nominally in 2036, after which the demand from this section of the network will not need to be supplied by Yellow Pinch.

The DAF and filtration design loading rate will be designed according to:

- **Stage 1 until nominally 2036:** Pre-Eden WTP commissioning, DAFF designed to operate at 10 m/hr to minimise infrastructure spend in Stage 1. This loading rate is considered sufficiently conservative and is not expected to negatively impact the plant's performance against treated water targets.
- **Stage 2 nominally post-2036:** Once Eden WTP is commissioned, DAFF can be operated at 8 m/hr or less depending on flows. This is expected to result in more stable operation and better treated water quality in the longer term (i.e., the plant may exceed Stage 1 performance).

This design staging is a pragmatic approach to managing the elevated flows through until 2036 as it avoids oversizing the main process once the Eden demand is supplied by an Eden WTP and the Yellow Pinch demand drops off. If the plant was designed for 8 m/hr DAFF rate in 2036, the DAFF tanks would be approximately 25% larger and therefore more costly.

*Table 11 Comparison of design DAF and filtration rate for Stage 1 and Stage 2 of Yellow Pinch WTP operation*

| Peak Day Demand | 2022 | 2036 | 2048 |
|---|---|---|---|
| Total PDD (ML/d) | 15.1 | 16.6 | 18.1 |
| Total PDD excl. Eden (ML/d) | 11.2 | 12.2 | 13.3 |
| Design DAFF Rate | Stage 1: 10 m/hr | | Stage 2: <8 m/hr |

## 4.2 Clear water storage siting and hydraulics considerations

Based on the required clear water storage (CWS) of 3.4 ML distributed evenly across two circular tanks, each tank would be roughly 21 m in diameter with a tank height of approximately 6 m (active water depth 5 m). The footprint of these tanks in relation to the rest of the plant can be seen in the Reference Design Drawings (Appendix B, DWG C002).

From a hydraulic perspective, it is possible to gravitate from the Yellow Pinch Dam to the head of the WTP if the dam is operating somewhat above its current BWL (estimated minimum water level for gravity operation TBC). Flows can further gravitate from the head of the WTP through the main treatment process, then requiring a lift to the CWS. Under this arrangement, relift pumping will be required within the WTP. It would then be possible to supply the Merimbula Reservoirs No. 1-3 (RL117) by gravity from the CWS tanks at the WTP, provided the BWL is not set below approximately RL (TBC).

Based on the site constraints and topography, it is not practical to site the two 21 m diameter CWS tanks at a lower elevation such that flows can gravity through the entire WTP without a relift step, which would require the tank base to sit at around RL155.5:

- Siting the tanks to the east of the plant is not suitable as this would require cutting into a steeply sloped hill.
- Siting the tanks in the cleared area north of the WTP has similar issues with slope as well as limiting the available area for ground mounted solar panels.
- Excavating a shelf from the area north-east of the plant to lower the tank level to RL155.5 is also not practical.
- Other potential areas are either constrained by high value biodiversity areas or power easements.

Therefore, for the Reference Design the CWS tanks have been located in the area northeast of the plant with tank base at approximately RL159. This location is sensible in terms of proximity to the plant whilst also being close to

the treated water pipeline cut-in point (thus minimising treated water and backwash pipe lengths). This will be significantly easier in terms of construction and incur a lesser CAPEX compared to attempting to excavate into the slope to achieve the optimal CWS levels. The trade-off for elevating the CWS at the WTP is that there will need to be relift pumping within the WTP, which will result in wasted energy to supply Merimbula with drinking water (as it could be gravity fed under optimal hydraulic design). Water supply to Eden and Tura will need to be pumped regardless of the CWS levels, therefore any added head at the WTP should be retained when supplying these arms of the network at no energy penalty, i.e. the downstream Hart's Flat PS will have a lower head duty point.

Based on the significant practical challenges in realising the optimal hydraulic level for the CWS tanks at Yellow Pinch WTP, it is recommended that Council opt for the higher CWS with intermediate relift pumping. It is worth noting that the additional pump duty could be offset by the solar generation when the plant is operating during daylight hours.

It is also noted that alternate site layouts and further detailed consideration of site topography and construction methodology by D&C contractors could result in a different outcome.

# 5. Site works

The following is an overview of the siteworks required for the Yellow Pinch WTP Construction:

- Modification of the existing property entrance
- Access and site road works (detailed below in Section 5.1)
- Administration building with office, bathroom, laboratory and mechanical room
- Chemical buildings housing all new chemical systems
- Estimated 560 kW of solar power to be implemented on the following structures and locations. Note that this scope will be delivered by a separate subcontractor to the WTP D&C Contractor.
  - Admin/mechanical building
  - Chemical buildings
  - 2 No. clear water storage tanks
  - Ground mounted in cleared areas north of WTP
- Vegetation removal
- All bulk earthworks, levelling and surface treatments including pavement works required to allow full plant operation, including footpaths around the admin/mechanical building
- Site stormwater system to be sized for 1% AEP floods including:
- Design philosophy to disperse stormwater across the surface of the site as much as possible to avoid concentrated flows and potential erosion.
  - Swales across site to be sized
  - Culverts underneath roads
- Groundwater removal system to include provision of suitable means to control groundwater underneath road pavements and sludge drying beds
- Pipe cut-ins to existing raw water supply pipework from Yellow Pinch Dam and associated pipework reconfiguration. Separate treated water cut-ins are required to supply:
  - The Merimbula/Eden end of the network to the south-east, and
  - The Wolumla high level storage to the north-west.
- Security fencing of WTP complex including actuated gate at entry from Red Gum Road with swipe card access to the primary access road. A manual lockable gate shall be provided between Red Gum Road and the secondary access point.

## 5.1 Access and site roads

The site access road requirements are governed by bushfire safety, as outlined in Section 2.8.1. The key works are summarised below:

- A sealed access road is required to connect the WTP to the existing unsealed Red Gum Road.
- An upgrade of the existing property driveway to provide a crushed rock secondary entry/exit point to the WTP for use when the primary access road is obstructed or in an emergency.
- Construct new entrance from Red Gum Road to the WTP site to an Austroads BAL standard
- Consider upgrading and sealing Red Gum Road from end of existing sealed section to new WTP entry point
- Access roads will cross existing water supply assets (DN450 and DN225 pipes) and further consideration will be required for pipe protection at the D&C phase, accounting for construction traffic as well as ultimate operations and maintenance vehicle access
- Design vehicle – roads to be designed to accommodate a large rigid truck base. Consider using a semitrailer to check passage.
- Road design based on a large rigid truck is to be checked against the bushfire safety requirements outlined in Section 2.8.1. The more stringent requirements are to be adopted.

- A crushed rock ring road around the new WTP is required for chemical deliveries and access for large maintenance vehicles is required.
- A chemical delivery bund will be required within the ring road, as per NSW EPA Bunding and Spill Management Requirements.
- A crushed rock perimeter road around the circumference of the APZ is required to provide firefighting access to protect the perimeter of the WTP site. The perimeter road is to be located outside the site fence.
- Technical specifications for roadworks to be Council's current specification for subdivision works

# 6. Cut-in strategy

Major cut-ins are required to connect raw water from the Yellow Pinch Dam to the new WTP and return treated water into the existing Kiah-Tantawangalo supply network. The cut-in requirements are outlined below.

***General considerations***

– Minimise downtime of the existing DN450 pipeline from Yellow Pinch Dam to minimise system supply disruptions.
– Cut-ins are required to be less than 12 hours and shall be timed for low demand, winter periods or overnight in peak demand times.
– Cut-ins shall include an isolation valve on the new branch to allow offline construction of the rest of the pipeline.
– To enable supply of the network via the WTP or directly from the Yellow Pinch Dam (i.e. WTP bypass in exceptional circumstances) the cut-ins to the DN450 pipeline from Yellow Pinch Dam shall add isolation valves on the existing pipeline:
    - Downstream of the branch at the raw water offtake
    - Upstream of the branch at the treated water connection
– The raw water offtake and the treated water connection will both have to cross the alignment of the existing DN225 water main to/from Wolumla

***Cut-in location***

– The two key cut-in locations are into the existing DN450 pipe which currently runs through the WTP site north of the facilities with a diversion towards Red Gum Rd to avoid the site high point.
– Additional cut-in to the existing DN225 raw water main to/from Wolumla to be further considered for treated water use (separate scope of work).

***Structural requirements***

– Design of the works is to consider and incorporate pipe thrust restraint and all other loads.
– The stability and integrity of the existing pipe is to be maintained during any temporary works during construction.
– The durability of any thrust restraints (concrete and reinforcement) to both the existing pipe and proposed works is to achieve a design life of 100 years.

# 7. Electrical and control works

Currently under review. To be discussed in workshop.

# 8. Solar reference design

## 8.1 Summary

**Error! Reference source not found.** provides an overall summary of the potential system size. The system sizes listed below are indicative only and are subject to site constraints and design considerations specified in Section **Error! Reference source not found.**. The system will also require approval from network service provider, Essential Energy in this case. There is potential they may limit system export or other specific aspects of the design and therefore early liaison with Essential Energy is required. This initial engagement is included as part of Essential Energy's "Preliminary Enquiry Form"; GHD has initiated completion of this document.

*Table 13 Summary of Solar Design Capacity*

| Area Description | Installation Type | kWp PV |
|---|---|---|
| Chemical Building | Roof Mount PV | 22 |
| PAC & Poly Building | Roof Mount PV | 8 |
| Mechanical/Control Building | Roof Mount PV | 24 |
| DAFF & Flocc Tanks Building | Roof Mount PV | 27 |
| Clean Water Storage Tank 1 | Tank Mount PV | 38 |
| Clean Water Storage Tank 2 | Tank Mount PV | 38 |
| Ground Mount Solar | Ground Mount PV | 407 |
| **Total** | | **562** |

Based on the preliminary figures shown above, the ground mounted solar panels will provide the majority of the solar power generated on site (>70%). For an indicative panel layout, refer to the Reference Design Drawings (Appendix B[3]).

As part of the tender documentation for Yellow Pinch, a separate technical specification will be prepared for the solar design. This will be submitted in a package with the WTP technical specification.

## 8.2 Solar design considerations

### 8.2.1 Rooftop solar

As per the table above, utilising the available rooftop surface areas could potentially result in a system size of 81 kWp. The actual system size will vary based on the specifics of the roof structure, roof pitch, roof profile, panel tilt, and locations of obstructions on the roof such as ventilation, skylights, antennas etc.

Ideally the roof profile should be suitable for a non-penetrative installation, such as kliplok or longline profile. A suitable edge clearance needs to be considered depending upon the racking system used. Increasing the edge clearance will reduce the system output.

The most suitable roof pitch would be monoslope with a 10-degree pitch towards North. The building containing the DAFF & flocc tanks is assumed to be taller than the other buildings to accommodate the tanks. There will be slight shading on the adjacent buildings at periods of the day, thus reducing the overall system output.

Inverters and PV distribution board should ideally be located within the electrical room to avoid any potential degradation of the equipment from the harsh environmental conditions. This will also enable easy connection to the LV main switchboard in the facility.

It is assumed that all DC cabling will be run directly to the inverter location.

[3] Solar drawings not included in Draft submission. Sketch to be presented during workshop.

### 8.2.2 Tank mounted solar

The clear water storage (CWS) tanks are assumed to have a flat concrete roof surface. Panels would ideally be North facing with a fixed tilt of 10 degrees and mounted on a ballast frame. It is assumed that there will not be a parapet wall installed around the perimeter of the tanks, as this would cast shadows and reduce system efficiency.

It is assumed that all DC cabling will be run in trench to the inverter location.

### 8.2.3 Ground mount solar

The ground mounted panels have been positioned with sufficient clearance from the power easement and the Telstra underground cables. Without accurate and recent aerial imagery, it is difficult to assess the level of vegetation in the cleared areas to the north of the WTP. It is assumed that the vegetation in the vicinity of the arrays will be cleared to avoid any potential shading issues. Council is undertaking a drone survey which will be overlaid on the existing survey drawing to refine the panel arrangement; results are expected within a timeframe that allows incorporation in the Final Reference Design submission.

The ground mount system size is constrained by overhead line clearances, Asset Protection Zone (APZ), and the heavy vegetation surrounding the property. These constraints will be informed by the Bushfire Assessment and the environmental survey (to be undertaken by BVSC via a subconsultant).

Ideally the ground mount panels shall be North facing for optimal generation, however this is likely to be impacted by the terrain. Based on the provided survey, the panels have been oriented to align with the contour lines and maximise the system size based on the site conditions. The slope will need to be assessed in more detail and will require liaising with the racking manufacturer to determine whether standard piling for the racking mounts would be suitable.

Ground mount systems will require an access track around the perimeter of the arrays. Furthermore, to ensure the restricted DC access requirement, a security fence will be required around the perimeter.

Soil testing will be required to determine the installation requirement of a ground mount system.

It is recommended that DC cables will be combined and run in trenches back to the inverter location on site.

# 9. Key D&C interfaces

The following are key areas where the Yellow Pinch WTP D&C Contract will interface with third parties (i.e., utilities providers, other contractors, etc.).

## Integration with solar installation

Council's preference is for the solar installation to be undertaken as a separate contract to the main water treatment plant D&C. There will be an interface point that will require careful management.

## Site access

Site access is via Red Gum Road and the access road entry/exit points will provide an interface point between the D&C contractor and the Council.

## Sewer and stormwater

No sewer servicing is proposed for the Yellow Pinch WTP as the nearest sewer network is at Wolumla approximately 3 km away. A septic tank will be required for building/office facilities.

The stormwater system will be designed to disperse stormwater across the surface of the site as much as possible to avoid concentrated flows and potential erosion. The design must maintain the existing levels of natural run off and surface flows into neighbouring properties without causing scouring, erosion or other damage to adjacent properties.

## Power supply

Approval from Essential Energy will be required to supply the WTP from the existing 11 kV overhead power supply requiring a new substation. Completion of Essential Energy's Preliminary Enquiry form is required as the first step in the process for engaging with Essential Energy to confirm capacity of existing HV electricity network; GHD has initiated this process.

At this stage, it is not expected that the WTP siting will require relocation of the existing powerlines through the property.

## Telecommunications

The new WTP's control and communication systems will be integrated into BVSC's existing central SCADA system to enable remote monitoring and control of operations.

The system will rely on an NBN connection to BVSC's central SCADA servers as the primary communications network with a radio link via BVSC's existing radio telemetry network as a back-up connection if the NBN is down.

# 10. Project cost estimate

Pre-tender estimate to be undertaken by subconsultant WT Partnership following Council's review of the draft Reference Design.

# 11. Reference design drawings

The following drawings were prepared and are included in Appendix B.

– C001 – General Arrangement – Access & Constraints
– C002 – General Arrangement - Site Layout
– C003 – Building Layout Plan
– P001 – Process Flow Diagram
– P002 – Hydraulic Profile

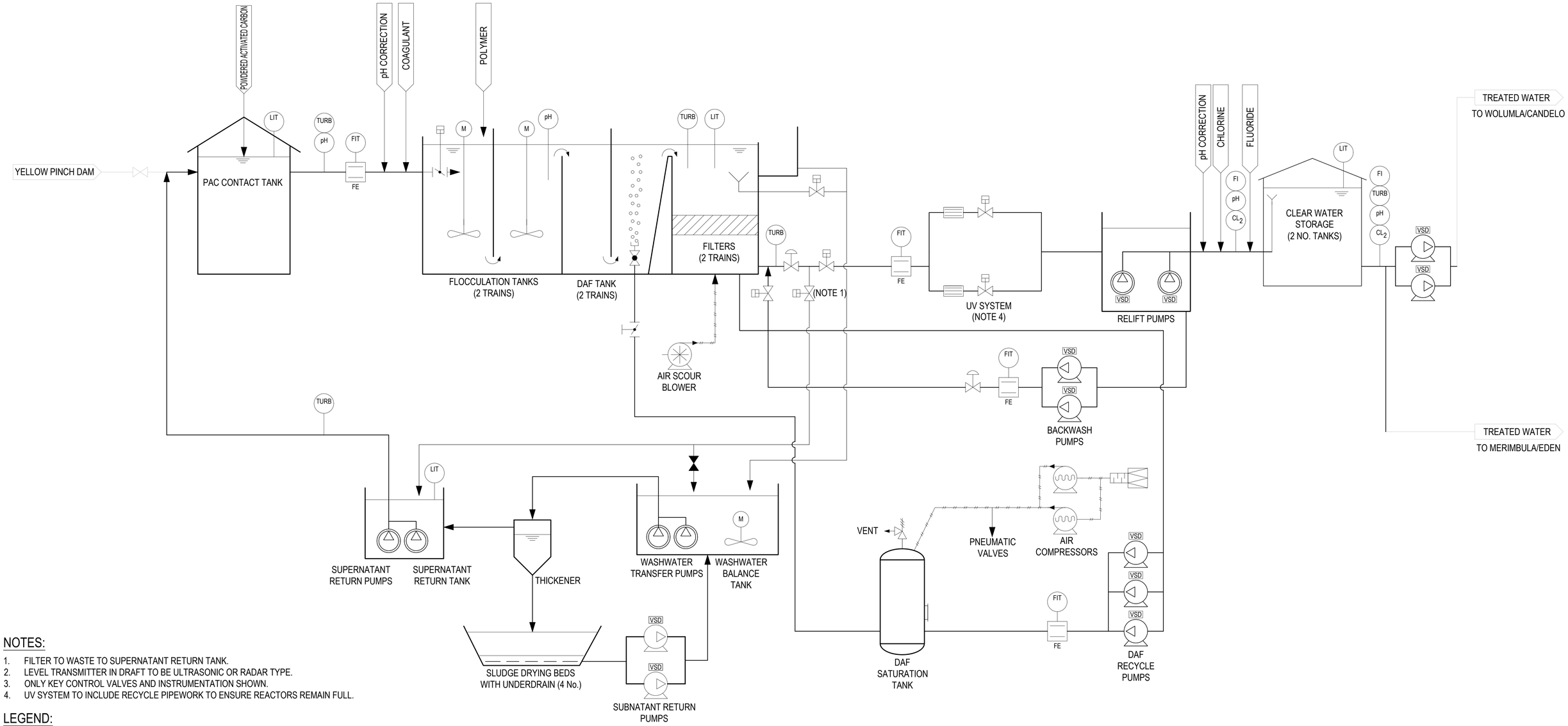
# Appendices

# Appendix A

## Basis of Design Workshop & Minutes

# Appendix B

## Reference Design Drawings




## NOTES:

1. FILTER TO WASTE TO SUPERNATANT RETURN TANK.
2. LEVEL TRANSMITTER IN DRAFT TO BE ULTRASONIC OR RADAR TYPE.
3. ONLY KEY CONTROL VALVES AND INSTRUMENTATION SHOWN.
4. UV SYSTEM TO INCLUDE RECYCLE PIPEWORK TO ENSURE REACTORS REMAIN FULL.

## LEGEND:

- FIT — FLOW TRANSMITTER
- PUMP
- AIR BOWER
- AIR COMPRESSOR
- TURB — TURBIDITY
- F — FLUORIDE
- pH — pH
- MIXER
- M — MOTOR
- VSD — VARIABLE SPEED DRIVE
- MODULATING (CONTROL) VALVE
- ACTUATED VALVE (OPEN/CLOSE)
- BUTTERFLY VALVE
- CCP — CRITICAL CONTROL POINT
- COAG — COAGULANT
- POLY — POLYMER (FILTER AID CARBON)
- TURB — TURBIDITY
- NEW
- EXISTING
- SIGNAL
- VALVE (NORMALLY OPEN)
- VALVE (NORMALLY CLOSED)

FOR INFORMATION

| Rev | Description | Checked | Approved | Date |
|---|---|---|---|---|
| A | REFERENCE DESIGN | CM | CS | 28/11/22 |

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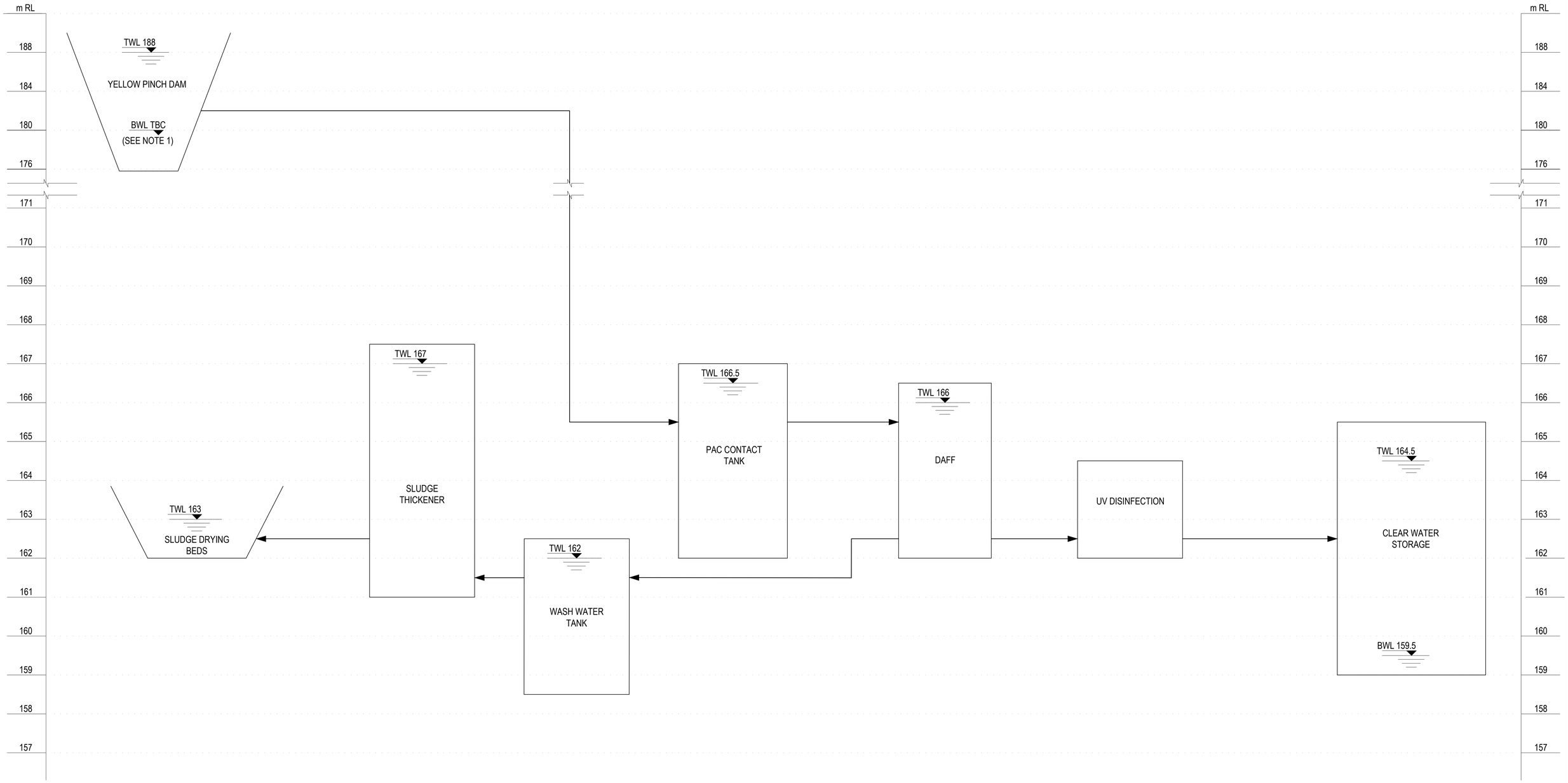
**Project No.** 12538990

Client: BEGA VALLEY SHIRE COUNCIL
Project: YELLOW PINCH WTP
Status: REFERENCE DESIGN
Status Code: S2

Drawing Title: PROCESS FLOW DIAGRAM
Size: A1
Drawing No: 12538990-P001
Rev: A

Plot Date: 28 November 2022 - 2:05 PM Plotted by: Emmanuel Estacio
File Name: N:\PH\Manila - 1029 EDSA\Projects\31\12538990\CADD\Drawings\12538990-P001.dwg




## NOTES:

1. BOTTOM OPERATING LEVEL OF YELLOW PINCH DAM TBC PENDING HYDRAULIC REVIEW.

## ABBREVIATION:

| | |
|---|---|
| TWL | TOP WATER LEVEL |
| BWL | BOTTOM WATER LEVEL |

FOR INFORMATION

| Rev | Description | Checked | Approved | Date |
|---|---|---|---|---|
| A | DRAFT REFERENCE DESIGN | CM | CS | 28/11/22 |

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**Project No.** 12538990

Client BEGA VALLEY SHIRE COUNCIL
Project YELLOW PINCH WTP
Status DRAFT REFERENCE DESIGN
Status Code S2

Drawing Title HYDRAULIC PROFILE
Size A1
Drawing No. 12538990-P002
Rev A

Plot Date: 28 November 2022 - 1:40 PM Plotted by: Emmanuel Estacio
File Name: N:\PH\Manila\Projects\31\12538990\CADD\Drawings\12538990-P002.dwg


## LEGEND:

- EXISTING ELECTRICAL
- EXISTING TELECOMMUNICATION CABLE
- EASEMENT BOUNDARY
- EXISTING FENCELINE
- PROPOSED FENCELINE
- PROPERTY BOUNDARY
- EASEMENTS
- EXISTING DN450 RAW WATER MAIN
- EXISTING DN225 RAW WATER MAIN
- EXISTING WATER SUPPLY

# PLAN

SCALE 1:1000

FOR INFORMATION

| Rev | Description | | Checked | Approved | Date |
|---|---|---|---|---|---|
| A | DRAFT REFERENCE DESIGN | | CM | CS | 28/11/22 |

**Author** J. PORCALLA **Drafting Check** E. ESTACIO JR.

**Designer** N. KAROLY **Design Check** N. JOHNSTON

0 10 20 30 40 50m

SCALE 1:1000 AT ORIGINAL SIZE

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**Project No.** 12538990

Client BEGA VALLEY SHIRE COUNCIL

Project YELLOW PINCH WTP

Status DRAFT REFERENCE DESIGN Status Code S2

Drawing Title GENERAL ARRANGEMENT PLAN

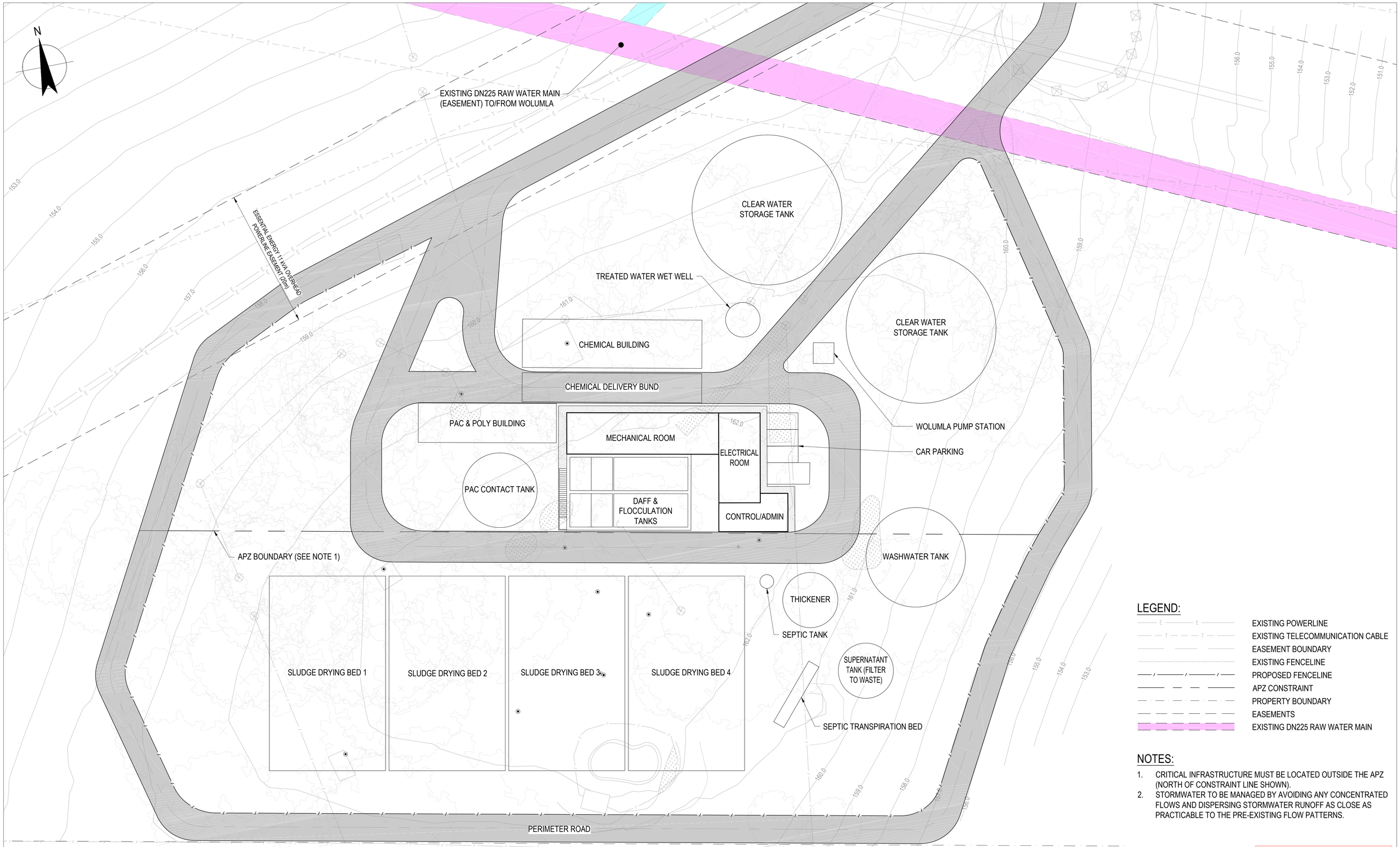
Size A1

Drawing No. 12538990-C001

Rev A

Plot Date: 28 November 2022 - 2:19 PM Plotted by: Emmanuel Estacio

File Name: N:\PH\Manila - 1029 EDSA\Projects\31\12538990\CADD\Drawings\12538990-C001.dwg




## LEGEND:

- EXISTING POWERLINE
- EXISTING TELECOMMUNICATION CABLE
- EASEMENT BOUNDARY
- EXISTING FENCELINE
- PROPOSED FENCELINE
- APZ CONSTRAINT
- PROPERTY BOUNDARY
- EASEMENTS
- EXISTING DN225 RAW WATER MAIN

## NOTES:

1. CRITICAL INFRASTRUCTURE MUST BE LOCATED OUTSIDE THE APZ (NORTH OF CONSTRAINT LINE SHOWN).
2. STORMWATER TO BE MANAGED BY AVOIDING ANY CONCENTRATED FLOWS AND DISPERSING STORMWATER RUNOFF AS CLOSE AS PRACTICABLE TO THE PRE-EXISTING FLOW PATTERNS.

FOR INFORMATION

| Rev | Description | Checked | Approved | Date |
|---|---|---|---|---|
| A | DRAFT REFERENCE DESIGN | CM | CS | 28/11/22 |

**Author** J. PORCALLA **Drafting Check** E. ESTACIO JR.
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0 2.5 5 7.5 10 12.5m
SCALE 1:250 AT ORIGINAL SIZE


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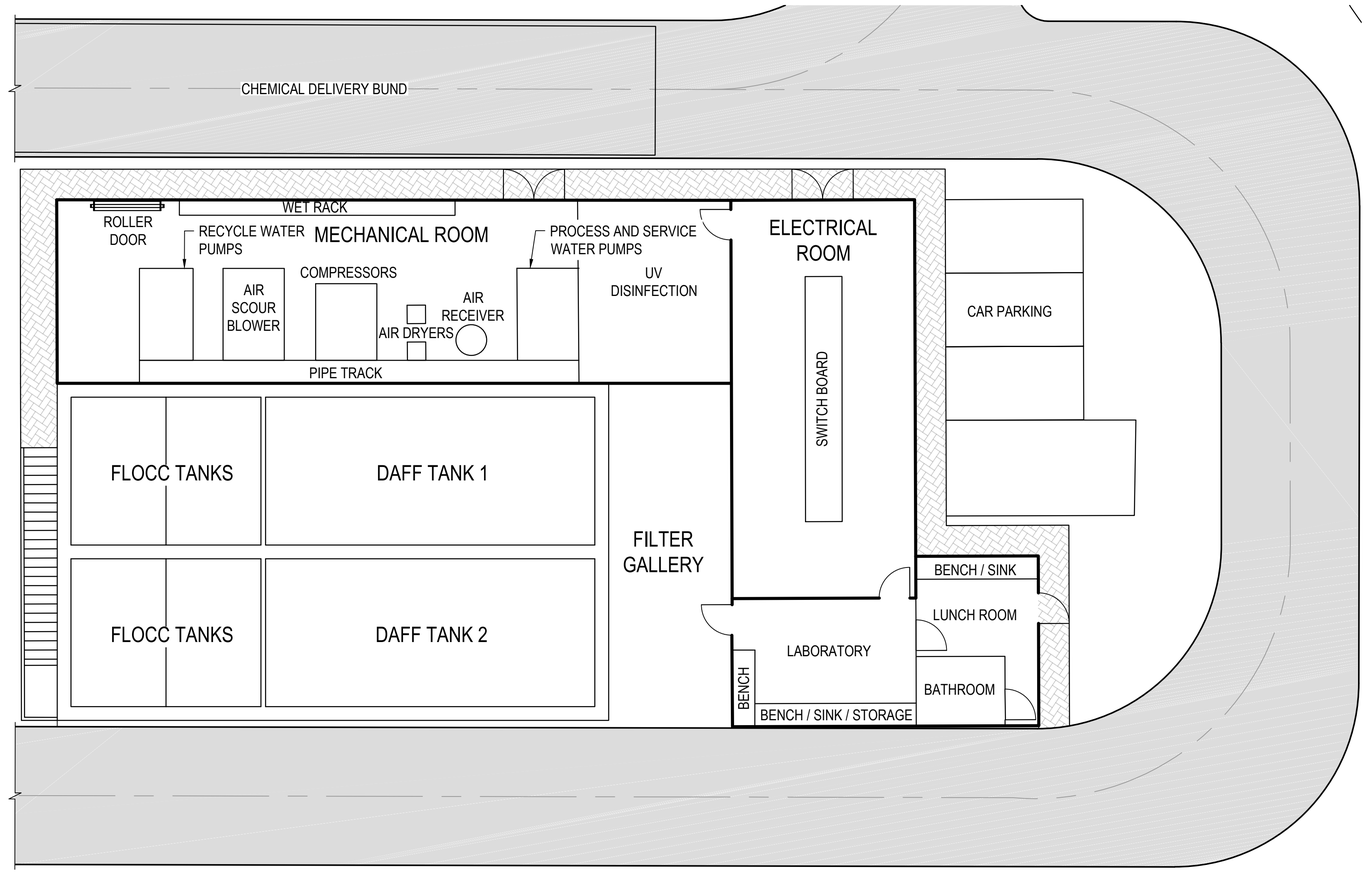
**Project No.** 12538990

Client BEGA VALLEY SHIRE COUNCIL
Project YELLOW PINCH WTP
Status DRAFT REFERENCE DESIGN Status Code S2

Drawing Title SITE LAYOUT PLAN
Size A1
Drawing No. 12538990-C002
Rev A

Plot Date: 28 November 2022 - 1:38 PM Plotted by: Emmanuel Estacio File Name: N:\PH\Manila\Projects\31\12538990\CADD\Drawings\12538990-C002.dwg




PLAN
SCALE 1:100

FOR INFORMATION

| Rev | Description | Checked | Approved | Date |
|---|---|---|---|---|
| A | DRAFT REFERENCE DESIGN | CM | CS | 28/11/22 |

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0 1 2 3 4 5m
SCALE 1:100 AT ORIGINAL SIZE

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**Project No.** 12538990

Client BEGA VALLEY SHIRE COUNCIL
Project YELLOW PINCH WTP
Status DRAFT REFERENCE DESIGN
Status Code S2

Drawing Title BUILDING LAYOUT PLAN
Size A1
Drawing No. 12538990-C003
Rev A

Plot Date: 28 November 2022 - 1:39 PM Plotted by: Emmanuel Estacio
File Name: N:\PH\Manila\Projects\31\12538990\CADD\Drawings\12538990-C003.dwg

# Appendix C

## Reference Design Datasheets

# Appendix D

## Yellow Pinch WTP Options Report

# Appendix E

## Jar Testing Results – Poor Raw Water Quality

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