Specification

Supplement to Sewage Pumping Station Code of Australia WSA 04-2005-2.1 - Sydney Water Edition – 2012

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REVISION DETAILS

Version No.	Clause	Description of revision
1	N/A	First issue

INTRODUCTION

Sydney Water's Supplement to WSAA Sewage Pumping Station Code of Australia WSA 04-2005-2.1 - Sydney Water Edition - 2012 sets out specific Sydney Water's design requirements for wet well sewage pumping stations (SPS) larger than 200L/s capacity.

The requirements for SPSs up to 200L/s are covered in the current Sydney Water Edition of WSA 04. This document is at present under review to align with the new version of the National Code (WSA 04-2022-3.1) and to include Sydney Water's learnings and additional requirements developed over the years. The revised code, planned to be published by mid-2025, will also incorporate this Supplement, which will then be withdrawn. On the interim, the design of new SPSs with capacity exceeding 200L/s must, as far as reasonably practicable, comply with the current SW Edition of the Code and the requirements listed herein.

The design must incorporate FMECA and Value Engineering studies to optimise function and reduce lifecycle cost.

Any deviations from the Sydney Water Edition of WSA 04 and this Supplement must be approved in accordance with Sydney Water's Procedure – Deviation from Standards (Document no. D0001738).

In order to assist the reader, the tables include references and clause numbers presented as they appear in WSA 04. Only the affected clauses are shown in the Supplement. Associated clause headings are also provided to provide context.

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SCOPE

The scope of this document includes the planning, design and construction of large SPSs for Sydney Water.

This Supplement is intended for Sydney Water personnel, consultant engineers and contractors engaged in the planning, design and construction of Sydney Water SPSs.

This Supplement is to be read in conjunction with the WSAA Sewage Pumping Station Code of Australia WSA 04-2005-2.1 - Sydney Water Edition – 2012.

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Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
5 PUMPING STATION DESIGN	
5.2 SITE SELECTION, LOCATION AND LAYOUT	
5.2.3 Location and layout	The top slab of the wet well, valve chamber, inlet maintenance hole and emergency storage structure (ESS) must be min. 300mm above the 1% AEP level. The same applies to the finished floor level of the electrical switch room and the base of the chemical dosing unit (CDU), odour control unit (OCU), electrical kiosk, control panels and junction boxes / turrets, and the mobile generator and temporary or permanent diesel/gas pump lay off areas. *The 1% AEP must be taken from the Council mapping using Australian Rainfall and Runoff flood estimation method based on Representative Concentration Pathway (RCP) 4.5. In the event where such information is not available and 0.5% AEP is higher than the station finished ground level, the designer must carry out a flood study using Australian Rainfall and Runoff method to determine 1% AEP based on RCP 4.5. Where the pumping station is deemed critical, high value or high risk, climate risk assessment must also be carried out for RCP 8.5 to identify adaptation actions which could be implemented at no cost or define actions if adaptation is required in future.*
	The access road / driveway to and from and within the SPS site, including the vehicle turning and parking and crane hard stand areas, must be trafficable in all weathers and above the 1% AEP level.
5.2.5 Site layout and access	The access road / driveway must include a 21m long setback from the main (public) road or a 20m long stopping bay on each side of the gate to allow drivers to open and close the station gate safely. Where access to an SPS is from a major arterial road a proper slip lane must be considered in liaison with Transport for NSW to provide safe access and egress to the site without causing major disruption to traffic or closing lanes of the main road.
	The pumping station site layout must include a concrete loop access driveway / vehicle turning circle similar to that shown on deemed-to-comply (DTC) drawing no. DTC-6006. The turning circle must be suitable for 19m long articulated tankers.
	Level crane hard stand areas, each min. 8m wide x 14m long, must be provided next to the wet well and valve chamber. One hard stand area is required for wet wells up to 10m width/diameter. Two crane hard stand areas must be provided for wet wells wider or larger than 10m in diameter, one on either side of the wet well to facilitate crane access to all pumps and valves. The crane hard stand areas must be concrete.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
	Vehicles barriers compliant with Sydney Water Technical Specification - Mechanical must be installed where required along the access road/driveway, hard stand and parking areas to protect adjacent structures and infrastructure from vehicles and vehicles from rolling down slopes.
5.3 INLET MH	
5.3.2 Design	The inlet maintenance hole (IMH) must be min. 1800mm in diameter. However, in most cases the actual size will have to be larger to accommodate the inlet and outlet pipes, overflow pipe(s), hydrostatic level sensor, buoyancy level switch, drains, chemical dosing lines, personnel access (via a work box) and provision for installation of bypass pumps and stop boards.
	Where the channels within the IMH are deeper than 600mm, staggered footholds must be provided in the channel's walls to facilitate safer access to their invert.
5.3.3 Pumping station wet-well stop valve	Wet well low-level inlet line must provide the means for double isolation. As a minimum, this must include an isolation valve in the wet well and stop boards in the IMH. The isolation valves DN450 and larger must be fitted with electric actuators installed on the wet well roof slab for regular exercising and operation during maintenance activities. The IMH must be adequately sized to accommodate the stop board frames and provide clear path for stop boards installation and removal through the roof openings.
	Knife gate valves are the preferred means for isolation of the low-level inlet and wet well cross-connecting lines larger than DN600. While PN16 is the preferred pressure class for the knife gate valves, min. PN6 is also acceptable for larger sizes where higher pressure class valves are not readily available. Penstocks are not to be used.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
5.4 WET WELL DESIGN	
5.4.1 General	Wet wells with four or more pumping units must be split in half with a dividing wall which must run from the invert to the roof slab so that the two halves can be completely isolated from one another during maintenance or upgrade work. Each half must be connected to the IMH via separate low-level and high-level inlet lines as per SW Edition of WSA 04. The two halves must be connected approx. 300mm above the invert level. The cross-connecting pipe must be at least the same size as the low-level inlet line. It must be fitted with a grade 316 stainless steel knife gate valve on each side of the dividing wall for double isolation. The isolation valves ≥DN450 must be fitted with electric actuators installed on the wet well roof slab for regular exercising and operation during maintenance activities. The wet well cross-connecting valves should normally be open.
	Wet wells of large SPSs with less than four pumping units which cannot be fully bypassed during peak wet weather flows (PWWF) must also be split to enable their maintenance.
	Wet well hydraulics design must comply with the recommendation of ANSI/HI 9.8 and pump supplier's design guidelines and be confirmed by Computational Fluid Dynamics (CFD) modelling. The CFD must also consider the flow splitting or diversion conditions, as appropriate, in the IMH and the potential for flow stagnation and solids sedimentation in the wet well.
	For wet wells, including each half where split, with up to two pumps an open Tee and a drop tube is usually an adequate inlet arrangement. Wet wells with three or more pumps may require a baffle wall with a bottom port(s) as per ANSI/HI 9.8 and pump supplier's design guidelines. The appropriate design for each site must be confirmed by CFD.
	The drop tube, where used, must be fabricated from grade 316 stainless steel.
	Standard submersible pumps are typically rated IP68 for up to 20m submergence. To avoid special orders, facilitate interchangeability with spare ('rotable') pumps kept in SW depots, reduce the size of mobile lifting equipment and facilitate cleaning and maintenance in general, the wet well depth must be kept to the minimum required. In any case, the max. depth must be such that the pumps cannot become submerged by more than 20m under worst possible conditions, including 1% AEP flood events.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
	Where one half of a split wet well is provided for future use (staging), the empty half must be provided with an automatically controlled permanent sump pump with discharge pipework to the IMH.
5.4.2 Sizing	Pump control volume and levels calculations must consider only the plan area of the wet well in which the pump is installed, i.e. in case of a split wet well the calculations must consider the possibility that one half of the wet well may be out of service for a prolonged amount of time.
	Wet well(s) must provide sufficient volume for periodic flushing of pressure main inverted syphons, such as trenchless sections. The flushing volume must be provided below the wet well ATWL to avoid false alarms during flushing cycles. For minimum flushing velocity and flushing volume refer to the National Code WSA 04-2022-3.1. The receiving system (sewer/pumping station/treatment works) must be able to cope with the increased flow rates associated with the periodic flushing cycles.
	Notwithstanding the above, the design must include measures to flush out the pressure mains which for any reason may not achieve minimum solids transportation (‘self-cleansing’) or sulphide slime control velocities during any part of their design life such as during early stages of catchment development. Adequate means of flushing may include arrangements for jetting, pigging, hydraulic flushing discussed above etc.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
5.6 OVERFLOW CONTAINMENT	
5.6.1 General	SPSs must provide emergency storage to retain sewage within the system prior to overflow for a time sufficient to make the station operational under emergency conditions or implement other contingency measures. Typically, this retention time is taken as min. 4 hours over peak dry weather period. Refer to SW Edition of WSA 04 for more details. Where this is not practical and where agreed with Sydney Water, other means of dry weather containment must be provided, including dual power supply, dual pressure main, dual wet well, 100% standby pumping capacity, permanent diesel or gas pumps etc. In such cases, a provision for construction of an ESS in the future must be considered.
5.6.2 Emergency storage *5.6.2.4 Access and cover arrangements*	Where provided, the ESS must have provision for either manual or (semi)automatic cleaning / washing down. For manual washing down, a sufficient number of hatches with safety grilles must be provided, no more than 5m apart along each wall with suitably positioned hydrant connections. For automatic washdown facilities, min. 4 distinct zones to wash each wall / segment of the storage must be provided. Each zone must be provided with an individual electric actuator operated isolation valve.
	Minimum pressure required for washing down is 25m. Where the supply pressure is excessive, a pressure reducing valve preferably within the RPZD cage must be provided.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
6 PUMPING SYSTEM	
6.4 PUMP SELECTION	
	For 'symmetry' and simplicity of controls and operation, SPSs with split wet wells should preferably have the same number of identical pumping units installed in each well.
	SPSs discharging directly to treatment works must be fitted with variable speed pumps able to follow the diurnal inflow pattern. Variable speed pumps must also be employed where required to protect the pressure mains and their fittings from excessive water hammer pressures during normal operation and prevent air valves operation at each pump start or stop. Variable speed drives, however, do not provide protection during power outages and other water hammer mitigation measures must be considered if the calculated pressure surges during abnormal events may exceed the design pressure of the pressure mains and fittings.
	SPSs must have at least 33% standby pumping capacity. Hence, pumping stations with one, two and three duty pumps must have at least one standby unit, and those with four to six duty pumps must have min. two standby pumps.
	In addition to the standby pumping capacity, at least one identical spare pump must be purchased and stored in the Sydney Water nominated location, unless a similar rotable pump is already available and is not dedicated to any existing pumping station.
	Pump motors must be low voltage (400V). Motor size must not exceed 310 kW as power supply cables for larger motors are considered too heavy, rigid and difficult to handle.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
6.7 ANCILLARY EQUIPMENT	
6.7.1 Flushing valves	Where pumps can't be fitted with hydraulic flush valves or where flush valves would not be effective due to the size and/or shape of the wet wells (to be confirmed by CFD), a return flushing system must be employed which uses a small portion of the pumped flow to stir up the wet well content for a short period of time at each pump start. The return flushing lines must be tapped off each pump riser upstream of the non-return valve, manifolded and fitted with a timer controlled electrically actuated eccentric plug valve in the valve chamber, and then run back into the associated wet well. Each flushing line must branch off in the wet well as required and terminate with a duck-foot bend directed away from the pumps.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
7 POWER SYSTEM	
7.2 POWER SUPPLIES	
7.2.2 Security of supply	Regardless of the available retention time, SPSs pumping directly to treatment plants and those positioned in difficult to reach or flood prone areas must be provided with dual power supply. Where a secondary power supply is provided by an onsite diesel generator, the generator must be sized for the pumping station full load (design capacity), i.e. be able to run all duty pumps, controls and ancillaries. Energy suppliers network configuration and supply reliability data for the last 5 years must be assessed against the on-site generation option to determined which option would bring the best value from performance, reliability, accessibility, maintainability, environmental, community impact and financial point of view.
7.3 POWER AND CONTROL CUBICLE	
7.3.1 Design	Electrical power and control equipment for large SPSs must be installed in electrical switch rooms. The switch rooms should, generally, comply with DTC-3000 where the building is specifically designed to operate the electrical switchgear without dependency on any mechanical ventilation systems. This design complies with the SW specifications and corporate guidelines on energy minimisation and allows flexibility for future alterations during renewals without having to replace the switch rooms.
	Standard electrical kiosks which accommodate motor starters, power supplies, IICATS control system etc. may be used for pumping stations with max. two pumping units and soft starters with maximum demand up to 400A, or variable speed drives up to 22kW power rating. Where used, the electrical kiosk must be provided with a suitable shading structure. The design of the electrical kiosk is standard and included as part of the standard electrical template drawings. The standard electrical kiosk design shows the minimum panel width required and, except for increase in panel width to accommodate varying size of equipment the configuration of the kiosk and its paint work, must not be changed.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
8 CONTROL AND TELEMETRY SYSTEM	
8.1 GENERAL	
	The control and monitoring of all SPSs must comply with the current Sydney Water IICATS I&C standards, including SPS specific standard doc. no. HSS0007 and general standard doc. no. HSS0009. Only minor site specific modifications may be allowed, subject to SW approval.
	Standard electrical template drawings for submersible SPSs are currently available for various types of pump control needs (variable speed, soft starter, DOL, series pumping etc). These drawings are in line with the IICATS I&C standards and may only require minimal changes to accommodate site specific needs based on the number and size of the pump units. The standard drawings do not include site layouts, conduit layouts and lighting layouts which are dependent on the site conditions and layout of civil structures. These drawings need to be developed and added to the overall electrical design package.
8.3 PUMPING CONTROL	
8.3.1 Control design	In case of a split wet well, each half must be provided with a level sensor and a buoyancy level switch. The level sensors should preferably be a non-contact, radar type (e.g. Vegaplus C23, or equivalent). A hydrostatic level sensor in a stilling tube may only be considered where a clear radar beam path to the wet well invert cannot be provided. The radar level sensor must be installed under a separate roof lid to the buoyancy level switch to prevent the switch cable interfering with the radar beam.
	To minimise sewage stagnation and solids settlement in one half of a split wet well and sewage detention time in the associated pressure main, the pumping station control system must be configured such that subsequent pumps to start are always from the opposite well than the previous pump.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
8.8 EQUIPMENT AND DEVICES	
8.8.1 General	Pressure mains must be fitted with a pressure transmitter for continuous pressure monitoring via IICATS. The pressure transmitter must be installed in the SPS valve chamber within the SPS site.
8.8.2 Flow measurement	SPSs discharging to treatment plants must be provided with a clamp-on ultrasonic flowmeter on each pressure main installed in a chamber within the pumping station site. Other pumping stations must have a provision in the valve chamber for installation of a portable clamp-on ultrasonic flowmeter for testing and commissioning purposes. This must include a min. 1000mm long straight pipe upstream of each pump discharge non-return valve.
	To maximise the accuracy of ultrasonic flow meters, the pipes on which they are installed must be grade 316 stainless steel Sch. 40S.
8.8.5 Level sensors	Valve chambers must be provided with a buoyancy level switch to raise an alarm should it become flooded.
	ESSs must be fitted with a hydrostatic level sensor along with a buoyancy level switch positioned at its deepest end close to the inflow/outflow drain.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
9 PUMPING STATION PIPEWORK	
9.4 EMERGENCY BYPASS ARRANGEMENT	
	SPSs must have the required number of bypass pump connections to meet the station ultimate PDWF as per SW Edition of WSA 04, or PWWF as stated herein. Where dual pressure mains are provided, the bypass pump connections must be connected to both pressure mains.
	SPSs with only two pumps (i.e. one duty and one standby) installed in a single wet well must have a bypass arrangement sized for the full pumping station capacity since large SPSs tend to receive lot of grit and rags and require frequent wet well isolation for access for cleaning and dredging.
	The bypass arrangement for SPSs with split wet wells must be sized for PDWF, provided that the bypass pumps running in parallel with the pumps in one wet well half can meet the full station capacity.
	As for large SPSs provision of the required number of bypass connections and required bypass pumps may be difficult, the following options must be considered: • Split the bypass pump connections into two banks to facilitate bypassing from multiple structures (e.g. IMH, ESS, wet well) and simplify discharge hose arrangements. • Provide appropriate openings for installation of electric bypass pumps in the IMH or/and ESS. • Consider a combination of electric and diesel bypass pumps where the SPS overflow level is reasonably close to the ground level. • Provide permanent bypass pump discharge bends, guide bars and risers inside the IMH or/and ESS. This option should consider sizing the discharge connections to suit the main pumps which can be used to bypass the wet well and maintain the full SPS capacity.
	Bypass pipework longer than 15m must to be provided with a scour to drain its contents back to the wet well.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
10 PRESSURE MAIN	
10.1 DESIGN	
10.1.1 General	SPS pressure mains should preferably rise continuously to the discharge point. Undulating pressure mains should be avoided wherever possible. Where unavoidable, their longitudinal profile must be straightened as much as practical to minimise the number of high and low points.
	SPSs pressure main must be duplicated where, in case of a break, dry weather inflows to a pumping station cannot be stored or managed otherwise, e.g. by tankers. This is usually considered as >30L/s ADWF. The need for dual pressure main must be confirmed by FMECA and Value Engineering.
	Ideally, dual pressure mains should be of the same size and designed to provide 100% redundancy. If deemed impractical or too expensive, FMECA and Value Engineering may be employed to optimise their size. As a minimum, each pressure main must be capable of operating with all duty pumps and convey at least half of the pumping station ultimate design capacity.
	Dual pressure mains must be connected via a discharge manifold with an electrically actuated isolating valve in the SPS valve chamber. For 'symmetric' SPSs, i.e. those with split wet wells with the same number of duty pumps in each half, this valve may be normally closed. Where uneven number of duty pumps is installed in the wet wells the valve must open automatically when the pumping capacity exceeds the capacity of one pressure main.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
10.2 LOCATION OF PRESSURE MAINS	
10.2.4 Alignment	Pressure main location and clearances from other utility services must comply with SW Edition of WSA 04. Where an SPS pressure main and a water main are in the same street, they must be on opposite sides.
10.9 PRESSURE MAIN VALVES AND SCOURS	
10.9.2 Stop valves	Long pressure mains must be fitted with section valves and scours for inspection and maintenance. The section valves must be spaced to allow for scouring using reasonable number of tankers within no more than 4 hours unless agreed otherwise with Sydney Water. Long dual pressure mains must also be cross connected at min. 2,000m spacing. The cross-connecting valves are to be normally closed.
	Pressure mains must be provided with readily accessible inspection points spaced max. 500m apart to allow their internal inspection with a CCTV camera. Each inspection point must include a vertical DN300 Tee with a blank flange on top fitted with a DN15 tapping point with a ball valve for depressurisation and measurement.
	All pressure main valves and fittings must be fitted with correct surface boxes and clearly marked with direction of closure.
10.9.3 Gas release valves	The gas release valve chambers must be readily accessible and must not be positioned in unsafe locations, such as roadways.
10.9.5 Scours	Pressure main low points must be fitted with scours. The scours must be installed in valve chambers. The valve chambers must be readily accessible and must not be positioned in unsafe locations, such as roadways. Where pump scours are required, Sydney Water operational team must be contacted to assess if more than one scour is required. In this case, location to park multiple tankers out of traffic needs to be provided.
10.10 ODOUR AND SEPTICITY CONTROL	
	Most large SPSs will receive flows from a number of upstream SPSs whereby the sewage is likely to be aged and septic. As such, they may require odour and septicity control, especially during early stages. The need for odour control and chemical dosing units (OCU and CDU) must be confirmed by modelling. Regardless, adequate space must be allowed for the installation of the OCU and CDU in

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
	the future should it be necessary. As part of SPS commissioning, monitoring of H_2S concentration must be undertaken at the pressure main discharge point over a proving period to determine whether or not a CDU is required or, if there is one, whether it is effective in keeping the H_2S levels within the acceptable limits.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
12 SUPPORTING SYSTEMS	
12.1 SERVICES	
12.1.1 General	Unless stated otherwise, SPSs must provide a dedicated interim operating plan (IOP) tankering discharge arrangement consisting of a bunded DN200 female Kamlock fitting and pipe discharging into the IMH.
	The design must make provision for storage of stop boards and blank flanges for high-level inlet pipes. This may include a concrete bunded area with a shelter. The bund must be provided with a hydrant and a hose cock and must drain to the IMH.
12.1.6 Water closet	SPSs with electrical switch rooms must be provided with a toilet and washbasin. The toilet facilities must be incorporated into the switch room building.
12.3 SECURITY	
	SPS site perimeter fencing must align with the site boundaries which must be located at least 1500 mm beyond the top of any embankments and toes of any batters.
12.4 FIRE CONTROL	
	The designer must consult with the Local Council and NSW Rural Fire Service to determine if the SPS is located in a bushfire prone area and whether an asset protection zone (APZ) is required around any structures within the SPS site, including electrical switch rooms and kiosks.

Code References	Supplement to WSA 04-2005-2.1 - Sydney Water Edition 2012
15 DESIGN DOCUMENTATION AND DRAWINGS	
15.2 DESIGN DRAWINGS	
15.2.1 General	The design of large SPSs may adopt relevant details from the Sydney Water SPS deemed-to-comply (DTC) drawing series.
15.2.9 Electrical and telemetry	The design drawings must include lighting distribution plan showing minimum illuminance requirements are met in the key areas, such as the wet well, IMH, valve chamber, bypass connection etc.
	The layout of electrical pits, turrets and conduits must be shown on the civil and mechanical drawings in plan and elevation views.

OWNERSHIP

Role	Title
Group	Engineering and Technical Support
Owner	Manager, Engineering
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CHANGE HISTORY

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1	Milan Rubcic	1/03/2024	R. Madhok, N. Keong, D. Leong-Scott, D. Frucci, C. Chee, J. Nunes, S. Gardner, S. Nadin, M. Pathirana, M. McGowan, S. McDonald, L. Cramp, S. Ross, L. Siriwardane, R. Loncar, A. Rehman	Norbert Schaeper	30/09/2024