Technical Specification

Sydney WATER

Chemical Dosing Unit Specification

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Revision details

Version No.	Clause	Description of revision
5	All	Format change and minor revision
4	All	Full Revision
3	All	Full Revision
2	All	Full Revision
1	All	First Issue

Introduction

This Specification is for the design, supply and construction of Chemical Dosing Units for Sydney Water.

Sydney Water makes no warranties, express or implied, that compliance with the contents of this Specification shall be sufficient to ensure safe systems or work or operation.

It is the user's sole responsibility to ensure that the copy of the Specification is the current version as in use by Sydney Water.

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Acronyms

Acronym	Definition
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
ATWL	Above Top Water Level
CHAIR	Construction Hazard Assessment Implication Review
CDU	Chemical Dosing Unit
DTC	Deemed To Comply (drawing list)
FAT	Factory Acceptance Testing
FMECA	Failure Mode, Effects and Critical Analysis
FRP	Fibre Reinforced Plastic
HAZCHEM	Hazardous Chemical
HAZMAT	Hazardous Material
HAZOP	Hazard and Operability Study
HSP	Health and Safety Procedure

Acronym	Definition
IICATS	Integrated Instrumentation, Control, Automation, and Telemetry Systems
I/O	Input/output
MAXIMO	Sydney Water's Maintenance Management System
NPER	National Professional Engineers Registration
NTC	National Transport Commission
OHS	Occupational Health and Safety
P&ID	Process & Instrumentation Diagram
PE	Polyethylene
PLC	Programmable Logic Controller
PN	Pressure Nominal, Pressure Rating
PVC	Polyvinyl Chloride
RPZ	Reduced Pressure Zone
RTU	Remote Telemetry Units
SAT	Site Acceptance Test
SDS	Safety Data Sheet
TOG	Telemetry Operations Group
UV	Ultraviolet
VSD	Variable Speed Drive
WAC	Work As Constructed

1. General

1.1 Scope

This document specifies the design and construction requirements for a standard Chemical Dosing Unit (CDU) located in the sewer network. The primary function of the CDU is to accurately dose the specified chemical for suppression of hydrogen sulphide generation in sewage, as a part of corrosion and odour control management.

This Specification does not apply to temporary dosing units but may form the basis for the supply and performance requirements for temporary units. Temporary CDUs may only be used where approved by Sydney Water.

The document is to be used for the design, construction, installation and commissioning of both, transportable and permanently installed CDUs. The selection of type (transportable or permanent) must be agreed with Sydney Water. In general, the units must comply with the following:

Transportable CDU - Total effective storage below 27kL consisting of a two tank system.

Permanent CDU - System whereby storage of chemicals at the plant is greater than that of a transportable unit. Where the technical requirements for the design and construction of the plant varies for a particular section these variations must be clearly stated in this Specification. Otherwise the Contractor is to comply with all sections for both transportable and permanent plant types.

1.2 Style of this specification

This document is written in the directive style. Where an obligation is given and it is not stated who is to undertake these obligations, they are to be undertaken by the Contractor. Guidance on the allocation of tasks or separation of a contract into sub-packages or work orders is not included in this Specification. The Specification must outline the final requirements of the units however not dictate who must undertake these works.

Where a submission, request, or proposal is required, and it is not stated who the recipient should be, it is to be provided to Sydney Water for approval.

Any discrepancies between this Specification and other standards and/or regulatory requirements must be clarified with Sydney Water.

1.3 New designs and innovations

This document provides an indicative solution for the Works. The Contractor may wish to develop the indicative solution shown or produce their own design that will fully comply with the requirements of this specification.

Any alternative materials, designs, methods of assembly and processes that do not comply with the requirements of this Specification, or are not mentioned in it, but give equivalent performance outcomes to those specified, will be considered by Sydney Water. Written approval from Sydney Water must be sought with the design submission, prior to the commencement of construction.

1.4 Responsibilities

Responsibilities relating to the contractual terms and conditions, including financial matters and site issues are covered in the relevant contract documents. Specific responsibilities are noted in this document, but they do not necessarily describe all the activities required for the Works.

For the purpose of developer funded works, the words “Principal” and “Contractor” in this Document must be replaced with the words “Sydney Water” and “Developer” respectively.

1.4.1 Contractor

The Contractor must be fully responsible for the design and construction being fully compliant with the requirements of this Specification, and provide a complete, functional CDU that meets all the relevant Australian Standards, Codes of Practice, industry standards, and all statutory requirements. The complete system must include but is not limited to, all structures, pipework, fittings, valves, pumps, instruments and controls, from the point of bulk delivery to the point of chemical dosing into the process streams.

The Contractor should be aware that this Specification is for a standard CDU. As sites vary each site must be assessed on an individual basis for site specific risks.

In addition, the Contractor must provide the following:

- Design drawings and review of the CDU standard design
- The Contractor must submit CDU design drawings for Sydney Water's review at concept, 50% detailed design and 90% detailed design stages
- A lifting plan for the installation and removal of the CDU
- Review Sydney Water supplied HAZOP report
- Carry out a total of two Construction Hazard Assessment Implication Review (CHAIR 1 & 2) workshop. CHAIR 1 must be undertaken at the concept design stage, and CHAIR 2 at the detailed design stage. The CHAIR workshops must be in accordance with Sydney Water Health and Safety Procedure, HSP-058: Risk Assessment in Design and the guidelines prepared by WorkCover NSW.
- Review Sydney Water supplied CHAIR 3 report. Refer Appendix C.
- Review the Sydney Water-supplied Failure Mode, Effects and Critical Analysis (FMECA) workshop report. Refer Sydney Water Business Management Information System (BMIS).
- Commissioning plans including: Inspection & Test Plans (ITPs) and Defects Rectification Plan in accordance with Sydney Water's D0001440 Commissioning – transitioning assets into operation.
- FAT testing (wet FAT/Pre SAT) in the factory prior to delivery to site
- Update of Sydney Water information systems including:
  - Sydney Water's Maintenance Management System (MAXIMO) asset listing to be completed and sent to Asset Information (Data Creation), who will allocate asset numbers and notify the HYDRA Register & the Operational Technology Service (OTS). Refer to Section 2.15.
  - Operations and Maintenance (O&M) Manuals, Work as Constructed (WAC) drawings and other documentation necessary for the optimal operation and maintenance of the CDU, as detailed in Sydney Water's Technical Specification - Commissioning and the Sydney Water supplied O&M manual shell document (refer Appendix D).
- All documentation submitted to Sydney Water must be formatted such that it complies with Sydney Water's quality documentation requirements. Typically, electronic versions in PDF, Word and DWG formats need to be provided via SWDelivery Portal as well as two hard copies.
- Additional specific equipment as may be necessary for the operation, maintenance and cleaning of the particular chemical system being provided, or as specified by Sydney Water or recommended by the chemical supplier and regulatory bodies
- Storage tanks, process pipes, drain and overflow pipes, fittings, valves, equipment and instruments constructed of materials compatible with the chemicals stored and conveyed. All materials of construction must be non-corroding for their chemical usage.
- Stairs, ladders and walkways, where appropriate, to allow ease of access to all storage tanks and equipment for maintenance purposes. All such stairs, ladders and walkways must be constructed of appropriate corrosion resistant materials.
- Provide adequate access for maintenance purposes
- Necessary facilities to ensure all spills and leakages are contained

- Safety facilities, such as safety showers, eyewash stations, fire extinguishers and so on
- Tags, labels, signs, and other markings, for all these systems which clearly indicate the individual system, chemical contents, hazards, warnings and any other pertinent information in accordance with the requirements of the relevant standards, Codes of Practice and statutory authorities
- Safety Data Sheets (SDS) for the dosing chemicals supplied
- SPS Contingency Plans (GA drawing emailed to spsplans@sydneywater.com.au)
- Any additional items/equipment requested by Sydney Water.

1.4.2 Principal (Sydney Water)

The Principal (Sydney Water), through its appointed representative / consultant, will provide input for the development of the design required in this Specification. The input includes, but is not limited to:

- This Specification
- Items in this Specification that will be done by others
- Deemed To Comply (DTC) drawings including Layouts and Process and Instrument Diagrams (PIDs)
- HAZOP documentation - refer to BMIS
- CHAIR 3 report. refer Appendix C
- FMECA workshop report - refer BMIS
- Standard general arrangements of the chemical dosing unit; refer DTC drawings
- SDS for the dosing chemicals supplied
- Sample template for O&M manuals - refer Appendix D
- Contact details of Sydney Water security systems contractor
- General scope of civil works required at site for access and egress of service and delivery vehicles
- Provide the information in the following table:

Parameter	Quantity/requirements	Units
Type of dosing system	Flow paced/Diurnal rate	-
Type and properties of dosing chemical	(Insert name of chemical, concentration, acid content etc.)	-
Chemical supplier name and contact details		-
Location of the CDU	(Insert street address, asset number etc.)	-
Mobility requirement of the CDU Building	Transportable / Permanent	-
Rate of chemical dosing minimum		Litres/hour
Rate of chemical dosing maximum		Litres/hour
Dilution/carrier water flow rate	10:1 with maximum chemical dosage rate	-
Delivery Bund Sump Pump (if required)		Metres head
Pressure of available water supply for process water		Metres head
Pressure of available water supply for safety shower and eyewash		Metres head

Parameter	Quantity/requirements	Units
Advise whether H_2S monitoring is to be fed back to the CDU	Yes / No	-
Diurnal minimum pressure of the pressure sewer main being dosed into		Metres head
Diurnal maximum pressure of the pressure sewer main being dosed into		Metres head
Delivery tanker size		Kilolitres Length / Vehicle Type
Maximum temperature of the delivered chemical		℃
Minimum chemical tank storage size		kilolitres
Minimum performance parameters, (for example, pH and dissolved sulphide levels expected before and after chemical dosing).		-
Protective coating system to be applied (external)	PUR-B or PSL for Anti-Graffiti ACL for Aesthetic PUR-A for Coastal Environment	-
Protective coating system to be applied (bund floor and wall)	NOV (Novolac Epoxy)	

1.5 Contents of this document

Section 2 contains requirements for the standard design of the CDU.

Sections 3 to 6 contain requirements for the design of specific components of the standard chemical dosing system, namely the Chemical Unloading Bay, the CDU Building, the Chemical Storage tank, and the Chemical Dosing system.

Sections 7 and 8 contain requirements for the submission of the design and for the testing and commissioning of the CDU respectively.

2. General requirements

2.1 Containment methodology

The CDU will include the development of a complete containment methodology for the chemical, from the delivery bay to and including the storage tank(s) to the dosing location(s), inclusive of the dosing point(s). The containment must direct any leakage or spillage to a safe location where it may be managed appropriately. This methodology is to include appropriate locations for visual identification of leaks and leak detection at any low points.

The containment methodology is to be discussed and accepted by Sydney Water prior to implementation. The method may include proprietary product pipe in pipe, single run PE dosing lines inside PE/U-PVC pipe, leak detection pits or a combination of the above. Any other containment systems which are viable for the chemical and Site Acceptance Testing (SAT) requirements will also be considered. The containment methodology is the responsibility of the contractor responsible for the construction of the plant as well as the civil contractor running dosing lines, unloading points, pump out locations and any other chemical pipework or pits.

Bunding must be provided for the delivery bay and storage tanks to contain any chemical spillages as described in the following clauses.

2.2 Minimum criteria

This Specification represents the minimum requirements for the chemical dosing unit.

The CDU must be designed to:

- Provide a minimum service life of:
  - 50 years for structural elements
  - 20 years for tanks and pipework
  - 10 years for mechanical, pumping, electronic and control equipment
- Achieve a level of treatment according to the minimum requirements outlined in Section 1.4.2 of this Specification, over the designed service life, taking into account the increase in sewer system loading
- Comply with all relevant regulatory requirements, Standards, and Codes of Practice, including, but not limited to:
  - Work Health and Safety Act 2011
  - Work Health and Safety Regulation 2017
  - SafeWork NSW - Storage and Handling of Dangerous Goods Code of Practice 2005
  - National Transportation Commission (NTC) - Australian Dangerous Goods Code Edition 7.4 (2016)
  - AS 3780 - The Storage and Handling of Corrosive Substances
  - NSW Protection of the Environment Operations Act, 1997, and its amendments
  - All other referenced documents in this Specification.
- Not cause interruption to the normal operation of the Sydney Water sewerage system
- Have complete chemical receiving, storage, transfer, and dosing systems, and the necessary safety facilities
- Be capable of automatic operation via Sydney Water's Telemetry System (IICATS)
- Be capable of local manual operation
- Be capable of adjustment of the treatment level during operation
- Be safe to operate, maintain and decommission
- Contain all spills of the chemical being used and have a bund capacity of 9,000 litres or a minimum 110 % of the chemical storage volume, whichever is greater

- Give effective process control under both routine and non-routine operations
- Be self-contained, to allow transport and relocation
- Have online hydrogen sulphide monitoring installed downstream of the chemical dosing point, at a location nominated by Sydney Water, which is linked to the Sydney Water IICATS network.

2.3 Site conditions

The site is normally subjected to temperate climate conditions, with an ambient temperature range of (minus) -6℃ to 50℃, and humidity of up to 100%.

Additional consideration must be given for sites that are subjected to strong wind and saltwater spray/mist, for example, marine conditions. Thus, all equipment must be designed to accommodate and operate satisfactorily within these weather conditions.

Consideration must be given to Sydney Water's requirements for building over or close to Sydney Water sewer, water or stormwater assets.

2.4 Materials

2.4.1 General

All materials selected or adopted in the design must be suitable for installation in the proposed environment, including contact with the chemical being used and high humidity conditions. They must be corrosion resistant and selected to match the relevant specified design life. Where required, materials must be coated in accordance with the latest edition of Water Services Association Manual for Selection and Application of Protective Coatings, WSA 201 and Sydney Water's Supplement to WSA 201, ACP0166.

2.4.2 Corrosion resistance

All internal parts in contact with the chemical substances are required to be corrosion resistant against the chemical involved.

All bolts, nuts, and washers must be made from stainless steel grade 316, or equivalent, which is deemed to be suitable for the application.

2.4.3 Adhesive, sealants and gaskets

All adhesives and sealants must be resistant to oil and water, non-supportive of microbial growth, and dimensionally stable. They must also be resistant to chemical attack by the dosing chemical. All gaskets must be made from Viton rubber materials. Refer Appendix E: 'Sydney Water Guide to Proven Products'.

2.5 Pipework and fittings

Materials for CDU pipe work and fittings must be uPVC or cPVC ANSI Schedule 80 or Polyethylene PE to AS4130 (except magnesium hydroxide dosing lines, see 2.5.2 below). Refer Appendix E.

Pipework for the dosing line (except magnesium hydroxide dosing lines) to the dosing point must be either:

- UPVC/cPVC George Fischer double containment system (Double-See™), or equivalent approved by Sydney Water
- PE100 polyethylene PN16 dosing pipe with PE100 polyethylene PN16 containment pipe
- PE100 polyethylene PN16 dosing pipe with DWV containment pipe.

All pipes, including those in pipe trays and trenches, must be painted in accordance with WSA 201-Application of Protective Coatings and Sydney Water supplement ACP0166.

A solvent welding course is to be completed by the piping installation team to satisfy Sydney Water's and pipework supplier's requirements.

The minimum pressure rating class of all pipes and fittings must be PN 16. All pipework selected must be designed specifically for use in the chemical industry and resistant to chemical attack.

All pipework, fittings and equipment installed and fabricated will be in accordance with the following:

- Sydney Water Technical Specification - Mechanical and the Sydney Water Procedure 724 - Solvent Cement Welding.
- Method of jointing polyethylene pipe work must be electrofusion jointing. The manufacturer's recommendations must be followed with the correct specialised tools when installing pipes and fittings (no compression fittings to be used).
- All personnel undertaking pipework installation to be competent and have undertaken PVC installation training (Sydney Water and supplier's), polyethylene electro-fusion jointing training and Sydney Water chemical dosing training.
- Pipe work jointing and installation must be carried out in accordance with the manufacturer's specification and requirements, inclusive of pipe cutters, chamfering and de-burring tools.
- All pipework is to be painted (ACL system) or coloured and labelled as per Sydney Water Technical Specification - Mechanical and points a) to c) below:

  a) Below ground double contained pipework - only carrier pipework is required to be coloured and labelled.

  b) Above ground double contained pipework - double containment pipework must be coloured and labelled as per specification, carrier pipework is not required to be coloured and labelled.

  c) All other non-pipe in pipe chemical pipework (i.e. single containment) is required to be coloured and labelled as per the Specification.

- Pipes less than 50 mm in diameter, located outside of the CDU structure must be suitably lagged to prevent freezing at low weather temperature (< 6 ℃). Pipe trays located outside must be supplied and installed with suitable covers.
- Buried non-metallic pipes must have continuous metal tape placed in the trench above the pipe to allow detection.
- All chemical dosing lines external to the CDU (above ground or buried) must be double contained arrangement. In addition to this, all chemical dosing and/or water lines passing through the CDU electrical controls room must also be double contained arrangement. Where lines are installed in the CDU electrical controls room they must be shielded with PE covers to prevent leakage spray reaching electrical cubicles and to direct any leakage onto the floor. A drain must be installed to the outside.
- The arrangement of all pipes must allow a leak to be readily identified and contained, and facilitate repair or replacement of the inner pipe. The arrangement of the pipework must allow a leak to drain into the CDU bund or the dosing point. All drainage should be vermin proof. Underground dosing lines must be designed so that the pipework can be replaced without the need for excavation.
- All ball valves must be full-bore type. For throttling purposes, a diaphragm valve suitable to the specific application must be used. These, along with other non-standard pipework fittings must be double union type to minimise damage during repair and maintenance. Appropriate space is to be left around unions to enable dismantling. Utilise spacers under pipe clips where attaching directly to flat surfaces.
- Valves, piping and fittings must be from the same supplier for a specific dosing system and where possible, for any existing chemical dosing system on site. All valves of the same size, duty and type supplied under the contract must be identical.
- Joints must be either solvent welded (glued), electro fused, or flanged. Screwed connections may be permitted as an exception where there is no other alternative. For example, magnesium hydroxide dosing systems require a stainless steel actuated ball valve, due to the abrasiveness of the product. These valves normally exhibit screwed connections.
- Only approved pipe glues (Weldon 724) and solvents (coloured primer) that are designed for use with the specific chemicals and piping systems are to be used. Minimum curing times for primers and glues, as specified by the manufacturer, are to be strictly adhered to.

- Potable water must be provided for the eyewash and safety shower at all sites. All potable water lines coming from Sydney Water mains must be provided with Reduced Pressure Zone (RPZ) valves to prevent carrier water flowing back into the mains. RPZ device should be installed downstream of the supply feeding the potable water supply on site to prevent pressure loss to safety showers and eye washes.
- A separate RPZ must be provided to ensure backflow from the Chemical Dosing Unit dilution water cannot enter the emergency shower and eye wash facilities. All RPZ devices are to be installed by a licensed plumber and appropriately tested in accordance with the requirements of AS3500. Where required, booster pumps or pressure reducing valves must be installed based on the incoming water pressure and the pressure at the dosing point.

A generic CDU Site Layout General Arrangement for the Potable Water Supply is provided in the DTC drawings of this Specification.

A list of proven products is included for reference in Appendix E. Products may be added to this list with the approval of Sydney Water.

2.5.1 Pipework supports

All pipework supports must be suitable for contact with the chemical being dosed. Metal support systems such as 'Unistrut' or metal brackets and clips must not be used. Proprietary systems such as Georg Fischer must be used where available.

2.5.2 Magnesium hydroxide pipework

The following are additional requirements for Magnesium Hydroxide dosing systems to those stated above:

- Flexible lines internal and dosing lines to be 20mm NBR thick walled flexible rubber hose instead of PE. Spares for all flexible hoses to be provided.
- Rigid dosing manifold from tank to pumps must be as compact as possible to reduce potential for blockages. Furthermore, the hoses feeding to and from the dosing pumps must be provided to allow easy disassembly for cleaning.
- Spare dosing line to be run.
- The dosing and batch pump suction and discharge connections must be constructed for easy access and removal. Pipework must consist of Y-pieces for all divergent and convergent sections to promote flow in direction of dosing and reduce clogging.
- Long radius bends to be used in pipe runs.
- All take-offs are to be from the bottom of the line.
- Provide a roddable run which is steep (1:10 fall) and of large bore diameter for CDU drain line to sump.
- Union bends are to be provided to facilitate rodding.
- Non return valves to be tideflex type (except in the case of a non-pressure system).
- Strainer mesh to be 5mm SS Grade 316.
- SS Grade 316 two-part ball valves to be used on storage tank automatic outlet valve and drain valve to sump for wear purposes.
- All valves on the dosing line must be full bore valves, except where specified on the P&ID.
- Fill lines for Magnesium Hydroxide to be aluminium camlock fittings.

2.6 Civil works

The design and construction of the civil works must be in accordance with the requirements contained in Sydney Water's Technical Specification - Civil, unless specified otherwise in this document. Where necessary, relevant Dangerous Goods Regulations must be complied with.

As a minimum for the transportable CDU, the foundation pad must have a sub-base of 200 mm thick cement stabilised DGB20 road base (3% minimum cement content), any soft spots in the founding material must be

compacted to 98% of maximum dry density prior to laying sub-base. The top of the foundation pad must be 50mm above the surrounding ground level and must extend 150mm past the building perimeter. The CDU base must be placed on 50mm of packing sand and a 0.25mm waterproof membrane double lapped and taped at joints. The waterproof membrane must be increased to 2 layers for saline conditions. A 50mm layer of sand is required under the CDU to ensure the load is evenly distributed on the foundation pad. A geotechnical engineer or engineering geologist is to confirm the allowable bearing capacity of the foundation soil is sufficient for the requirements specified by the CDU supplier. If the foundation is not sufficient then the geotechnical engineer is to provide direction on ground improvement works required at site. The geotechnical engineer is to be engaged by the contractor undertaking the Civil works.

Where insufficient or unsuitable access to site is provided then a detailed design is to be undertaken in accordance with Sydney Water Technical Specifications.

2.7 Mechanical works

The design and construction of the mechanical works must be in accordance with the requirements contained in Sydney Water's Technical Specification - Mechanical, unless otherwise specified in this document.

2.8 Electrical works

2.8.1 Scope of work

The electrical scope of work of this contract is for the design, manufacture, supply, delivery, installation, testing and commissioning of all electrical equipment. This includes the incoming power supply system, communication, control, instrumentation, and all necessary accessories and associated equipment, for the proper functioning of the dosing system to be installed at the site.

This includes, but must not be limited to the following:

- Where the CDU is a standalone plant install the power supply cables from the point of common coupling, and 3-phase power supply from the Electricity Authority supply, to the CDU connection point of the dosing system, including metering, termination, lightning and surge protections. Where the CDU is installed within a sewage pumping station site the power supply must be provided from the pumping station electrical switchboard via a separate circuit breaker. The electrical loading must incorporate an extra allowance of 30% for future loads.
- Installation of a non-metallic cable tray around the complete inside perimeter wall of the dosing room. The cable tray must have segregated sections for power and controls cable.
- Provision of IICATS interfacing signals.
- Provision of all cabling and wiring between the CDU and the Sydney Water supplied IICATS RTU (Remote Telemetry Unit) including surge protection units.
- Provision of internal and external lighting.
- Provision and installation of all equipment, materials, accessories, cabling, conduits, power poles/posts, connections and housings to enable the system to be fully operational.
- All necessary electrics are earthed to comply relevant aspects of AS/NZS 3000.
- Where non-standard CDU designs are used (in terms of DTC drawings and P&IDs) then the application specific settings in the standard Plain English Functional Description (PEFD) proforma must be changed by the process designer and the Functional Design Specifications (FDS) must be customised by OTS.
- Site testing and commissioning.
- Provision of Work As Constructed (WAC) drawings.

2.8.2 Standards

The design and construction of the electrical works must be in accordance with the requirements contained in Sydney Water's Technical Specification – Electrical, unless specified otherwise in this document. The RTU panel is to comply with I & C Standard.

2.8.3 Electrical equipment

All equipment must be new and suitable for its purpose, comply with Australian Standards and be rated for continuous in service condition within a switchboard. All electrical equipment supplied should be available from suppliers within Australia.

All items of equipment must be designed, manufactured and installed to perform their required functions reliably and efficiently. The Contractor must take into consideration the conditions and functions of the equipment when designing the systems, and selecting equipment, to ensure the system could be operated safely and efficiently. Particular attention must be given to equipment installed in an adverse environment and/or exposed to weather.

Temperature rise within electrical enclosures and cubicles must not exceed the maximum temperature specified for components inside those enclosures, including the thermostat and heater. Adequate ventilation must be provided in the enclosures and cubicles. Switchboard ventilation fans should be considered for installations using dosing pumps with Variable Speed Drives.

A thermostat and heater must be supplied to prevent condensation inside the electrical and controls enclosures and cubicles.

Live equipment and terminals must be located behind removable covers or doors, and shrouded to prevent accidental contact when the control panel's front doors are open, including equipment mounted on doors.

The switchboard must have touch protection included in the design. Where more than one item of equipment is supplied and installed to perform a particular function, all such items of equipment must be identical and completely interchangeable.

The site is subject to power failure. The equipment must be designed for automatic restart when the power returns.

The Contractor must develop electrical circuits, and submit the electrical circuit diagrams to Sydney Water for review prior to manufacture Circuit design must be in accordance with DTC electrical drawings provided at time of tender. This will be a hold point.

2.8.4 Battery backup

The controls and RTU must be provided with 2 off 24V battery backup units, one for the RTU modem and instruments and the other for the motorized and solenoid valves. The battery supplied for the RTU should be sized according the requirements in TOG_TS01. The battery for the valve power supply must be sized to provide 2 complete operations for the maximum number of open motorized valves. The batteries must be suitable for a life of at least 3 years continuous use with checks at 12 monthly intervals.

2.9 Instrumentation

All instrumentation including level transmitters, flow transmitter, flow switches and level switches must comply with the TOG_TS01. If there is any discrepancy between this document and the TOG_TS01, it must be raised to Sydney Water at the Design phase, to allow him / her to make an appropriate ruling on the matter. The Contractor must resolve any issues of concern with the Principal and obtain written approval prior to proceeding with ordering and manufacture.

The contractor must install permanent online hydrogen sulphide monitoring at a strategic location downstream of the chemical dosing point, that will communicate daily with Sydney Water IICATS. The online hydrogen sulphide monitoring must be a separate standalone site (i.e. will not provide a feedback loop to the

dosing control system of the CDU) and be installed at a location and be of a type specified by Sydney Water.

2.10 Telemetry and control

The CDU is to be supplied as a package by equipment supplier with all necessary control and instrumentation. The CDU must be designed for connection into Sydney Water's Telemetry System. Telecommunications must be provided as per TOG_TS01.

Specific requirements of telemetry and control for a CDU are detailed in Sydney Water's IICATS Sewer Odour and Corrosion Standards TOG_TS08. Unless directed otherwise, the digital and analogue inputs and outputs must be provided as specified in TOG_TS08. If there is any discrepancy between this document and the TOG_TS08, it must be raised to Sydney Water prior to design commission to allow them to make an appropriate ruling on the matter.

Telecommunications must be provided by a 3G link to the mobile network. The Contractor must supply a suitable 3G aerial mounted on the CDU building and cabled to the RTU panel. A surge protector should also be installed.

Where available, recycled water must be used for dilution water and hosing purposes. Potable water of suitable pressure and flow must be provided for the eyewash and safety shower at all sites.

The selection and installation of field mounted electrical equipment within the chemical storage and dosing area of the CDU building must have a minimum IP54 rating and comply with the requirements of AS/NZS 3000 Section 6: Damp Situations.

Additionally, where the CDU is co-located with a sewer pumping station, the level sensors on the sewer pumping station wet well must be hard wired into the CDU RTU to cut dosing at the wet well ATWL and stop overflow of chemicals into the environment.

2.10.1 CDU controller

The primary control of the CDU must be provided by a local RTU. The controlling RTU must be to TOG_TS01.

The CDU must be installed with monitoring and control equipment to Sydney Water Standards, which must enable it to integrate into Sydney Water's IICATS.

2.10.2 RTU

Control and monitoring of the CDU must be provided through the RTU which will be connected to the IICATS network. The RTU and IICATS network will provide the means for supervisory control and monitoring from remote workstation. Supervisory control must permit overriding control from the SOC.

A stand-alone RTU must be provided in the CDU control panel to control and monitor the plant. In this case:

- The RTU must be installed in a segmented section of the control panel or in a separate fully accessible adjacent panel.
- The RTU power supply must be provided by Dyne Industries with 8 hours battery back-up and sized as per TOG_TS01.
- Digital and analogue I/O must be connected to the RTU in accordance with TOG_TS01. Hardwired signals must be terminated through the knife switch terminals in the RTU panel. External inputs to the RTU must be connected through surge diverters.
- The supplier must interconnect all telemetry components, including connection of the RTU equipment. (Refer TS01 for details).
- The RTUs and Modem, as well as configuration of this equipment, will be free-issued by Sydney Water. The contractor will be responsible to provide the external aerial for the site (COL7195/7199 with SMA Male Connector) mounted on j bracket external to the building, as per the I&C Standard.

2.11 Internal cable tray

There must be a non-metallic cable tray around the complete inside perimeter wall of the dosing room and into the electrical controls room. The cable tray must 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 must be spaced off the wall using spacer so that control cables will fit between the wall and cable tray where relevant. Power cables must come out of the bottom of the cable tray and controls cables must come out of the top or back of the cable tray. The cable tray must be sealed with a removable compound where it penetrates through the wall between the dosing room and electrical controls room.

2.12 Services

Services to the CDU must include potable water supply, electrical power, telephone connection (if required), and drainage. These services are to be identified as to their location relative to the dosing unit.

2.13 Security and access control

All doors must be keyed for Sydney Water security “CBY” (yellow key). The Illawarra system however uses a PS1 key.

2.14 Facility and equipment identification and labelling

All equipment must have a unique identification number beginning with SX in accordance with ACP0055 Asset Numbering Standard Operating Procedure. Sydney Water designates unique identification numbers for all its asset and associated equipment and Sydney Water will assign these.

The facility and equipment identification and labelling must be in accordance with Sydney Water’s Specification SDIMS0026 Facilities Site Signage Specification and D0001440 Commissioning – transitioning assets into operation.

A standard Sydney Water facility asset sign must be mounted on the outside of the CDU building.

2.15 Entering asset details into Maximo, IICATS & HIDRA

The Contractor must provide information for the update of Sydney Water information systems including:

- Sydney Water’s Maintenance Management System (MAXIMO) asset listing to be completed & sent to Asset Information (Data Creation), who allocate asset numbers & notify the HYDRA Register & OTS.
- SPS Contingency Plans (GA drawing emailed to sps-plans@sydneywater.com.au)

Use the “Location Number Request Form for New/Existing Assets” form MEPR0063 (refer Appendix B) to add new assets and have asset numbers assigned to them by Asset Information Data Creation group. MEPR0063 form is available from the Asset Information page on iConnect.

Request new asset numbers from Asset Information (Data Creation), then forward with P&IDs to OTS for IICATS updates.

Sydney Water shall ensure that HYDRA GIS is updated to include the location of the CDU and chemical dosing line, from the CDU to the dosing location. The dosing line shall be shown in HYDRA as a pressure main with pipe size, pipe type, etc. noted. The chemical dosing line shall have the term CHEMICAL DOSING LINE entered into the ‘General Information’ field in HYDRA.

2.16 Signage

Signage must be erected as required in accordance with Facilities Site Signage Specification. These include, but are not limited to the following:

- Sydney Water Facilities’ site signage Specification - Document Number: SDIMS0026

- For sites with capacity greater than 10kL, a Hazardous Chemical (HAZCHEM) warning placard with UN number and chemical class to be placed on the main site entrances or on the CDU building as well as the storage tanks, when a hazardous chemical is stored on site.
- Information panels as per current edition of the Australian Dangerous Goods Regulation must be placed in prominent and visible locations. As a minimum, there must be one each on the chemical storage tank, and another on the inside of the door to the bunded area.
- Confined Space Entry Permit placard to be placed on the storage tank.
- Capacity of the storage tank stated on the tank.
- A sign that identifies the chemical, specifies tank asset number, full tank capacity and safe tank fill volume must be placed adjacent to the fill point.
- Safety signage as per DTC Drawings must be placed at the front of the CDU building or inside the door.
- If required by National Construction Code (>100 square metres) luminous emergency EXIT sign placed inside above the exit door.

Other relevant OHS signs must be installed in accordance with AS 1319. The signs may include, but are not limited to, safety shower, eye wash station, and non-potable water tap.

2.17 Fencing (if required)

To prevent access from the general public and protect against vandalism, a man proof, fence must be supplied and installed with a gate at the perimeter of the CDU area. It must be located so as not to interfere or restrict operational and maintenance activities, including chemical tanker delivery. Any fencing must allow the largest chemical delivery tanker servicing the site to park completely off the road to allow access gates to be opened and closed safely. Sydney Water will specify when fencing is required.

Fencing must be designed in accordance with Sydney Water's Deemed to Comply (DTC) drawings – Facility Fencing. Where this fencing is not suitable due to gate span or other parameters the Contractor must be responsible for providing a separate fence design to Sydney Water for approval during the design phase of the contract.

2.18 Elements of CDU

A CDU must consist of the following elements:

- Chemical tanker delivery bay
- CDU building, which contains two rooms; one for the electrical control panel and IICATS RTU, and the other a self-bunded room for the chemical storage tank, dosing pumps and pipe work
- Electrical control panel with RTU
- Chemical storage tank(s)
- Dosing system
  - Pumps
  - Pipes
  - Valves
  - Instrumentation
- Safety and wash down equipment

Specific requirements for each chemical dosing system and components of the CDU are detailed in the following sections of this Specification.

A set of CDU Process and Instrumentation Diagrams (P&ID), and general arrangement drawings and sketches are available as appendices at the end of this document. The proposed design must be conceptually similar to them, unless instructed otherwise by Sydney Water.

2.19 Maintenance access

The layout of the equipment inside the CDU building must be submitted to Sydney Water for approval prior to construction. This is to ensure that access hatches, level indicators, pumps and so on, can be easily reached by personnel for maintenance and operation. For standard general arrangements of the chemical dosing unit; Refer DTC drawings.

3. Chemical delivery bay

A chemical delivery bay and associated roadworks or re-grading must be designed and constructed to provide safe arrival, parking, off-loading, turning around (if necessary), and departure of bulk chemical tanker trucks.

3.1 Location

The delivery bay must be located adjacent to the CDU building. Unless otherwise specified, the CDU building must be located on the left side of the tanker.

The unloading point must allow the chemical delivery tanker to be fully inside the delivery bay when unloading. The unloading hose connection point is typically located inside the CDU building, and must be no more than 6m from the tanker connection point, as per the Dangerous Goods Code of Practice.

3.2 Access

The chemical delivery tanker must be able to access the site safely without traffic controllers. It must be safe for the truck to turn off the roadway into the property and for the driver to stop the truck and open the gate. Depending on traffic conditions in the area, slip lane(s) may be required.

The delivery bay and its access must be large enough to accommodate a tanker to be reversed into the bund and exit the site in a forward direction. Alternatively, the access must allow the tanker to drive through and exit the site in a forward direction. The design is to avoid the possibility of the delivery truck having to pass back through a bund in which a spill has occurred.

3.3 Delivery bay bund

The delivery bay must be a concrete slab with a bund wall, to provide containment for any spill or leaks. Relevant aspects of AS 3780 must be complied with where corrosive chemicals are used.

The bund must be designed as a water retaining structure in accordance with AS 3735. It must have a capacity of 9,000 litres or 110% capacity of the largest tanker vehicle compartment, whichever is greater.

The bunded area must be designed with a 1 in 75 grade towards the sump drain, such that no pools of chemical will accumulate on either side of the bund. The bund walls must also be painted yellow to increase visibility and reduce the risk of tripping onsite. The step between the delivery bay bund low level and CDU footpath is to be a maximum of 225mm as per AS1657 step size criteria unless approved by Sydney Water.

Any roll-over kerbs in the roadway at either end of the tanker delivery bay bund must be designed to allow normal passenger vehicles (Class B99) to enter and exit without scraping the bottom of the vehicle as per the clearance requirements of ADR43/03 unless other vehicle agreed or specified by Sydney Water. Bund should be red oxide colour for ferrous chloride sites only.

The area between the tanker bay bund and the CDU building must be concreted, and any spills in this area must be contained and drain into the delivery bay bund.

The delivery bay and CDU arrangement must ensure any stormwater from the surrounding roadway and ground must be channelled away, and not flow into the delivery bay bund. Any expansion joints in the concrete path between building and delivery bay must be mastic filled to prevent chemical seepage in between joints.

3.4 Sump and discharge line

A sump pit to collect liquid from the bunded area must be provided. It must have minimum dimensions of 600 x 600 x 600 mm to ensure sufficient capture of rainwater or hosedown water without filling the bund sump, whilst the drain valve is closed during deliveries. The drain valve must be installed in the sump pit including union joint and extension spindle.

The sump must drain by gravity (typically a 100 mm UPVC pipe) where feasible, to an appropriate location. This may be either to a Sewage Pumping Station (SPS) inlet maintenance hole, or a wet well of the SPS.

The connecting pipe from the sump to the drain point must be pressure rated and sealed with a suitable chemically resistant coating to avoid chemical ingression into the concrete wall. The pipe outlet must be above the sewage overflow level (to create an air gap). A P-trap and a flap valve must be installed at the other end of this drain line to help prevent sewer odours escaping via this line. A manual isolation valve must be provided on this line in a separate dry pit adjacent to the sump. This pit must have a lightweight lockable lid. If a gravity arrangement is not feasible, then a manually started, self-priming pump must be provided to empty the sump.

In addition, where the site has a submersible pump installed, the bund sump needs to be substantially larger to ensure efficient operation of the submersible pump and prevent pump short cycling. High-level alarms must be provided in the event of heavy downpours or pump failure.

In the event that the sump pump is required to pump into a pressure main it must be the same size and type used in the household pots for the pressure system.

The submersible pump must be corrosion proof and must be a fitted with a titanium impeller (e.g. Tsurumi or equivalent). The submersible pump must be elevated from the floor of the sump to prevent clogging by dirt and debris. It must be furnished with an accessible discharge union coupling, to enable removal for cleaning and servicing without the need for confined space entry.

The pump must have a suction leg and automatic low-level trip and be installed in the sump. The pump will be used for pumping any spills back to a discharge point fitted with a 50 mm Camlock style coupling. It must only be activated by a local stop/start station, which can be operated without entering the bund, and include an automatic low-level cut-out.

The sump pit must be located where it is not subjected to vehicle loading at one of the sides (outside) of the delivery bay bund. It must be fitted with a grate/cover made from lightweight materials, in accordance with AS 3996 (Class A), weighing no more than 16 kg. The weight limit must be labelled where appropriate. Where the unit's location is subject to falling debris from trees in the area, perforated sump covers with 12mm diameter holes must be used as opposed to grated covers to prevent blocking of drainage system.

3.4.1 Camlock pump out point

A camlock pump out point must be installed to allow pump out from the sump pit and bund area. The location of the camlock pump out point must be adjacent to the sump. The pump out point must be installed on an up-stand off the pumped discharge line from the sump pump, or on its own upstand if no sump pump is required on the site. Isolation valves must be installed to allow pump out from the sump pit pump or camlock connection.

3.5 Safety equipment

The following safety equipment must be provided:

- A safety shower and eyewash station, which complies with AS 4775, located within 2 to 7m of the chemical unloading connection point. This is typically mounted to the inside of the right-hand door of the transportable CDU building. An additional eyewash station must be located within the CDU dosing room near the exit, on the furthest wall away from the dosing system and tank. Safety shower and eyewash facilities must be tested and tagged in accordance with AS 4775. Refer to Appendix E.
- Long water lines to the safety shower and eye wash station (above ground and external to CDU building) that are exposed to sunlight must be lagged, as water may be heated up by the sun and therefore unsuitable for use. Lagging is to consist of mineral wool insulation with aluminium sheet covering to protect from water ingress and damage.
- If adequate supply pressure for the safety shower and eyewash is not available, a booster pump must be installed. The contractor must determine the capacity of the booster pump including pipeline, RPZ and valve losses.

- A UV resistant hose reel permanently attached to a water tap and capable of reaching all parts of the CDU, including the unloading area. The hose reel is to be fitted with a 20mm female camlock fitting making it suitable for use as a flushing mechanism.
- Sufficient lighting to enable safe work beyond daylight conditions, particularly for the chemical delivery activities.
- An ABE fire extinguisher for use in electrical fires must be provided for dosing sites excluding magnesium hydroxide and calcium nitrate.

When the delivery bay is not adjacent to the CDU building (that is, in a remote location), an additional safety shower is required within 2 to 7 meters of the tanker connection point.

All equipment provided must be located such that the potential for vandalism is minimised.

3.6 Tanker power connection outlets

Two permanently mounted electrical power outlets are required for unloading of the dosing chemical. These power outlets are 415 V (20 amps) and 240 V (15 amps) and are interlocked with the storage tank level transmitter (90%) and high-level switch (95%), to prevent operation of the tanker unloading pump on high-level. That is, automatic cut out of the outlets during filling when the tank level reaches high-level (90%).

They must be located within 7.5 m of the unloading hose connection point, and inside the CDU building and guarded from splashback at the fill point. For further detail on the switch arrangement, refer to Sydney Water's IICATS Sewer Odour and Corrosion Standards TOG_TS08.

3.7 Fill point

At the tanker filling point, a 50mm tanker fill pipe with a 50mm suitable male camlock fitting angled downwards at 45°, with removable cover, must be supplied and installed. From this fill line a branch, with valve and extension piece pointing vertically down must be supplied and installed for hose draining purposes. Refer to typical chemical dosing unit DTC drawing set.

The camlock coupling point must be positioned at least 600mm and no more than 900mm above the ground and firmly supported above and below the wye fitting. Transfer pipes should rise vertically from the tee and slope downward (1 in 100) at the top of the tank(s) to minimise drainage losses. The tank inlet branch should be above the level of the overflow pipe. The fill point must be fully contained inside a bund to prevent release of chemicals in the event of leaks at the connection point. The fill point is to be fitted with a digital display and associated equipment in accordance with this specification.

A second tanker fill point must be provided with valves and drain line but with a screwed plug fitted instead of a camlock. This line will connect to the dosing tank but be used only in an emergency to feed direct to the dosing tank. An individual fill point is required for each tank if there are multiple tanks in series.

A placard containing information on chemical, tank capacity and safe fill volume must be placed clearly on each line at the loading point as shown in DTC drawings and as per SDIMS0026 Customer Delivery Safety Signage Specification.

Refer to Section 2.5.2 for special requirement for Magnesium Hydroxide.

4. CDU building

A reinforced concrete, two-room building must be designed to accommodate the chemical storage tanks and its bund, dosing equipment and control panel, along with the necessary control functions, alarms and telemetry links.

The building must be designed to be weatherproof and prohibit unauthorised entry. Its construction must be vandal-proof and painted in accordance with the WSA Manual for Selection and Application of Protective Coatings, WSA 201 and Sydney Water's Supplement to WSA 201. Sydney Water shall advise whether the protective coating must be Aesthetic (ACL coating System), Anti-Graffiti (PUR-B or PSL coating System) or coastal environment (PUR-A coating system) The colour of the plant shall be as advised by Sydney Water.

4.1 Building layout and dimension

The building must consist of two separately accessible rooms; a bunded dosing room for chemical storage and dosing equipment, that is capable of containing any chemical leaks or spills. The second room is an electrical controls room for electrical controls, telemetry, and document storage. The rooms must be divided by a wall with a fixed transparent window (polycarbonate) of a reasonable size (typically 1m wide by 0.6 m high) to allow viewing of all key elements in the dosing room when operating from the control panel inside the electrical controls room. The windowsill must be positioned a minimum of 100mm above the chemical bund level. Separate doors must provide external access into the two rooms. The doors must be steel fabrication and adequately corrosion protected in accordance with WSA 201 and Sydney Water's supplement to WSA 201.

The dimension of the building must be designed to allow adequate space to work in, and regular operation and maintenance of the tank(s) and equipment to be carried out, without removal of the roof. As a minimum, the ceiling height must be greater than 2.2 m from the ground or 0.5 m from the highest tank whichever is the greatest.

Normal working areas must have immediate access to the point of safe egress. The width for emergency access and egress must be no less than 1 m, unless specified otherwise.

The door of the chemical dosing room must be a double door that can accommodate removal and replacement of the storage tank(s). The doors must have a mechanism to lock them in the open position whilst the site is attended, and lockable shut when not attended. Door must be replaceable without damaging the concrete substrate of the unit. Refer DTC drawing for more information.

Alternatively, a removable modular roof with stainless steel grade 316 lifting lugs must be provided with a single door for access. Where a removable roof is provided, all electrical wiring connected to equipment on the roof, such as ventilation fans must have dismantling joints or sockets to unplug and disconnect prior to removal of the roof.

A single hinged door must be provided to the control room that opens to the outside. The door has to be provided with a lock and latch mechanism.

4.2 Mobility

Unless specified otherwise, the building must be designed to be transportable, without having to dismantle and reinstall the chemical storage tank(s), pipework, pumps, control system and all other equipment. Suitable lifting lugs made from corrosion resistant steel must be provided and located at the base of the building. Lifting lugs must be grouted over after installation and locator markings made at the lifting point locations.

The design life of the lifting lugs must exceed the design life of the building. Structural certification from a structural engineer with National Professional Engineers Registration (NPER) with the Institution of Engineers Australia must be provided to certify the lifting of the building. The lifting procedure must be stated in the O&M manual and the detailed drawings.

A stainless steel plate must be mechanically fastened to the building, stating lifting certification date, construction materials, dry weight, maximum loaded lifting weight, and maximum load for each individual lifting lug must be provided.

Structural drawings must be submitted to Sydney Water for written approval prior to construction. This must include, but is not limited to:

- Concrete drawings with all dimensions specified (clearly showing the location of the lifting lugs)
- Concrete reinforcement drawings (plan view and sections)
- Notes pages, which captures:
  - Concrete grade
  - Finishes
  - Reinforcement grade and cover reinforcement
  - Sub-grade preparation with notes (detailing allowable baring capacity and so on)
  - Design life of building and lifting lugs
  - Design capacity of lifting lugs and lifting procedure, clearly identifying which lifting lugs to be used for transport, and loads imposed by lifting lugs
- Building certification of design and fabrication referenced for each individual drawing.

4.2.1 Permanent plant specific requirements

Where storage requirements do not facilitate the use of indoor tanks and an external tank is required for dosing then a separate bunded area must be provided. The bunded external tank area must be designed for chemical storage capable of containing any chemical leaks or spills and must be designed as a water retaining structure in accordance with Section 3 of this document.

The tank bunded area must be covered with a carport type steel structure to provide sufficient weather protection for intermittent works within the bund and to ensure rainwater does not collect in the bunded area. The roof is to have sufficient storm water drainage and downpipes. The roof connections are to be bolted to minimise the works involved in removing the roof if a tank replacement is required. The roof must be designed to withstand all forces associated with dead, imposed and wind loading as specified in AS1170.0, AS1170.1 and AS1170.2. The design must be site specific to evaluate wind direction, topographic and shielding factors. The walls must be clad to a height 1m below the roof line on all four sides.

Around the perimeter of the bund fence in compliance with the DTC 5000 series is to be provided to increase site security of the outdoor asset as specified by Sydney Water. The gate must be fitted with a lock compatible with a Yellow CBY key (or PS1 key for Illawarra system).

4.2.2 Lifting plan

As part of the design the Contractor must provide a lifting plan for the CDU unit for installation and removal. The plan must show the location of the crane and its outriggers and include the mass of the crane and the maximum force at each outrigger point. The lifting plan must be site specific and include the make and model of the crane used in the design. The lifting plan must include details of the lifting points and their maximum loads.

The lifting plan must be reviewed by a geotechnical engineer engaged by the contractor who will undertake any testing and calculations necessary to confirm suitable bearing capacity of the earth at the outrigger location. Geotechnical engineer must confirm the temporary works required to achieve required bearing capacity at outrigger location and any works for locating the crane at the lifting point.

4.3 Bund floor and wall

Any chemical storage area in the CDU building must be bunded in accordance with the requirements detailed below. The bund must be designed as a water retaining structure in accordance with AS 3735. It

must have the capacity of at least 110% of the total capacity of the tank(s) located within the bund compartment.

The bund wall height must be a minimum of 400 mm. The need for high bund walls needs to be balanced against the more difficult access and emergency egress and the overall size of the building. For wall height greater than 400 mm, access stairs are required in and out of the building. Where access steps/stairs are required, they must be provided on the inside and outside of the bund wall to provide safe access and egress, in accordance with AS1657 and DTC drawings.

A high level alarm (connected to IICATS) must be installed in the bund, to alert the operator that a spill may have occurred. The alarm set point must be agreed with Sydney Water, and cause an automatic shutdown of the CDU.

The bunded area must be designed with a 1 in 75 grade towards the sump pit such that no pools of water/chemical will accumulate on the bund floor.

The bund wall and floor must be coated with NOV coating systems in accordance with the Manual for Selection and Application of Protective Coatings, WSA 201 and Sydney Water's Supplement to WSA 201 ACP0166. This includes Magnesium Hydroxide bunds and sumps, although this is not required for chemical protection but is a major aid to cleaning.

All pipework must be run around the perimeter of the dosing room to minimise trip hazards, and as far away from electrical wiring as practicable. With exception to the bund drainage pipe, all pipes must pass through the building wall above the top of bund wall.

4.4 CDU Internal sump and discharge line

To allow for the management of any chemical spills occurring in the internal bunded area, it must drain to a low point recessed into the floor of the building. A DN50 PVC pipe must be installed through a penetration at the low point of the building. The penetration for this pipe through the CDU floor must consist of a PVC socket cast into the floor with a puddle flange glued to it (as shown in the drawing DTC-7009) such that chemicals will not come in contact with the concrete. The PVC pipe must connect to either the delivery bund sump or a new sump (minimum dimensions 600mm x 600mm x 600mm) if the delivery bund sump is not at an appropriate location. The sump must be fitted with a lightweight lockable lid. A manual isolation valve must be provided on this line

Where it is feasible to drain any sump under gravity (typically a 100 mm pipe) to either a SPS inlet maintenance hole or a SPS wet well a drain line must be run from the sump to the drain location. Refer section 3.4 of this Specification for sump and discharge details.

If a gravity arrangement is not feasible, then a manually started self-priming pump must be permanently installed to empty the sump (refer Section 3.4).

The discharge line may be combined with the chemical delivery bay discharge line (refer Section 3.4). A recessed low point inside the chemical room of the building is to be located adjacent to the door to facilitate maintenance.

External sumps must have a lockable, easily operated lid that will permit the addition of a sump pump. The lid must prevent the ingress of rainwater and debris.

Where there is water supply within the CDU bunded area, a 50 mm overflow pipe must be provided above the 110% bund directing the flow away from electricals, operator accesses and where possible, to the delivery bay/intermediate sump. This can be provided through the wall of the CDU. The design must include ready isolation of the water supply without the need to enter the bund.

4.5 Electrical controls room

The electrical controls room must have an external entrance door opening outwards. The chemical delivery lines and water supply lines must pass through a hole in the floor of the electrical controls room. The pipework must rise above bund height and then enter the bunded dosing room. The pipework in the controls

room must be shielded with PE panels, designed to prevent impact damage to the pipes and prevent any leakage or spray from the pipes reaching the electrical and controls cubicles. Any leakage must be diverted onto the floor of the room. The floor must be sloped so that any leakage flows towards and out of the door and into the delivery bund.

The Contractor must provide a table and chair in the control room.

4.6 Electrical

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

One 3-pin, 240 V power outlets must be provided in the electrical control room for power supply. An additional twin GPO should be provided in the RTU section of the control panel.

A high impact weatherproof IP 55 socket outlet must be provided for the sump pump. This outlet should match that of the sump pump provided. Most often this is a single phase sump pump. The outlet must be mounted inside the building, on the wall, a minimum of 300 mm above the bund level. Power lead to the pump must be captive when the switch is in the on position. The outlet must be provided with a chemically resistant, engraved plastic label (10 mm high minimum lettering) screwed to the wall above the outlet, indicating, “For sump pump - do not use for filling”.

4.7 Ventilation

Adequate ventilation must be provided to prevent condensation build-up inside the building using door vents and extraction fans.

Separate electric ventilation fans must be provided for the chemical dosing room and the electrical controls room. Where ferrous chloride/ferric chloride is the dosing chemical, the ventilation fans must run continuously, be corrosion resistant and be able to be operated via a 24-hour timer if required.

In other dosing systems, the fan is only required to operate when plant personnel are inside the CDU building. An automatic door switch on the CDU building must be provided to automatically start the fans when the doors open, and stop the fans when the doors close. This switch will also log building access to RTU and turn on / off interior lighting.

The electrical controls room and chemical dosing room fans must be mounted on the roof of the building. To provide adequate cross flow ventilation, mechanical vents must be provided low down, preferably on the eastern wall, a minimum of 300 mm above floor level in the electrical room and above the bund level in the chemical room. These vents must be vermin proof. The fans must be capable of achieving 6-12 air changes per hour. The ventilation fans are not required to be monitored or controlled by the RTU.

If required, an air conditioning system must also be provided for the electrical controls room.

4.8 Lighting

Internal and external lighting of the CDU building must be provided to allow normal work to be carried out 24 hours a day. The external lighting must be provided to cover the area where filling is to take place and the entry door.

The lighting installation must meet all the applicable requirements of Sydney Water’s Technical Specification - Electrical. Specific lighting requirements are described in the following:

A minimum illumination level for internal lighting of 400 LUX using LEDs must be supplied and installed in each room. An automatic door switch must be provided, to automatically turn on the lights when the CDU doors are open, and shut off the lights when the doors close. One emergency luminary with a 2 hour battery backup, must be supplied and installed for each room.

The external lighting must be 30W LED floodlight fitting. Glare from the fitting must be carefully controlled for comfort. Lighting using unshielded lamps must not be visible to the public at normal viewing angles.

The external lighting design must be vandal proof. It must utilise the building for mounting, where practicable. The lighting must be controlled via a light switch located inside the control room in the CDU building. During automatic mode, the operation of the lights must be controlled via a photocell. During manual mode, light can be switched on and off by operator with an 'OFF' 15 minutes delay to allow operators to safely egress the site with lights still on.

An overall site lighting study must be completed after layouts are complete, including but not limited to, delivery bay, roadways, access road, gates and approach road.

Additional lighting must be provided at roadways, gates and approach road.

4.9 Platform ladder

A lightweight, corrosion resistant 1200mm high safety type platform ladder must be supplied to provide access to the manholes of all tanks, level sensor, room lighting, and any elevated equipment. Platform ladder to be compliant with AS/NZS 1892 and any applicable SafeWork NSW requirements. Platform to include closable gate to provide fall protection on all four sides and to have braking system for the wheels to prevent movement during use.

4.10 Safety equipment

Refer Section 3.5.

4.11 Chemical manifest

If the chemical is above the Dangerous Goods manifest quantity (i.e. >10,000 L), then a Hazardous Material (HAZMAT) box must be mounted just inside the site main entrance gate. A chemical manifest must be provided in the box and must meet the requirements of NSW Storage and Handling of Dangerous Goods Code of Practice 2005. Chemical manifest should comply with WHS Regulation 2017 Schedule 11. This typically contains the following details:

- Date of preparation
- Name and contact details of Occupier / Sydney Water 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
- 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
  - Location of emergency assembly area.

5. Chemical storage tank

Chemical storage tank(s) must be provided for safe storage of the dosing chemical. The tank(s) must be located within the bunded area inside the CDU building dosing room. The preferred arrangement of the tank(s) is furthest away from the control room and the entry door.

The storage tank(s) must be designed and constructed to provide maximum draining of the tank and its connections while still maintaining the structural integrity of the tank walls and base.

Equipment, such as access hatches and level sensors must be easily reached from the platform ladder for ease of operation and maintenance.

The storage tank must be designed for the maximum delivery temperature of the chemical. This temperature will be advised by Sydney Water or its representative.

The tanks provided must be the tallest and thinnest available with sufficient access to the level transducer on top. Clearance above the tanks must be a minimum of 500mm.

There are 3 acknowledged references to tank capacity as follows:

Nominal Capacity – This is the tanks capacity as stated by the manufacturer. It is the tanks nominal capacity without fittings.

Effective capacity – This is the capacity of the tank to contain product. It is the tanks volume as determined from the floor of the tank to the invert of the tank overflow.

Working capacity – This is the tank capacity to deliver product. It is determined from the obvert of the discharge to the invert of the overflow.

The storage volume must be calculated from the Working capacity. Level sensors that communicate through IICATS operate between 5% & 90% of the Working capacity.

5.1 Material

The storage tank must be manufactured from rotomoulded polyethylene or other material suitable for the chemical specified. It must be designed and constructed in accordance with AS/NZS 4766. Where the dosing chemical is a corrosive substance, the chemical storage tank must be resistant to chemical attack and designed and constructed in accordance with the relevant requirement of AS 3780. A minimum of 1.5 times the specific gravity of the fluid to be stored in the tank must be assumed for calculation of wall thickness requirement.

To avoid external corrosion, all welded brackets such as hold-down lugs, pipe supports and lifting lugs must be designed to allow water/chemical to drain away without pooling.

The tank supplied must be fitted out with the required branches, fittings, labelling and identification number. The labelling requirements must include, but is not limited to the material of construction, the name of the manufacturer and the date of manufacture.

All stub flange nozzles must be complete with stiffened gussets and supplied 316 stainless steel backing rings, ANSI 150. For indicative tank layout drawing including all required appurtenances refer to DTC drawings.

5.2 Structural

The tank must be suitably reinforced and supported to withstand all forces, including filling forces, without deforming when it is full. The tank must be fabricated such that the top of the tank is capable of supporting the weight of maintenance personnel.

For a FRP tank, it must be anchored and mounted on a suitable concrete plinth. Suitable lifting lugs must be fitted. Bitumen sealed mats must also be installed between the storage tank and concrete plinth.

Where the tank requires a mixer, such as when magnesium hydroxide is used as the dosing chemical, the mixer must not be supported by the tank.

5.3 Access hatch

For a covered tank with a sidewall height of not greater than 2 m, a minimum of one 600mm diameter access hatch must be provided in the top of the tank. Where the tank is small <5kL and a 600mm diameter access hatch is not feasible, a 450mm diameter access hatch must be provided.

For any other tank, the minimum dimension of the side access hatch is 600 mm diameter. The side access hatch must be hinged to the tank wall.

The hatch must be made from lightweight materials, weighing no more than 16 kg, in accordance with AS 3996, Class A. Weight limits must be labelled where appropriate.

When magnesium hydroxide is used as the dosing chemical, the access hatch must provide sufficient sealing to prevent humidity loss.

5.4 Tank inlet and outlet

Tank must be as per the DTC drawings and have a minimum of the following pipework features:

- One 50 mm diameter vent (breather) on the apex of the tank roof must be supplied. The vent must run from the top of the tank grading up to an external vent with a conical top sealed with vermin proof mesh.
- One 80 mm diameter overflow branch. The overflow line diameter should be at least 1.5 times the diameter of the filling line. The overflow line must be located such that it prevents immersion of instruments and equipment located in the tank roof and directs chemical safely away from operators and to the bund sump. The overflow must terminate in a water trap consisting of a bucket supplied by the Contractor.
- One drain branch with minimum diameter of 50 mm must be provided as close to the tank floor level as practicable.
- One 50mm diameter fill pipe to the top side inlet from tanker unloading point, complete with a fill valve. A 50 mm suitable male camlock style fitting, with cover, must be supplied and installed at the tanker filling point. This pipe must rise vertically and then slope downwards towards the tank (1 in 100 fall). It must enter the top of the chemical storage tank and be located above the level of the overflow pipe.
- Two suitably sized branches in the tank roof of the tank for Ultrasonic level transmitter fitted with female camlock connection. One must be used the other is to be a spare, both are to be located in positions which are accessible from a moveable access platform.
- One suitably sized branch in the roof of the tank for the relief line return from the chemical dosing cabinet.
- One suitably sized bottom side outlet. It must be located 100 mm above the tank floor. It must be fitted with a manual isolation valve and a motorised isolation valve which must have a battery backup sufficient to drive the valve close in a power failure.
- Two 25mm Diameter branches located in the same vertical plane at appropriate levels for the installation of a magnetic level indicator. An additional branch may be required if the level switch low is not integral with the magnetic level indicator.
- Automatic cut out during filling when the tank reaches High Level (90%).
- Automatic cut out during dosing when the tank reaches Low Low level (5%).
- Isolation (stop) valves on each of the inlet and outlet connections.
- All branches on the tank must finish with 150 mm or more from the tank wall or roof with ANSI flanges with stainless steel backing rings. All stub flanges to be gusseted.
- If multiple tanks are used in a balanced or train arrangement, all interconnecting or balancing pipework must be adequately sized such that filling the primary tank will collectively fill all interconnected tanks without the need to wait for tanks to balance.

- The overflow pipe must be piped to the sump in such a way, that the tanker driver can view the discharge point from outside of the bund to indicate if the tank is overflowing.

5.5 Level instruments

An ultrasonic level indicator to show the level/quantity of the contents inside the tank must be provided above the overflow line. It should be mounted on a removable camlock style fitting and easily accessible from a platform ladder. The transmitter must be connected to the control and telemetry system to allow remote monitoring as specified in Sydney Water's IICATS Sewer Odour and Corrosion Standards TOG_TS08. 0% level must be at the bottom of the tank and 100% must be at invert tank overflow.

In addition to the ultrasonic level indicator, a visible indicator must also be provided. A transparent tank with level markings is acceptable. Otherwise the transparent tube indicator must be adjacent to the tank wall, in order to indicate actual liquid level inside the tank during filling and must be visible from the filling/transfer point.

A separate capacitance type High Level (95%) switch (LHL) and automatic cut out during filling must also be provided.

A separate capacitance type Low Level Switch (LSL) must be provided.

An alarm is to be sent to IICATS if the tank is dropping too fast, indicating a major leak. Rate of drop to be confirmed with Sydney Water controls team.

5.6 Digital display

A weatherproof digital display of the tank level must also be installed at the filling transfer point to indicate the actual level during filling. An alarm system consisting of a klaxon and beacon must also be installed at the filling transfer point, to alarm if tank has overflowed during filling. The digital display for tank level must be suitable for operation with 24V DC power supply. It must be equipped with sunlight readable LEDs and a minimum reading range of 10m. It must be suitable to display percentage values.

The digital display must have a minimum rating of IP 56, and must be installed with suitable mounting accessories. The digital display must be mounted on the fill line above the isolating valve as shown in the DTC drawings.

5.7 Additional requirements for magnesium hydroxide tank(s)

When magnesium hydroxide is used as the dosing chemical, the following requirements must also be met:

5.7.1 Storage tank(s)

- The inside walls of the tanks must be smooth, so that no accumulation of chemical precipitate occurs on the internal tank walls, ribs or bends.
- The tank, including the vent and overflow must be completely water sealed.
- The overflow pipeline from the storage tank must be provided separate to the tank drain line and have a downstream water seal to prevent loss of humidity in the tank.
- Include an outlet pump suction nozzle separate to the drain line, as close to the tank floor as practicable. This outlet must be a 50 mm diameter pipe. The outlet must extend into the storage tank and be chamfered such that the opening is pointing in the opposite direction of mixing.
- Include an isolating valve fitted on the outlet to the pump suction nozzle as close as practicable to the tank wall then an IP 57 Stainless Steel Gr. 316 motorised valve. The motorised valve must close on power failure. Refer PIDs.

Storage Tank Mixer

A slurry type chemical such as magnesium hydroxide requires a tank mixer to keep the slurry chemical in homogeneous state. It must be supplied with, but not limited to:

- Mixer to be a minimum of 1/3 the diameter of the tank, mixer blade size and specification to be confirmed with Sydney Water chemical dosing team staff prior to purchase. Lifting arrangement to be provided for safe retrieval of mixer.
- 200RPM mixer with VSD, bottom blade of mixer must sit at discharge outlet level. Second blade at 1/3rd up.
- Bottom blade angled, top blade paddle shaped.
- Mixer shaft must rest in locator welded to the base of the tank.
- Mixer to be capable of being split in two sections in order to be able to remove the mixer from the tank without removal of CDU roof. Shaft must be removable from drive.
- Mounting hole to be square cut in top of the tank to limit the high torque applied to the tank roof. Tank manufacturer to confirm suitability of the square cut for mixer torque forces.
- Impellers and shaft made from 316 grade stainless steel.
- The ability to stir the chemical from its minimum to maximum depth. A galvanised steel-mounting frame, structurally independent of the mixing tank.
- Automatic control and manual capability.
- A control timer to set the mixer running time.
- A neoprene or similar suitable material gasket must be provided around the mixer shaft to prevent humidity loss.

Mixer blades should extend to a height just above that of the discharge outlet to maintain agitation of the MHL down to Low Lever Cut-out.

5.7.2 Batching tank (if required)

This section to be revised when updated standard designs for magnesium hydroxide dosing are available.

At low pumping rates (below 10L/hr), magnesium hydroxide may solidify and cause blockages. As such, the design of low dose rate systems involves a batch tank, to make a diluted magnesium hydroxide slurry to dose at greater than 10L/hr.

Where a batch tank is required, the following must be met:

- The inside walls of the batch tank must be smooth so that no accumulation of chemical precipitate occurs on the internal tank walls, ribs or bends.
- The tank must include an overflow pipe fitted at the High High (HH) alarm level and installed such that excess liquids drain away from trafficked areas and to the bund sump.
- Separate fill lines for magnesium hydroxide and dilution water into the batching tank must be provided. They must enter directly into the top of the batch tank.
- The dilution water pipework must include an isolation valve, flow switch, rotameter, solenoid valve(s) and non-return valve(s). The rotameters must have a minimum length of 250 mm. A flow switch must be installed on the common line to provide a “dilution system failed” alarm (failsafe) as an input to the IICATS RTU, on low flow.
- The dilution water solenoid must be made of materials compatible with magnesium hydroxide dosing, and set to open on low level alarm from the level sensor. It must be set to close on level sensor high alarm.
- A transfer pump must be provided to transfer concentrated magnesium hydroxide from the storage tank to the batching tank. It will be PLC controlled, started on low alarm from the level sensor and stop on a timer. The pump must be identical to the dosing pumps used in the unit, and set at a constant speed. A Doppler flow meter must be installed outside of the transfer line in order to confirm transfer of chemical.
- A level sensor must be provided to control the batching process. A high level alarm (H) must stop the dilution water by closing the dilution water solenoid. A low level alarm (L) must be used to begin the batching process. A low low level alarm (LL) must inhibit dosing pumps, and a no change alarm will

inhibit the process and raise an IICATS alarm. The level sensor must be located such that the mixing and fill line operation do not interfere with the level sensor's accuracy. A "dilution system failed" alarm (failsafe) as an input to the IICATS RTU, must be raised on the following conditions.

- Dilution water low flow
- Level sensor HH
- Level sensor LL
- Level sensor no change
- Transfer pump no flow

- A batching tank mixer must be provided. The batching tank mixer must comply with the requirements of the Storage Tank Mixer with the exception that it will operate at a speed between 150 and 1,500 rpm. A variable speed drive must be attached to the mixer.
- The tank must have a conical bottom with a manual ball valve at the lowest point to allow the slurry to be fully drained out. An IP 57, stainless steel, three-way motorised valve that closes off chemical supply on power failure must be provided after the manual valve. This valve inhibits dosing pumps when closed as this line feeds the dosing pumps and enables flushing water to clear the dosing line.

6. Dosing system

The required dosing system must be designed to provide a reliable, continuous dosing of metered volumes of chemical. Where more than one dosing chemical is used, each type of dosing chemical must have its own dosing system. All valves, fittings and pipework necessary for the proper operation of the dosing system must be provided. The piping must be suitable for the chemical conveyed. The system must be capable of operating in both automatic and local manual modes.

The system must be supported by suitable supports for the required pumps, valves, fittings and pipework (uni-strut is not considered suitable), all pipework to be supported by pipe manufacturer proprietary product as they allow for movement without damage.

6.1 CDU dosing pumps and pipework

Refer Appendix A: DTC drawings for a list of generic P&IDs.

6.1.1 Ferrous chloride / calcium nitrate

Pumps

Two identical duty and standby digital dosing pumps of suitable type and capacity range, must be provided for dosing. The switchover to the standby pump must be automatic via IICATS. Automatic changeover between pump duties must be configured on pre-set time as well as pump fault.

The dosing pumps must be designed to allow minimum dosing during the initial operation of the CDU.

The dosing pumps must be digital with a turndown ratio of 500:1 or better. Solenoid-driven pumps, double simplex capabilities via multiplexing and ganging of gearboxes are not acceptable.

The pumps are to incorporate digital indication of the set rate. Metering accuracy of the pumps must be better than 2.5% of the set rate at a variable suction head.

Each pump must be fitted with an external pressure relief valve, vented back into the calibration vent line returning into the storage tank.

Approval from Sydney Water must be sought prior to procurement of pumps to be installed in the CDU.

Pipework and Appurtenances

Adjustable pressure retaining valves must be incorporated on each discharge line from the dosing pumps to maintain dosing accuracy over the range of operating depths in the storage tank, and to act as anti-syphoning protection.

Duty and standby suction strainers with an opening of 1.5 mm must be provided.

6.1.2 Dosing cabinets

The pumps and associated instruments must be enclosed in a polypropylene dosing cabinet, thickness of plate may vary depending on size and weight of the pumps required and must be designed specifically to the requirements of each unit. The doors to the cabinet must be transparent (polycarbonate) for safe viewing of the dosing system.

The dosing cabinets must be designed for ease of access and pump maintenance. There must be a divider in the centre of the dosing cabinet to separate the two dosing pumps. There must be a catch pot on the base of the dosing cabinet to ensure all spillages are contained and directed to the sump. A high level switch to detect fluid in the catch pot will be hardwired interlocked to stop the dosing pumps when activated. The cabinet requires adequate ventilation.

Dosing pipework from the point it exits the dosing cabinet must be double contained and drain back to the dosing cabinet for pipework within the CDU building.

All valve handles are to be lockable.

6.1.3 Magnesium hydroxide (neat or batched)

Pipework needs to be clearly labelled for direction of flows as well as the fluid contained in it and appropriately colour coded according to WSA 201 and Sydney Water's supplement to WSA 201.

When a slurry type chemical such as magnesium hydroxide is used as the dosing chemical, there is an option to operate the dosing system in either "Neat Mode" or "Batch Mode". At low pumping rates, magnesium hydroxide may solidify and cause blockages. As such, the design of low dose rate systems involves a batch tank to make up diluted magnesium hydroxide slurry for dosing.

A generic P&ID of these systems are provided in DTC drawings.

Pumps

Two identical duty and standby dosing pumps Bredel or equivalent of suitable capacity range, must be provided for dosing. The switchover to the standby pump must be automatic via IICATS. Automatic changeover between pump duties must be configured on time as well as pump fault.

The pumps must be fitted with a cooling fan on the motor to enable to operate at low speed. The fan is not to be separately monitored or controlled but integrated into the pump.

If a batching system is selected, a third identical pump must be provided for chemical transfer.

All pumps must be peristaltic type and have adjustable speed. The minimum and maximum operating speeds must follow the manufacturer's operating instruction to prevent overheating, excessive wear or damage.

Turndown must be carried out using a variable speed controller. If turndown cannot be achieved using a single pump, multiple pumps must be used. The pumps must be designed to allow minimum dosing during the initial operation of the CDU.

A dose rate turndown ratio of 30:1 must be provided.

Pump speed must not exceed 3000rpm at 50Hz.

Approval from Sydney Water must be sought prior to procurement of pumps to be installed in the CDU.

Pipework and Appurtenances

Refer Section 2.5.2 for all piping requirements for Magnesium Hydroxide

Flexible piping must not be used except where specified on the P&ID.

Spare tubing, fittings and lubricant must be provided for each pump supplied.

Where a batching tank is installed, the magnesium hydroxide pipeline must enter the batching tank directly from the top of the tank. This line must not be mixed with the dilution water line before entering the tank.

6.2 Not applicable to chemical dosing unit

6.3 Dosing cabinets

Refer Section 6.1.2.

6.4 Pulsation dampeners at pumps

Pulsation dampeners must be provided in the discharge pipework from the dosing pump and must be suitably sized for the displacement of the pump so that discharge pressure fluctuation does not exceed 10%. The pulsation dampeners must have a diaphragm separating the air chamber from the liquid chamber. The air chamber must be pressurised, and be capable of re-pressurising by air pump via a Schrader valve. A pressure gauge must be installed. The position of the pressure gauge must be located before the pressure relief valve and the loading valve.

Where possible, pulsation dampener should be located vertically at the top of the common discharge from the dosing pumps, such that discharge flow is directly into the dampener before a change of direction along the dosing line.

6.5 Depressurising, flushing and draining

Adequate provision must be made for draining of lines for maintenance. This typically involves at least one drain valve on each of the suction and discharge sides of the pump. These valves must be fitted with a camlock style fitting. The valving must be provided to allow for flushing of the chemical dosing lines without dismantling the lines.

A 20mm Male polypropylene camlock style fitting must be provided on all flushing points to match that on the hose reel.

A 50mm Male polypropylene camlock style fitting must be provided at the chemical filling line fitted with a lockable cap.

All camlocks are to be supported.

Where magnesium hydroxide is used as the dosing chemical, an automatic flushing system connected to a dedicated timer, must be installed for the outlet line to flush excess magnesium hydroxide that may settle and clog the line.

6.6 Automatic isolation valves

The automatic isolation valve must be a motorised PVC-U ball valve (stainless steel where magnesium hydroxide is the dosing chemical). The valve must consist of two separate modules – the valve body and the actuator. The valve must include a compact electric actuator capable of open/close feedback and be complete with position indicator and a facility for manual control. The valve position signal must be sent to the control system. The valve must close on power failure and the actuator must be IP 65/67 per EN 60529.

6.7 Pressure transducer indicator

Where dosing is going into a pressure main, a pressure transmitter must be installed and interlocked to stop the dosing at high pressure.

6.8 Dosing chemical flowmeter

A flowmeter (magnetic and Teflon coated type preferred) must be installed in each common dosing line (typically prior to the pressure sustaining valve). There must be sufficient upstream and downstream straight pipe run to prevent flow disturbances affecting the flowmeter. The dosing flowmeter must be calibrated to units of litres per hour. The flow meter must measure the flow and transmit the flow signal to the control system. The flow meter must display the flow rate and any error messages.

Flowmeter must be flanged to ANSI 150.

This is not required for systems where the dosing chemical is a slurry type, such as magnesium hydroxide.

6.9 Carrier water system

Carrier water must be piped from the service water system to provide a minimum dilution ratio of 10:1 of carrier water to dosing chemical. If site pressure is not able to accommodate 10:1 ratio then booster pump must be installed in the CDU. The contractor must determine the capacity of the booster pump including pipeline and RPZ and valve losses.

Flow from the carrier water line must pass through an isolation valve, flow switch, rotameter, actuated valve(s) and non-return valve(s). The rotameters must have a minimum length of 250 mm.

Actuated valves must be solenoid valve for lines <50mm and motorised valve for lines > or equal to 50mm.

Actuated valves, isolation valves and all other items of equipment in the carrier water system must be compatible with the chemical being dosed.

A flow switch must be installed on the common line to provide a “carrier water system failed” alarm (failsafe) as an input to the IICATS RTU, on low flow.

A suitably sized RPZ valve must be provided in the carrier water line for backflow prevention.

Only proprietary back flow prevention devices must be used.

Where dosing chemical is a slurry type such as magnesium hydroxide, the carrier water system is used as a flushing system. This is to flush the dosing lines clean of magnesium hydroxide once dosing is complete.

The flushing water must operate with a dedicated timer, where a solenoid valve must open and flush the dosing line and the solenoid valve will close at the end of timer duration. The flushing line must have a pressure indicator installed.

Where recycled water is available, it must be used for the carrier water (excluding eyewash facilities and safety showers, which are connected upstream of the RPZ). The recycled water supply line must also be fitted with an RPZ (work by site contractor).

6.10 Potable water booster pump

At locations where the water pressure is insufficient to meet the service water requirements for the CDU (wash-down hose, safety shower and eyewash), a potable water booster pump must be installed.

One duty pump of suitable type and capacity range, must provide the required flow and pressure requirements. The booster pump is not controlled or monitored by the IICATS control system and requires integral or independent controls.

Approval from Sydney Water’s representative must be sought prior to procurement of pumps to be installed in the CDU.

6.11 Double containment of filling and dosing lines

Chemical dosing lines outside of the bunded area must be a pipe-in-pipe arrangement. The intention is to prevent a leak in the pipe from contaminating the soil and groundwater, and to protect it from accidental damage. Care must be taken with the design and installation of the outer pipe so that leaks from the inner pipe can be readily detected and must be sealed to stop ingress of ground water.

Concrete encasement of a conduit for the containment lines when laid in ground is acceptable.

Double containment from within the bunded area through to the dosing point must be constructed in such a way to facilitate replacement of dosing line without excavation of that section of pipe. Continuous PE or pressure rated uPVC pipe are preferred.

Where requested, an additional dosing line must be installed as a backup.

Leak detection must be included in accordance with Sydney Water’s Technical Specification - Mechanical.

6.12 Dosing point

6.12.1 Pressure sewer dosing

When dosing into a pressurised sewer, the following must be included in the dosing point design;

- Pressure dosing must be located in a pit.
- Have a 20mm valved drain/flushing line fitted to the main with hose connection point.
- Have a high level switch (LSH) in the pit to detect flooding or chemical leakage.
- Have an isolating ball valve and a non-return valve.
- Have a flexible PE dosing line fitted with compression fittings for <20mm Dosing line and fusion welded for >20mm dosing line.
- Be fitted with double isolation ball valve at the tapping point. For Tapping point configuration refer to DTC Drawings.

- The pit is to drain back to the delivery bay sump where possible. Drain line to be fitted with an isolation valve.

6.12.2 Gravity sewer dosing point

For gravity sewer dosing, a maintenance access hole must be used for the dosing point. A suitably sized guide tube must be installed down the wall of the maintenance access hole for the dosing line to be fed down. The outlet of the dosing line must be positioned so that chemical flows directly into the flow without splashing chemical on the walls of the maintenance access hole. Mechanical compression elbows must be used inside the maintenance hole for maintenance access.

6.13 Leak detection pits

Leakage detection pits must be installed at low points in the double contained dosing line. The double containment pipe must end at this pit to allow any leaks in the dosing lines to partially fill the pit. The leakage detection pit must be fitted with a LSH switch to detect a leak. The LSH signal cable must run back to the CDU and be connected to the controls cubicle. The signal must stop the dosing system and send an alarm to the RTU.

If the leakage detection pit is next to a gravity sewer maintenance access hole being dosed it must have an overflow above the LSH switch level feeding into the maintenance access hole with a flap valve to prevent sewer gas backflow into the leak detection pit.

6.14 Gas sampling

Sydney Water requires installation of H_2S gas monitoring equipment at a maintenance hole location downstream of the CDU. The location of which is to be nominated by Sydney Water. The online equipment must be to Sydney Water's requirements.

6.15 Sewer flow meters

An inline flow meter is required to be installed on installations which dose into sewage pressure mains. This enables flow paced chemical dosing to be performed on the pressure main.

A non-intrusive ultrasonic flow meter must be used. Magnetic flow meters are not acceptable.

The CDU contractor must provide power and control functions from the CDU cubicles for the flowmeter

A sample line must be provided downstream of the flowmeter.

6.16 Not applicable to chemical dosing unit

6.17 Labelling and identification

Labelling and identification of equipment and structures must follow the requirements of Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation.

7. Submission

The following must be submitted to Sydney Water for approval prior to ordering.

7.1 Design drawings

Design drawings of the proposed CDU installation must be provided. They must cover all design issues including:

- Location of the CDU on site including access and egress points, delivery bunds, drains, services, dosing lines, pits and where required, truck turning bays (general arrangement).
- Process & Instrumentation Diagram (P&ID) drawing(s) with an associated list of equipment, material and size details. Supplied by Sydney Water with this specification.
- Position and layout of all equipment including pipework and storage tank (dimensional layout – plan and elevation). Supplied by Sydney Water with this specification.
- Electrical drawings (including circuits, control systems, equipment lists, manufacturer general arrangement, items, list, site general arrangement, conduit sizes and locations).
- Structural drawings, including the building.

The drawing format must be in accordance with Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation.

The Contractor must submit all "Work-As-Constructed (WAC)" drawings, as follows:

Type of copy	Number of copies required
Hard Copies	1 – A3 size bound in A3 size folders
Electronic copies (CD-R/DVD/USB) in both AutoCAD DWG and Adobe PDF formats	2 – Distribution Asset Information – Engineering Drawing Management System (EDMS) Contractor Portal Reliability Maintenance Engineering

7.2 Operating and maintenance manual

A draft Operating and Maintenance (O&M) Manual for the CDU must be prepared and submitted to Sydney Water prior to SAT. It must be finalised and re-submitted after successful commissioning of the unit.

An exploded view of pump and consumables list is required in the O&M manual.

A template for the O&M manual is included with this specification.

The O&M manual must be in accordance with Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation.

7.3 Critical spare parts

The Contractor must supply critical spare parts lists for the installation. The list of critical spare parts must be discussed and agree with Sydney Water prior to procurement. Sydney Water may purchase critical spares form the Contractor or elsewhere.

8. Testing and commissioning

Factory Acceptance Testing (FAT) of prefabricated units needs to be conducted in the presence of representative(s) from Sydney Water's end once all operation and maintenance manuals are complete and an updated set of all drawings are made available. Typical FAT requirements are outlined in Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation. This needs to be conducted prior to installation of the unit at the site.

Following installation, the CDU must be tested and commissioned in accordance with Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation. The Contractor must develop a Commissioning Plan based on D0001440 which must be submitted to Sydney Water for review. Written approval from Sydney Water must be sought prior to commissioning.

An example Commissioning checklist is shown in Appendix F.

The Contractor must provide the necessary expertise and resources for successful commissioning of the unit.

In addition, the following tests must be carried out:

8.1 Hydrostatic test and leak detection

The chemical room bund area should be watertight prior to the application of the internal coating. The bund area of chemical storage area must 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 must be filled with water and inspected for leakage for at least 24 hours. Tanks must be tested to the SG of the tank. Pipework must be pressure tested to 1.5 times the operating pressure.

8.2 Commissioning test run

For the purpose of the Site Acceptance Test (SAT), a test run must be undertaken in accordance with the Contractor's site commissioning methodology, which must be approved by Sydney Water. The test run must be a minimum of one month in duration. Typical SAT requirements are outlined in Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation. The test run must be carried out in the following stages:

- Manual operation using water
- Automatic operation using water
- Manual operation using chemical
- Automatic operation using chemical.

Commissioning must be deemed complete when the whole of the works are capable of running continuously without any fault for a period of two weeks. The plant must start and stop during this two-week period as required by Sydney Water. The SAT must include at least one chemical delivery.

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

The reduction of the dissolved sulphide in the downstream sewage must be recorded by Sydney Water or its representative and used to adjust the dose rate.

At the end of this period, the Contractor must issue a certificate stating the outcome of the testing and commissioning to allow Handover, in accordance with Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation.

8.3 Building certification

The Contractor must provide all building certification documents for design and certification of the unit to Sydney Water.

8.4 Submission of work as constructed (WAC) documents

The Handover is not complete until all WAC documents, such as detailed drawings, O&M Manuals, FMECA documentation, MAXIMO entries and so on, have been submitted to Sydney Water. Refer to Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation. This is a Hold Point.

8.5 Handover

The Asset Commissioning SAP as detailed in Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation must be followed to ensure all issues are finalised before handover of the CDU to Sydney Water.

9. Context

9.1 Reference documents

The following documents are to be referenced with this Specification:

Reference documents	
AS	**Australian Standard**
AS 1319	Safety signs for the occupational environment
AS 1345	Identifications of the contents of pipes, conduits and ducts
AS 2129	Flanges for pipes, valves and fittings
AS 3500	National plumbing and drainage code
AS 3735	Concrete structures retaining liquids
AS 3780	Storage and handling of corrosive substances
AS 3996	Access covers and grates
AS 4775	Emergency Eyewash and Shower Equipment
AS 4130	Polyethylene (PE) pipes for pressure applications
AS/NZS	**Australian Standard/New Zealand Standard**
AS/NZS 3000	Electrical Installations (Australian/New Zealand Wiring Rules)
AS/NZS 4766	Polyethylene storage tanks for water and chemicals
ANSI	**American National Standards Institute**
ANSI Z358.1	Compliance requirements- Emergency shower and eye wash stations
EN	European Standard
EN 13121	GRP Tanks and Vessels for Use Above Ground
Austroads Design Vehicles and Turning Path Templates AP-G34-13 (3rd Edition).	
Australian Design Requirements ADR 43/04 2006.	
National Transportation Commission (NTC) – Australian Dangerous Goods Code (latest edition)	
SafeWork NSW – Storage and Handling of Dangerous Goods: Code of Practice, 2005	
Work Health and Safety Act 2011	
Work Health and Safety Regulation 2017	
NSW Protection of the Environment Operations Act, 1997, and its amendments	
Orica (Ixom) Bulk Delivery Requirements	
Orica (Ixom) Bulk Installation Guidelines	
Orica (Ixom) On-Site Inspection Guidelines	
Sydney Water's Health and Safety Procedure HSP-058: Risk Assessment in Design	
Sydney Water's Instrumentation and Control Standards TOG_TS01	
Sydney Water Sewer Odour & Corrosion Control Standards TOG_TS08	
Sydney Water's Commissioning – transitioning assets into operation D0001440	

Water Services Association (WSA) Manual for Selection and Application of Protective Coatings, WSA 201
Sydney Water's Supplement to WSA 201 (ACP0166)
Sydney Water's Procedure for Disinfecting New Mains, WPIMS5027
Sydney Water's Technical Specification - Civil CPDMS0023
Sydney Water's Technical Specification - Mechanical BMIS0209
Sydney Water's Technical Specification - Electrical CPDMS0022
Sydney Water Electric Intruder Detection Specification EIDS

Sydney Water Health and Safety Procedure, HSP-058:
Sydney Water Business Management Information System (BMIS)
Risk Assessment in Design and the guidelines prepared by WorkCover NSW (CHAIR)

Ownership

Ownership

Role	Title
Group	Asset Life Cycle
Owner	Manager, Engineering
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Revision log

Version No	Prepared by	Date	Approved by	Issue date
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4	Jason Smith	October 2018	Ken Wiggins	October 2018
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2	Sally Rewell	February 2011	Janssen Chan	February 2011
1	Jerry Sunarho	August 2008	Louisa Vorreiter	August 2008

Appendices

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2	Appendix B – Sydney Water Asset Data Management and Commissioning
3	Appendix C – Construction Hazard Assessment Implication Review (CHAIR)
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Appendix A - DTC drawing list

	CHEMICAL DOSING UNITS, COMMON DETAIL DRAWINGS
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DTC7001	CHEMICAL DOSING & RECHLORINATION UNIT, INSTRUCTIONS AND NOTES
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	13.5 kL CHEMICAL DOSING UNIT, FERROUS CHLORIDE, FERRIC CHLORIDE AND CALCIUM NITRATE
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	5 kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE
DTC7130	5kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE, P&ID
DTC7131	5kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE, GENERAL ARRANGEMENT PLAN & ELEVATIONS
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DTC7133	5kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE, PIPEWORK DETAILS, SHEET 1 OF 2
DTC7134	5kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE, PIPEWORK DETAILS, SHEET 2 OF 2
DTC7135	5kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE, STORAGE TANK DETAILS
DTC7136	5kL CHEMICAL DOSING UNIT, MAGNESIUM HYDROXIDE, STORAGE TANK MIXER DETAILS

Appendix B - Sydney water asset data management and commissioning

Refer Sydney Water's Specification D0001440 Commissioning – transitioning assets into operation

A sample "*Location Number Request Form for New/Existing Assets*" template is shown in the succeeding table. More information can be found from Sydney Water's Asset Information* group page on iConnect.

MEPR0063.02: Maximo (MXES) - Location Number Request Form for New/Existing Assets

Instructions:

1. Columns marked in RED are mandatory for Service Provider.
2. Sydney Water will allocate Maximo Location Numbers for finalisation of the P & ID for Assets.
3. Reference on P & ID (by Service Provider) is a temporary identifier until Location Number is allocated by Asset Data Management.
4. Examples (below highlighted in blue) are given for guidance only.
5. Do not over write or delete blue example area. Start entering your data after the last blue line (Line 18)
6. Please email completed spreadsheet and P & ID diagrams to AssetDataMgmt@sydneywater.com.au
7. For further assistance, please contact the Asset Data Management representative of Sydney Water.

FMIS Project Number	SW Project Manager or Rep (for Minor works)

Facility	Location Number (by SWC)	Maximo Location Number (by SWC)	External Reference Number (by SWC)	Ref on P & ID (Service Provider)	Location Description (by SWC)	Location Description (By Service Provider)	Location Within Facility	Asset Description	SWC Parent Location	Parent Location	P&ID / Drawing Number	Is High Voltage Asset? Yes/No	Telemetry Monitored	Comments

NOTE: * Asset Information is the new business unit name for the previous Asset Knowledge.

Appendix C - Construction hazard assessment implication review (CHAIR)

CHAIR Safety in Design Tool, developed by Work Cover NSW needs to be carried out in three phases namely:

- CHAIR-1: Conceptual Design Review (To be completed by the Contractor)
- CHAIR-2: Detailed Design Construction or Demolition Review (To be completed by the Contractor)
- CHAIR-3: Detailed Design Maintenance & Repair Review. See attached CHAIR 3 report prepared by Sydney Water for the standard CDU Unit (refer below).

More information as to guidewords and how to conduct CHAIR can be found at Work Cover NSW.

13.5kL CHEMICAL DOSING UNIT, FERROUS CHLORIDE, FERRIC CHLORIDE AND CALCIUM NITRATE

1 Site General Access — Chemical Delivery Bund

	Maintainability Aspect	Why?	Causes	ACTION		
				Recommendation/Comment	*Person/Department Responsible*	*Comments*
1	POSTURE / MANUAL HANDLING	Lifting of valve chambers Sump pump removal etc Cut-out for valve key to be provided\		FRP grating to be used from preference FRP to be added to acceptable products list Refer GRP specification	Delivery Management	
2	ACCESS / EGRESS	Potential for tampering/injury	Unauthorised access to site	Camlock to be locked with padlock. Spindle extensions and extension handle to be used for valves in bund sump. Handles to be stored in switchroom.		
3	ACCESS / EGRESS	Truck access to delivery bay.	Delivery of chemical and equipment	Ensure that appropriate truck access/turning is provided.		
4	ACCESS / EGRESS	General access to site.	Unauthorised access to site	Ensure site is appropriately secured with fencing and locked gates.		
5	ACCESS / EGRESS	General site layout	Need space for future maintenance	Allow for future laydown area for repair works.		
6	ACCESS / EGRESS	Ladders/ Access Required		Bailey Part Number Required	Customer Delivery	
7	ACCESS / EGRESS	Camlock Connection for Delivery		To suit 600-900 Orica specification Support for Camlock hose connection to be provided Safety shower eyewash height to be in accordance with Orica guidelines	Delivery Management	
8	ACCESS / EGRESS	Dangerous Goods Trucks stopping in public Area. Preferred option is to stop truck in private area owned by Sydney Water where truck driver can safely egree truck to open gates. If this is not possible individual solution to be sought		Create footprint plan views with rigid truck turning circles showing minimum acceptable dimensions on drawings Atlas to prepare drawings based on conservative truck bund width Minimum footpath width to be specified (to allow opening of doors without stepping backwards off)	Delivery Management	DTC Drawings
9	ACCESS / EGRESS			Stripes to be added to bund rollovers Colour coding of concrete Ferrous Chloride colour	Delivery Management	
10	HEIGHTS / DROPPED OBJECTS					
11	WEIGHT	Roads and delivery bund	loading from delivery and maintenance trucks on site.	Design for expected loads.		
12	DISCOMFORT / STRESS					
13	PERSONNEL PROT. EQUIPMENT	Signage		New signage specification to be referenced		
14	VISIBILITY	Refer lighting issues	Refer lighting issues	Standard lighting design to be undertaken	Delivery Management	DTC Drawings
15	SLIPS, TRIPS, FALLS	Potential for injury	Movement of operations and maintenance personnel and delivery drivers.	Appropriate paint markings on speed bump and trip points around bund Step height of CDU bldg relative to footpath. Non-slip additive to epoxy coating		
16	ROTATING / MOVING EQUIPMENT		Lockable valve	Fill valve to be lockable by Sydney Water personnel and not accessible ny non Sydney Water staff (i.e. truck driver) Camlock on bund pump out line to be fitted with padlockable cover/ dustcap	Delivery Management	DTC Drawings
17	IS REPAIR DIFFERENT?					

	Maintainability Aspect	Why?	Causes	ACTION		
				Recommendation/Comment	*Person/Department Responsible*	*Comments*
18	OTHERS THAT MAY APPLY (list below)	Site drainage	Chemical spillage onto footpaths	Footpaths to drain back to delivery bund.		
19	OTHERS THAT MAY APPLY	Safe vehicular access to site.	Movement of vehicles on site	Provide appropriate site signage. Provide bollards where traffic is prohibited. Traffic engineer to confirm the access is suitable, according to Australian Standards and safe.		
2	**CDU unit**		**Internals and externals of CDU**			
20	POSTURE / MANUAL HANDLING					
21	ACCESS / EGRESS	Layout of electrical cabinets	Limited space within CDU	Electrical equipment to have adequate space for occupants within the CDU.		
22	ACCESS / EGRESS	Layout of equipment	Limited space within CDU	Internals of CDU to have adequate space for personnel movement and use of tools and equipment.		
23	ACCESS / EGRESS					
24	HEIGHTS / DROPPED OBJECTS	Maintenance of light on top of CDU Building	Need for night works	Platform ladder access - light to be LED.		
25	WEIGHT	Potential for damage due to incorrect lifting procedure, unknown lift type, unsound lifting points, equipment not restrained	Lifting of equipment for maintenance	Lightweight grates (FRP). Tank to be tied back to wall.		
26	WEIGHT	Site layout	Need for use of large cranes for off loading	Design to include how CDU will be offloaded, lifted and located on site and cranage needs and loading.		
27	DISCOMFORT / STRESS	Ease of access	Chemical delivery process	CDU building is to be located on the passenger side of the tanker.		
28	PERSONNEL PROT. EQUIPMENT	Exposure to chemicals	Chemical deliver and maintenance work.	BYO PPE. Folder on site with MSDS and emergency contacts etc. already in Switchroom.		
29	VISIBILITY	Safe work requires adequate lighting	Night work	Provide external building light. Bollards with reflectors are located at various sites to protect discharge locations and act as guidance for reversing trucks onto site.		
30	SLIPS, TRIPS, FALLS					
31	ROTATING / MOVING EQUIPMENT					
32	IS REPAIR DIFFERENT?	Easy repair offers less chance of injury Pipe specification to indicate correct materials to ensure and repairs required will use correct solvents for different materials.	Need to repair in constricted space.	Long radius bends on double-contained dosing line for ease of replacement of dosing line in future. Pipe specification to be provided on IFC & WAE drawings.		
33	OTHERS THAT MAY APPLY	Leakage of chemicals	Use of inground pipes to delivery dosing chemicals to	Use secondary containment pipes.		
34	OTHERS THAT MAY APPLY	Important to know site safety hazards before starting work or accessing areas where known hazards are present.	New or inexperienced workers on site.	Safety Signage: Following new Sydney Water safety signage specification.		

	5kL Magnesium Hydroxide Dosing					
	Maintainability Aspect	Why?	Causes	ACTION		
				Recommendation/Comment	*Person/Department Responsible*	*Comments*
1	**Site General**	**Chemical Delivery Bund**				
1	POSTURE / MANUAL HANDLING	Lifting of valve chamber covers Sump pump removal etc. Cut-out for valve key to be provided.	Heavy weights to be lifted for maintenance and operation tasks.	FRP grating to be used as preferred F R P to be added to acceptable products list Refer GRP specification	Delivery Management	DTC Drawings
2	ACCESS / EGRESS	Location of bund sump and cover	Too close to access ladder, trip point	Review design to move away from access stairs. Need to minimise length of drain pipe before drain valve.	Delivery Management	DTC Drawings
3	ACCESS / EGRESS	Potential for tampering/injury	Unauthorised access to site	Camlock to be locked with padlock. Spindle extensions and extension handle to be used for valves in bund sump. Handles to be stored in switchroom.	Delivery Management	DTC Drawings
4	ACCESS / EGRESS	Truck access to delivery bay.	Delivery of chemical and equipment	Ensure that appropriate truck access/turning is provided.	Delivery Management	DTC Drawings
5	ACCESS / EGRESS	General access to site.	Unauthorised access to site	Ensure site is appropriately secured with fencing and locked gates.	Delivery Management	DTC Drawings
6	ACCESS / EGRESS	General site layout	Need space for future maintenance activities.	Allow for future laydown area for repair works. Generally, use delivery bund for large items (EG tanks) or keep on trucks until needing to be moved into position. Building roof to be suspended off crane whilst tank is replaced.	Delivery Management	DTC Drawings
7	ACCESS / EGRESS	Ladders/ Access Required	Access to top of tank level sensor and roof fans and lights.	Portable Ladder provided for access as needed. Bailey Part Number Required	Customer Delivery to provide to Delivery Management. Delivery Management to add to drawings.	DTC Drawings
8	ACCESS / EGRESS	Camlock Connection for Delivery	Need to take load of hose off camlock fitting to minimise breakage.	To suit 600-900 Orica specification Support for Camlock hose connection to be provided, preferably resting on lip of entrance door.	Delivery Management	DTC Drawings
9	ACCESS / EGRESS	Safety shower/eyewash height	Needs to be not too low or too high	Safety shower eyewash height to be in accordance with Orica guidelines	Delivery Management	DTC Drawings

	Maintainability Aspect	Why?	Causes	ACTION		
				Recommendation/Comment	***Person/Department Responsible***	***Comments***
10	ACCESS / EGRESS	Goods Trucks stopping in public Area. Preferred option is to stop truck in private area owned by Sydney Water where truck driver can safely egress truck to open gates. If this is not possible individual solution to be sought.	Unsafe access by delivery truck driver to open gates. Vehicle parked in unsafe area, risk of being hit by other vehicles.	Create footprint plan views with rigid truck turning circles showing minimum acceptable dimensions on drawings Atlas to prepare drawings based on conservative truck bund width. Minimum footpath width to be specified (to allow opening of doors without stepping backwards off	Delivery Management	DTC Drawings
11	ACCESS / EGRESS	Bund roll over not clear to drivers and pedestrians	Nig ht wor	Stripes to be added to bund rollovers Colour coding of concrete Ferrous Chloride colour	Delivery Management	DTC Drawings
12	HEIGHTS / DROPPED OBJECTS	N/A	N/A	N/A	N/A	N/A
13	WEIGHT	Roads and delivery bund	loading from delivery and maintenance trucks on site.	Design for expected loads.	Delivery Management	DTC Drawings
14	WEIGHT	N/A	N/A	N/A	N/A	N/A
15	DISCOMFORT / STRESS	N/A	N/A	N/A	N/A	N/A
16	PERSONNEL PROT. EQUIPMENT	Signage	Signage requirements have changed for	New signage specification to be referenced	Delivery Management	DTC Drawings
17	PERSONNEL PROT. EQUIPMENT	N/A	N/A	N/A	N/A	N/A
18	VISIBILITY	Refer lighting issues	Night work on site.	Standard lighting design to be undertaken	Delivery Management	DTC Drawings
19	SLIPS, TRIPS, FALLS	Potential for injury	Movement of operations and maintenance personnel and delivery drivers.	Appropriate paint markings on speed bump and trip points around bund Step height of CDU bldg relative to footpath. Non-slip additive to epoxy coating	Delivery Management	DTC Drawings
20	ROTATING / MOVING EQUIPMENT	Mixer discussion	Refer to HAZOP for discussion and action on the Tank Mixer.	Refer to HAZOP for discussion and action on the Tank Mixer.	Refer to HAZOP for discussion and action on the Tank Mixer.	Refer to HAZOP for discussion and action on the Tank Mixer.
21	IS REPAIR DIFFERENT?	N/A	N/A	N/A	N/A	N/A
22	OTHERS THAT MAY APPLY	Site drainage	Chemical spillage onto footpaths	Footpaths to drain back to delivery bund.	Delivery Management	DTC Drawings
23	OTHERS THAT MAY APPLY	Safe vehicular access to site.	Movement of vehicles on site	Provide appropriate site signage. Provide bollards where traffic is prohibited. Traffic engineer to confirm the access is suitable, according to Australian Standards and safe.	Delivery Management	DTC Drawings
24	OTHERS THAT MAY APPLY	Chemical dosing line	Clogging of dosing pipe with MgOH solids over time.	20mm rubber hose for dosing line instead of PE.	Delivery Management (DTC drawings) Specification	DTC drawings Specification

	Maintainability Aspect	Why?	Causes	ACTION		
				Recommendation/Comment	*Person/Department Responsible*	*Comments*
2	**$Mg(OH)_2$ unit**	**Internals and externals of Magnesium Hydroxide Dosing Unit**				
26	POSTURE / MANUAL HANDLING	Location and removal of mixer	issues with the mixer location	removable mixer size to be min. 1 / 3 diameter of tank and lifting arrangement required for it.	Delivery Management (drawings) Specification	DTC drawings Specification
27	ACCESS / EGRESS	Layout of electrical cabinets	Limited space within RCP	Electrical equipment to have adequate space for occupants within the CDU.	Delivery Management	DTC Drawings
28	ACCESS / EGRESS	Layout of equipment	Limited space within RCP	Internals of CDU to have adequate space for personnel movement and use of tools and equipment.	Delivery Management	DTC Drawings
29	HEIGHTS / DROPPED OBJECTS	Maintenance of light on top of CDU Building	Need for night works	Platform ladder access - light to be LED.	Delivery Management	DTC Drawings
30	WEIGHT	Potential for damage due to incorrect lifting procedure, unknown lift type, unsound lifting points, equipment not restrained	Lifting of equipment for maintenance	Lightweight grates (FRP). Tank to be tied back to wall.	Delivery Management	DTC Drawings
31	WEIGHT	Site layout	Need for use of large cranes for off loading	Design to include how CDU will be offloaded, lifted and located on site and cranage needs and loading.	Delivery Management	DTC Drawings
32	DISCOMFORT / STRESS	Ease of access	Chemical delivery process	CDU building is to be located on the passenger side of the tanker.	Delivery Management	DTC Drawings
33	PERSONNEL PROT. EQUIPMENT	Exposure to chemicals	Chemical deliver and maintenance work.	BYO PPE. Folder on site with MSDS and emergency contacts etc. already in Switchroom.	Delivery Management	DTC Drawings
34	VISIBILITY	Safe work requires adequate lighting	Night work	Provide external building light. Bollards with reflectors are located at various sites to protect discharge locations and act as guidance for reversing trucks onto site.	Delivery Management	DTC Drawings
35	SLIPS, TRIPS, FALLS	N/A	N/A	N/A	N/A	N/A
36	ROTATING / MOVING EQUIPMENT	N/A	N/A	N/A	N/A	N/A
37	IS REPAIR DIFFERENT?	Easy repair offers less chance of injury Pipe specification to indicate correct materials to ensure and repairs required will use correct solvents for different materials.	Need to repair in constricted space.	Long radius bends on double-contained dosing line for ease of replacement of dosing line in future. Pipe specification to be provided on IFC & WAE drawings.	Delivery Management	DTC Drawings
38	IS REPAIR DIFFERENT?	Hoses for pumps and lines.	High wear rate on hoses due to abrasive chemical.	repair of hose, spares to be required	Delivery Management (drawings) Specification	DTC drawings Specification
39	IS REPAIR DIFFERENT?	Clogging at tee connections	shape angle 90 degrees promotes clogging.	Y" type tee pieces to be used.	Delivery Management (drawings) Specification	DTC drawings Specification
40	OTHERS THAT MAY APPLY	Leakage of chemicals	Use of inground pipes to delivery dosing chemicals to dosing point.	Use secondary containment pipes.	Delivery Management	DTC Drawings
41	OTHERS THAT MAY APPLY	Important to know site safety hazards before starting work or accessing areas where known hazards are present.	New or inexperienced workers on site.	Safety Signage: Following new Sydney Water safety signage specification.	Delivery Management	DTC Drawings

	Maintainability Aspect	Why?	Causes	ACTION		
				Recommendation/Comment	***Person/Department Responsible***	***Comments***
42	OTHERS THAT MAY APPLY	Water pipes and chemical dosing lines enter through floor of electrical switchroom.	Water or chemical leakage onto switchroom floor.	Switchroom floor to fall to door	Delivery Management	DTC Drawings
43	OTHERS THAT MAY APPLY	Slope of footpath	Spillage of chemical onto footpath.	Footpath to slop towards delivery bund.	Delivery Management	DTC Drawings

Appendix D - Operations & maintenance manual template

[NOTE: Sections highlighted in yellow are to be completed by the Contractor supplying the Chemical dosing Unit (delete)]

Chemical Dosing Unit Specification
[Name of Chemical]
Chemical Storage and Dosing System Operation and Maintenance Manual

Sydney Water Facility No:
SX????

Installed at

Address Line 1
Suburb NSW Postcode

Sydney Water Contract No.??????

Manufactured by

Name of Company
Address
Suburb NSW Postcode
Phone: ??????
Service Telephone Name: mobile phone number

Table of Contents

1. Description

1.1 General

This Chemical Storage & Dosing System is a complete storage and dosage system for (insert name of chemical). Additionally, referred to in the technical data specifications detailed in Chapter 2.

1.2 General description

The chemical storage and dosing system is contained within a fully reinforced concrete monolithic structure exhibiting a seamless connection between the floor and walls. This structure comprises 2(two) separately accessible rooms. The design of which, along with epoxy coating, ensures the bunded process room is capable of containing any unforeseen chemical spills or leaks whether minor or catastrophic except for a leak in the water supply.

The roof of the structure has the ability of being removed, if required, to enable unimpeded access to the process and control rooms, if either replacing a chemical storage tank or installing large process equipment skids. Even without removing the roof the process room, the access doors have a large enough opening whereby a storage tank up to 5KL capacity can be removed through the door opening if required. The structures walls and roof have a smooth finish both inside and outside and are painted to the approved Sydney Water colour.

The separately accessible, segregated control room has a viewing window to enable operators to view and manage the control of process from a protected area. This room houses the process control panel, RTU, site safety information in addition to operator manuals and drawings etc.

The bunded process room is accessed via external and internal stairs through double security doors. The right hand door is interlocked to open first and provides the mounting for a safety shower/eyewash which remains charged and ready for operation. The left hand door then can be opened providing access to the storage tank filling point including the digital tank level indicator.

Both the external and internal stairs for accessing the process room are suspended from the door frame and feature a hinge arrangement, enabling the stair assemblies to pivot. Suspending the stairs independently from the ground ensures they remain level irrespective of the slope of the surrounding walkway and provides the benefit of swinging upwards to allow access underneath for ease of cleaning.

A mobile work platform ladder is included for accessing both the manhole on the top of the storage tank and to inspect the storage tank ultrasonic level transmitter. It also provides operator access to unplug the roof mounted ventilation fans & lights from their switched outlets in the event the roof requires removal.

Relevant safety signage is mounted on both doors, clearly visible when accessed by operators. Both doors are supplied with a Deadlatch which is retrofitted with Sydney Water bi-lock barrels when required.

The drain point for the bunded room is located on the front wall adjacent to the stairs. For ease of access in the event of a bund high level, the process room bund isolation valve is located externally to the structure within the delivery bund sump. The capacity of the bunded room easily exceeds the storage tank capacity which ensures full containment of chemical in the unlikely event of a

catastrophic tank failure. System design parameters ensure that in the event of a flood in the bunded area, normal operation can recommence once the bunded area has been evacuated.

Storage tank and process equipment mounting arrangements employed in the construction of the system minimise where possible the number of penetrations for fixings within the bunded area to further ensure its long term containment integrity. All fixings required that are larger than 6mm are made by way of chemical anchors.

1.3 Electrical

Installation of all the process electrical services and equipment is carried out in accordance with Australian Standards with attention to ensure all equipment (IP) ratings are maintained. Cabling is surface mounted and enclosed where possible within chemical resistant PVC ducting, conduits and saddles are clearly labelled for individual circuit identification. Fans are fitted to the roof of each room of the structure to ensure adequate ventilation; weatherproof lighting fixtures for both rooms provide sufficient lighting to enable operation and maintenance day or night.

The ventilation fans are designed to operate when the site is accessed to provide operator comfort when on-site. Both the ventilation fans and internal lighting are activated automatically by limit switches on the access doors and the external flood light is operated by a manual switch within the control room.

The door limit switches also automatically activate the 'site attended' input to the IICATS RTU negating the need for a manned/unmanned switch to be manually activated.

Storage tank digital level display, high level warning flashing beacon and high level warning klaxon are all situated on the storage tank fill line above the fill point in full view of the delivery driver. The delivery truck pump power outlets are mounted within easy reach of the door way, allowing the driver to remain outside the bund whilst connecting power and delivering product into the storage tank. The truck pump power outlets are both interlocked to the tank high level switch, automatically shutting off the power supply when a tank high level is reached. The high level flashing light and warning siren is activated upon reaching a predetermined high level to warn the driver of an imminent overfill occurring, this klaxon however can be muted by way of a pushbutton on the control panel.

The electrical control designed into this system provides for both automatic and manual operation. This will be covered in detail in Chapter 3.

1.4 Plumbing

Plumbing pipework used for the delivery of potable and non-potable water is (insert piping material). An accessible roof mounted hose reel is installed within the process room to aid in flushing dose lines and to enable washing down of the process room as well as the truck bund if required.

All chemical process and delivery lines within the building are fabricated using Schedule 80 uPVC pipe and fittings. The selection of pipe and fittings are determined by their suitable resistance to (insert name of chemical).

Dosing pumps nominated for the system are (insert brand of pump) Pumps. The pumps have been selected due to their suitable resistance to the effect of the dosed chemical, user friendliness and the ability to easily deliver the required dose rates. Dosing pumps are installed above the bund height in dosing cabinets to provide equipment protection in the event of a bund flood occurring.

Operators are quickly alerted to any dosing pump leak or pipe rupture by way of a capacitive level switch located directly beneath the dosing pumps in the dosing cabinet sump.

1.5 Chemical dosing unit dimensions and parameters

a) Structure:

Overall Length	?? metres
Overall Width	?? metres
Overall Height	?? metres
External Wall Thickness	?? mm
Internal Wall Thickness	?? mm
Floor Thickness	?? mm
Dry Weight	?? Tonnes
Construction Materials	?? MPa reinforced concrete

b) Process Room:

Internal Length	?? metres
Internal Width	?? metres
Internal Height	?? metres (at lowest point)
Bund Wall Height	?? mm
Door Opening	?? metres Wide x ?? metres Height

c) Control Room:

Internal Length	?? metres
Internal Width	?? metres
Internal Height	?? metres (at lowest point)
Door Opening	?? metres Wide x ?? metres Height

d) Building Security

Process Room Doors	Double Steel Doors and Frame
Control Room Door	Single Steel Door and Frame
Locks	Brand and type

2. Technical data

Details of the parameters of the dosing process

Parameter	Quantity/Requirements	Units
Type of dosing system;	Flow paced/Diurnal rate	-
Type and properties of dosing chemical;	(Insert name of chemical, concentration, acid content etc.)	-
Chemical supplier name and contact details		-
Location of the CDU	(Insert street address, SPS number etc.)	-
Mobility requirement of the CDU Building;	TRANSPORTABLE / PERMANENT	-
Rate of chemical dosing minimum	??	Litres/hour
Rate of chemical dosing maximum	??	Litres/hour
Dilution/carrier water flow rate	10:1 with maximum chemical dosage rate	-
Delivery Bund Sump Pump (if required)		Metres head
Pressure of available water supply for process water	??	Metres head
Pressure of available water supply for safety shower and eyewash;	??	Metres head
Advise whether H_2S monitoring is fed back to the CDU;	YES / NO	-
Diurnal minimum pressure of the pressure sewer main being dosed into;	??	Metres head
Diurnal maximum pressure of the pressure sewer main being dosed into;	??	Metres head
Delivery tanker size;	??	kilolitres Length / Vehicle Type
Maximum temperature of the delivered chemical;	??	°Celsius
Chemical tank storage size	??	kilolitres
Minimum performance parameters, (for example, pH and dissolved sulphide levels expected before and after chemical dosing).	??	-
Protective coating system to be applied (external)	PUR-B or PSL for Anti Graffiti ACL for Aesthetic PUR-A for Coastal Environment	
Protective coating system to be applied (bund floor and wall)	NOV (Novolac Epoxy)	

Details of the major components of the dosing process.

Storage Tank TNK01 ***Tank Content: ??***

Manufacturer:	??
Model:	??
Part Number:	??
Effective Capacity	?? litres
Inlet / Drain Diameters	NB50
Discharge	?? (NB50 for Magnesium Hydroxide)
Overflow Diameter	NB80
Flanges	ANSI 150
Vent	NB50mm
Access Manhole	Removable 600mm dia. (600mm dia. if <5kL)
Height of tanks	?? mm
Nominal Diameter of tank	?? mm
Circumference of tank when filled with chemical at top, middle and bottom.(This information is used to track the deformation of the tank over time.)	?? mm top ?? mm middle ?? mm bottom
Tank wall thickness (This information is used to track the deformation of the tank over time.)	?? mm

Mixer MIX?? (if fitted)

Manufacturer:	??
Model:	??
Lower mixer paddle size and type	600mm Dia.3 blades angled at 45º
Upper mixer paddle size and type	600mm Dia. 3 blades vertical orientation
Part Number:	??
Maximum mixer rotating speed	200 RPM
Motor Manufacturer	??
Motor Model	??
Motor speed and power	1380 RPM and1.5 kW 415V
Mixer drive	VSD
Gearbox Manufacturer	??
Gearbox model No.	??
Gearbox ratio	?? : ??
Mass of Motor and Gearbox assembly	?? kg
Shaft diameter	42mm OD
Shaft support	At gearbox and locator on floor of tanks
Shaft removal	Shaft is split with a flange.

Level Transducer LTX01

Manufacturer:	??
Model:	??
Part Number:	??
Serial Number:	??
Power:	24VDC Loop Powered
Signal output:	4-20mA
4mA output distance (tank empty 0%)	?? metres
20mA output distance (tank full 100%)	?? metres
Programmed Span distance	?? metres
Manufactures Range (default)	?? metres
High Level Setpoint LSA	*??% of Full Scale.*
Low Level Setpoint LSC	*??% of Full Scale*

Dosing Pumps PMP10 & PMP20 Chemical Pumped: ??

Manufacturer:	??
Model:	??
Part Number:	??
Serial Numbers:	*PMP10: ??* *PMP20: ??*
Power:	*?? KW @ ??Volts AC/DC*
Control Input:	*??*
Signal Output:	*??*
Minimum Dose Rate:	*??Ltr/Hr @ ??Hz*
Maximum Dose Rate:	*?? Ltr/Hr @ ??Hz*
Turndown:	*??:1*

Level Display LIX02

Manufacturer:	??
Model:	??
Part Number:	??
Serial Numbers:	??

Level Switches LSH01 & LSL01

Manufacturer:	??
Model:	??
Part Number:	??
Serial Numbers:	??
Power:	*24VDC*
Control Input:	??
Control Output:	*Programmable*

Sump Pump PMP03(if Supplied)

Manufacturer:	??

Model:	??
Part Number:	??
Serial Number:	??
Power:	?? *KW @ 415 Volts AC*
Control Input:	

Carrier Water Pump PMP??(if Supplied)

Manufacturer:	??
Model:	??
Part Number:	??
Serial Number:	??
Power:	?? *KW @ 415 Volts AC*
Control Input:	

Potable Water Pump PMP??(if Supplied)

Manufacturer:	??
Model:	??
Part Number:	??
Serial Number:	??
Power:	?? *KW @ ?? Volts AC*
Control Input:	

Level Switches LSH03 & LSL03 & LSHH03 (if supplied) (delete this table if no sump pump)

Manufacturer:	??
Model:	??
Part Number:	??
Serial Numbers:	??
Power:	*24VDC*
Control Input:	??
Control Output:	*Programmable*

Motorised Isolating Valve VLV05

Manufacturer:	??
Model:	??
Part Number:	??
Serial Numbers:	??
Power:	*?? watts at 24VDC*
Control Input:	??
Control Output:	*??*

Carrier Water Solenoid Valve VLV55

Manufacturer:	??
Model:	??
Part Number:	??
Serial Numbers:	??
Power:	*??* *watts at 24VDC*
Control Input:	??
Control Output:	*??*

Flowmeter FTX02

Manufacturer:	??
Model:	??
Part Number:	??
Serial Number:	??
Power:	24VDC Loop Powered
Signal output:	4-20mA
Minimum measurable flow	?? Litres/hour
Maximum measurable flow	?? Litres/hour
Measurement Accuracy	??% of ??

Provide additional data tables for other major equipment items supplied.

2.1 Manufacturers technical information

NOTE: Information for preparation of this section. This note to be deleted when information is completed.

- Provide information from the manufacturers of the equipment.
- Each page must have the relevant equipment number on it.
- Irrelevant pages or sales literature not to be included.
- Where several models or sizes are covered on the information supplied the information relevant to this chemical dosing unit must be highlighted preferably in yellow.

Insert data from equipment list here.

Add general information for ball and NRV valves

3. Principles of operation

3.1 Introduction

The purpose of this standard operating procedure (SOP) is to provide personnel with a clear and easy to follow set of operating instructions for the ?insert name of chemical? Chemical Dosing System, SX??, at ?insert address?.

The Dosing System is designed to dose ?insert name or chemical? solution based on ??.

The chemical solution is delivered into the ?insert name of receiving sewer? by gravity/pressure through a dedicated dosing line that is secondary contained to prevent any leak in the dosing line escaping into the environment. The dosing pumps in this system are ?diurnal or flowpaced? controlled ?insert type of pump? dosing pumps.

The dose rate for the system will be based on a pre-determined pattern to allow modifications if desired. A facility will be provided to change the set point of this pre-determined pattern. This will allow manual adjustment of dosing rates if desired by Sydney Water.

The system is designed to react with the sulphides in the sewage, change the pH of the sewage or precipitate iron suphide, oxidise the sulphides (delete the non-applicable reactions), which in turn prevents the release of Hydrogen Sulphide gas along the sewer main and in the downstream wet wells, resulting in odour and corrosion problems.

SX?? consists of the following major components:

- ?size of tank?L Chemical Storage Tank (TNK01) Effective capacity
- Duty / Standby Dosing Pumps (PMP10, PMP20)
- Carrier water supply

The Chemical dosing process in Automatic is continuous diurnal or flow paced in operation, with the dosing rate profile pre-determined by IICATS. Confirmation of dosing is through monitoring of the tank level trend over time.

When the duty pump is called to run, an automatic ball valve (VLV05) on the storage tank initially opens. Once the valve is opened, as determined by the valve limits switches (ZSC05 & ZSO05) the duty pump then starts.

Once the pump is running, dilution water, which is flow rate adjusted through diaphragm valve (VLV53) and controlled from solenoid (SOV55), is simultaneously delivered with the chemical solution to the dose point. This aids in the mixing of the chemical into the sewerage. The dilution water is set to run on for a preset time when the duty pump is called to stop to aid in flushing the dose point.

Upon loss of any or all dosing permissives, the dosing pump stops, the automatic valve (VLV05) closes and the system is inhibited from operation until receipt of another dosing permissive signal. Dosing will also be inhibited in addition to IICATS alarms being raised if the Low-Level Switch (LSL01) in the storage tank, Dosing Cabinet High Level Switch (LSH26) or Bund Flood Alarm (LSA26) is activated. The dosing system will also be inhibited if there is a remote wet weather interlock active within the network.

The Storage tank effective capacity will nominally provide >30 Days storage based on anticipated flows. The frequency of chemical deliveries will be dependent on the dose rate. A re-order set point (LSB01), determined by IICATS and referenced off the storage tank level transducer (LTX01), generates a notification for the reorder of chemicals.

A high-level switch (LSH01) is fitted to the storage tank (TNK01) along with a high level set-point (LSA01) derived from the level transducer (LTX01). If either is activated during filling of the storage tank, this isolates the power to both the Single and 3-phase GPOs used by the chemical delivery tanker to power the electrical unloading pump. Upon reaching a high level determined by either (LSH01) or the level transmitter set point (LSA), an audible alarm (KLX01) and beacon (BEA01) will be activated. The audible alarm (KLX01) can be muted from the control panel, however the beacon (BEA01) remains on until the tank level falls below that of (LSH01) and (LSA01).

Other notable inclusions within this Chemical Dosing Unit:

- Door mounted Safety Shower and Eyewash (SEQ50)
- Internally mounted eyewash (SEQ51)
- Roof Mounted hose reel (UTY52)
- Fill point line isolation and drain valves (VLV01 & 02)
- Storage tank drain valve (VLV03)
- Dose line filter/strainers (STN01 and STN02)
- Multiple dose line flushing and drain valves
- Fill line mounted digital Storage Tank Level Indicator (LIX01)
- Secondary Storage Tank Level Indicator mounted on control panel (LIX02)
- Weather proof lighting including internal and external.
- Ventilation fans within each room.
- Safety Signage

This Standard Operating Procedure (SOP) covers the following operational tasks:

1) Start up of the chemical dosing unit in AUTOMATIC control.
2) Start up of the chemical dosing unit in MANUAL control.
3) Shutdown of the chemical dosing in MANUAL control.
4) Chemical delivery procedure.

Refer to Drawing No: SX?? P&ID Rev ?? for the P&ID layout of the chemical dosing process. (as attached).

3.2 Responsibilities

- Treatment Operations is responsible for reviewing this SOP
- Treatment Operations is responsible for carrying out this SOP

3.3 Conditions

- Treatment Operations personnel are trained in this SOP
- This SOP is carried out on normal weekdays and whenever required
- Any equipment operating in an abnormal manner must be investigated and rectified.
- Any process reading that is out of range must be investigated and rectified
- Personnel comply with all safety requirements
- All equipment is tagged, if required, as per Sydney Water procedures

3.4 Dosing profile

The Chemical Dosing Profile for SX?? is based on a diurnal or flow paced profile.
This profile is loaded by IICATs into the RTU and changed upon request from Treatment Operations (OCR).

3.5 Control modes

The dose rate will be controlled by either of two control modes.

Mode 1: Diurnal Control

Dosing must be initiated by the RTU. When selected to run on diurnal speed control the dosing pumps will run at an operator adjustable preset rate dependant on the time of day, this is operator adjustable between 30-100%. Twenty four (24) setpoints, one for each hour of the day will be available. There will be two diurnal profiles, one for weekdays and one for weekend use.

In order to fine tune the pump setpoints without continually adjusting each individual setpoint within the diurnal profile, an operator adjustable Pumping Factor Multiplier (PFM1) (Adjustable 0-2, default 1) and Pump Factor Offset (PFO1) (Adjustable -50% + 50%, default 0) must be applied to the diurnal profile in order to determine the required pump speed setpoint, as shown below.

Pump Speed % = (?? Setpoint * PFM1) + PFO1

Note: the pump running speed will be bounded by the minimum and maximum allowable pump running speed. (Engineering Adjustable, programmed at 10-50Hz).

The pump will run at the speed preset by the operator for that time of day.

Mode 2: Flow Paced Control

Dosing must be initiated by the RTU. When selected to run on flow paced control the dosing pumps will run at an operator adjustable pre-set dose rate dependant on the flow in the sewer pressure main. This is operator adjustable in terms of mg/litre.

Mode 3: Fixed Speed Control

Dosing must be initiated by the RTU. When called to operate in this control mode, the pumps will run at a fixed, engineering adjustable, speed (10-50Hz).

The initial Dose Rate will be as follows using ?insert chemical name? as the dosed chemical.

Chemical Dosing Rate: .....?? L/Hr.

Carrier Water Flow Rate (nominal).....?? L/Hr.

3.6 Specific safety requirements

- Refer to attached hazard identification and risk assessment and site specific hazard identification
- Ensure appropriate personnel protective equipment (PPE) is worn, minimum to include safety shoes, gloves, eye protection, appropriate work clothing
- Ensure procedures for entry to confined spaces is followed
- Comply with occupational health and safety requirements

3.7 Environmental aspects

- Failure to carry out this SOP may result in odour complaints in the vicinity of the site installation and increased corrosion in the receiving waste water holding tank.

4. Operating instructions

4.1 Start up and pre-start checks of the Chemical Dosing System for Automatic Mode

Steps / Activity (AUTO)	Photographs
1. Acknowledge and reset any alarms on electrical control panel	Insert photograph here
2. Check level of MHL in storage tank via the Digital Level Indicator (LIX01). Re-order chemicals if required.	Insert photograph here
3. Check all equipment and instruments are available for operation and all LOTO tags are removed.	Insert photograph here
4. Ensure Non-Potable Water Valve (VLV52) and Potable Water Valves (VLV50 & VLV51) are all ON.	Insert photograph/s here
5. Check operation of the door mounted safety shower and eyewash (SEQ01)	Insert photograph here
6. Check operation of the internally mounted eyewash (SEQ02)	Insert photograph here
7. Check the following isolation valves are CLOSED: • Suction manifold flushing and drain valves (VLV19, VLV20, VLV?? & VLV22) • Discharge manifold drain valve (VLV25) • Dilution Water Solenoid bypass isolation valve (VLV56)	Insert photograph here

Steps / Activity (AUTO)	Photographs
8. Check the following isolation valves are OPEN: • Storage tank discharge isolation valve (VLV04) • Dosing Pump 1 & 2 suction isolation valves (VLV11 & VLV21) • Dosing Pump 1 & 2 discharge isolation valves (VLV19 & VLV23)	Insert photograph here
9. Check the following isolation valves are OPEN: • Dilution water Manifold Isolation Valves (VLV54, VLV57 and VLV61) Note: Dilution Water is flow rate adjustable through (VLV53) and is set upon commissioning to provide a dilution water to chemical rate in the order of 10:1.	Insert photograph here
10.Ensure the field isolation switches for the dosing pumps (PMP10 & PMP20) are switched to the ON position.	Insert photograph here
11. Ensure the “TANK IN SERVICE” selector switch is set to the IN position.	Insert photograph here
12. Position the Dilution Water Control Switch to AUTO.	Insert photograph here
13. Position the control selector switches for dosing pumps (PMP10 & PMP20) to AUTO. The duty dosing pump will then start automatically based on the IICATS preset pump speed with reference to the dosing profile.	Insert photograph here

Steps / Activity (AUTO)	Photographs
14. Visually confirm the dilution water flow by looking at the rotameter (FIX54) float elevated to the set flow position	Insert photograph here
15. Contact SOC to confirm that the dosing system is operating and that no alarms have been raised.	

4.2 Start up and pre-start checks of the Chemical Dosing System for Manual Mode

Steps / Activity (MAN)	Photographs
1. Undertake steps 1 through to 15 as per startup in AUTOMATIC mode.	
Position the control selector switches for dosing pumps (PMP10 & PMP20) to MAN.	Insert photograph here
17. Press the required dosing pump start Pushbutton. The Automatic Valve (VLV05) will open and the pump will run at a speed determined by the operator adjustable potentiometer on the panel. • Pump speed feedback is displayed on the VSD display in % of maximum speed.	Insert photograph here

4.3 Shutdown of the Chemical Dosing System for Manual Mode

Steps / Activity (MAN)	Photographs
1. On the control panel, press the pump STOP button to stop the system operation. The pump which has returned to running based on the current diurnal profile now stops. • This sends a signal to close the automatic isolation valve (VLV05) and initiates the shutdown of the dilution water solenoid valve	Insert photograph here

Steps / Activity (MAN)	Photographs
(SOV55). Local indication of the valve position is provided by status lights on the control panel. Note the lamp illumination to confirm valve operation.	
2. Contact SOC to confirm that the dosing system has stopped operating and that no alarms have been raised.	

4.4 Shutdown of the Chemical Dosing System for Automatic Mode

Steps / Activity (AUTO)	Photographs
1. Position the control selector switches for dosing pumps (PMP10 & PMP20) to OFF. The duty dosing pump will then stop automatically. • This sends a signal to close the automatic valve (VLV05) and initiates the shutdown of the dilution water. Local indication of the valve position is provided by status lights on the control panel. Note the lamp illumination to confirm valve operation.	Insert photograph here
2. Contact SOC to confirm that the dosing system has stopped operating and that no alarms have been raised.	

4.5 Chemical delivery procedure

Steps / Activity	Photographs
1. Unlock the Dosing system building, fully open the doors and engage the captive door stops. This allows access to the safety shower & eyewash (SEQ01), hose reel (UTY01), fill point connection (VLV01) and High level alarm mute on the control panel.	Insert photograph here
2. Visually check the level of the storage tank (TNK01) using the fill point mounted level display (LIX01) showing tank level in percentage • The storage tank level can also be confirmed by viewing the secondary level indictor (LIX02) mounted on the control panel.	Insert photograph here
	Insert photograph here

Steps / Activity	Photographs
3. Ensure Non-Potable Water Valve (VLV52) and Potable Water Valves (VLV50 & VLV51) are all ON.	
4. Check that the Safety Shower/ Eyewash (SEQ01) and hose reel (UTY01) are both operational.	Insert photograph here
5. Inspect the fill point connection for damage and any sign of contamination, report prior to filling if evident. 6. Connect the chemical transfer hose to the camlock fitting. 7. Ensure the fill point drain valve (VLV02) is CLOSED. 8. Open the fill point isolation valve (VLV01)	Insert photograph here
9. Connect the transfer pump power cable from the delivery tanker to either the Single Phase or Three Phase RCD Power Outlet located beside the fill point within the process room. 10. Once connected, initiate the power by pressing the START button.	Insert photograph here
11. Start the chemical transfer pump on the delivery tanker and commence chemical transfer to the storage tank. 12. Whilst filling, inspect the transfer hose for any leaks. If leaks are detected, stop the chemical transfer pump immediately by pressing the STOP button located on the power outlet. 13. If the leak cannot be rectified on-site then cease the chemical transfer operation. 14. Monitor the filling of the storage tank (TNK01) by viewing the level indicators (LIX01 or LIX02). 15. STOP the chemical transfer pump when the storage tank nears safe fill capacity (90%), or when the chemical load has been delivered. Above 90%, the storage tank high level switch (LSH01) will be activated which in turn cuts power to the truck power outlets. This is designed to prevent inadvertent overflows.	

Steps / Activity	Photographs
A flashing Beacon (BEA01) and audible warning (KLX01) will also be activated. The audible warning can be muted from the control room switchboard however the flashing beacon and power outlet interlock continues until the storage tank level drops below that of (LSH01)	
16. Open the fill point drain valve (VLV03) to drain any residual chemical from the fill line and transfer hose into a bucket. 17. Close the fill line isolation valve (VLV02) 18. Disconnect the chemical transfer hose and replace the protective camlock cap on the fill point. 19. Disconnect the transfer pump power cable from the truck power outlet.	Insert photograph here
20. Hose down any splashes or small spills in the Chemical Dosing Unit or chemical unloading bay to ensure the area remains clean and tidy.	
21. Close building doors, secure and depart site.	

4.6 Emergency stopping in automatic mode

Steps / Activity (AUTO)	Photographs
1a. Position the control selector switches for dosing pumps (PMP10 & PMP20) to OFF. **1b.** Or turn pump isolator switches to OFF. The duty dosing pump will then stop automatically. • This sends a signal to close the automatic valve (VLV05) and initiates the shutdown of the dilution water. Local indication of the valve position is provided by status lights on the control panel. Note the lamp illumination to confirm valve operation.	Insert photograph here

Steps / Activity (AUTO)	Photographs
2. Contact SOC to advise them off the problem and check on alarm status.	
3. Close isolating valves as required.	

4.7 Emergency stopping in manual mode

Steps / Activity (MAN)	Photographs
1a. On the control panel, press the pump STOP button to stop the system operation. The pump which has returned to running based on the current diurnal profile now stops. **1b.** Or turn pump isolator switches to OFF. • This sends a signal to close the automatic isolation valve (VLV05) and initiates the shutdown of the dilution water solenoid valve (SOV55). Local indication of the valve position is provided by status lights on the control panel. Note the lamp illumination to confirm valve operation.	Insert photograph here
2. Contact SOC to advise them off the problem and check on alarm status.	
3. Close isolating valves as required.	

4.8 Abnormal Operation

This plant should not be operated unattended in abnormal conditions.

Abnormal conditions include testing of the system, flushing of the system and dosing to achieve an agreed outcome and should be done with operators present at all times.

5. Installation and commissioning instructions

5.1 Installation procedures

Provide instructions for installations of the chemical dosing unit here including:

Footing and compacted base requirements.

Lifting arrangements

Positioning in place requirements

Methods of connecting the pipework. electrical power, controls and instrumentation

5.2 Pre-commissioning and commissioning checklists

Detail checklist for pre-commissioning checks here.

Detail commissioning procedure and checklists here.

5.3 Commissioning instructions

Refer to Commissioning Plan attached as Appendix B

6. Maintenance plans (preventative maintenance)

6.1 Periodic maintenance

Item	Plant or Equipment Reference	Operation	Frequency
1	Dosing Pumps (PMP10 and PMP20)	Clean pumps of any dust or debris to allow adequate cooling.	Monthly
		Relace diaphragms, valves or peristaltic hoses.	Annually
2	Manual Valves	Check operation of manual valves not normally operated	Annually
3	Storage Tank TNK01	Check for leaks from the tank or piping	Each Visit
		Inspect tank externally for visible defects	Annually
		Inspect inside of tank via Manhole.	Annually
4	Carrier Water pumps (PMP?? and PMP??) Potable Water pump (PMP??)	Check for leaks	Each visit
		Clean pump of any dust or debris to allow adequate cooling.	Monthly
5	Storage Tank Mixer MIX?? if fitted	Check for vibration and gearbox oil level.	Monthly
6	Loading Valve (PCV??), Pulsation Dampener (PD??), Pressure Relief Valves (PRV?? and PRV??).	Replace diaphragms.	Annually
7	Flow switch alarm (FSA??)	Check operation	Annually
8	Pressure indicators (PIX??)	Check operation	Annually
9	Pressure Relief Valves (PRV?? and PRV??)	Check operation	Annually
10	Rotameter (FIX??)	Check operation	Annually

Item	Plant or Equipment Reference	Operation	Frequency
11	Controls Panel 24V Battery and Level Transmitters and motorised valves 24V Battery	Check battery condition	Annually
		Replace Batteries	3 yearly
12	Electrical Power and Control Cabinets	Check and clean	Annually
13	Emergency Shower, eyewashes and hosereel	Inspect and clean	Each visit
14	Control Panel Indication Lamps	Activate Control Panel “Lamp Test” Function to indicate any faulty lights. Replace if necessary	Annually.
15	Doors, Hinges and Locks	Lubricate Hinges and locking mechanisms with suitable penetrating grease or similar. Lubricate lock barrels with Graphite powder or similar	Annually.
16	Ventilation Fans	Clean Roof mounted ventilation fans of all debris, dust etc to maintain airflow within structure	Annually
17	Sump Drain Valve and Pipework	Prevent blockage of the bunded room drain valve and pipework by avoiding hosing any rubbish into it. Sweep floor and remove all material that could block the drain prior to hosing down area.	Monthly.
18	Internal and external Bunds	Sweep down to remove leaves, debris etc. Do not hose into the sumps.	Monthly
		Inspect for damage to linings.	Annually
19	External Sump	Inspect for damage to linings. Inspect for damage and corrosion of pump (if fitted), valves, pipes and instruments	Annually
20	General	Check doors, lighting, door open alarm, vent fans, leaks, condition of fill point Camloc.	At each visit

6.2 Spillage cleaning procedures

Delete or add as relevant

6.2.1 Spill prevention

Spillage or leakage of chemicals should be avoided during filling and maintenance work by locating a bucket or drip tray under the location where a spill or leak might occur (EG storage tank fill point) and disposing of the chemical into the storage tank if clean or offsite to a suitable location if contaminated.

6.2.2 Magnesium hydroxide

Magnesium hydroxide spills and leaks should be allowed to dry out and be swept up and removed as a powder/solid. Magnesium Hydroxide should not be hosed down as this leaves a residue on the surfaces it comes in contact with.

6.2.3 Ferrous chloride

Ferrous Chloride spills should be lightly hosed down into the nearest sump taking care to not to splash the chemical onto any surface not treated with an epoxy coating.

6.2.4 Calcium nitrate

Calcium Nitrate solution spills should be lightly hosed down into the nearest sump taking care to not to splash the chemical onto any surface not treated with an epoxy coating. If the Calcium Nitrate dries out to a powder care should be taken as the dust is an irritant and can ignite combustibles (paper, wood or oil).

7. Maintenance plans (overhaul/major maintenance)

The following excerpts from the equipment and instrument suppliers' manuals detail the procedures for undertaking major periodic maintenance and troubleshooting.

Procedures include:

Item	Plant or Equipment Reference	Operation	Frequency
1	Storage Tank TNK01	Message diameter of full tank. Compare with original diameter (no greater than 2% bigger than original) Empty tank and inspect for cracks, opaqueness, and damage to inlet/outlet nozzles.	10 Yearly

List additional procedures here

Attach equipment suppliers information for major maintenance here.

8. Test data, inspection results and troubleshooting

Insert documents for:

Concrete Structure Inspection and Tests Plans

Letter from Structural Engineer confirming acceptance of the Structure Re-enforcing.

Test reports from the Concrete Supplier

Process Room Bund Hydrostatic Test

Bund Epoxy Coating

Storage Tank Hydrostatic Certificate

Switchboard Inspection and Test Plans.

Electrical Fitout Inspection and Test Plans

Pipework & Mechanical Fitout Inspection and Test Plans

Pipework installer's certificate

Dosing Pumps Configuration

VSD Programming Settings (configuration) for (dosing pumps if required)

Equipment, Instruments and Drives Inspection Checklists

Calibration Certificates

FAT Test Results

SAT Test Results

Attach equipment suppliers' information for troubleshooting here.

9. Parts list and recommended spares

Insert Parts list here

9.1 Equipment supplier details

Supplier	Phone	Fax/email address	Street Address
Insert Details here			

9.2 Equipment spare parts drawings and details

Insert any suppliers information here E.G. exploded diagrams, tank details including nozzles and manholes etc.

Provide an exploded drawing of the dosing pump here showing enough detail to allow for regular wearing part replacement and including descriptions and part numbers of replaceable parts.

9.3 Recommended spares

Insert list of recommended spare parts for 2 years operation, suppliers and recommended stock levels.

Appendix A - Drawings

W.A.E. DRAWING REGISTER

Drawing Reference	Description
Insert Details here	

W.A.E. DRAWINGS

Attach all Work as Executed Drawings here.

Appendix B – Commissioning plan

Attach Commissioning Plan here.

Appendix E – Sydney Water guide to proven products

1. Introduction

The following tables contain most of the equipment found within Networks or Treatment Plant chemical dosing installations at Sydney Water sites. These lists have been developed to assist Contractors and Sydney Water employees with identifying equipment that has been found to be suitable and complying to Sydney Water's stringent requirements.

It is to be noted that use of Supplier/Manufacturer equipment not listed on the following tables will be subject to Sydney Water approval.

If any noted equipment is no longer available or superseded, please advise Sydney Water such that the document may be updated.

This document is to be read in conjunction with the current revisions of the Sydney Water Specifications. Where ambiguity exists, this must be raised with Sydney Water.

2. General

The following sections cover general requirements regarding chemical installations within Sydney Water. These requirements are in addition to those covered in;

- Sydney Water Technical Specification - Civil
- Sydney Water Technical Specification - Mechanical
- Sydney Water Technical Specification - Electrical
- Sydney Water Instrumentation and Control Standards
- The CDU (ACP0002) and RCP (D0000389) Technical Specifications
- The Project Specific DS100 Technical Specification
- The Sydney Water Generic Chemical Dosing P&IDs.

2.1 Spill and leak containment

All chemical dosing installations are to be designed to provide a complete containment strategy. This requires the designer to develop a solution for containing chemical spills at any point of a chemical dosing installation.

A double containment piping system should be selected based on the practicalities of the site, and provision of the highest level of safety to plant personnel. Selection should be made in consideration of site-specific aspects such as;

- Will the pipe work be buried?
- Access for maintenance/emergency repair.
- Length and bends in pipe runs.
- Proximity of pipe runs to walkways, process units, vehicle operating areas etc.
- Can the outer containment become pressurised?
- Where will a leak in the pipe run be directed to?

It should be noted that all systems have mechanical limitations, with most external containment pipes being de-rated in pressure due to jointing methodologies. The supplier of the selected system should be consulted in this regard.

2.2 Chemical training

The following specific training requirements apply to all personnel working on chemical dosing systems: All project engineers, design engineers, projects managers, supervisors and leading hands specifically working on the chemical dosing systems will attend Sydney Water 's Chemical Dosing Training (also refer Sydney

Water Jointing Requirements for Solvent Cement Welding Using Weldon 724 System, Introduction to SWC Chemical Dosing Systems, Awareness of Safe Operations of SWC Chemical Dosing Plants).

- All personnel installing plastic pipework including uPVC, cPVC and fusion polyethylene will undertake specific supplier or industry training on installation techniques.
- Records/ certificates for this training will be produced when requested by Sydney Water.

2.3 Consistency of installation

Consistent brands/models are to be used throughout all chemical dosing installation. Where possible, equipment should be selected in consideration of what has been used at other installations located at the same site. This is particularly applicable to Treatment Plants.

2.4 Material selection and standard chemicals used

The following chart lists the commonly used chemicals at Sydney Water assets. All chemicals have specific requirements, and as such the following list is to be used as a guide only. Chemicals highlighted in **red** are less common and as such will have specific requirements for materials or fittings not covered within this document.

All pipes are to be painted and/or coloured as specified in Sydney Water Technical Specification - Mechanical.

Chemical	Chemical/Seal Material
Aluminium Sulphate	FPM (Viton)
Hydrochloric Acid	FPM (Viton)
Sulphuric Acid	FPM (Viton)
Citric Acid	FPM (Viton)
Sodium Bisulphite	FPM (Viton)
Calcium Nitrate	FPM (Viton)
Magnesium Hydroxide	FPM (Viton)
Lime Solutions	FPM (Viton)
Potassium Permanganate	FPM (Viton)
Carbon Dioxide Solutions	FPM (Viton)
All forms of Chlorine (incl. Hypochlorite and Chlorine solutions)	FPM (Viton)
Iron Salts (incl. Ferric Chloride, Ferric Sulphate and Ferrous Chloride)	FPM (Viton)
Ammonia Solutions	EPDM
Methanol	EPDM
Ethanol	EPDM
Caustic Solutions	EPDM

3. Acceptable products list

Table 1 Chemical pipework and fittings – acceptable supplier list

Item Description	Supplier/Model	Supplier/Model	Supplier/Model	Comments/Requirements
uPVC/cPVC Schedule 80 Pipe	Georg Fischer	Ipex (currently available through Allmach)		ASTM D1784 ASTM D1785 **NOTE:** PN15 is not acceptable.
uPVC/cPVC Schedule 80 Fittings	Georg Fischer	Ipex (currently available through Allmach)		ASTM D1784 ASTM D2467 ASTM D2464 **Unions to be PN16 or better**
uPVC/cPVC Double Containment Pipe Systems	Georg Fischer Double-See™ Schd. 80 x Schd. 80 Schd 80 x Schd. 40	Ipex (currently available through Allmach)	Georg Fischer Contain-It™ Schd. 80 x PE100 **Must specify Sched 80**	• Rating of outer containment subject to the containment strategy adopted (can the containment pipe be pressurised). • Un-pressurised outer preferred.
PE100 Polyethylene PN16 Pipe with PE100 Polyethylene PN16 Containment Pipe (*PE Use Subject to Approval)	-	-	-	AS4130 AS4131
Polyethylene PN16 Fusion Fittings (*PE Use Subject to Approval)	Georg Fischer	Vinidex/Plasson	-	AS4129 AS4131
PE100 Polyethylene PN16 Pipe with DWV outer containment pipe.	-	-	-	• Outer pipe to be coloured and labelled. Buried lines should be identified with custom labelled and colour coded tracing tape or approved alternative. • All solvent welds must utilise the IPS Weldon 724 as per below..
Solvent Welding Products/System	IPS Weldon 724 System (with P70 Primer)			• Fitters to be trained on and use Sydney Water's Solvent Welding procedure. • Acceptable training currently conducted by PAAS or Georg Fischer.

Item Description	Supplier/Model	Supplier/Model	Supplier/Model	Comments/Requirements
Pipe Support/Clip Systems	Georg Fischer	Unistrut/Ezystrut etc. Loose fitting with suitable isolation material only.	Ipex and Stauff	• Pipe clips to allow for axial movement. • Allow sufficient spacing off backing boards/concrete for access to unions and fittings. • Consideration to be given to thermal expansion and bends on long runs.
uPVC/cPVC Ball Valves	Georg Fischer Type 546 pro	FIP VKD	-	Valves must be suitable for chemical use.
uPVC/cPVC Check Valves	Georg Fischer Type 561	FIP SXE	-	Valves must be suitable for chemical use.
uPVC/cPVC Check Valves (Spring Loaded)	Georg Fischer Type 562	FIP SXE	-	Any internal spring to be suitable for the chemical used.
uPVC/cPVC Diaphragm Valves	Georg Fischer Type 514	FIP VM	-	
uPVC/cPVC Motorised Valves	Georg Fischer Type 546 with EA-25 24VDC	(Mag Hydroxide) Process Systems BLSE	-	• Motorised valves to be 24VDC. • Stainless steel option for Magnesium Hydroxide
uPVC/cPVC Solenoid Actuated Valves	Burkert 0142	Process Systems	-	• Not to be used on main chemical dosing lines. • Used for dilution water - PVC body for corrosion resistance
uPVC/cPVC Strainers	Georg Fischer Type 305	FIP RV	-	Highest Pressure Rating Available.
uPVC/cPVC Back Pressure Control/Relief Valves, Anti-syphon valve.	Stubbe Reducing – DMV Relief – DHV712-R	Georg Fischer Type 582	-	• Valves to be selected in consideration of process requirements. • Anti-syphon applications should be designed to close if a suction effect occurs downstream of the valve.
Camlock Connections	Dixon (or equivalent)	-	-	• Poly camlock fitting for sodium hypochlorite, ferrous chloride and calcium nitrate. • Stainless Steel 316 or Aluminium for MHL.

Table 2 Mechanical equipment – acceptable supplier list

Item Description	Supplier/Model	Supplier/Model	Supplier/Model	Comments/Requirements
Bund and Unloading Bay Sump Pumps	Tsurumi TM Series	-	-	Titanium to be used where any aggressive chemical is used.
Transfer Pumps - General	Iwaki	-	-	Magnetic type, suited to the required duty and chemical.
Chemical Dosing Pumps - Digital	Grundfos DME, DDA	-	-	• Pumps to be selected in consideration of site control/electrical setup. • Digital dosing pumps that utilise DC stepper motors are preferred to ensure constant dosing in lieu of a pulse dosing arrangement. • Where possible 10 bar dosing pumps are preferred.
Chemical Dosing Pumps – Peristaltic	Bredel SPX	-	-	• Forced ventilation dependant on turn down ratio • Bredel requires a VSD. Preferred VSD is Schneider Altivar 61
Pulsation Dampeners	Blacoh	AccuPulse (rebadged Blacoh)	-	• Include bladder pressure gauge and Schrader valve for hand pump. • Bladder holder to be flanged & bolted. • Solvent Cement Connections. (Flange is the second preference)
Storage Tank Magnetic Level Indicators	Weka (uPVC/cPVC)	Faco	-	Any fabricated PVC pipework supplied must be constructed by appropriately trained fitters (in the gluing and piping system)
Calibration Cylinders	KoFlo	Other	-	Requirement for Schedule 40 minimum PVC clear tube. May require custom fabrication.
Backflow Prevention Devices	Valvcheq RP03	Caleffi	-	
FRP Chemical Storage Tanks	Corrosion Technology Australia	Newel Composites	RPC	Refer Sydney Water FRP Chemical Storage Tank Specification
3rd Party Verifiers of FRP	Oceania Composites	Dennis Southam &	-	

Item Description	Supplier/Model	Supplier/Model	Supplier/Model	Comments/Requirements
Tanks		Associates		
Polyethylene Rotomoulded Storage Tanks	Dex Australia	Duraplas	Polymaster Rotadyne	• Generally Networks Installations only. • Minimum SG 2 rating
Safety Showers/Eyewash	Enware	-	-	AS4775 compliant.
Mixers	Teralba Industries Mixquip	-	-	

Table 3 Instruments for chemical systems – acceptable supplier list

Item Description	Supplier/Model	Supplier/Model	Supplier/Model	Comments/Requirements
Pressure Indicating Gauges	Stubbe w/diaphragm	Wika	-	Solvent welded connection.
Pressure Transmitters	Refer to TS01 – I&C Standards	Vega	-	• Consistent with site. • Drawing of commissioned instrument setup (heights etc.) to be provided. • Consistent brand across installations
Rotameters	Georg Fischer	Stubbe	Prominent	
Float Type Level Switches	Refer to TS01 – I&C Standards	Xylem ENM -10	-	Consistent with site.
Capacitive Type Level Switches	Refer to TS01 – I&C Standards	IFM Efector	-	Consistent with site.
Level Transmitters	Refer to TS01 – I&C Standards	Vega Vegapuls	-	• Consistent with site. • Drawing of commissioned instrument setup (heights etc.) to be provided. • Consistent brand across installation.
Flow Transmitters (Water/Sewer)	Refer to TS01 – I&C Standards	ABB Magmaster Endress + Hauser	Siemens	Consistent with site.
Flow Transmitters (Chemical)	Refer to TS01 – I&C Standards	Yokogawa	-	• Consistent with site. • Hastelloy flanged connections
Flow Switch	Refer to TS01 – I&C Standards	IFM Efector (Thermal Dispersion)	-	Consistent with site.

Table 4 Miscellaneous other equipment

Item Description	Supplier/Model	Supplier/Model	Supplier/Model	Comments/Requirements
Mobile Platform Ladder	Bailey FS10863	-	-	
Hose Reels	ReCoila AW1215	-	-	Minimum 12mm diameter
Ventilation Fans	Fantech Compact 2000	-	-	
Analogue Level displays	Amalgamated Instruments LDIV	-	-	High visibility LED version
Door switches	Panasonic AZ	Tend TZ	-	
Door catches	SABRE	-	-	
Power supply (Battery backed 24V)	Dyne Industries	-	-	
Surge Protection	Erico	Pheonix	-	

Appendix F - CDU commissioning checklist

Also refer D0001440 – Sydney Water Technical Specification – Commissioning.

CDU Site commissioning checklist

Prior to commencing commissioning the following mandatory requirements to be addressed: -

a) Latest revision of construction drawings are provided including: -
   - Electrical.
   - Process & Instrumentation Diagram.
   - Civil showing pipework layouts, services and operational valve locations.

b) A draft copy of the O&M manual is available.

c) A copy of the function design specification is available.

d) The relevant IICATs RTU I/O listing is available.

e) Dosing Pump performance curve is laminated and attached to control room wall.

f) Completed Inspection & Test Plans as well as Factory Acceptance Test Documentation.
   - Sign off from IXOM (formerly ORICA) for installation conformance to chemical delivery requirements.
   - Sydney Water Bi-Lock barrels to suit the CBY key are installed on the access doors to the Chemical Dosing Unit. Sydney Water Bi-lock padlocks to suit the CBY key are installed on all pit covers and site access gates.

g) Access doors to the Chemical Dosing Unit are able to be secured in the open position.
   - Externally located electrical meter panels where supplied will have a spare key provided to suit the energy suppliers proprietary padlock.

h) Delivery bund complies with capacity requirement as per ACP0002.

i) Power to the Chemical Dosing Unit is connected and phase rotation is correct.
   - A label clearly identifying the origin of the electrical sub-circuit is provided above the main isolator for the Chemical Dosing Unit.

j) Potable & Non-Potable water is connected.
   - Potable water pressure is adequate at all times of the day to operate the safety shower (minimum 75.7 L/min @ 210 kPa).
   - Potable and Non-Potable RPZs are clearly labelled, protected by vandal resistant cages and fitted with Sydney Water Bi-Lock padlocks that suit the CBY key.
   - Externally located taps are fitted with vandal resistant handles and are clearly labelled NON POTABLE, DO NOT DRINK.
   - A roof mounted retractable Hose Reel (UTY) c/w camlock fitting and hose nozzle is provided and has sufficient length to reach the entire truck delivery bund.
   - The chemical dosing line is installed according to site design either in a dedicated chemical dosing pit or where installed in a gravity sewer system, into the Inlet Maintenance Hole, to direct chemical delivery into the centre of the incoming sewerage flow. The dosing line is appropriately supported and terminated to allow future removal and re-installation where possible, negating the need for confined space entry.

- The IICATs RTU is operational, program is loaded and communications available (3G or Fibre Optic).
- Internal and external lighting is operational.
- Ventilation fans are operational.
- All electrical instrumentation is programmed and correctly ranged including: -
  - Variable Speed Drives. (VSD)
  - Digital Dosing Pumps. (PMP)
  - Level Transducers. (LTX)
  - Pressure Transducers. (PTX)
  - Flow Transducers. (FTX)
  - Set-point relays within Analogue Level Displays. (FIX)
  - Programmable Level Switches. (LSH,LSL)
  - Programmable Flow Switches. (FSL)
- Motor thermal or electronic overloads are correctly set to the F.L.C. of the motors.
- Time clocks if applicable are programmed.
- Automatic Valves are configured for open / close operation and feedback position indication.
- Chemical Storage tank holds sufficient water to conduct automatic and manual testing (i.e. above low-level cut-out).
- Pressure loading and relief valves are adjusted to the required operational pressures and marked accordingly. (PCV, PRV)
- Pulsation dampeners are charged with nitrogen to 80% of system designed operational pressure. (DMP)
- All internally and externally located equipment is labelled with allocated MAXIMO numbered tags as required.
- Appropriate valve isolation keys and or handles are provided for operation of below ground valves and removal of associated pits or covers.
- Relevant site safety signage is securely affixed to access doors and is clearly visible when doors are open.
- Safety Shower and eyewash signs securely affixed to the wall and door as required.
- DG Labelling is correct and affixed to the chemical storage tank. A tank capacity label is affixed to the tank.
- DG labelling is also affixed to the external wall of the building so it is clearly visible when approaching from the access roadway.
- All chemical pipework is correctly labelled for the chemical to be dosed. Direction of flow is clearly indicated.
- Potable and Non-Potable water pipes are correctly labelled.
- HAZCHEM signage is attached to site access gates.
  - Site access gates can be secured in the open position.
  - HAZMAT box is installed inside the site perimeter fence and contains site safety folder (applicable for chemical installations over 10KL).
  - All plug-in electrical equipment is tested and tagged.
  - A dry powder fire extinguisher is located on the wall of the control room and is tested and tagged.
  - Fire extinguisher signage is affixed to the wall above the extinguisher.

- A suitable mobile platform ladder is located within the process room for access to instrumentation located on the roof of the chemical storage tank. Instrumentation as well as the tank manway should be within easy reach whilst standing on the ladder. The level transducer (LTX) should be able to be removed for cleaning without unscrewing from the tank.
- A table, chair, document storage and spare parts cabinet (if required) are supplied in the control room.
- Electrical control panel is lockable with either a standard electrical switchboard key (92268, CL001) or Sydney Water padlock.

Chemical dosing unit sequence testing

k) RTU Digital and Analogue Inputs

- Manually activate each RTU input and confirm both local and remote operation.
- RTU Digital and Analogue Outputs
- Remotely activate each digital and analogue output to check for automatic sequence operation.
- Drop test each Dosing Pump (PMP) to confirm correct calibration to the chemical dosing Flowmeter (FTX)
- Sequentially run each Dosing Pump (PMP) in manual and check for the following operations: -
  - Standby Dosing Pump is interlocked from operation when Duty Dosing Pump is running.
  - Dilution Water Solenoid activates when the Dosing Pump runs. Dilution Water Running light illuminates. Dilution water Rotameter (FIX) indicates a water flow of 20:1 to that of the Dosing Pump.
  - Switch off Dosing Pump local isolator, Dosing Pump stops and auto valve closes. Pump fault light illuminates.
  - Dosing Pump drives from minimum to maximum speed when operated in manual from the control panel.
  - Dosing Pump stops operation and the auto valve closes in accordance with the FDS when associated interlocks are activated. These interlocks include: -
    - Process Room Bund High Level (LSH)
    - Dosing Cabinet Catch-pot (if applicable) (LSH)
    - Secondary Containment High Level (if applicable) (LSH)
    - Dose Pit High Level (if applicable) (LSA)
    - Storage Tank Low Level (LSL & LSC)
  - Isolate the chemical dose line discharge isolation valve and check the Dosing Pump Pressure Relief Valve (PRV) opens at the set pressure. Re-open the chemical dose line discharge isolation valve and check the Pressure Relief Valve fully closes.
- Place both of the Dosing Pumps (PMP) in auto and check for the following operations: -
  - Dilution Water Solenoid (SOV) activates when Dosing Pump runs. Dilution Water Running light illuminates. Dilution water Rotameter (FIX) is set to provide a dilution water flow of 20:1 to that of the Dosing Pump.
    - Isolate the dilution water and check for correct operation of the Dilution Water Low Flow switch (FSL) and associated alarm input on the RTU.
  - Switch off the duty Dosing Pump local isolator, the duty Dosing Pump stops, pump fault light illuminates, and the standby Dosing Pump starts running.

  - Dosing Pumps drive throughout the diurnal profile speed range or speed set-points programmed in the RTU.
  - Dosing Pumps stop operation and the auto valve closes in accordance with the FDS when associated interlocks are activated. These interlocks include: -
    - Process Room Bund High Level (LSH)
    - Dosing Cabinet Catch-pot (if applicable) (LSH)
    - Secondary Containment High Level (if applicable) (LSH)
    - Dose Pit High Level (if applicable) (LSH)
    - Storage Tank Low Level (LSL)
- Where applicable, the storage tank agitator (MIX) is correctly sized and located within the storage tank to adequately agitate the entire tank contents to a minimum level equal to the low level cutout (LSL & LSC) of the storage tank.
- Where applicable check the automatic operation of the batching sequence including Batch Pump run time and Dilution Water Solenoid (SOV) activation with cut-out on high level.
  - Check batching sequence stops operation when associated interlocks are activated.
- Activate the Truck Power Outlets and then fill the storage tank with water to activate both High Level set-points (LSA & LSH). Confirm Truck Power Outlets are de-activated and subsequent activation of the High Level warning Klaxon (KLX) and Beacon (BEA). Press the Siren Mute button on the control panel to silence the Klaxon.
- Drain the storage tank to flood the process room bund in order to check the bund containment capability and bund capacity.
- Drain the bund then re-initiate the chemical dosing system in manual to ensure continued operation of the automatic valve after it has been submerged.
- Fill the delivery bund sump with sufficient water to activate the delivery bund Sump Pump (if applicable). Place the delivery bund Sump Pump in auto and close the doors to the Chemical Dosing Unit. Check automatic operation of the delivery bund Sump Pump. Open the doors to the Chemical Dosing Unit and check that the automatic operation of the Sump Pump is inhibited. Run the delivery bund Sump Pump in manual to check for low level cut-out.
- Check for correct mounting and operation of the Safety Shower / Eyewash and separate Eyewash (SEQ).
- Undertake site inspection to identify all externally located valves and controls associated with the Chemical Dosing Unit. These include: -
  - Process Room Bund Drain Valve
  - Secondary Containment Drain Valve (if applicable)
  - Dose Pit Drain Valve (if applicable)
  - Delivery Bund Drain Valve (if applicable)
  - External Lighting Switch
- Check valving for correct labelling and descriptions are in accordance with design requirements.
- Identify access and egress to the Chemical Dosing Unit for delivery operations, after-hours access, potential trip hazards and obstacles.

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