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Pr10852 - Specification for Design and Construction of MHL Dosing Systems

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Document Sponsor	Infrastructure Standards and Product Approvals Committee
Document Owner	Head of Asset Management
Subject Matter Expert	Network Engineering Manager
References	Refer to Appendix B of this document

Version Review

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0.0 Draft	Unitywater			Initial draft
0.10 Final	Unitywater			Final draft
1	Unitywater	Head of Asset Managemnet	16/05/2022	Approved for release
2	L. Bryson	N/A	N/A	24/05/2023 Minor admin amend to replace manhole terminology with maintenance hole
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Contents

1. Purpose

The purpose of this specification is to define Unitywater's requirements the design, construction, commissioning, and handover for Magnesium Hydroxide Liquid (MHL) Dosing system at Sewage Pumping Stations within Unitywater's sewer network.

This Specification shall be read in conjunction with relevant project drawings (where applicable), Project Specification and supplementary specifications.

2. Scope

This Specification shall apply to works to be constructed by contract, sub-contract or direct labour.

This Specification shall apply to works being constructed directly for Unitywater or other authority or for an owner/developer who will hand over the ownership of the constructed works to Unitywater or who will retain ownership.

The Scope of Work shall include the design, supply, installation, testing and commissioning/handover of all MHL design system and associated equipment as shown in the Contract documents.

3. General requirements

3.1 General introduction to MHL dosing

Unitywater doses the chemical, Magnesium Hydroxide Liquid (MHL) to lift the pH level of sewage at key locations within its sewerage network. This serves to keep Hydrogen Sulphide (H_2S) in its liquid phase, which increases asset life and decreases the likelihood of odour complaints. The intended use of this specification is for sewage networks but can be used as guidance for treatment-based facilities where required.

3.2 Spares

Prior to commissioning, the Contractor shall supply to Unitywater a complete set of all foreseeable spare parts and consumables that would be expected to be required in the first 12 months of the asset's operation. The list shall include item, model, supplier and lead time. Unitywater will decide which spare shall be purchased.

4. Planning phase

4.1 Confirmation of need for MHL dosing

As part of the planning phase, the requirement for MHL dosing should be determined in accordance with the SEQ Code Design Criteria, and the WAS04-2005 code which provide guidance on when and why MHL Dosing should be considered for reducing measured or expected hydrogen sulphide.

The SEQ Code Design Criteria, Section 13.6 - Septicity and Odour Control states:

> *"Where high retention times are likely to occur, some form of odour / sulphide control will be required. As a guide, average retention times in excess of two hours may lead to hydrogen sulphide generation. The 90$_{th}$ percentile gaseous hydrogen sulphide concentration in the sewer headspace shall not exceed 10ppm anywhere in the system. If modelling predicts concentrations greater than 10ppm, then either pump station chemical dosing or headspace gas extraction/treatment will be required. Refer to the WSAA Sewerage Code and the WSAA Sewage Pumping Station Code (as amended) for further guidance on odour management studies."*

Section WSA04-2005 code (Part 1_2_1) Section 10.10 Odour and Septicity Control states that:

> *The design shall meet the following corrosion pre-cursor limits:*
>
> *(a) Hydrogen sulphide (H_2S) gas concentration to be ≤10 ppm anywhere in the system.*
>
> *(b) Total dissolved sulphide in sewage to be less than 0.5 mg/L.*
>
> *(c) pH of sewage to be in the range of 6.8.*

NB: Unitywater manages the pH of sewage in the range of 8.2 to 8.5.

Whilst the WSA04-2005 code also states that the need for remedial measures such as injecting agents or chemical dosing shall be avoided, where the volume of the pressure main cannot be reduced sufficiently to overcome a detention a suitable solution includes pH correction using MHL.

Further to the above (H2S) gas concentrations (≤10 ppm) referenced. Where fugitive emissions are known to escape the sewerage system such as vent stacks, MH's and are a risk to the public.

The designer may need to consider the requirements under the Queensland Government Environmental Protection (Air) Policy 2019, which stipulates air quality objectives for indicators for both 'health and wellbeing' as well as 'protecting aesthetic environment'. A summary of these requirements is listed below in Table 1 from the Queensland Government Environmental Protection (Air) Policy 2019. Were such occurrences exist the designers need to also consider local odour treatment at such source of fugitive emissions.

Column 1	Column 2	Column 3		Column 4	Column 5
Indicator	**Environmental value**	**Air quality objectives**		**Period**	**Days**
		µg/m3 (except where noted)	**ppm (volume/volume)**		
hydrogen sulphide	health and wellbeing	164	0.108	24 hours	-
	protecting aesthetic environment	7.5	0.005	30 minutes	-

Figure 1 – Table 1 from the Queensland Government Environmental Protection (Air) Policy 2019

4.2 Confirmation of assets to be protected

Once it has been determined that MHL dosing is the most appropriate remedial measure to achieve the required H_2S gas concentrations and the dissolved sulphide and pH levels in sewage, then the following details shall be identified.

- List of Main / Direct Assets being protected (Including Asset ID, Description and Estimated Replacement Cost and/or Current Value) including:
  - Pipe Segments;
  - Maintenance hole;
  - Grit Chamber etc.
- List of Indirect Assets (further downstream) being protected (Including Asset ID, Description and Estimated Replacement Cost and/or Current Value):
  - Pipe Segments;
  - Maintenance hole;
  - Grit Chamber etc;
  - STP Inlet Works etc.
- Location of any historical Odour Complaints being Addressed (if being applied to existing infrastructure):
  - List of Site and also number of complaints per site.
  - Map showing sites / numbers of odour complaints.

4.3 MHL dosing location

The selection of the most appropriate location of the MHL dosing site should take into consideration the following:

- Relative location of Direct and Indirect assets being protected.
- Available space at existing/new Unitywater assets (Sewage Pumping Stations) to accommodate the chemical dosing unit including truck delivery bund.
- Ease of ingress and egress of Chemical Deliver to the site.

4.4 H_2S and pH sampling points

Pre-Dosing Sampling

Sampling should be taken prior to the dosing system design phase to confirm the appropriateness of MHL design for the system and the severity of the problem being addressed.

Depending on the preferred method of determining MHL dosing rates, the sampling regime may include either or both aqueous and gaseous phases.

Gaseous sampling involves in installing H2S logging (gas detector) instruments within the upstream collector MH at the pumping station and within the rising mains discharge MH or next downstream MH. The purpose of collecting data at the PS and at the discharge of the rising main is set a baseline for existing odour concentrations.

The gas detectors in maintenance holes are to be located with the pre-set positioning ropes at the top, middle and bottom of the shaft, with the bottom most logger being located approximately 30cm above the obvert of the incoming sewer pipe.

(Apptek “Odalog” units or equivalent in specification) are to be used for H2S sampling, units that are to be hired for the duration of the sampling works shall have certificates for proof of calibration.

Aqueous sampling regime

Sampling periods should be agreed with Unitywater including:

- Diurnal sampling;
- winter sample; and
- summer sample.

For larger sites, all of the above sampling will be undertaken to ensure confidence in configuring, commissioning and operating variable dosing rates (i.e to be able to accurately determine the correct program co-efficient variables required to configure the RTU).

Post-Dosing Sampling

As part of the commission process (refer to 7), sampling will be taken to determine the success and efficiency of the MHL dosing system. (To ensure the system is not over / under dosing). The position of the sampling point shall be determined in consultation with Unitywater during the design phase.

4.5 Deliverables from the planning phase

The planning phase will prepare the design inputs for the subsequent design phase including but not limited to the following details:

Table 1 – Design Parameters

Planning Parameter	Value (Supplied by Unitywater)	Value (Supplied by Designer/Contractor)
Asset ID	<< Site ID >>	
Asset Name	<< Site Name >>	
Asset Location: Address	<< Street Address >>	
Asset Location: GPS Co-ordinates / GIS?	<< GPS Co-ordinates >>	
Diurnal Minimum Flow Rate of Sewage Pump Station		<< ##.# L/hr >>
Diurnal Maximum Flow Rate of Sewage Pump Station		<< ##.# L/hr >>
Type of Dosing	<< Name of Chemical >>	
Concentration of Dosing Chemical	<< Concertation of Chemical >>	
Minimum Dosing Rate of MHL / L of Sewage		mL / L
Maximum Dosing Rate of MHL / L of Sewage		mL / L
Minimum Required Dosing Rates		<< ##.# L / hr >>
Maximum Required Dosing Rates		<< ##.# L / hr >>
Maximum Daily Chemical Usage		<< ## L / day >>
Minimum Storage Volume to achieve 14 days Storage		<< ### L >>
Location for pH monitoring	<< GPS Co-ordinates >>	
Minimum Performance Parameter: pH	<< #.# >>	
Location for H_2S monitoring	<< GPS Co-ordinates >>	
Minimum Performance Parameter: Dissolved Sulphides	<< #.# >>	
Pressure of Available Water Supply for process water	<< mAHD >>	
Pressure of Available Water Supply for eyewash	<< mAHD >>	

5. Chemical Dosing Unit (CDU) requirements

5.1 General requirements

Sizing and solutions overview

The application of MHL dosing for odour and corrosion control is specifically intended for installation at pump station assets, and is a function of catchment septicity, pumping station flowrates and rising main detention times.

As such, the requirements can vary significantly across network assets for small pumping stations within emerging developments with low flows, to large transfer pumping stations located within densely populated environments.

The provision for the CDU facility is highly dependent on the size of the pumping station, required dose rate and chemical storage requirements.

As general guidance:

- Small sites with less than <500L of storage requirement would utilise a prefabricated enclosure style CDU with a reduced footprints and civil requirements.
- Sites where storage volume exceeds >500L+ of total storage, the CDU is to be housed within permanent facility (building).

Design to include a minimum 14 days of MHL storage at the normal dry weather sewer flows.

Containment methodology

As with all chemicals MHL supplied and delivered to site in tankers, the chemical is unloaded using a pumped or gravity feed from the vehicle to the onsite storages via camlock hoses.

With all manual handling of hazardous and non-hazardous liquids there is a potential for spillage and equipment failure or malfunction.

MHL is considered a non-corrosive, non-toxic chemical in general, however a significant release to the environment (creeks / waterways) could be considered harmful, and chemically altering to the natural pH balance.

The onsite containments provisions are mandatory unless specifically assessed as not being required on a site-specific basis through the Safety in Design, and HAZOP process.

Facility and equipment identification and numbering

The facility and equipment for the CDU shall be in accordance with the following Unitywater technical standard: *Pr8843 - Specification for Drawing, Document and Equipment Tag Numbering.*

Chemical manifest

A Hazardous Material (HAZMAT) box shall be mounted just inside the site main entrance gate. A chemical manifest shall be provided within the storage building or compartment. his typically contains the following details:

- Date of preparation;
- Name and contact details of Occupier / Unitywater Responsible Person;
- Contact details for two people in case of emergency;
- Details of dangerous goods storages including type, location, number, and volume of tanks;
- Safety Data Sheet (SDS) of the chemical; and
- A site plan of the premises which includes:
  - Location of essential site services, fuel and power isolation points;
  - Location of fire extinguisher and safety shower/eye wash facilities;
  - Location of the manifest;
  - Main entry and exit points;
  - Location and classes of dangerous goods storages and how they are identified;
  - Dosing area;
  - Location of all drains on site;
  - Nature of adjoining water storage facility; and
  - Location of emergency assembly area.

5.2 Civil requirements

Site layout

Notionally, the MHL CDU facility shall be appropriately located within the specified pumping station compound, with considerations of the following elements:

- Site access, chemical delivery, safety.
- Proximity to dosing points, power and communications.
- Visual amenity.
- Spatial constraints based on CDU facility.
- Delivery bunding and site drainage.
- Security.

Location

In general, the CDU facility shall be positioned to accommodate appropriate access for chemical deliveries and maintenance of the CDU and associated pumping station facilities. The unloading point shall be located adjacent to the CDU facility where practicable. The unloading connection point (camlock) will be located within the CDU facility, as such the delivery vehicles (tankers) shall be within 6m of the CDU connection point in accordance with NOHSC:2017(2001) - National Code of Practice for the Storage and Handing of Workplace Dangerous Goods.

Flooding

Sewage pump stations are typically sited in the lowest points in a gravity catchment, as such these sites could be subject to flooding. Typically, such sites should be designed to have a minimum flood immunity to Q100 events particularly for electrical assets. However, some existing sites may exist where flood immunity is achieved by position infrastructure above ground level on raised level platforms. It may not be practical for dosing facilities and civil works to fully conform to this criterion. Chemical storage tanks must be suitably restrained to avoid floating or transport and shall have their openings, vents and overflow pipework above Q100 levels. Electrical assets must have immunity of Q100 +300mm. Dosing pumps where practical should be located above design flood levels, however with standardising low cost item such as MHL dosing equipment, it could be viewed practical in certain circumstances to rely on hot spares.

Access

Site access and layout shall accommodate the needs of chemical deliveries vehicles, anecdotally these typical consist of (10tonne) rigid tankers, however the design shall cater for up to the equivalent specifications of NHVR Common Rigid Trucks, 2/3 axle, <12.5m length. The access provisions shall permit the delivery vehicle to either drive through or reverse manoeuvre to the chemical unloading point. The design shall fully consider turning movements in accordance with the relevant standards. Preference is for the delivery vehicle to manoeuvre forward in, forward out of the site, and to be fully located within the site when unloading. There should only be one access point for all vehicles entering the site, including sewer pump out vehicles.

Chemical delivery bay

It is acknowledged that the application of this specification for MHL dosing provisions, will be applied to new greenfield site (pump stations) as well as brownfield sites with established infrastructure and access provisions.

All pumping station sites that require MHL dosing shall include bunded access provisions. It is not an expectation that such bunding facilities need to accommodate containment of the full delivery volume, given appropriate drainage to the wet-well.

Where possible, modifications to the site access should be considered to provide nominal means of containment of MHL that could result during receipt of deliveries. The designer should fully consider the site conditions, including access drainage/ grading, valving, receiving environments when making recommendations.

At a minimum consideration of a rollover bund and provisions of kerbing around the perimeter of the access pavements. Drainage of the bunded delivery area to a sump pit 900x900x600mm is required to facilitate the ability to direct spills back to the wet well or an

upstream gravity network. The sump pit is to be connected to the wet-well via control valve and as a minimum a DN100 discharge line.

(NOTE - The designer shall provide hydraulic verification that the discharge line is capable of matching spill rates eventuating from a rupture of the tanker delivery pipe).

Likewise, the sump pit shall have a drainage valve and as a minimum a DN100 drainage line be connected to the wet-well/MH.

(NOTE - The designer shall provide hydraulic verification that the drainage line is capable of conveyance watershed captured in the bund).

To facilitate appropriate spill containment and flow diversion to the wet-well, both the sump control valve and drainage valve shall be accessible and visible, with visible position indication to the operator.

Sump pit shall be provided with a grated cover constructed from FRP or Aluminium and rated suitably to trafficable loads.

Valves located in pit shall not be in a trafficable location but fully accessible off driveway.

Gating should be less the 15kgs for manual handling purpose or have alternative means to lifting and removal.

Building

The MHL dosing facility is to be housed in a masonry block structure designed in accordance with AS3700 Masonry Structures and Building Code of Australia requirements and also the following Unitywater Standard: *Pr9903* - *Specification for Building and Structural Works.*

Other structures styles and construction methods may be used when accepted by Unitywater at the design stage.

Size and arrangement of the building could vary depending on the dosing requirements of the site and the required minimum storage volumes of 14 days. It is envisaged that the requirements of the facility can be adapted to suit, with common dimensions.

Unless agreed otherwise, the building is to be constructed of reinforced painted concrete blocks in line with Unitywater requirements.

The structure shall have a large, manually operated roller door lengthways to provide access to the CDU's from the adjacent access/ delivery bund. A separate heavy duty, secure doorway for personnel access into the facility.

Natural ventilation of the structure is preferred and to be achieved via drawing cool air in through side entry vents (insect/vermin proof) and egress through the roof structure via static ventilator/s, where required whirly birds type ventilator/s maybe considered. The designer shall assess natural ventilation requirements in accordance AS1664.4.

A single large ventilation portal shall be provided in the end wall of the structure, fitted with fixed louvres, and vermin proof meshing accessible from the inside for cleaning.

All ventilation, door framing and louvres systems shall be constructed from 6063 T5 heavy duty extruded framing conforming to AS 1866.

The roof structure shall be a mono-slope construction, with a minimum 3-degree pitch for draining from front to rear of the building. The roof drain shall be pipes. No gutter to be provided, a 300mm wide (minimum) concrete apron under the rear overhang to prevent erosion. The apron shall drain to nearest stormwater system or a minimum of 3m from the building.

Minimum 600mm overhanging eaves shall be provided over sides with access openings, standard eaves on all other sides.

A concrete mowing strip, minimum 300mm wide shall be provided to the perimeter of the building.

The structural shall have metal roofing with a fully watertight and birdproof roofing system of the type shown and specified, complete with all necessary accessories, and trim including capping, and flashings.

The roof framing, purlins, battens, etc shall be concealed from view internally with a false plasterboard finish ceiling, with provisions for ventilation, ceiling insulation and light fittings.

The building structure shall have sufficient space provisions for the required MHL storage tanks, including the removal of the storage tanks, delivery connection; associated pipework, dosing pumps and fittings to be contained within a self-draining bund structure, set below the access level. The walls of the bunding structure wall consist of watertight solid concrete construction conforming and is considered liquid retaining and shall be confirming to AS3735.

The layout of the of dosing storage tanking, pumps, pipework, valve facilities should consider access and ergonomics in kind.

The facility shall have provisions for a potable water supply (via RPZ), washbasin and the potential requirement for eye washing facilities. (Note: Some smaller facilities may not warrant permanent eye-washing facilities, as such portable eye wash amenities will be carried by delivery and field personnel). Washdown facilities shall be provided for cleaning and flushing of the delivery pipework.

Grey water plumbing and sump drainage shall be directed into common plumbing to the wet-well which shall be provided with backflow prevention.

All other generic design considerations of the building and facilities shall follow the requirements of *Pr9903* - *Specification for Building and Structural Works* and shall may include but are not limited to the following:

- Materials of construction;
- Waterproofing;
- Lighting and Power;
- Security;
- Concrete works;
- Structural Steelwork.

Figure 2 – Example of typical standards MHL Dosing building

Chemical storage tanks

The preferred means of Chemical storage for MHL is tanks manufactured from rotomolded PE (maxi-bin tank) with 50-degree conical bottoms which can range in volume between 0.63-2m3. The tanks shall be designed and constructed in accordance with AS/NZS 4766. The wall thickness of the tanks shall be designed with a minimum factor of safety 1.5 times the specific gravity of the fluid to be contained (MHL).

The tanks are supported in a galvanized mild steel cradle that utilise a standard 1.12m x 1.12m footprint across the size range.

The tanks shall be provided with a common inlet/ outlet as the base of the steep 50-degree conical section of the tank.

Overflow provisions will be provided for storage tanks and overflow pipes are to be directed towards the sump.

Dedicated venting for the storage tanks is required.

Safe access to the top of the tank is required for cleaning purposes.

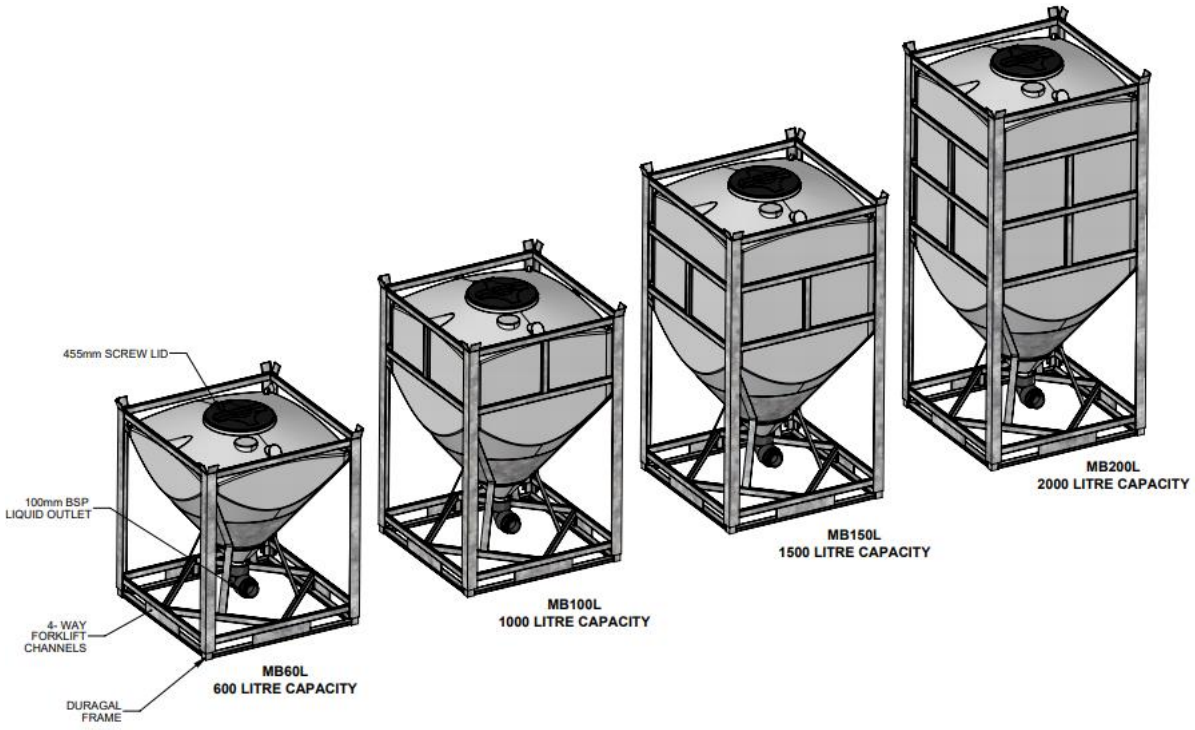

Figure 3 – Maxi Bin Liquid General Arrangement (Courtesy of Polymaster)

Chemical storage bund

Containment of the chemical storage could vary depending on the size of the building and required storage volume. The size and number of MHL storage tanks (Maxi bin) is to be determined with the projects needs specification.

However, generally the standard arrangement shall utilise a common footprint within a recessed shallow concrete bund, with a minimum separation between tanks of 1m to permit access for maintenance to pipework, valves, and pumps.

Unlike the requirements for other 'hazardous' chemicals which typically require a bund capacity equal to 110% of the total capacity of the largest tank. MHL is considered as less hazardous to environment and the process, by which large volumes could be discharged to the sewer system in the event of spill. As such a shallow bunding of notionally 150mm deep and appropriately size drainage system to the wet-well capable of conveying the entire contents of either or both tanks due to a failure of common pipework should suffice. The designer shall provide hydraulic verification that the drainage system is capable of matching spill rates eventuating from a rupture manifold pipe.

The bund shall comply with AS1657 safe access.

The bunding concrete surfaces shall be protected with a NOV coating system, which shall assist cleaning and wash-down.

The storage bund shall have 600mm square sump with a minimum DN100 free drainage line to the nearby wet-well structure.

(NOTE - The designer shall provide hydraulic verification that the discharge line is capable of matching spill rates eventuating from a rupture of the tanker delivery pipe).

Drainage line to utilise an inline check valve to mitigate against fugitive odour emissions entry to the building. A FRP grating is to be provided for the sump.

Where multiple storage tanks are to be accommodate within a facility, and it is not efficient nor practical to provide bunding, it may be viewed more efficient to grade the flooring to a central drainage system and arrange the tanks around perimeter walls of the facility to maximise use of space. The whole floor area could be recessed slightly from ground level, with a ramped access from the roller door for forklift access.

Camlock filling point

The connection point for chemical deliveries to the facility shall be via a DN80 standpipe with a male DN50 camlock connection located within the dosing facility bund area, hydraulically connects with a connection to the common manifold pipework between the tanks and the dosing pump. A standpipe shall be provided with inline isolation.

5.3 Mechanical requirements

Valve selection

Isolation valves (manual) for dosing applications shall be full bore, ball valves preferably uPVC construction (George Fisher or equivalent) with socket or union ends. Valves shall show the direction of flow.

Water lines coming from UW supply mains must be provided with Reduced Pressure Zone (RPZ) valves for backflow (contamination) prevention, refer to accepted variants for UW SEQCode IPAM list.

Table 2 – Valve List

ID	Valve	Description
Vlv0x1	Tank Isolation Valve(s)	80mm Manually Operated Full Bore Ball Valve (uPVC)
Vlvx2	Tank Waste Outlet Valve(s)	50mm Manually Operated Full Bore Ball Valve (uPVC)
Vlv002	Waste Discharge Point	Camlock Coupling (Male??)
VLV002	Filling Point Isolation Valve(s)	80mm Manually Operated Full Bore Ball Valve (uPVC)
VLV003	Dosing Pump Isolation Valve(s)	50mm Manually Operated Full Bore Ball Valve (uPVC)
VLV005	Pump Washout Connection Valve	25mm SS316 ball valve
VLV004	Reduced Pressure Zone (PRZ)	Refer to IPAM list for accepted product.

Pump selection

The preferred design for the MHL dosing pumps is peristaltic type, adjustable speed pumps, Bredel or similar in specification. A single duty pump shall be provided, with a close/direct coupled drive and motor. Minimum turn down ratio of 30:1 shall be specified.

Pumps shall be fitted with a cooling fan to enable operation at low speed. The fan is to be integrated into the pumps and not separately monitored or controlled.

Suction and discharge fitting and diameters shall be nominally suit 20mm thick-walled hose. Fittings shall be designed for easy access and removal for cleaning and maintenance.

Table 3 – Pump List

Description	Details	Preferred Equipment (Make / Model)
PMP001	Dosing Pump	Bredel 15. Port size (flanged): DN20 (3/4") Capacity (L/rev): 0.083 Approx Flow Rate @ 50Hz: ??? L/hr Motor: 415V, 3 Phase, 0.37 kW Approximate weight of pumphead (kg):48 Approximate weight of motor/gearbox (kg):15
PMP002	Sump Pump	

Pump flushing requirements

There is a requirement for flushing facilities for outlet/discharge line of the dosing pumps to flush excess magnesium hydroxide that may settle and clog the line. Flushing shall be achieved by connecting the wash-dose hose to the manual wash-out connection.

Pipework and fittings

Pipework jointing and installation to be carried out in accordance with manufacturers requirements.

Pipe materials selection for use for MHL CDU pipework and fittings shall consider potential for blockages. Pipes and fittings shall be assembled to allow an easy cleaning process to the pipework internals and simple disassemble if required. Internal/ external dosing lines from pump to wet-well should be flexible 20mm NBR thick-walled rubber hose. Connection and termination of flexible lines shall utilise polyethylene DN20 camlock fittings (type C&E) with heavy duty SS316 clamps OR SS316 equivalents.

Rigid pipework for use of manifolds between tanks, pumps, and filling points shall be minimum DN50-80 uPVC ANSI Schedule 80 or Polyethylene PE to AS4130. Pipework arrangements shall be designed to be compact as possible, utilise union joints or flange connections (breakpoints), rodding points, long radius bends, and Y-branches for converging and diverging flow paths. (short radius bends shall not be used) Drain/ flushing points shall be integrated into manifold arrangements, for manual flushing.

Rigid pipework within the CDU shall be where possible routed above ground and supported on appropriately spaced SS316 brackets, utilising threaded SS316 rods chemically set into the underlying slab. Water lines for eyewash basin and washdown facilities shall be PE100, SDR11 (PN16), fittings to be PN16 metric compression fittings accepted variants for UW SEQCode IPAM list.

Camlock fittings shall be Polyethylene or Stainless Steel 316 construction.

All pipework shall be labelled and coloured in accordance with Unitywater Standard: *Pr9693* - *Specification for Mechanical Installations.*

5.4 Electrical requirements

All electrical works shall be installed in accordance with the following Unitywater standard: *Pr9380* - *Unitywater Specification for Electrical Installation at Network Sites*.

All electrical equipment in the chemical room, including wiring, shall be installed above the full chemical bund level.

All electrical equipment shall be capable of working when the bund is full of liquid. As both water and the dosing chemicals are electrical conductors, safety of personnel within the bund must be considered when designing the layout of electrical equipment within the building.

Pipelines installed near electrical controls shall be shielded with PE covers to prevent leakage/spray from effecting electrical components and to direct leakage onto the floor and to the sump.

Integration to existing Sewage Pump Station switchboard

The dosing system electrical and instrumentation system can be directly and individually integrated into the onsite sewage pump station switchboard, or, for existing sewage pump stations if space is limited in the existing board, then a remote dosing panel is also acceptable.

The dosing system will integrate the following circuits into the onsite sewage pump station switchboard:

- Dosing Pump:
  - Power Circuit, including:
    - Circuit breaker;
    - Run contactor;
    - Thermal Overload;
    - Field Isolator.
  - Control Circuit including:
    - Manual / Off / Auto Switch;
    - Run Relay;
    - Reset Button.
- Building Power and Lighting:
  - Lighting Circuit including safety switch and light switch;
  - Power outlet including safety switch and power outlet.
- Instrumentation:
  - Tank Level Sensor Analog Input and level display.

Dosing pump

If the dosing pump is selected to run in Auto Mode on the selector switch, it will run when the digital output from the RTU is active.

If selected to Manual Mode on the selector switch, the pump will run continuously until switched to the OFF mode on the Selector Switch.

Level instrumentation

Levels measurements within the tank(s) is via load cells, which is displayed on a visible digital display.

The transmitters shall be connected to the control and telemetry system to allow remote monitoring with the full range of the device measure in % and (L)

- 0.0% = 0.0 L
- 100.0% = Maximum capacity of the tank.

Cable tray

There shall be a stainless steel or non-metallic cable tray around the complete inside perimeter wall of the dosing room and into the electrical controls room. The cable tray shall have plastic divider segregated sections for power and controls cables. The power cable section will be 2/3 of the space and the controls cable section will be about 1/3 of the space. The cable try shall be spaced off the wall using spacer so that control cables will fit between the wall and cable tray where relevant. Power cables shall come out of the bottom of the cable tray and controls cables shall come out of the top or back of the cable tray. The cable tray shall be sealed with a removable compound where it penetrates through the wall between the dosing room and electrical controls room.

Power outlets

One 15 Amp IP66 switched socked outlet (3-pin, 240 V) power outlet must be provided in the chemical dosing area as well as a 10 amp 240v power outlet adjacent to the roller door.

Lighting

The Contractor shall design and supply lighting system to comply with the relevant Australian Standards. Lighting shall be designed to allow safe access and operation of the asset at night time. Energy efficiency, easy maintenance and reliability of the lighting system shall be taken into consideration in the design.

5.5 Control System Requirements

The following Standard Inputs and Outputs to be added to the SP site RTU.

Required physical IO

- Digital Inputs:
  - Dosing Pump Running.
  - Dosing Pump Healthy.
- Digital Outputs:
  - Dosing Pump Run Command.
- Analog Inputs:
  - Dosing Tank Level (4-20mA).

Control philosophy

The CDU design is based on a standard sized pump, which will operate once every normal dry weather pump cycle. The dosing pump will start when the wet well reaches the stop level and will continue to run for an operator adjustable time which is determine the volume amount of MHL that is injected into the Wet Well during a pump down cycle.

The time is determined using the following formula:

$$MDT = \frac{RDR * VOL}{PDR}$$

MDT = **M**aximum Dry Weather **D**osing **T**ime [Seconds]
RDR = **R**equired **D**osing **R**ate of MHL / Dry Weather Sewage Flow [L/kL]
VOL = **Vol**ume of Pump Cycle (Start Level Vol – Stop Level Vol) [kL]
PDR = **P**ump **D**osing **R**ate of Fixed Speed Dosing Pump [L / s]

The current dosing time **CDT** will be calculated in the RTU using the following formula:

$$CDT = vwxyz(MDT)$$

CDT = **C**urrent **D**osing **T**ime (Seconds)
MDT = **M**aximum Dry Weather **D**osing **T**ime (Seconds)
v = Peak adjustment coefficient (based on adjustable peak time)
w = Off-Peak adjustment coefficient (based on adjustable off-peak time)
x = Inflow adjustment coefficient (based on current inflow of the station)
y = Seasonal adjustment coefficient (based on the current season)
z = Weekend adjustment coefficient (based on the current day)

The value of CDT is the determined to the nearest second.

The coefficients v, w, x, y and z are further explained in the following sections.

Peak adjustment coefficient (v)

A coefficient is provided to adjust the dosing time during peak periods (either up or down):

Detail	Value
Peak Time Start	7:00 am
Peak Time Stop	9:00 am
Peak Time coefficient (Site Specific – default 1.00)	1.00

If the current time is between the start and stop time, then the coefficient v is equal to the Peak Time Coefficient Variable, else it is equal to 1.0.

Off Peak adjustment coefficient (w)

A coefficient is provided to adjust the dosing time during off-peak periods (either up or down):

Detail	Value
Off-Peak Time Start	3:00 pm
Off-Peak Time Stop	6:00 am
Off-Peak Time coefficient (Site Specific – default 1.00)	1.00

If the current time is between the start and stop time, then the coefficient w is equal to the Off-Peak Time Coefficient Variable, else it is equal to 1.0.

Inflow adjustment coefficient (x)

Detail	Value
Peak Dry Weather Inflow (Site Specific Value)	x.xx l/s
Minimum Dry Weather Inflow (Site Specific Value)	x.xx l/s
Wet Weather Inflow SP1 (site specific - default 137.5% of peak dry weather inflow)	137.5%

Wet Weather Inflow SP2 (site specific - default 175.0% of peak dry weather inflow)	175.0%
Co-efficient (x) when Inflow = Lowest Dry Weather Inflow	1.00
Co-efficient (x) when Inflow = Peak Dry Weather Inflow	0.7
Co-efficient (x) when Inflow = Wet Weather Inflow SP1	0.5
Co-efficient (x) when Inflow = Wet Weather Inflow SP2	0.0

The inflow adjustment coefficient (x) is interpolated linearly between all the 4 x setpoints above based on the current inflow value. Value is based is between 0.0 and 1.0

Wet weather events

It is understood that during 'extreme' wet weather events, that design will not be required. As many pump-stations are configured to have duty capacity equivalent to PWWF, the control system will need to identify such an event. It is proposed that this would be determined by run times.

Seasonal adjustment coefficient (y)

The seasonal adjustment coefficient (y) is based on the time of year to account for the different average temperatures of the seasons.

Detail	Value
Winter SP(Site specific – default is 0.85)	0.85
Autumn / Spring SP (Site Specific – default is 0.90)	0.90

The Seasonal Adjustment Coefficient mode is to be controlled by Unitywater Control system.

Weekend adjustment coefficient (z)

The weekend adjustment coefficient (z) is based on day of the week, to account for the site-specific variances based on Weekdays vs Weekend in the system (i.e. Catchment is industrial, has a school etc).

Detail	(z)
Weekday SP (site Specific – default 1.0)	1.0
Weekend SP (Site Specific – default 1.0)	1.0

If the current day is a weekday, then the Weekend Adjustment coefficient (z) is equal to the Weekday SP, else it is equal to the Weekend SP.

Example SCADA page

The below shows SCADA screen for MDN181.

It shows the wet well diagram with the volume SP, the base dosing SP and all the adjustment factors.

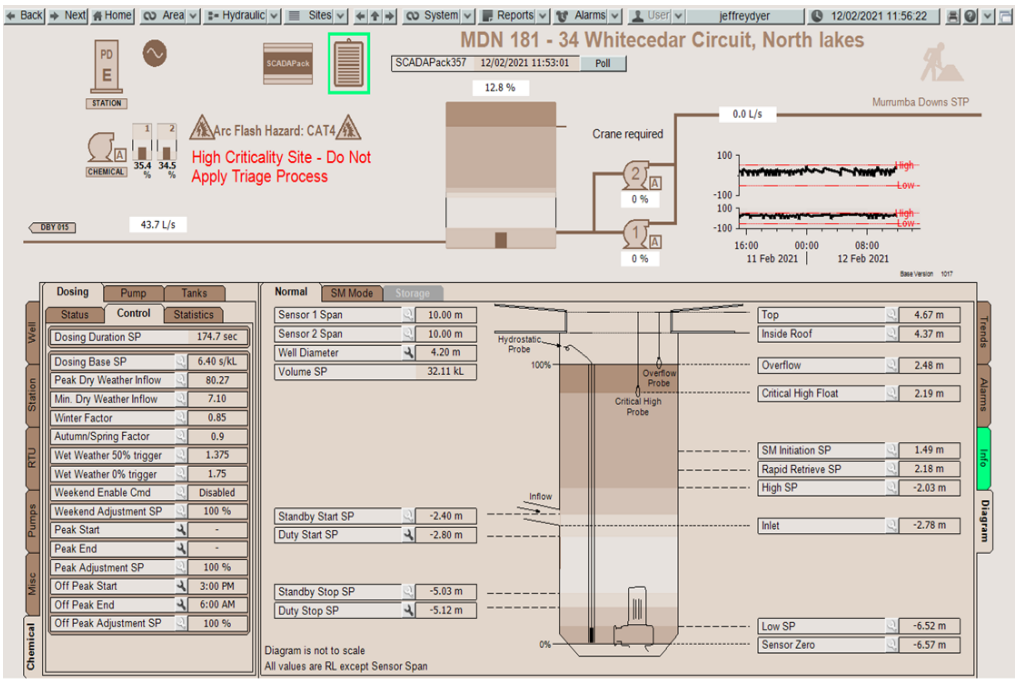

Figure 4 – Example SCADA Page

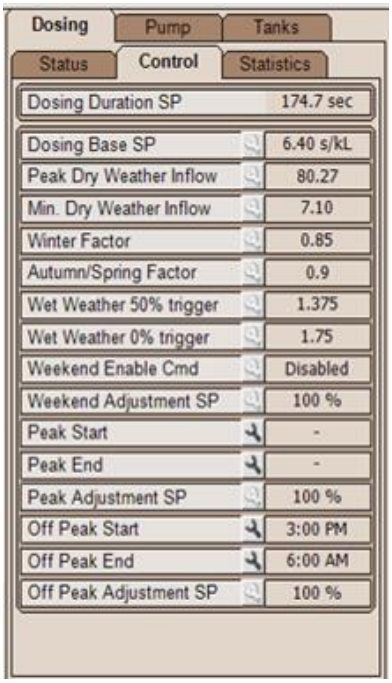

Figure 5 – Example Setpoint Tab of SCADA Page

Example trend data

The below trend shows the inflow and the dosing duration at PWS003 and how during wet weather it stops dosing.

Figure 6 – Sample Trend Page

6. Design requirements

6.1 Process, Civil and Mechanical Design

General

The design and construction of the civil works shall be in accordance with the requirements contained in Unitywater specifications:

- *Pr9902 - Unitywater Specification for Civil and Earth Works;*
- *Pr9903 - Unitywater Specification for Building and Structural Works; and*
- *Pr9693 - Unitywater Specification for Mechanical Installations.*

In addition to the above the design shall fully consider the relevant Australian, internationals and industry standards where relevant.

Deliverables

Detail Design is to utilise the standard design templates and create site-specific design drawings and design basis deliverables, for this site detailing the civil design including:

- Basis of Design Report – Civil and Structural sections;
- Basis of Design Report – Mechanical and Hydraulic sections;
- Equipment Schedules (Drives, Valves and Instruments);
- Safety in Design Register and Report;
- Civil and Mechanical Drawings as per the following table:

Table 4 – Civil and Mechanical Drawings List

Sheet	Drawing Title	< 500L storage CDU Cabinet	> 500L storage CDU Building
01	Cover Sheer, with Locality Plan and Drawing List	✓	✓
02	Site Specific P&ID	✓	✓
02	Notes pages	✓	✓
03	General Arrangement of Site Layout and Access	✓	✓
04	Delivery Bunding, Access sections and Concrete details, Sump valve pit details	✓	✓
05	Delivery Bunding, Access, Structural details	✓	✓
06	CDU Cabinet layouts, sections, and details	✓	✓
07	Structural Steel Details	✓	✓
08	Dosing tank, pipework, pumps GAs, sections, and details	✓	✓
09	Dosing Lines Plan and section, penetration details	✓	✓
10	CDU Building GA layouts, sections, and details		✓
11	CDU Building Structural Details		✓
12	CDU Building facilities		✓

6.2 Electrical Design and Control System Design

General

The design and construction of the electrical works shall be in accordance with the requirements contained in Unitywater specification: *Pr9380* - *Unitywater Specification for Electrical Installations at Network Sites*.

In addition to the above the design shall fully consider the relevant Australian, internationals and industry standards where relevant.

Deliverables

Update to Sewage Pump Station Drawings to include:

Table 5 – Electrical and Drawings List

Sheet	Drawing Title
01	Cover Sheer, with Locality Plan and Drawing List
02	Schematic for Dosing Pump
02	Schematic and Termination Diagram for Level Instrument(s)
03	Update of RTU Termination Diagrams to include all IO from Pumps, Valves and Instruments
04	Update of Switchboard GA to include any new equipment added (ie CBs, Terminals, etc)
05	General Arrangement Drawing of Panel (if not integrated into Sewage Pump Station Board)

In addition to the above drawings the Site Specific Functional Specification shall also be prepared including all design calculations to determine **M**aximum Dry Weather **D**osing **T**ime:

Table 6 – Control System Parameter List

	Parameter	Units	Default Value
VOL	Volume of Wet Well / Pump Cycle	kL	
	Concentration of MHL	%	
	Pump Design Flow Rate (L / hr)	L / s	
RDR	Required Dosing Rate (L / kL) (MHL Chemical / Raw Sewage)	L / kL	
MDT	Maximum Dry Weather Dosing Time	s	
v	Peak adjustment coefficient		
	Peak Stark Time	hh:mm	
	Peak Stop Time	hh:mm	
w	Off-Peak adjustment coefficient		
	Off-Peak Stark Time	hh:mm	
	Off-Peak Stop Time	hh:mm	
x	Co-efficient (x) when Inflow = Lowest Dry Weather Inflow		1.00
x	Co-efficient (x) when Inflow = Peak Dry Weather Inflow		0.70
x	Co-efficient (x) when Inflow = Wet Weather Inflow SP1		0.50
x	Co-efficient (x) when Inflow = Wet Weather Inflow SP2		0.00
	Peak Dry Weather Inflow (Site Specific Value)	L / s	
	Minimum Dry Weather Inflow (Site Specific Value)	L / s	

	Parameter	Units	Default Value
	Wet Weather Inflow SP1	%	137.5%
	Wet Weather Inflow SP2	%	175.0%
y	Winter SP(Site specific – default is 0.85)		0.85
y	Autumn / Spring SP (Site Specific – default is 0.90)		0.90
z	Weekday SP (site Specific – default 1.0)		1.0
z	Weekend SP (Site Specific – default 1.0)		1.0

6.3 Design methodology

The design methodology will be in accordance with the following design stages:

- **30% Design – Preliminary Design**
- Preliminary Design Review by Unitywater
- Safety in Design (SiD1) Meeting, HAZID & HAZOP
- **80% Design – Detailed Design - For Review**
- Detail Design Review by Unitywater
- Safety in Design (SiD2) Meeting – CHAIR & CHAZOP
- **90% Design – For Acceptance**
- Detail Design Acceptance Review by Unitywater
- **100% Design – Issued For Construction**
- Design Phase Complete

30% Design – Preliminary Design Deliverables

- All - Design Report – Rev A: 30% Design - Preliminary
- Civil - Site Layout Diagram Rev A: 30% Design - Preliminary
- Process - P&ID Rev A: 30% Design
- Electrical - Single Line Diagram (or modifications to existing SPS SLD)
- Control System - Site Specific Functional Specification Rev A: 30% Design

Safety in Design (SiD1) Meeting, HAZID & HAZOP

- Minutes of Safety in Design Meeting.
- HAZID Risk Register.
- HAZOP Outcomes.

Preliminary Design Review by Unitywater

- Consolidated Comments on 30% Design by Unitywater including confirmation of required outcomes from HAZID & HAZOP.
- NOTE - if there are major non-conformances in 30% Design, then requirement to re-submit 30% Design).

80% Design – Detailed Design - For Review

- Update of 30% Design Deliverables to 80% - incorporating any changes identifies in the design review, SiD, HAZID and HAZOP.
- Civil - Site Detail Design Drawings:
  - Kerb;
  - Truck Turning;
  - Fencing.
- Civil - Building Detail Design Drawings:
  - Plan View;
  - Elevation;
  - Cable Management System including Cable Tray and Conduits.
- Civil - Pipe and Pump Details.
- Civil and Electrical – Building Electrical fit out including Lighting Layout and GPOs.
- Electrical – Schematic and Termination Diagrams.

Safety in Design (SiD2) Meeting – CHAIR & CHAZOP

- Minutes of Safety in Design Meeting.
- Risk Register.
- CHAZOP Outcomes.

Preliminary Design Review by Unitywater

- Consolidated Comments on 80% Design by Unitywater including confirmation of required outcomes from CHAIR & CHAZOP.

90% Design – For Acceptance

- Update of 80% Design Deliverables to 80% - incorporating any changes identified in the design review, SiD, CHAIR and CHAZOP.
- NOTE - if there are major non-conformances in 80% Design, then requirement to re-submit 80% Design).

Detail Design Acceptance Review by Unitywater

- Acceptance, or Conditional Acceptance with minor comments, by Unitywater.
- NOTE - if there are major non-conformances in 80% Design, then requirement to re-submit 90% Design).

100% Design – Issued For Construction

Drawing update to 100% Design, Marked “ISSUED FOR CONSTRUCTION” accepted and signed by RPEQ Engineer.

7. Inspection, Testing and Commissioning requirements

7.1 Commissioning

The Contractor shall prepare a Commissioning Plan in accordance with Pr11211 - Specification for Commissioning and Handover of Active and Passive Assets and must be submitted to the Superintendent for acceptance a minimum of 6 weeks prior to commencing any commissioning activities and no commissioning activities may commence until the Plan has been accepted.

The Contractor shall ensure adequate contingency planning during network interventions is implemented and shall be included as part of the Contract price.

7.2 Civil and Mechanical Inspection and Testing

For general inspection and testing requirements for civil, structural, and mechanical works refer to Unitywater standard specifications:

- *Pr9902 - Specification for Civil and Earthworks;*
- *Pr9903 - Specification for Building and Structural Works;* and
- *Pr9693 - Specification for Mechanical Installations.*

Building Certification

The Contractor shall provide all building certification documents for design and certification of the unit to the Principal.

Hydrostatic Test and Leak Detection (Bund, Tanks and Pipework)

The chemical room bund area should be watertight prior to the application of the internal coating. The bund area of chemical storage area shall be filled with water for at least 24 hours and prior to the internal coating being applied. It will be satisfactory if there is no water leakage through the wall, slab, penetrations, joints, etc. The storage and dosing tank(s) should be filled to prevent any movement due to flotation.

- New storage and dosing tanks and pipework shall be filled with water and inspected for leakage for at least 24 hours.
- Tanks shall be tested to the SG of the tank.
- Pipework shall be pressure tested to 1.5 times the operating pressure.

Pump Inspection and Testing

Pump Testing shall be in accordance with *Pr9693 - Specification for Mechanical Installations*:

- Section 10.9.1 - Hydrostatic testing; and
- Section 10.9.2 - Pump performance testing.

Coating Testing

Refer to WSA201 – Manual for selection and application of protective coatings, Section 10 - Quality Control Inspection and Testing.

Electrical and Control System Inspection and Testing

The Contractor undertake all inspection and testing for electrical and control system works in accordance with the requirements contained in Unitywater specification: *Pr9380* - *Unitywater Specification for Electrical Installations at Network Sites.*

The testing will include as a minimum the following Electrical ITPs, FAT and SAT requirements:

- Switchboard Electrical Testing;
- Switchboard Visual check;
- Equipment Isolation Checks;
- All protection and Control equipment settings;
- Control System Functionality Checks; and
- SCADA control and alarm Tests.

7.3 Process commissioning

Once the electrical and control system testing has been completed successfully, the process can now be commissioned including:

- Manual Operation - Using Water
- Automatic Operation - Using Water
- Manual Operation - Using MHL
- Automatic Operation - Using MHL

7.4 Proof of Performance - Downstream Sampling

Commissioning shall be deemed complete when the dosing system can run continuously without any fault for a period of two weeks.

The plant shall start and stop during this two-week period as required by the Principal's Representative. The Proof of Performance shall include at least one chemical delivery.

During this period, the Contractor shall maintain the unit in a proper working manner. The unit shall be used to demonstrate system performance. The Contractor shall carry out any work necessary to ensure the unit is working correctly.

The reduction of the dissolved sulphide in the downstream sewage shall be recorded and used to adjust the dose rate.

Performance sampling shall be undertaken at an agreed downstream location (generally discharge MH or next MH). Sampling should be undertaken for a minimum period of 4 weeks. The maximum performance target is 10PPM or less.

8. Handover requirements

The Contractor shall provide commissioning documentation and information in accordance with:

- *F8607 - Project Deliverables Checklist – As Built Documentation;*
- *Pr11211 - Specification for Commissioning and Handover of Active and Passive Assets; and*
- Electrical test certificate.

8.1 Project closure

Provide final project cost and confirmation that all identified works have been completed.

A completed Unitywater Asset Template of all active and decommissioned assets on site shall be returned to Unitywater.

All relevant QA documentation to be provided through Objective Connect.

8.2 As Constructed Information

The As Constructed drawings shall be prepared and supplied in accordance with the Asset information data shall be recorded on the 'As-Constructed Asset Record for Water Supply Assets' spreadsheet will be provided by Unitywater. This asset data shall include full asset details including installed value of all items.

8.3 Asset manuals

Asset manuals shall be prepared and provided in accordance with the SEQ WS & SD & C Code Asset Information Specification.

8.4 Operating and maintenance manual

A draft Operating and Maintenance (O&M) Manual for the CDU must be prepared and submitted prior to process commissioning. It must be finalised and re-submitted after successful commissioning of the unit and incorporate any learnings or changes required during commissioning and proof of performance.

9. Appendices

Refer to the following pages.

Appendix A – Definitions/Acronyms

The following definitions, abbreviations and acronyms are used throughout this specification.

Term	Meaning
ANSI	American National Standards Institute
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
CHAIR	Construction Hazard Assessment Implication Review
CDU	Chemical Dosing Unit
EPDM	Ethylene Propylene Diene Monomer Rubber
FAT	Factory Acceptance Testing
FMECA	Failure Mode, Effects and Critical Analysis
HAZCHEM	Hazardous Chemical
HAZMAT	Hazardous Material
HAZID	Hazard Identification
HAZOP	Hazard and Operability Study
HDPE	High Density Polyethylene Pipe
H_2S	Hydrogen Sulphide
I/O	Input/Output
ITP	Inspection and Test Plan
MHL	Magnesium Hydroxide Liquid
NBR	Acrylonitrile Butadiene Rubber, Nitrile, Buna-N
NC	Normally Closed
NO	Normally Open
NOV	Novolac Epoxy
OHS	Occupational Health and Safety
P&ID	Process & Instrumentation Diagram
PE	Polyethylene
PE100	Polyethylene pipe with MRS (minimum required strength) of 10.0MPA Pipe
PLC	Programmable Logic Controller
PN	Pressure Nominal, Pressure Rating
PPE	Personal Protective Equipment
ppm	Parts per million
PVC	Polyvinyl Chloride
RPZ	Reduced Pressure Zone
RPEQ	Registered Professional Engineer Queensland
RTU	Remote Telemetry Unit
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisitioning
SDS	Safety Data Sheet
SS	Stainless Steel
UNO	Unless Noted Otherwise
U-PVC	Un Plasticised Polyvinyl Chloride
WSAA	Water Services Association of Australia

Appendix B – References

General

All works shall be completed in accordance with this Specification, the Project Specification and stated supplementary specifications.

Reference to specific clauses of the various codes is intended to highlight those points and shall not be taken to imply a lesser importance for all other applicable clauses.

All the works shall conform to the Rules and Regulations of the Statutory Authorities having jurisdiction over the Site.

If the requirements of this Specification do not comply with the minimum requirements of the statutory regulations and standards, the Statutory regulations and standards shall apply. If the requirements of this Specification are more exacting than the minimum requirements of the statutory regulations and standards, this Specification shall apply.

All Materials, fittings, accessories, and equipment supplied by the Contractor shall be new and the best obtainable of their kind and shall comply in all respects with the requirements of the relevant Unitywater and Standards Australia specifications.

All Contractors have an obligation to comply with all relevant legislation and regulations. As a minimum the following legislation, related Regulation and Codes apply to this specification:

- *Building Act 1975* (QLD);
- *Building Regulation 2021* (QLD);
- *Electrical Safety Act 2002* (QLD);
- *Electricity Regulation 2006* (QLD);
- *Electrical Safety Regulation 2013* (QLD);
- *Electricity Act 1994* (QLD);
- *Environmental Protection Act 1994* (QLD);
- *Professional Engineers Act 2002* (QLD);
- *Queensland Building and Construction Commission Act 1991* (QLD);
- *Water Supply (Safety and Reliability) Act 2008* (QLD);
- *Workplace Health and Safety Act 2011* (QLD);
- *Workplace Health and Safety Regulation 2011* (QLD);
- Managing Noise and Preventing Hearing Loss at Work Code of Practice 2021 WorkSafe QLD;
- Scaffolding Code of Practice 2021, WorkSafe QLD;
- National Construction Code (NCC);
- Queensland Development Code;
- South-East Queensland Water and Sewerage Design and Construction Code (SEQ WS & S D & C Code) includes SEQ Asset Information Specification and SEQ Infrastructure Products and Materials lists (Civil and Mechanical);

- WSA 201 Manual for Selection and Application of Protective Coatings.

Relevant Unitywater documents that relate to this specification

Document No.	Title
Pr10618	Power System analysis and Arc Flash Studies
F10678	Unitywater Approved Electrical Equipment List
Pr9903	Unitywater Specification for Building and Structural Works
Pr9080	Unitywater Specification for CAD BIM Drafting and Modelling Standards
Pr9902	Unitywater Specification for Civil and Earthworks
Pr11211	Unitywater Specification for Commissioning and Handover of Active and Passive Assets
Pr9769	Unitywater Specification for Concrete Surface Protection
Pr8843	Unitywater Specification for Drawing, Document and Equipment Tag Numbering
Pr9380	Unitywater Specification for Electrical Installation at Network Sites
Pr9693	Unitywater Specification for Mechanical Installations
Pr9834	Unitywater Specification for SCADA Standard

International and Australian Standards referenced within this specification

Standard	Title
Quality Systems	
AS 2990	Quality Systems for Engineering and Construction Projects
AS 3901	Quality Systems for Design/Development, Production, Installation and Servicing
AS 3902	Quality Systems for Production and Installation
AS 3903	Quality Systems for Final Inspection and Test
Drawings	
AS 1100	Technical Drawings
AS 1101	Graphical Symbols for General Engineering
AS 1102	Graphical Symbols for Electrotechnology
Workplace, Health and Safety	
AS 1319	Safety signs for the occupational environment
AS 1657	Fixed platforms, walkways, stairways and ladders
AS 3780	Storage and handling of corrosive substances
AS 4775	Emergency Eyewash and Shower Equipment
AS 60417(IEC 60417)	Graphical symbols for use on equipment
[NOHSC:2017(2001)]	National Code of Practice for the Storage and Handing of Workplace Dangerous Goods
Structures	
AS 1664.4	The use of ventilation and air-conditioning in buildings Natural ventilation of buildings

Standard	Title
AS 1866	Aluminium and Aluminium Alloys – Extruded Rod Bar, Solid and Hollow Shapes
AS 3600	Concrete Structures
AS 3610	Formwork for concrete
Pipework, Vessels and Associated Standards	
ANSI C901-17	Polyethylene (PE) pressure pipe and tubing for water service
AS 1159	Polyethylene pipes for pressure applications
AS 1260	PVC-U pipes and fittings for drain, waste and vent application
AS 1275	Metric Screw Threads for Fasteners
AS 1345	Identification of the contents of Pipes, conduits and ducts
AS 1460	Mechanical jointing fittings for use with polyethylene pressure pipes
AS 1462	Methods of test for plastics pipes and fittings
AS 1477	PVC pipes and fittings for pressure applications
AS 1657	Fixed platforms, walkways, stairways and ladders - design, construction and installation
AS 2032	Installation of PVC pipe systems
AS 2033	Installation of PE pipe systems
AS 2129	Flanges for pipes, valves and fittings
AS 2492	Cross-linked polyethylene (PE-X) pipes for pressure applications
AS 2537	Mechanical jointing fittings for use with crosslinked polyethylene (PE-X) for pressure applications
AS 2566	Buried flexible pipelines
AS 3500	National plumbing and drainage code
AS 3500.1	Plumbing and drainage – water services
AS 3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
AS 3996	Access covers and grates
AS 4041	Pressure Piping
AS 4087	Metallic flanges for waterworks purposes
AS 4129	Fittings for Polyethylene pipes for pressure applications
AS 4130	Polyethylene pipes for pressure applications
AS 4131	Polyethylene compounds for pressure pipes and fittings
AS 4343	Pressure equipment – Hazard levels
AS/NZS 4766	Polyethylene storage tanks for water and chemicals
AS ISO 9624	Polyethylene (PE) pipes for fluids under pressure – Mating dimensions of flange adapters and loose backing flanges
ASTM A213/A213M	Standard Specification for Seamless Ferritic and Austenitic Alloy Steel Boiler, Superheater, and Heat-Exchanger Tubes
ASTM D1290	Standard specification and practice for electrofusion joining of polyolefin pipe and fittings
ASTM D1785	PVC plastic pipe – schedule 80
ASTM D2467	PVC socket fittings – schedule 80

Standard	Title
ASTM D2683	Standard specification for socket type polyethylene fittings
ASTM D3261	Standard specification for butt heat fusion
[NOHSC:2017(2001)]	National Code of Practice for the Storage and Handing of Workplace Dangerous Goods
Electrical	
AS 1680	Interior Workplace Lighting
AS 2293	Emergency Escape Lighting and Exit Signs for Buildings
AS 3000	Electrical Installations – Building, Structures and Premises (SAA Wiring Rules)
AS 3008	Electrical Installations – Selection of Cables Part 1 Cables for Alternating Voltages Up To and including 0.6/1 kV
AS 3021	Electrical Installations – Construction and Demolition Sites

Appendix C – Standard Drawings

Civil drawings

Sheet	Drawing Title	Obj ID
UWD-C-DR-8070-00	MHL Standard Drawing - Drawing Index and General Notes	A7225083
UWD-C-DR-8070-01	Typical Layout for MHL Dosing Facilities at Pump Station Site	A7032774
UWD-C-DR-8070-02	MHL Dosing Building Layout Plan	A7032771
UWD-C-DR-8070-03	MHL Dosing Building Section A	A7032773
UWD-C-DR-8070-04	MHL Dosing Building Section B	A7032776
UWD-C-DR-8070-05	MHL Drainage and Drainage Valves Site Plan and Section A	A7032772
UWD-C-DR-8070-06	MHL Dosing Building Single Tank General Arrangement	A7032775
	Combined set	A7032772

Electrical drawings

Sheet	Drawing Title	OBJ ID
UWD-E-DR-8070-01	MHL Dosing Electrical Details – Title and Index Sheet	A6821647
UWD-E-DR-8070-02	Not Used	
UWD-E-DR-8070-03	MHL Dosing Electrical Details – Power Distribution Schematic Diagram	A6821630
UWD-E-DR-8070-04	MHL Dosing Electrical Details – Digital Inputs & Outputs Schematic Diagram	A6821634
UWD-E-DR-8070-05	MHL Dosing Electrical Details - Analog Inputs & Outputs Schematic Diagram	A6821648
UWD-E-DR-8070-06	MHL Dosing Electrical Details – Termination Diagram	A6821631
UWD-E-DR-8070-07	Not Used	
UWD-E-DR-8070-08	MHL Dosing Electrical Details – Dosing Panel General Arrangement	A6821645