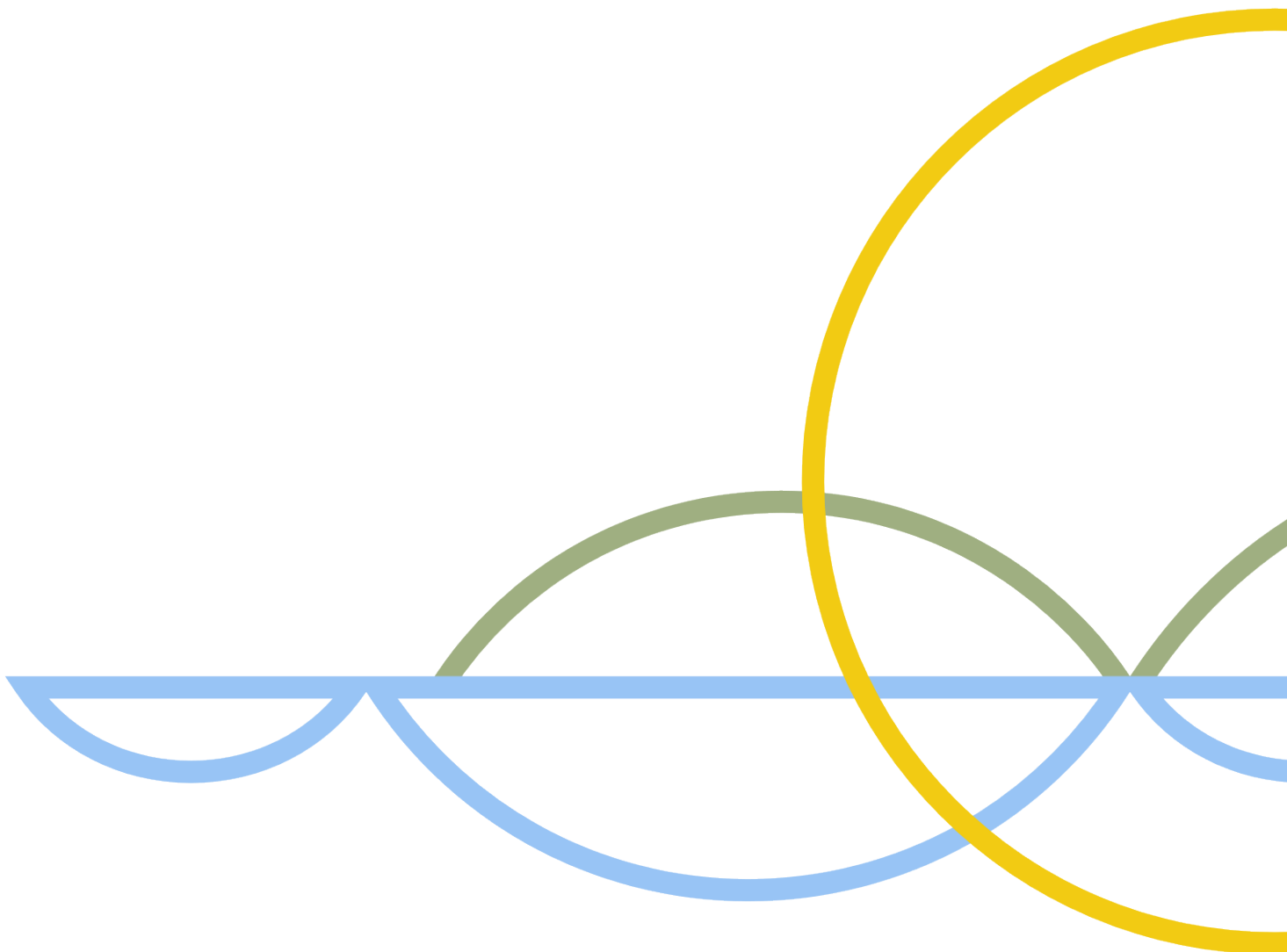


Pressure Sewer System Specification



Document control

Version	Version date	Changes	SME	Approver
1	15/09/2026	Approved first version	Principal Engineer Asset Planning Treatment, Strategy and Planning	Head of Design, Capital Delivery
0	1/10/2021	Initial draft release		Chief Advisor Wastewater

Review information

Latest review date	15/09/2026
Next review date	15/09/2029
Review cycle	3 years
Owner	Head of Design, Capital Delivery

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1 Purpose

This specification sets out the requirements for the design and installation of pressure sewer systems within the Tiaki Wai management area.

A pressure sewer system is a reticulated network with at least four (4) dwellings that each convey wastewater under pressure to a small diameter pressure main. Refer to the description in **Section 5**.

2 Scope

This specification provides the minimum requirements related to designing and installing pressure sewer systems.

This specification does not address pressurised wastewater systems with three or fewer connections, which are typically referred to as pump-ups.

Technical elements of the telecommunications platforms fall outside the scope of this document.

3 References

The following supporting information and legislative documentation should be read in conjunction with this guide. Developers, consultants and contractors should also inform themselves on all other legislation, standards and guidelines that may apply to any potential land development project.

Where a standards year has been nominated, then that specific issue is to be used. Where no year is nominated, the latest version is to be used.

Standard reference	Title
Feb 2020	Water New Zealand Pressure Sewer National Guidelines – October 2024 update
AS/NZS 3500.2	Plumbing and drainage: Part 2: Sanitary plumbing and drainage
AS/NZS 1546.1	On-site domestic wastewater treatment units: Septic tanks
WSA 07	Pressure Sewerage Code of Australia Version 1.1
NZS 3109	Concrete construction

4 Related documents

Standard drawings referenced throughout this specification provide detailed construction requirements for pressure sewer systems - see **Section 8**.

Tiaki Wai standards and specifications referenced in this document are listed below.

<u>QPulse number</u>	Title
STD_0001	Regional Standard for Water Services
STD_0002	Regional Specification for Water Services
STD_0003	Asset Information Requirements (as-built specification)
ACM_0002	Handover and Commissioning Procedure

5 Definitions

Term	Definition
Detention	Water that enters a device and is temporarily detained, before being slowly released.
Flushing mode	The mode set via the smart control system, where a number of pumps can be set to discharge at the same time, creating sufficient velocity to achieve solids self-cleansing. Generally used during the early stages of development build-out.
Inflow and infiltration (I&I)	The process of liquids other than wastewater, such as stormwater and groundwater, entering the wastewater system.
Multi-unit development	A single property with multiple dwellings on it. This includes apartment buildings, townhouse, and properties with self-contained units.
On-property equipment	Collectively refers to the smart control system, pump and collection tank and individual household gravity drain up to the boundary kit. This excludes all upstream plumbing (sanitary drainage).
Peak flow shifting mode	The mode set via the smart control system, where the number of pumps running simultaneously can be limited to reduce the peak flowrates and reduce the network pipe size requirement. Generally used at full build-out of the development.

Term	Definition
Pressure sewer systems	Reticulated networks servicing at least four (4) dwellings that each convey wastewater under pressure via individual collection tanks and associated pumps (generally located on private property), to a small diameter pressure main (generally located within the Council road reserve). Pressure sewer systems include the following elements (see Figure 1) regardless of ownership. • A pump and collection tank, specifically designed for pressure sewer applications, is installed on each property. • The smart control system controls the operation of the pump and contains the alarm components, electrical connection to the property and associated circuit breaker. The smart control system communicates with a centralised monitoring system (via the cloud) and allows for remote control and monitoring of each pump station and wider network. • A pressure lateral connects the pump to the boundary kit. • A boundary kit for each pump provided a means to isolate the pressure sewer network from a pressure lateral and pump. • The pressure sewer main or network of mains is specifically designed for this application, consisting of pressure mains, isolation valves, flushing points and air valves where required. A pressure sewer system does not include the household gravity drain from the gully trap to the pump. This drain remains as a private line belonging to the property owner and is not considered to be part of the system.
Retention	The time that the wastewater stays in the pressure sewer system.

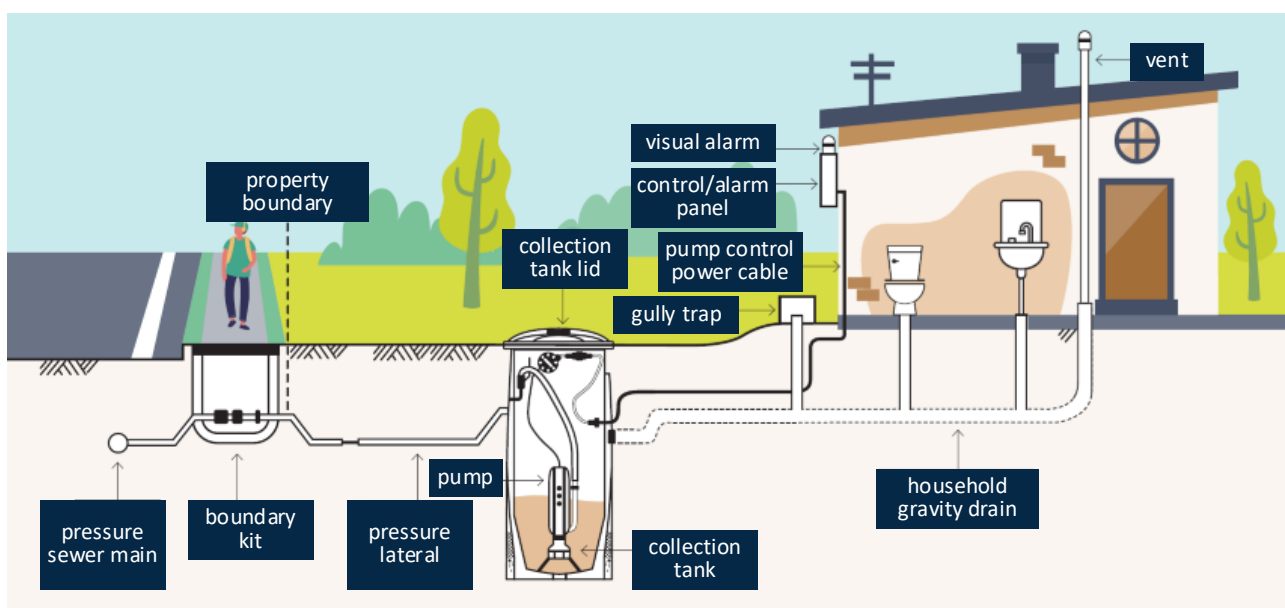


Figure 1: Generalised schematic of a pressure sewer system

6 Design requirements

6.1 Overview

Tiaki Wai Limited (Tiaki Wai) has adopted pressure sewer systems as an alternative wastewater reticulation technology to (preferred) gravity reticulation. Primarily, this is to facilitate greenfield development, while mitigating adverse effects of the development on the performance of the existing wastewater system, with particular regard to containment and overflows.

Approval to adopt pressure sewers as an alternative sewer system requires application to and approval by Tiaki Wai. A proposal needs to be prepared, considering options to service the site, risks, and a feasibility assessment of servicing options including Net Present Value (NPV) analysis. Contact Tiaki Wai for guidance on the assessment process.

This design and installation specification applies to pressure sewer systems for greenfield and brownfield developments.

All pressure sewer systems within the Tiaki Wai region shall be a smart pressure sewer control system. Via the smart control system, the pressure sewer system has the functionality of:

- flushing mode
- peak flow shifting mode.

This specification includes Design Requirements (**Section 6**) and Technical Specifications (**Section 7**).

6.2 Pressure sewer hydraulic design requirements

The pressure sewer network hydraulic design elements covered in this specification include:

- network layout guidelines
- the determination of inflow loading rates and storage requirements
- determination of network pipe flows
- network performance assessment for varying flow conditions
- air movement assessment
- retention time assessment.

Pressure sewer network hydraulic design is generally to be undertaken in two stages, being the:

- preliminary design - a preliminary hydraulic assessment
- detailed design and performance assessment - detailed hydraulic assessment via modelling and a detailed network design.

6.2.1 Preliminary design

A preliminary hydraulic assessment must be approved by Tiaki Wai, and includes the:

- conceptual development layout
- capacity assessment of the existing downstream network
- proposed discharge location

- indicative network configuration and layout
- a preliminary hydraulic assessment, including maximum retention times, to indicate pipe sizes and discharge flowrates from the proposed network
- preliminary air-management requirements.

A preliminary hydraulic design, capacity assessment report and relevant drawings shall be submitted to Tiaki Wai for approval.

Note: The purpose of the preliminary design stage is to outline and document the hydraulic requirements and operation of the pressure sewer scheme with respect to assessing the wastewater mitigation requirements, so that implications can be adequately assessed. Specific hydraulic design with regard to optimising pipe sizes will occur during detailed design.

6.2.2 Detailed design and performance assessment

A detailed hydraulic assessment, including hydraulic modelling, is required and must be approved by Tiaki Wai. It includes:

- final development layout
- network pipe routes
- valve and fitting locations
- discharge location and connection detail
- a detailed hydraulic assessment, via hydraulic modelling, to confirm pipe sizes and assess the performance of the proposed development to meet the required design criteria in terms of pipe velocity and retention times
- wastewater retention time assessment
- air movement assessment
- impact on downstream infrastructure, including odour and potential corrosion
- operation and maintenance requirements
- smart control system operation (operating regimes and functionality)
- documentation of minimum development population required to achieve hydraulic requirements and maximum retention times
- mitigation of odour risk at network commissioning and early development build-out.

A detailed hydraulic design, network performance assessment report and relevant drawings shall be included in an engineering approval application, where applicable.

The following sections include the design criteria and methodologies to assist with the above assessments.

6.3 General design criteria

The design of the pressure sewer system shall meet the following four criteria.

Design Priority 1: Solids self-cleansing **velocity** is to be achieved daily.

This is the most critical design requirement, and any design must show that this is achieved. Solids retention is a significant contributor to odour and septicity issues.

Design Priority 2: Pumps are not to exceed their **maximum dynamic pump head**.

Proper operation of pumps is essential to ensure that pumps can be used for their design and operation life. Short spikes of high dynamic heads are acceptable, but pumps operating at high heads for long durations of time are not desirable.

Design Priority 3: Ensure **air movement** along down-sloping pipe sections.

Air build-up in pipeline high points affects the hydraulic performance of the network and pump operation. Although air can be expelled with air valves, sufficient air movement can also be achieved with a specific operating procedure such as flushing.

Design Priority 4: Network wastewater **retention times** minimised.

Ensure that the maximum retention time in the pressure sewer network is less than eight hours.

6.3.1 Self-cleansing velocity

Self-cleansing velocity refers to the velocity required to convey solids along the wastewater pipe and is a function of flow and pipe diameter. In a pressure sewer system, solids must be conveyed out of the network on a daily basis. Accumulation of solids within the network can lead to anaerobic digestion of the solids. This in turn leads to high liquid phase sulphides, which can cause substantial odour, corrosion and health and safety issues when discharged into existing gravity wastewater assets.

- 0.75 m/s is required as the minimum velocity.
- 1.2 to 1.5 m/s is the target velocity.
- At full population build-out, peak daily velocity shall convey solids out of the network on at least a daily basis. Refer to **Section 6.9** (Network operation and maintenance considerations) for requirements during partial build-out.

6.3.2 Maximum hydraulic pump head

Under normal network operation, each individual pump must not exceed the maximum specified pump head. The maximum specified pump head is dependent on the make and model of pumps used in the catchment.

- For preliminary hydraulic designs, the maximum pump head may be assumed to be 55 m.
- For detailed hydraulic designs, the maximum pump head shall be based on the specific pumps to be used in the network.

6.3.3 Air movement requirements

Wastewater gas and air movement must be considered as an integral element of the network layout and hydraulic design.

Accumulation of air in the pipe soffit at local high points may lead to increased friction and air locking. Assessment of the hydraulic ability of flows to sweep air pockets downstream or the need for air valves is required. Due to ongoing maintenance requirements and the risk of nuisance odours, air valves should be avoided unless assessed as required. See **Section 7.6.4** (Air valves) for technical requirements.

Where air valves are to be used, odour control measures shall be considered. Where the air valve is within 50 m of a property, the air valve shall be equipped with an odour control device.

Air valves require a minimum pressure within the pipeline to remain closed and sealed. The required pressure can vary from 0.5 to 5 m, dependant on the make or manufacturer of the unit. The designer shall check that a suitable air valve has been specified when one is required.

Free draining pipes within the network are undesirable and should be avoided. Pipes that free drain are known to draw air into the network that must then be displaced when the pipe fills. This is likely to cause nuisance odour issues. Further, the hydraulic performance of free draining pipe sections is difficult to predict over the diurnal range of flow conditions expected in the pressure sewer network and may cause unreliable network operation.

Where network discharge points are lower than other parts of the network, barometric loops may be considered.

See **Section 6.4** (Pressure sewer network layout) for further requirements.

6.3.4 Retention times and odour avoidance

The system shall be designed so that average retention times are minimised. Where maximum retention times in the main are predicted to exceed eight (8) hours during any stage of development build-out, an odour management plan is required to determine how odour and septicity issues are to be managed.

For the recommended retention time assessment methodology refer to **Section 6.8** (Wastewater retention time assessment).

Via the functionality of the smart pressure sewer control system, the number of pumps running simultaneously can be controlled within certain bounds. This includes the use of flushing mode and peak flow shifting modes.

- **Flushing mode** is useful at early stages of development build-out for reducing retention times. A number of pumps can be set to discharge at the same time, thus creating sufficient velocity to achieve solids self-cleansing. This may require several flushing periods throughout the day.
- **Peak flow shifting mode** is generally used at full build-out of the development to limit the number of pumps running simultaneously. This reduces the peak flowrates.

By using the capability of the smart control system, network pipe sizes can be reduced. The network can be designed around lower peak flows based on the peak shifting functionality. By reducing network pipe sizes, the retention time is reduced, and the ability to achieve solids self-cleansing at early stages of development build-out is improved. Collectively, by integrating the smart control system functions with the hydraulic design, the risk of underlying odour and septicity issues can be substantially reduced.

6.4 Pressure sewer network layout

6.4.1 Pipe network layout

The layout of the pressure sewer network shall meet the following requirements.

- The network shall be a dendritic network, that is, tree-like, without loops.
- Minimise pipe length and diameter to reduce retention times.
- Avoid free draining sections so that the network is fully pressurised and surcharged up to the discharge point.
- One public main per street. For major roads or other situations where service road crossings face obstructions, a public main may be placed on both sides of the road.
- To reduce retention times, it may be beneficial to have smaller mains on both sides of the road. The design shall demonstrate that the network configuration chosen offers the shortest retention times in the network.
- Public mains shall be located in the berm, except where it must be located through a road crossing.
- Service connections for 'far side' properties shall cross the road. To reduce the number of service road crossings, two dwellings can be serviced by a single service road crossing, where practical.
- Pressure sewer pipeline material to be polyethylene pipe and sizes as per **Section 7.4** (Network).
- Isolation valves shall be placed on the two upstream sides of every tee.
- Flushing points shall be placed at the dead end of all extremities of the network. Flushing point locations shall be discussed and agreed with the Tiaki Wai Network Operations Group.
- The layout of the network shall consider each stage of network development, in addition to the final network configuration. The intention is that the development of the network and associated hydraulic performance is considered during development build-out.

6.4.2 Discharge location

Where the discharge point from a pressure sewer network is to be into a **gravity network**:

- The discharge is to be into a manhole, via an appropriately designed drop structure to minimise splashing and turbulence.
- Effects of odour and corrosion should be considered. This may require odour treatment at the discharge location, and appropriate measures for corrosion, such as the coating of the existing manhole, or the use of a satellite discharge manhole made from corrosion proof material (such as PE, FRP) connecting into the existing gravity network.

Where the discharge point from a pressure sewer network is to be into an existing **pressure sewer network**:

- A hydraulic assessment, via hydraulic modelling, needs to verify that the inclusion of the new development will not negatively impact the performance of the existing network and operation of existing pumps.

Note: If an existing network has been designed to maximise solids self-cleansing velocity and minimise retention time, it is unlikely to have substantial spare capacity. Pressure sewer networks need to be designed for the maximum likely upstream development. It may however be more practical to lay an additional pressure main than to try and upsize a network, due to hydraulic performance issues during build-out. Dual mains of asymmetric sizes are an effective way of catering for uncertainties in maximum populations.

A pressure sewer network shall not discharge to a wastewater pump station rising main.

6.4.3 Network vertical alignment

Pressure sewer networks are generally constructed at minimum cover and tend to follow the ground contour. However, the designer must consider vertical alignment requirements to avoid air entrainment, and for air valve locations and the discharge point.

Longitudinal sections shall be provided to assess specific areas of the network requiring assessment for air movement or sections of pipe with the potential to free drain.

6.4.4 Operational monitoring requirements

Flow meter

A flow meter shall be located at or near the discharge of a pressure sewer system. Vertical alignment must ensure that the flow meter and associated upstream and downstream pipe sections remains surcharged at all times and that any air within the pipeline is expelled prior to passing through the meter. A minimum of ten and five times the diameters of straight pipe shall be provided upstream and downstream of the meter, respectively, or as per the specific flow meter requirements.

Pressure transducer

A pressure transducer shall be located at or near the most hydraulically disadvantaged pump in the network. The most hydraulically disadvantaged pump is defined as the pump with the highest total dynamic head (static and friction head) in the pressure sewer system.

For networks with greater than 300 dwellings, or with substantially separate branches, additional pressure transducers may be required at the hydraulically disadvantaged pump of each branch.

Pressure transducers can be located near flushing points and can be relocated as a network expands.

6.4.5 On-property equipment and connections

Pumps

- Each ordinary dwelling is to be serviced by an individual pump and collection tank.
- Multi-unit dwellings and apartments that cannot accommodate separate pump installations may require a common pump installation. All common pumps used must be grinder pumps and must be designed to integrate with the pressure sewer system in terms of head and velocity requirements. All individual building structures connected to the pressure sewer system shall be serviced by an individual pump installation. Lengths of gravity laterals shall be minimised.

Note: it is important that gravity lateral lengths are minimised to avoid potential for inflow and infiltration in the future. It is also important that quasi gravity networks are not created by linking multiple building structures to a single, larger pump station. This may offer lower capital cost to developers but has adverse outcomes for pressure sewer operation.

- Pumps and collection tanks shall be within the private property boundary. See **Section 7.2.5** (Equipment location).

Boundary kits

- Boundary kits shall be located on the public berm adjacent to the property.
- Manifold boundary kits may be used for up to six connections at a single service connection point to the public main. Each boundary kit must be clearly marked to indicate the property served.
- Public main may be placed in private right of ways (ROW) to service a maximum of six connections. Tiaki Wai shall approve the location of the main in the ROW. An easement in favour of Tiaki Wai shall be provided over the main up to and including the boundary kit.

6.5 Inflow and loading rates

6.5.1 Hydraulic loading rates

This section provides guidance on the range of hydraulic loads that are to be used as inflow into pressure sewer collection tanks.

Single Residential Dwellings

Collection tank inflow rates are to be calculated assuming a sewer load rating of 140 L/person/day. For greenfield single-dwelling residential subdivisions, tanks are to be modelled assuming an occupancy rate of three persons/dwelling, resulting in a nominal tank design inflow of 420 L/property/day. This will be the basis of the overall pressure sewer network design.

It is noted that the above loading rates are average loading rates for pressure sewers. These vary from gravity loading rates, which tend to be the maximum expected. Sensitivity assessments around loading rates are assessed separately. Higher and lower inflow rates will be assessed as part of the network performance assessment (see **Section 6.6.6** (Sensitivity scenarios)).

Commercial/Industrial Facilities

Where non-standard or non-residential connections are considered, appropriate loading rates shall be established on a case-by-case basis. Care should be taken to determine the average expected loading rate and not maximum likely loading rates. This may require the commercial/industrial facility to install suitable detention devices. These devices should be clearly indicated in the design with associated detailed calculations and/or hydraulic modelling if required. Maximum retention times in the overall network must be a primary consideration.

It is preferable to determine pressure sewer flow and loading rates via a direct assessment of wastewater production. Assess the likely wastewater production from a build-up of likely water consumption based on knowledge of the proposed development.

If a direct assessment is not possible, estimate wastewater loads using the design requirements in the *Regional Standard for Water Services* (STD_0001) - Wastewater design flow.

6.5.2 Daily inflow profile

Unless more accurate information is known, the diurnal pattern for normal daily inflow into a single residential collection tank shall be assumed as per the pattern shown in **Table 1**.

For non-residential development, refer to the peak dry weather flow (PDWF) specified in the *Regional Standard for Water Services (STD_0001)* and select the most appropriate category.

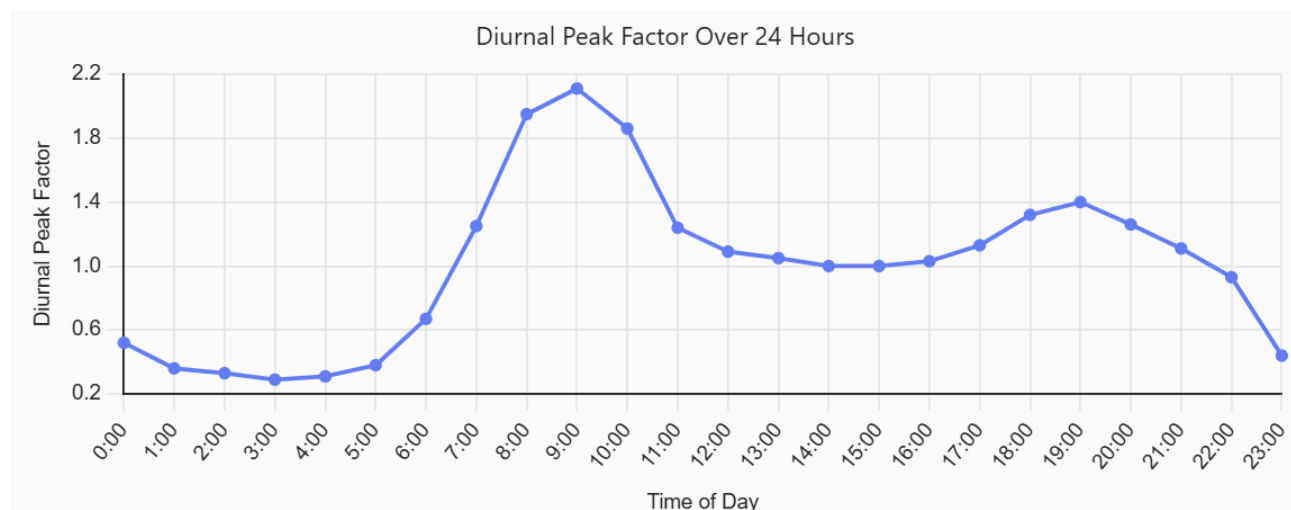


Figure 2: Diurnal peak factor variation over 24 hours

Note: The curve above is based on historical data analysis and represents a typical diurnal curve from a residential dwelling.

Table 1: Typical 24 hr diurnal cycle of a residential dwelling

Time of Day	Diurnal Peak Factor	Time of Day	Diurnal Peak Factor
0:00	0.52	12:00	1.09
1:00	0.36	13:00	1.05
2:00	0.33	14:00	1.00
3:00	0.29	15:00	1.00
4:00	0.31	16:00	1.03
5:00	0.38	17:00	1.13
6:00	0.67	18:00	1.32
7:00	1.25	19:00	1.40
8:00	1.95	20:00	1.26
9:00	2.11	21:00	1.11

Time of Day	Diurnal Peak Factor	Time of Day	Diurnal Peak Factor
10:00	1.86	22:00	0.93
11:00	1.24	23:00	0.44
Diurnal Peak Factor Sum = 24			
Diurnal Peak Factor Average = 1			

6.5.3 Wet-weather inflow and infiltration effects

The hydraulic design of pressure sewer systems shall be designed without allowance for inflow and infiltration (I&I).

The smart control systems shall be specified to monitor for possible I&I in an automated manner, with automated exception reporting to the asset owner.

Note: Primarily, this is by monitoring average pump run time, the ratio of pump run time in dry weather and wet weather and 'Night Flow' run time (to detect private side water leakage, in the same context as water network night flow studies).

Wet-weather inflow is most likely related to illegal connection of property stormwater drainage to the sewer line (for example, roof down pipe), or inappropriately designed gully traps which have surfaces draining to them.

The likely impact of wet-weather inflows on system performance is investigated as part of the network performance assessment (see **Section 6.6.6** (Sensitivity scenarios) but will not be used as the basis of the network design.

6.6 Hydraulic design and assessment methodologies

Established hydraulic design methods for pressure sewer systems without smart control systems rely on determining the peak daily flowrate, generally based on statistical relationships between the number of dwellings in a network, and the number of pumps running simultaneously.

In contrast, this guide, based on the use of smart pressure sewers, differs in the underlying principles of design, in that the flowrates can be dictated and controlled to some extent by the control system. Therefore, established design methods, such as the Probability and Rational Method, are not directly applicable to the design of smart systems.

6.6.1 Overview of smart hydraulic design principles

The objective of hydraulic design in smart systems is to optimise the system to achieve the design priorities detailed in **Section 6.3** (General design criteria) at full network build-out, and across as wide a range of population possible during development build-out.

Design priorities 1, 3 and 4 are more easily achieved when pipe sizes are smaller in relation to the daily wastewater volumes. However, smaller pipe sizes increase dynamic friction, meaning that Design Priority 2 can become an issue. The ability to control simultaneous pump operation is used to define the network peak flowrates and thus provide a basis for pipe sizing.

To enable design, the designer must determine the pipe sizes required to service the ultimate design population. This is done by using the ability of the smart control system to attenuate peak flows, using peak flow shifting mode. The minimum population can then be determined that is required to meet the design priorities, utilising the smart control system flushing mode capability.

Network configuration and staging requirements can be reviewed to optimise the design priorities. Where a significant development population is required to first achieve the design priorities, alternative engineering solutions shall be investigated to mitigate the operational effects of early-stage developments, for example, solids self-cleansing and retention times. Where these cannot be achieved, make-up water may be deemed appropriate to avoid substantial odour problems until adequate population levels are achieved. See **Section 6.3.4** (Retention times and odour avoidance) for details.

6.6.2 Hydraulic design criteria

All systems shall be designed to convey a maximum of 1.2 times Average Dry Weather Flow (ADWF) of the ultimate design population, whilst maintaining the most hydraulically disadvantaged pump in the system below its maximum continuous operating pressure.

Hydraulic designs shall be carried out using hydraulic modelling and by an experienced pressure sewer hydraulic designer approved by Tiaki Wai.

Note: It is theoretically possible to reduce the peak flow of a system to equal the ADWF using peak shifting. However, this does not give any margins of error or safety factors in system design. Further, the system must be able to recover from abnormal events, such as area wide power outages or planned network shutdowns. This is when collection tanks can be expected to be full, with regular demand inflowing to tanks at the same time as the network needs to recover to normal operation. The 1.2 times ADWF factor gives a safety margin to allow network recovery, etc.

Preliminary design

Preliminary designs may be developed using steady state hydraulic analysis, or by dynamic hydraulic modelling.

For steady state analysis, steady state design methods are available for conventional pressure sewer systems. Two methods are available, being the Probability Method and the Rational Method. Please refer to the Water New Zealand Pressure Sewer National Guidelines, Part B, for details. These methods are not directly applicable to smart pressure sewers, however, they can be used to determine a starting point for network pipe sizing.

The network pipe sizing can then be refined by first principles hydraulic analysis, at ultimate development population. It is expected that pipe sizes will be reduced until the most hydraulically disadvantaged pump is near but below the maximum continuous operating head.

Dynamic hydraulic modelling shall be as per **Section 6.6.5** (Normal operating scenario), with the design based on the normal operating scenario. Sensitivity and system recovery scenarios are not required at preliminary design.

The designer shall determine the minimum population required to meet the design priorities. The minimum populations shall be reported as part of preliminary design documentation.

Detailed design

Tiaki Wai requires all detailed design to be carried out by dynamic hydraulic modelling. Models shall be produced in InfoWorks ICM design package. The hydraulic model shall form a deliverable to Tiaki Wai. Designs shall be carried out by Tiaki Wai accredited designers, experienced in pressure sewer design, and proficient in InfoWorks ICM.

Note: It is fundamental for the effective operation and future asset management of pressure sewer networks to have a dynamic model available. This, combined with the smart system, remote monitoring, flow metering and pressure logging allows the network operator to gain visibility of network performance and fore-warning of developing issues. It also enables capacity assessments and the like, which are central to future asset management. A fundamental difference for network operators between gravity and pressure sewer is the inability to physically inspect the network, by lifting manholes or looking in wet wells to see what is going in. The provision of a network model combined with effective network monitoring aids gives operators the visibility required to effectively operate the network.

6.6.3 Dynamic hydraulic modelling

A model must be built to represent the proposed pressure sewer system, including all individual pumps and specific connections, including property-specific loading rates and diurnal patterns. The computer model can be used to simulate normal operating conditions and flow conditions such as a system recovery after a prolonged power outage.

The requirements for model setup for assessing pressure sewer networks are given below.

Pipework modelling

- The model layout of the network and collection tanks is to be spatially correct and representative of likely on-site pipe lengths.
- Property pressure lateral lengths are to be modelled as the straight-line distance between pump and connection point to the pressure sewer main. The length of this pipe in the model is to be representative of the actual as-constructed pipe length for the specific lot, with larger lots having longer service pipes etc.
- All pipework is to be modelled with an assumed installation depth of 0.9 m below ground level.
- All pipework is to be modelled with actual pipe internal diameters (not nominal) for PE100, SDR11 PN16 pipe.
- An appropriate density of nodes is to be modelled to break up the pressure mains such that there is sufficient resolution for optimising changes in pipe diameter, pressures at high and low points can be determined, and pump heads at individual property connections can be determined.

Modelling of on-site collection tanks

- Every pump is to be modelled separately for dynamic modelling.
- The actual pump curve (or a representative curve if a specific pump model is yet to be selected) is to be used in the modelling.
- The tank volume parameters (as based on tank diameter, depth) are to be representative of the specific units proposed to be installed for the development.

- Assigned pump operating levels shall be specific to each lot and are to be representative of the ground levels at which the unit will likely be installed. Based on the tank location, a tank surface level is to be identified from the contour or civil earthworks plan (if applicable). Operating levels (alarm, pump on, pump off, pump suction) are to be deduced based on tank dimensions and factory-set operating levels. If there is a range of feasible tank locations, the most disadvantaged elevation of each lot is to be adopted for modelling.
- Pumps are to be modelled to shut off when the pressure at the pump exceeds the pump shut-off head (as specified by the pump manufacturer).
- The standard daily tank inflow adopted for modelling shall be consistent with the daily design inflow profile as stated in **Section 6.5.2** (Daily inflow profile).
- For modelling, it may be assumed that the tank will not overflow until the storage level reaches the tank lid surface level.

Note: In reality the tank may overflow below this level if the property gully trap is lower than the tank lid (as may happen if the block slopes downhill from the tank).

Network discharge location

- The modelled invert level for system outlet(s) shall be representative of the proposed design and shall be the elevation of the system where it transitions from the pressure sewer network into a gravity network or pump station. Due allowance must be made for any barometric loops installed in the system.

Time intervals

- A maximum 15 second time interval is to be adopted for system modelling to provide resolution for pump and collection tank performance.
- Duration: Either 14 days or until the model stabilises (minimum 5 days results presented).

Roughness value

- A pipe roughness value of 0.60 mm is to be applied in conjunction with the Colebrook-White formula.

Collection tank starting levels

- The model is to be initialised to have randomised tank starting levels within the range of the assigned bottom water level (BWL) and top water level (TWL) for the tank. This is to be adopted for all scenarios except the sensitivity and system recovery scenarios described below, where alternate requirements for flows and tank levels are provided.

6.6.4 Model objectives

The primary model objectives are to optimise the design priorities, as per **Section 6.3** (General design criteria). Additional modelling objectives are to ensure that the proposed pressure sewer network will:

- recover within an acceptable period of time (less than 12 hours) after a system recovery operation, such as a power failure or network shutdown
- operate effectively within a range of conditions that may occur in operations over the life of the asset. For example, higher or lower than expected inflows.

To assess whether the network meets these objectives, various model scenarios are to be created.

6.6.5 Normal operating scenario

Network configuration and pipe sizing shall be assessed under the normal operating scenario.

Daily loading rates as specified in **Section 6.5** (Inflow and loading rates) shall be used as the basis for confirmation of the network's pipe sizes and pipe network layouts and normal operating performance assessments.

The results from this scenario are used for:

- calculating system wastewater retention times
- reviewing pipe velocities and ability to achieve minimum velocities
- identifying the most hydraulically disadvantaged pump, reviewing maximum head at individual pumps and assessing if they remain within target limits
- calculating the peak normal operating flow from the system (expected to occur once or twice per day).

6.6.6 Sensitivity scenarios

Sensitivity investigations are to consider the robustness of the design to possible changes in operational conditions over the life of the asset.

Loading rate sensitivity assessment

Loading rate sensitivity shall be assessed by varying the normal daily loading rates. This testing is intended to capture variation in system loading that could be expected throughout the year because of factors such as changes in population densities within the catchment (for example, due to holiday periods), or changes in water usage. It is also intended to capture uncertainty in the modelled sewer loads recognising the dry-weather inflows adopted may be different to the loads the system experiences over its asset life.

Lower collection tank inflows

A daily loading rate of 20% less than standard will be used – a factor of 0.8 times the normal daily loading rate over the 24 hrs diurnal inflow pattern. For single residential dwellings this is **340 litres/property/day**.

The results from this scenario are used for confirming the robustness of the system for achieving minimum velocity conditions and sensitivity of system retention times.

Higher collection tank inflows

A daily loading rate of 20% more than standard will be used – a factor of 1.2 times the normal daily loading rate over the 24 hrs diurnal inflow pattern. For single residential dwellings this is **500 litres/property/day**.

The results from this scenario are used for confirming the robustness of the system for pumps operating within the maximum continuous pump head requirements.

6.6.7 System recovery scenarios

System recovery scenarios can only be evaluated with a dynamic model and is used to understand the system's ability to recover from a system-wide failure that would prevent individual pumps from operating for a period of time. The cause of system wide failure is likely to be due to a network wide power failure or planned maintenance shutdown.

The smart control system shall include a means to recover the system from an extended shut down. The functionality of the control system shall:

- limit flows so that total dynamic head remains within the maximum continuous operating pressure of pumps that are operating
- control or limits flows so that downstream infrastructure is not inundated. Note, this is expected to require live communications links with assets outside of the pressure sewer system. Tiaki Wai shall be consulted and advise on specific system requirements and operating regimes
- ensure that the risk of spilling of individual on-property collection tanks is minimised. That is, smart control functionality is used to prioritise the tanks with the highest levels to pump out first.

The system recovery period is modelled by the following.

- The model simulation is started assuming 24-hours of low inflow into each pump above a randomised pre-failure tank level.
- A power failure or network shutdown is assumed to start at 5 am and last for 24 hours.
- Once the network is back online, priority pumping to pumps with higher water levels.
- Sequencing of pumps operating time to ensure total system outflow does not exceed the capacity of gravity infrastructure downstream of pressure connections or negatively impact the operations of the wider network.

The requirements for system recovery are confirming that:

- on-property collection tanks do not overflow/spill
- the system recovers to normal operation automatically
- the system recovers in an acceptable amount of time. This is expected to be 12 hours or less.

6.6.8 Post-commissioning and staged development scenarios

- The design of the pressure sewer scheme is to be optimised for the ultimate development, or ultimate planned population.
- For all designs, the minimum population to achieve design priorities as per **Section 6.3** (General design criteria) shall be determined and reported as part of detailed design documentation.
- Where any of the design priorities cannot be achieved post-commissioning of the network, mitigating measures are required to be determined. This is with regard to air management, solids accumulation, odour and septicity issues during operation, and includes impacts on downstream infrastructure.

- Where any of the design priorities cannot be achieved post-commissioning of the network, and mitigating measures are demonstrated to be impractical, an impact assessment shall be undertaken. The impact assessment shall consider effects and risks to the downstream receiving infrastructure, and the likely period of time these are expected to occur for.
- Where, in the opinion of Tiaki Wai, the impact and risk of not meeting the design priorities as per **Section 6.3** (General design criteria) post-commissioning are considered to be minor, dispensation may be given to approve the design.

6.7 Air movement assessment

Air movement does not need to be assessed for pipes which run uphill with respect to the direction of flow – as air will naturally move to the higher end of the pipe.

An assessment is required to determine the need for air valves. It is expected that automatic combination air-release/vacuum break valves are required at significant high points, and where pumped flows do not purge air from the system daily. The designer shall confirm the location of combination air or air release valves. For example, gas pockets can form at minor high points and downward sloping pipes where the slope increases significantly. Air valves may also be required on downward sloping pipes where a sufficient velocity and duration of flow is not achieved to move the air to the next air valve or upward sloping pipe section.

The potential for air entrainment is to be estimated for a system using the Walski et al equation given below.

For pipes with a downhill gradient with respect to the direction of flow:

- when P' is greater than 1.0 gas pockets will tend to move downstream, and
- when P' is less than one 1.0 gas pockets will not be moved downstream

$$P' = \frac{0.88V^2}{gDS^{0.32}}$$

- V = pipe flow velocity (m/s)
- g = gravitational acceleration (m/s²)
- D = pipe internal diameter (m)
- S = pipe slope (m/m)

Rearranging the Walski equation:

$$v = \left(\frac{P'gDS^{0.32}}{0.88} \right)^{\frac{1}{2}}$$

The minimum pipe velocity for air movement can therefore be determined substituting in $P' = 1$ as follows:

$$v_{min} = \left(\frac{1gDS^{0.32}}{0.88} \right)^{\frac{1}{2}}$$

Two key aspects to consider in applying the above equation are the duration and reliability of achieving the minimum pipe flow velocity to move gases along the pipe.

For a gas pocket to be successfully transported downstream to the next air valve or system outlet, there needs to be continuous duration of flow above the minimum velocity for a time long enough for the air pocket to move beyond any intermediate low points in the pipe.

The flow rate and duration required to move gas pockets through the system must be assessed to occur at least once a day, using system inflows expected during normal operating conditions.

If a sufficient duration to move the gas along a downward sloping pipe gradient to either an air valve or an upward sloping pipe cannot be reliably achieved daily, then an air valve will be required.

6.8 Wastewater retention time assessment

Wastewater retention time is to be calculated to inform an analysis of system risk to odour and septicity and any mitigation measures required. Wastewater age calculations are to be calculated based on the normal operation scenario, at development stages and full build-out, to confirm the development population required to give acceptable retention times.

Wastewater age calculations are to consider both:

- retention time in the collection tank prior to pumping, and
- travel time in the pipework system.

Both the above components are to be reported separately, and also summed together for calculation of overall age.

A standard methodology for calculating wastewater age is detailed below.

Total average age of wastewater leaving the network:

$$T_D = T_R + T_T$$

Time in pressure sewer network:

$$T_R = (V_N / I_N) \times 24 \text{ hours}$$

Time in collection tank:

$$T_T = (V_T / I_T) \times 24 \text{ hours}$$

Where:

- T_D = total average age of wastewater leaving the system (hours)
- T_R = average time of wastewater in pressure sewer network (hours)
- T_T = average time of wastewater in collection tank (hours)
- I_N = daily volume of inflow into the pressure sewer network from all connected properties (m^3)
- I_T = daily volume of inflow into the collection tank from an individual property (m^3)
- V_N = the total volume in the pressure sewer network upstream of the outlet, including volume in individual pressure laterals (m^3)
- V_T = collection tank control volume (m^3)

Wastewater age is to be calculated assuming normal operating collection tank inflows for the ultimate system and as per **Section 6.3.4** (Retention times and odour avoidance) and **6.4.1** (Pipe network layout).

6.9 Network operation and maintenance considerations

The Designer shall document all aspects of the design and intended operation of the network as part of the detailed design report, to enable the efficient operation and maintenance (O&M) of the network.

The scope of the documentation is intended to address the risk of odour and septicity post-commissioning and during build-out, until the ultimate population is achieved.

The documentation shall include the following.

- The basis of design, and associated design philosophy
- The functionality of the smart control system that the hydraulic design is based upon, including but not limited to:
 - specific requirements for flushing mode and peak flow shifting mode
 - the predicted flowrates for each mode
 - the number of pumps assumed to be operating in each mode
 - the collection tank level conditions
- Integration of monitoring equipment into network operation, specifically flow meters and pressure monitors, including expected operating range and exceptions

Note: this is intended to give a basis for how to monitor the network, and how to use the monitoring equipment that is outlined in the design guide. Specific examples include if maximum daily flow rates are below 0.75 m/s, or for less than a certain period of time, then solids self-cleansing is not occurring and corrective action should be taken. Additionally, if monitored pressure is over a certain level, or trending up then investigations should be carried out.

- The location of the most hydraulically disadvantaged pump and associated operating parameters
- The minimum population required to achieve each of the design priorities
- Any mitigating measures to address odour and septicity issues post-commissioning
- Sufficient details to enable the efficient use of the dynamic hydraulic model for the purposes of operational investigations and general asset management, when the model is delivered to Tiaki Wai.

6.10 Commissioning, handover and asset information requirements

For information on commissioning and handover, including how to develop a commissioning plan that details pressure/leak testing, flushing, pump operation, alarms, communications/telemetry, monitoring equipment and smart-control functionality prior to handover, please refer to the *Handover and Commissioning Procedure* (ACM_0002).

For information on asset information requirements, including as-builts, Operation & Maintenance manuals, and emergency/system recovery requirements, please refer to the *Asset Information Requirements (as-built specification)* (STD_0003).

Note: Please ask the Growth and Land Development Team at Tiaki Wai for additional guidance on commissioning, handover and asset information requirements specific to pressure sewer systems.

7 Technical specifications

7.1 Overview

All pressure sewer systems within the Wellington Region shall be a smart pressure sewer control system as described in **Section 6.1** (Overview).

On property equipment, including the pump, collection tank, control panel and smart control system (level sensing) shall be supplied as an integrated system, purpose designed for pressure sewer operation, and supplied by a single supplier.

The control panel shall have suitable interface functionality to accommodate a range of data communications platforms, giving the on-property equipment the ability to integrate with Tiaki Wai data hosting platforms.

Given the rate of advancement and functionality in telecommunications technologies, the specific data communications platforms are not prescribed, other than a requirement for on property control panels to be upgradable and have an ability to accommodate a range of technologies. In this regard, on property control panels shall be future proofed.

Data communications and data hosting platforms shall be managed by Tiaki Wai and fall outside of the scope of this guide.

7.2 On property equipment

7.2.1 Pump and motor

The pump shall be an integrally designed submersible type with vertical rotor, motor driven and with a grinder mechanism, as shown in **Figure 3**. The following shall be provided for each pump installation.

- A grinder pump, either free standing or mounted on a purpose-made base and/or be guiderail mounted with rails. These shall be 316 stainless steel.
- Electrical quick disconnect rated to IP68 (to not be affected by condensation build-up within the collection tank).
- Pump shall be supplied with a suitable harness, chain or rope fixed to the pump and secured at the access opening.
- Discharge assembly and shut-off valve, anti-siphon valve and check valve assembly, electrical alarm assembly, and all necessary internal wiring and controls. Refer to **Section 8** standard drawing PSS05.

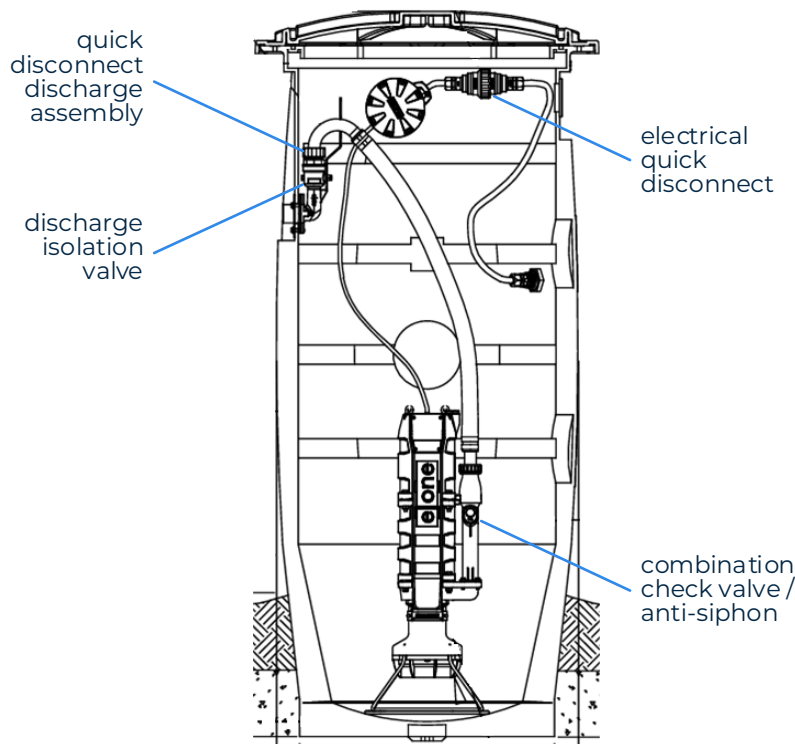


Figure 3: Example pump, collection tank and valves

The motor ingress protection shall be rated to IP68 or NEMA 6P submergence.

The pump shall have a predictable and constant flow rate across the required pressure head range, and shall comply with the following head and flow capabilities.

- A maximum flow rate of less than 1.25 l/s at zero head
- A minimum flow rate of greater than 0.4 l/s at 55 m head
- Rated for continuous operation at 55 m head
- An ability to operate intermittently at between 55 m and 80 m head. Intermittent running is expected to be on rare or unplanned occasions, for example, after prolonged power outages

The pump shall carry NSF/ANSI 46 certification. All model variations in the pump range shall also carry NSF/ANSI 46 certification, which demonstrate the pump's ability to handle potential in-service conditions.

The pump motor shall meet the following minimum requirements.

- Minimum 0.75 KW
- 240V 50 hertz, single phase

The pumps are intended to be incorporated into the residential power board. They must therefore be capable of being operated on single-phase power supply typical of a residential household, without the need to augment a standard residential power supply. Required power supply circuit shall be 20 amps or less.

Pumps shall have a minimum design life of 25 years.

Pump shall be of weight that can be handled safely by a single person. Alternatively, equipment shall be made available to facilitate the safe manual handling of pumps, as shown in **Figure 4**.

The installation and removal of the pump shall be possible without confined space entry requirements.



Figure 4: Example pump lifting device

7.2.2 Collection tank

The pump collection tank (see **Figure 5**) shall include the following.

- Casttight covers and venting via a separate vent
- Cleaning access, for example, ability to access bottom by vacuum hose
- Non-trafficable collection tanks shall be supplied with a waterproof polyethylene cover. The cover shall be securely fitted and bolted down or otherwise lockable with a padlock to prevent access from children and minors. It is recommended that lids shall have the provision for the fitment of a seal if required in the future
- Being sealed against ground water
- The collection tank shall be rotationally or injection-moulded, generally cylindrical in shape, polyethylene or Tiaki Wai approved alternative
- The use of a concrete collection tank is not recommended for non-trafficable installations, due to the risk of corrosion from retained sewage and limited ability to sufficiently slope the base for solids movement
- The use of a concrete collection tank is permitted where a trafficable installation is required
- The collection tank shall be of dimensions that provide for ease of installation and minimising cartage costs, while providing the minimum required wastewater storage volume
- The collection tank shall be designed assuming the ground water level is at ground surface. Provision of ribs or flanges shall be made for anchoring the collection tank with anti-buoyancy mass concrete ballast

- The collection tank shall be supplied with a sloping internal base towards the pump position, or otherwise designed to mobilise and entrain solids through the pump during pump operation
- The collection tank shall have all necessary penetrations moulded in and factory sealed
- The collection tank shall have design and manufacturing certification to AS/NZS 1546.1 for use in the sewer application, including the lid, access cover and riser if applicable
- The supplier shall state the design and recommend maximum vertical and horizontal loading rates on the collection tank

Installation requirements

- A sealed lid preventing the ingress of surface water, with venting via a separate high-level vent, or
- A self-venting type lid if inundation is not a risk, with venting through the polyethylene cover, or
- A suitably rated, trafficable cover where the collection tank is subject to traffic loads. The collection tank shall include inlet fittings that comply with standard drainage fitting dimensions that are readily available in New Zealand.
- The inlet pipe connection to the collection tank must be sealed to prevent ground water infiltration.
- Minimum 1 m horizontal and 1.8 m vertical clear area must be maintained around the lid of the collection tank.
- Geotextile filter fabric to be used around all pipe penetrations and, if needed, completely enveloping the backfill used in installation.
- Backfill shall be placed and compacted in accordance with the manufacturer's specifications.
- In areas predominated by native sand or silt, or areas mapped as having high or very high liquefaction risk (Greater Wellington Regional Council liquefaction potential mapping), the backfill shall be fully enclosed in geotextile to prevent migration of fines.

See **Section 8** standard drawing PSS05.



Figure 5: Typical pump collection tanks

7.2.3 Collection tank storage volume

The collection tank storage volume is the sum of the operational and emergency storage.

Operational storage is the volume between the “pump on” level and the “pump off” level, and the buffer storage up to the alarm level.

The emergency storage volume is the available volume of the collection tank, above the alarm level, and excluding unusable volume (dead space) at the top of the tank. The unusable volume is dictated by the lowest overflow point, such as gully trap levels.

The emergency storage requirement for a single residential dwelling is to provide a minimum volume equivalent to 24 hours of the normal dry weather design inflow that will enter the collection tank based on a daily loading rate of 420 L/property/day. This results in a minimum tank emergency storage volume of 420 L/tank.

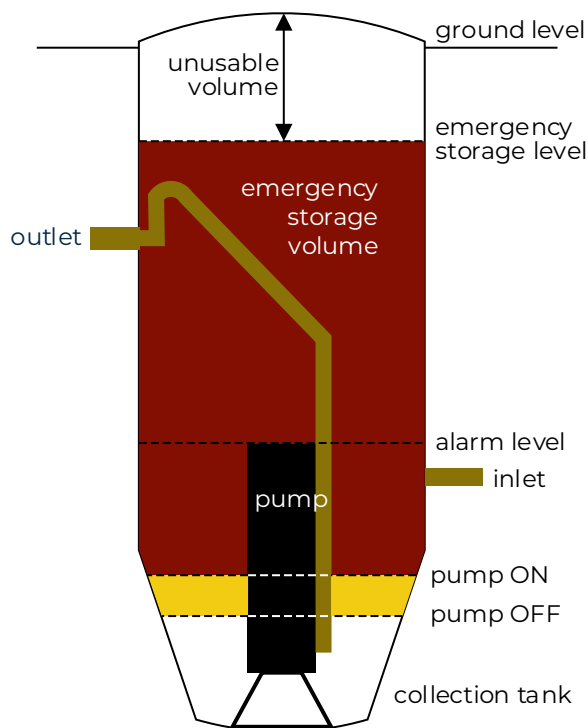


Figure 6: Collection tank levels – approximate only

Emergency storage requirements for properties other than single residential dwellings (including higher density residential) are to be based on 24 hrs of average dry weather flow. Non-residential (including commercial and industrial) storage volumes shall be reviewed by Tiaki Wai on a case-by-case basis.

7.2.4 Venting

Appropriate air venting shall be provided as part of collection tank design. The collection tank shall be vented above the system overflow level via an insect proof vent. The air vent shall be designed in such a way so as to prevent surface water ingress. Collection tanks located in flood plains, overland flow paths or any area where stormwater ingress may be possible shall be fitted with a watertight lid and separate vent pipe, routed to the building wall and up to a vent point above the existing roofline, in accordance with AS/NZS 3500.2.

7.2.5 Equipment location

Requirements for the location of equipment on private property are as follows.

- The pressure sewer collection tank shall be visible and accessible from the site access point.
- The tank shall have 1 m minimum clearance around the lid from boundaries, driveway (if using standard non-trafficable lid), building, fences, other services.
- The smart control panel shall be mounted on the dwelling a minimum of 1.2 m above ground level, visible and accessible from the driveway and collection tank, and where it cannot be fenced off. If on a side wall of the house, it must be no more than 300 mm from the front corner.
- The boundary kit box is to be located just outside the property boundary (in the berm) and connected to the collection tank via a 40 mm OD PE100 PN16 pressure sewer pipe. If the vehicle crossing is adjacent to or overlays the boundary kit box, a trafficable lid is required.

See **Section 8** standard drawing PSS05.

7.3 Electrical and controls

All electrical work shall comply with the latest electrical standards and requirements.

7.3.1 Pump controls

System controls located within the control cabinet shall include the following controls, as a minimum:

- pump/panel circuit breaker
- a switch with On/Off/Auto positions
- alarm and control components
- battery backup for alarms.

Installation must be in accordance with all applicable codes, regulations and manufacturer's requirements.

7.3.2 Pump and system protection

Pumps shall have the following pump protections:

- Pump run dry protection – (pump running continuously)
- High pressure – (pump operating at abnormally high wattage level)
- Thermal overload
- High voltage
- Low voltage (brown out).

7.3.3 Smart control panel

Refer to **Section 8** standard drawing PSS05.

Smart control panels (see **Figure 7**) allow for online network monitoring and remote operation by Tiaki Wai. A smart control shall have:

- individually fused circuits for alarm and pump
- pump/panel circuit breaker
- status LEDs: power, pump running, alarm(s)
- ability to operate as Manual; set to Auto; and to isolate
- terminal strip and ground lug for incoming connections
- pump fault diagnostic ability
- hours run meter and pump start counter
- electricity supply via an independent circuit from the house switch board.
- a 20 amp 'D' Curve circuit breaker is to be used for a one pump system.
- a lockable isolation switch is to be installed near the panel.
- 240 V +/- 10% to be provided to the Alarm Panel (216 V to 264 V).
- real time clock (date and time)
- programmable (variable stored volume and operating times), with pressure transducer
- data storage (minimum 2000 data point) including pump status and alarms
- ability to readily upgrade the communication system at later date, to be future proofed.
- an accessible box located a minimum of 1.2 m above ground level and kept clear of vegetation.

The two-way communications system enables Tiaki Wai to programme and/or remotely monitor and control the on-property pumping station.

The control panel shall be fitted with an alarm system. Alarm conditions may include an 'overflow imminent' condition combined with 'lost communications' and/or 'power outage'.

The following features shall be provided.

- A visual alarm, such as a flashing light that must be located so that it is visible to the property owner
- An audible alarm with a home-owner mute switch to silence the audible component of the alarm

The pump control panel enclosure shall be manufactured of a durable approved UV resistant material and be weatherproof to IP65 or better. The enclosure shall:

- include a hinged lockable cover to prevent unauthorised entry
- be connected to a circuit separate from the pump circuit
- be connected to a battery back-up to provide backup for alarm in case of mains power outages.



Figure 7: Example control panel

7.3.4 Electrical connection to the pump

Features of the electrical connection to the pump are:

- electrical conduits must not pass under structures
- flexible conduits are only allowed between the isolation switch and the control box
- power cable from box to ground must be on the outside wall of the building
- power cable(s) in 40 mm duct(s)
- electrical warning tape
- minimum depth is 450 mm, Maximum depth is 700 mm
- cable glands inside the collection tank with a 25/40 adapter outside
- pipe through uniseal or fitting
- care taken to not let moisture into the box.
- meet manufacturer installation requirements.

For electrical details refer to **Section 8** standard drawing PSS05.

7.4 Network

7.4.1 Pipe material

Pressure sewer pipe material shall be PE100, PN16 (SDR11) and coloured with a full red jacket.

Pipeline installation, and acceptance shall all be in accordance with the *Regional Standard for Water Services* (STD_0001) and *Regional Specification for Water Services* (STD_0002).

7.4.2 Pipe sizing

Pipe diameters of OD 50, 63, 75, 90, 110 and greater may be specified within the pressure sewer network, based on PE100 SDR11 PN16. The minimum on-property and service pipe size shall be OD 40.

The minimum pressure sewer main size shall be OD 50. Note that a pressure lateral connecting a boundary kit to a pressure sewer main shall be a minimum of OD 40. Sizing of pressure laterals connecting more than two boundary kits to a public main shall be by hydraulic design.

7.5 Joints and connections

Butt fusion welding shall be used for jointing PE pressure pipe OD 125 and greater.

PE100 SDR11 PN16 electrofusion socket couplers can be used to join PE pressure fittings and pipes less than OD 125, where required. Electrofusion socket couplers shall only be used to join pressure sewer mains of this size when welds must be completed in the trench - for example, to join pipe currently being laid to pipe previously laid. The number of joints on a sewer main should be minimised.

Approved axially restrained mechanical fittings may be used where electrofusion welding is not practical.

- Connection to a flange can be made by a PE100 SDR11 PN16 stub flange (with backing ring) that has been butt welded or electrofusion welded to the PE pipe.
- Connections to PE100 SDR11 PN16 pipes or fittings may be made by butt welding, if the diameter is suitable for this method.
- Connections to PE pipes or fittings may be made by electrofusion fittings, if connection by butt welding is not suitable or practicable.

Refer to **Section 8** standard drawing PSS06 and the *Regional Specification for Water Services* (STD_0002).

7.6 Valves and fittings

All valves and fittings shall be pressure rated to at least PN16 and be suitable for wastewater applications.

Isolating valves shall be anti-clockwise closing where possible and shall comply with the *Regional Specification for Water Services* (STD_0002).

7.6.1 Bends and tees

For laterals and small diameter mains, the preference is to use a long radius or swept bend constructed from a section of pipe. Two 45-degree bends may be used where required. 90-degree bends are not permitted on OD 40 and 50 sized pipes.

Note: This requirement is to avoid the risk of pipe blockages at abrupt bends in small diameter pipes. It is important to ensure the internal pipe ends are chamfered smoothly, and any ragged edges or burrs are removed to ensure there is no risk of fibrous ragging material catching and accumulating on burrs.

Pipeline bends, fittings, and tees shall be ductile-iron or PE in accordance with the *Regional Specification for Water Services* (STD_0002).

- Steel Cement line (STCL) can be used if ductile-iron or PE is not available.
- Moulded PE tees shall not be permitted.

7.6.2 Isolation valves

Isolation valves shall be installed such that no individual isolatable section of the pressure sewer network serves more than 50 connected properties. Additional isolation valves shall also be

provided on long or strategically important sections of main to enable practical isolation for maintenance and repair and to minimise the extent of network taken out of service.

Valve box covers shall be coloured red. Set out and construction detail requirements shall be as per the *Regional Specification for Water Services (STD_0002)*.

Additional Requirements

- Provide a DN 150 PVC pipe shroud to protect the valve spindle.
- The shroud length shall be to suit site conditions.
- Install a valve spindle extension of suitable length if needed and fixed directly to the valve spindle.
- Valves shall be tagged to indicate the closing direction and if normally shut or open.

Isolation valve boxes and surface reinstatement requirements are detailed in **Section 8** standard drawing PSS04.

7.6.3 Spindle cap

To differentiate wastewater valves from water valves, the valve spindle cap of triangular pattern shall be used, and a tag or other means used to clearly indicate closing direction, and the valve box lid shall be coloured red. See **Figure 8** and **Section 8** standard drawing PSS04.

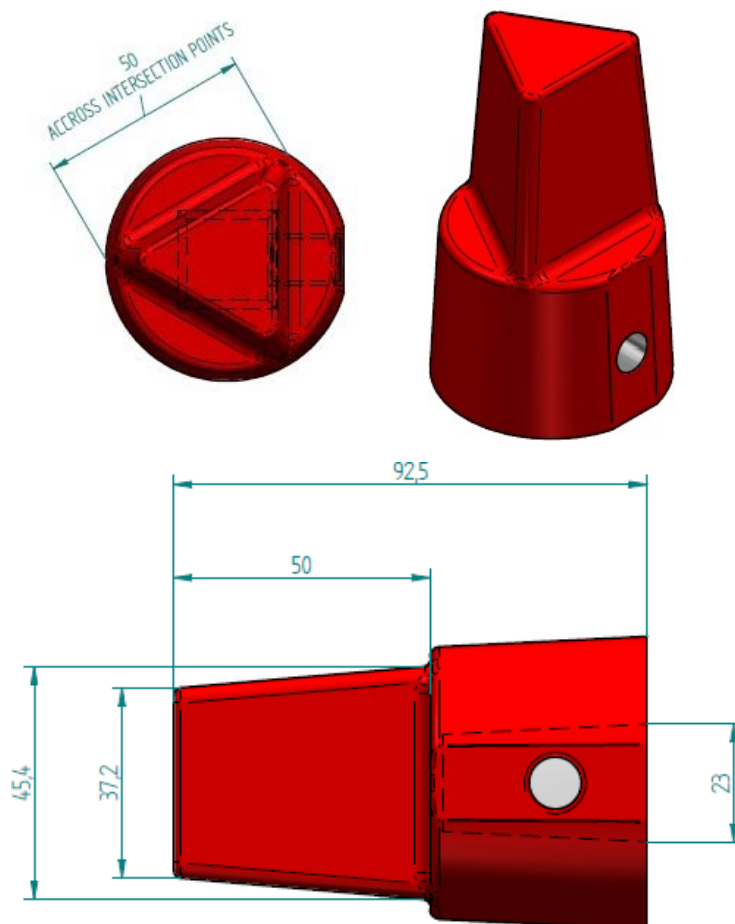


Figure 8: Triangular pressure sewer valve spindle cap

7.6.4 Air valves

The need for air valves shall be determined by design requirements. See **Section 6.3.3** (Air movement requirements).

Air valves (see **Figure 9**) must be specified for use in wastewater applications, be 50 mm NB (minimum), and shall be double acting.

Consideration shall be given to the head required to close an air valve for specific applications of air valves within the pressure sewer network. Air valves may weep wastewater if insufficient head is applied to the valve.

Water supply air valves are not acceptable as they rapidly block when passing sewage.

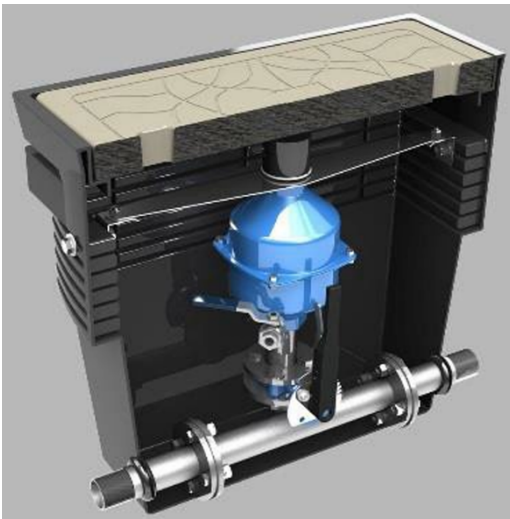


Figure 9: Typical air valve arrangement for a pressure sewer network

7.6.5 Flushing points

Refer to **Section 8** standard drawing PSS01.

The flushing point shall consist of:

- DN 50, Type 316 stainless steel manifold.
- Manifold secured with welded stainless steel brackets and stainless steel bolts.
- DN 50 stainless steel male camlock fitting.
- A precast concrete box with drain outlet and red cover shall be used. Epoxy mortar shall be used to surround the pipe at the opening.
- An upstream isolation valve, tagged to indicate closing direction and that the valve is normally closed.
- Flushing points are to be located in public road berm in proximity to the carriageway to allow tankers (6-wheel truck) suitable access.

Note: Suitable access within 10 m is required, to allow for loading or flushing with the use of lay flat hoses.

7.6.6 Boundary kits

Refer to **Section 8** standard drawing PSS02 and PSS03.

The boundary kit shall comprise the following.

- Isolation Valve (full bore or gate) - bronze (max zinc component 7%) or grade 316 stainless steel and pressure rated PN16
- Non-Return Valve with top access - bronze (max zinc component 7%) or grade 316 stainless steel and pressure rated PN16. The non-return valve shall be a swing check valve
- Flushing Tee - bronze (max zinc component 7%) or grade 316 stainless steel and pressure rated PN16
- All incidental fittings to be bronze (max zinc component 7%) or grade 316 stainless steel and pressure rated PN16

Boundary kits pipe diameters are to be sized to match the pump installation, for example, OD 40 for a single pump, OD 50 for a double pump.

7.6.7 Flow meters

A flow meter shall be installed at, or close to, the discharge of the pressure sewer system. The flow meter shall be specifically designed for wastewater applications. The flow meter may be mains or battery/solar powered and shall be equipped with a data link to Tiaki Wai systems. Specific data link requirements should be discussed with Tiaki Wai.

Monitoring frequency shall be at a minimum of every minute, but ideally every 10 seconds.

7.6.8 Pressure loggers

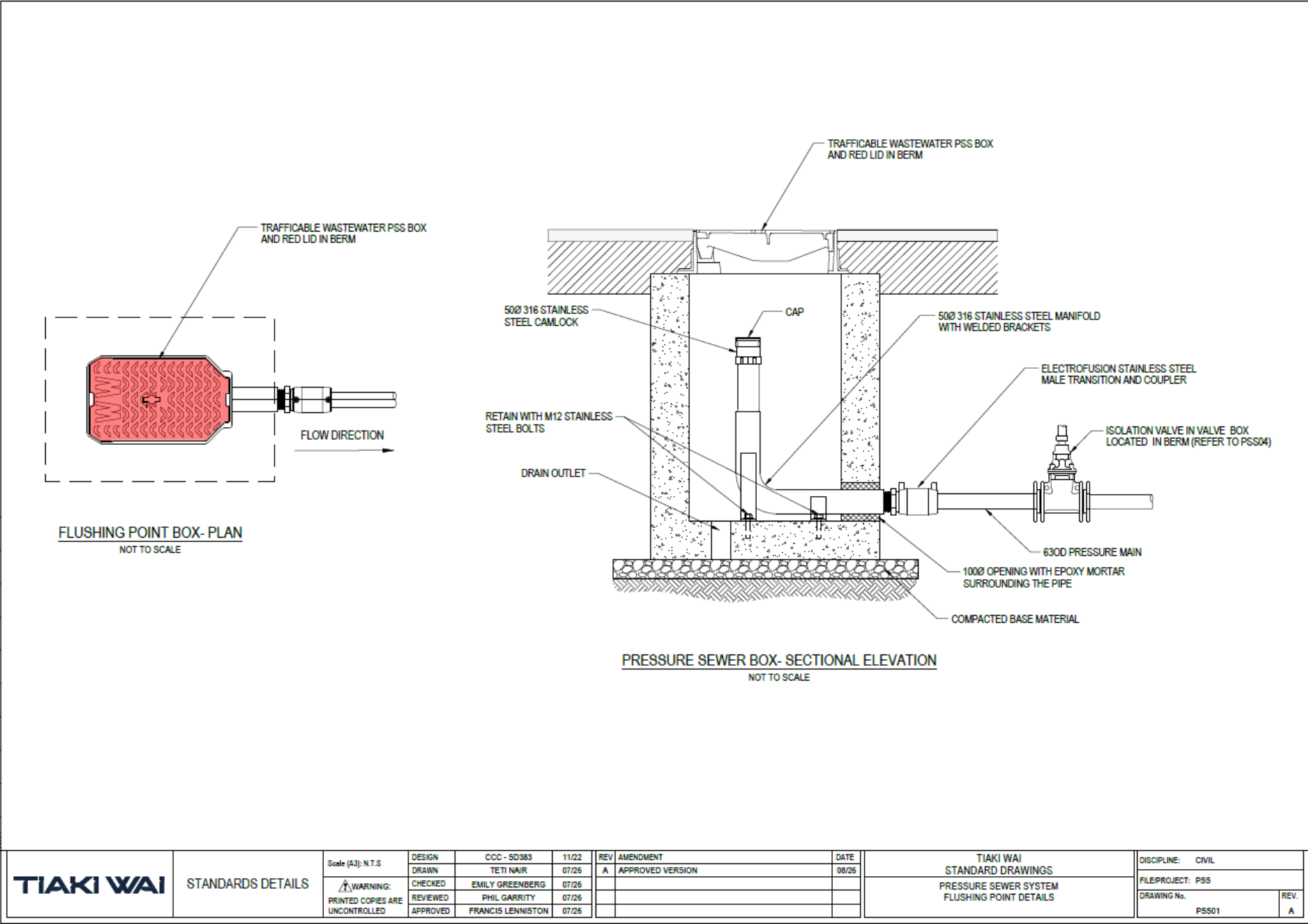
A pressure transducer shall be installed to allow pressures within the pressure sewer network to be monitored. The pressure transducer shall be located in the vicinity of the most hydraulically disadvantaged pump in the network. This is the location that is expected to experience the highest pressure in the network. The pressure sensors shall be equipped with a data link to Tiaki Wai systems. Specific data link requirements should be discussed with Tiaki Wai.

The pressure transducer shall be specifically designed for wastewater applications and may be mains or battery/solar powered.

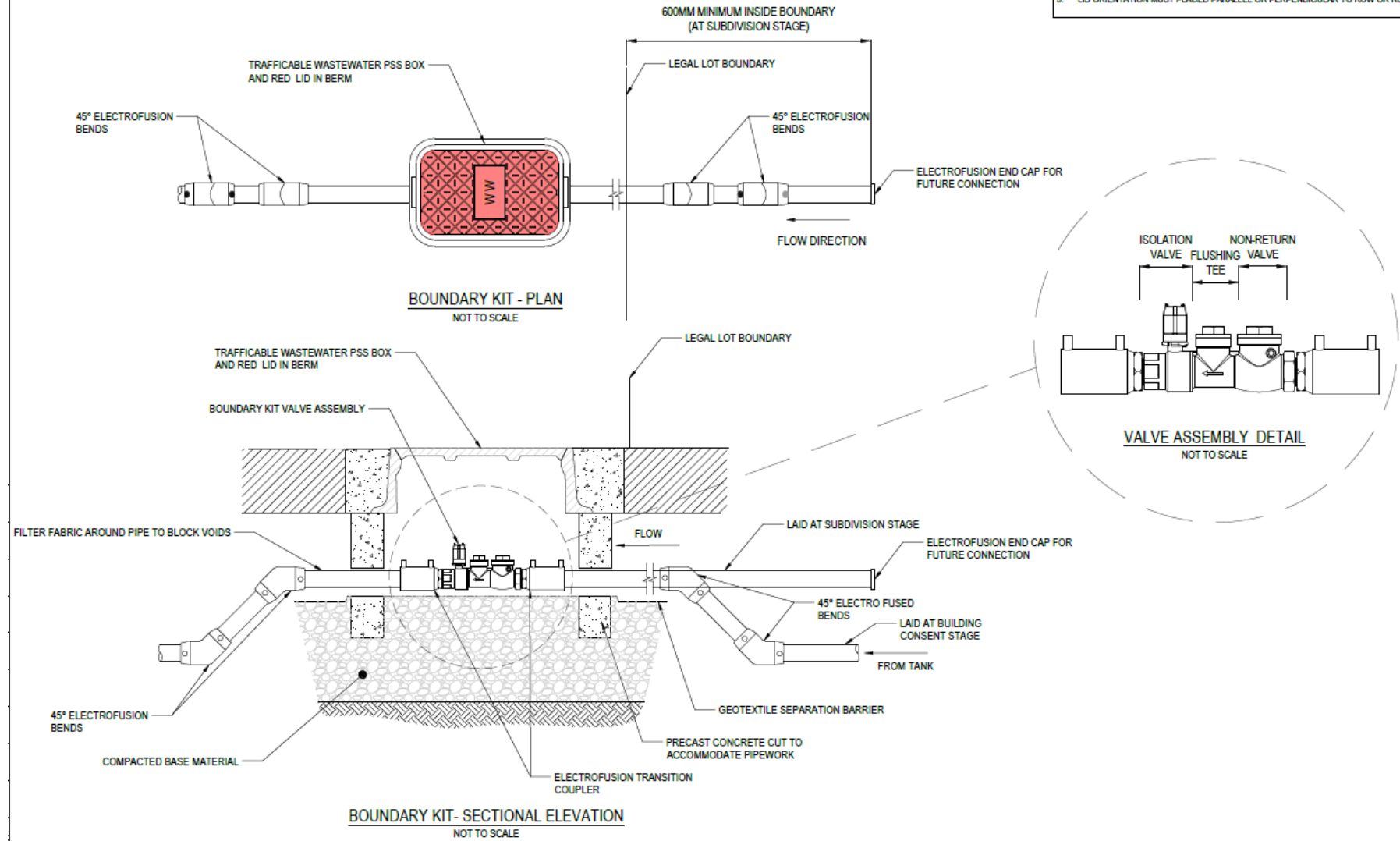
Monitoring frequency shall be at a maximum of every minute, but ideally every 10 seconds.

8 Standard drawings

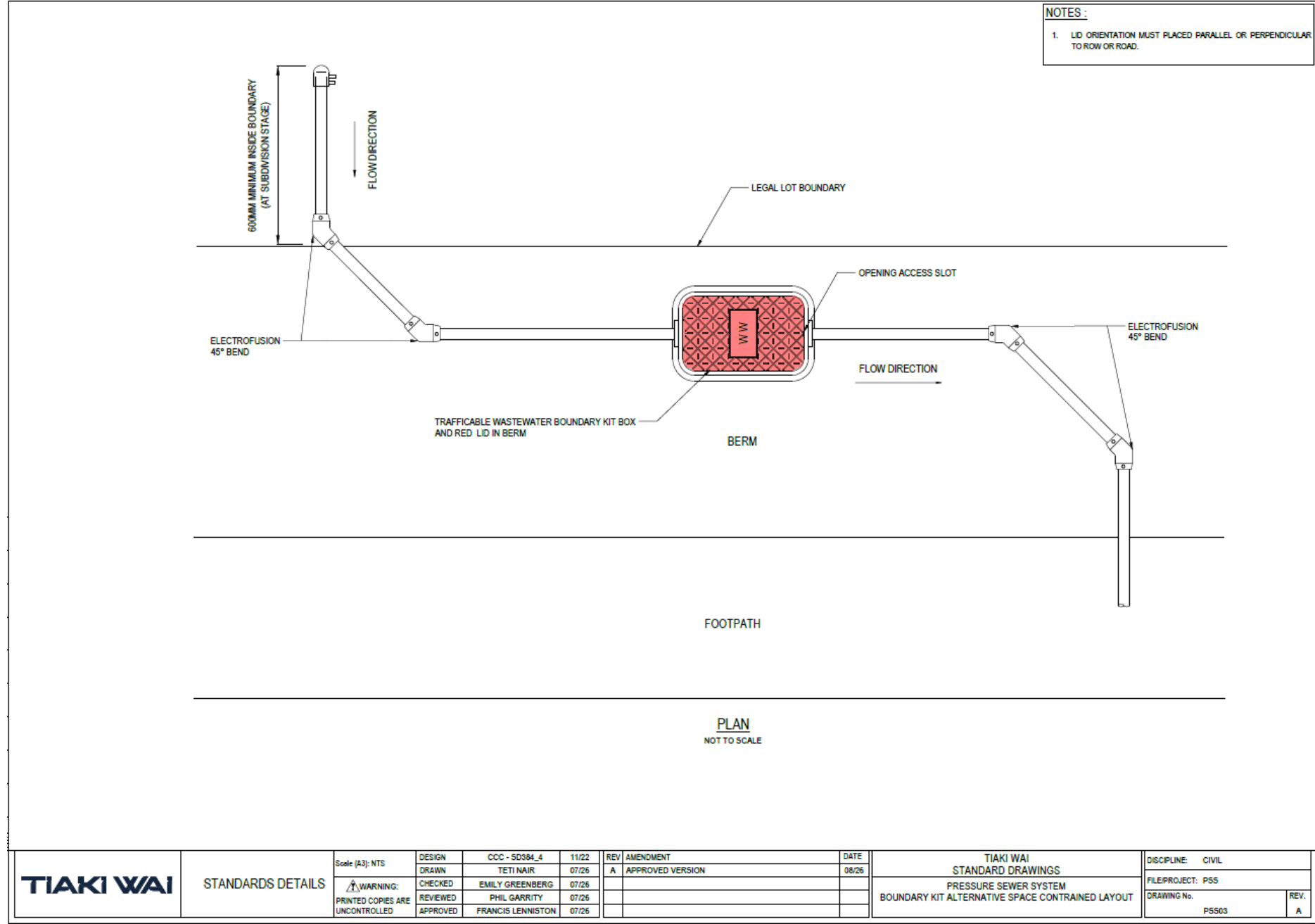
- PSS01 Pressure Sewer System Flushing Point Details
- PSS02 Pressure Sewer System Boundary Kit Details
- PSS03 Pressure Sewer System Boundary Kit Alternative Space Constrained Layout
- PSS04 Pressure Sewer System Isolation Valve
- PSS05 Pressure Sewer System Collection Tank Location and Electrical Configuration
- PSS06 Pressure Sewer System Reticulation Details

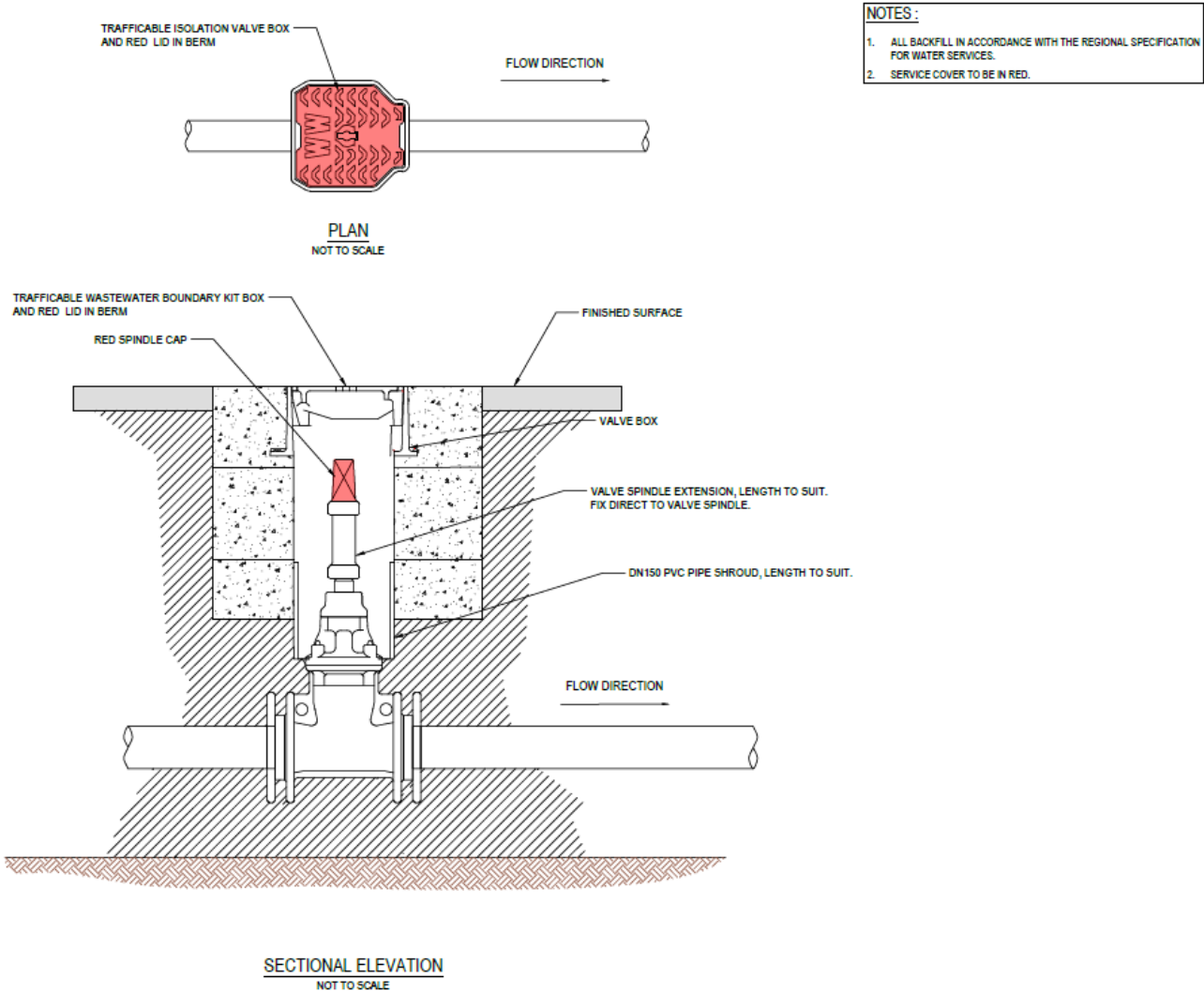


- NOTES:
- 1. VALVE ASSEMBLY TO BE AT CENTER OF BOUNDARY KIT.
 - 2. GEOTEXTILE AROUND ENTRY AND EXIT TO PREVENT AGGREGATE ENTERING.
 - 3. LID ORIENTATION MUST BE PLACED PARALLEL OR PERPENDICULAR TO ROW OR ROAD.



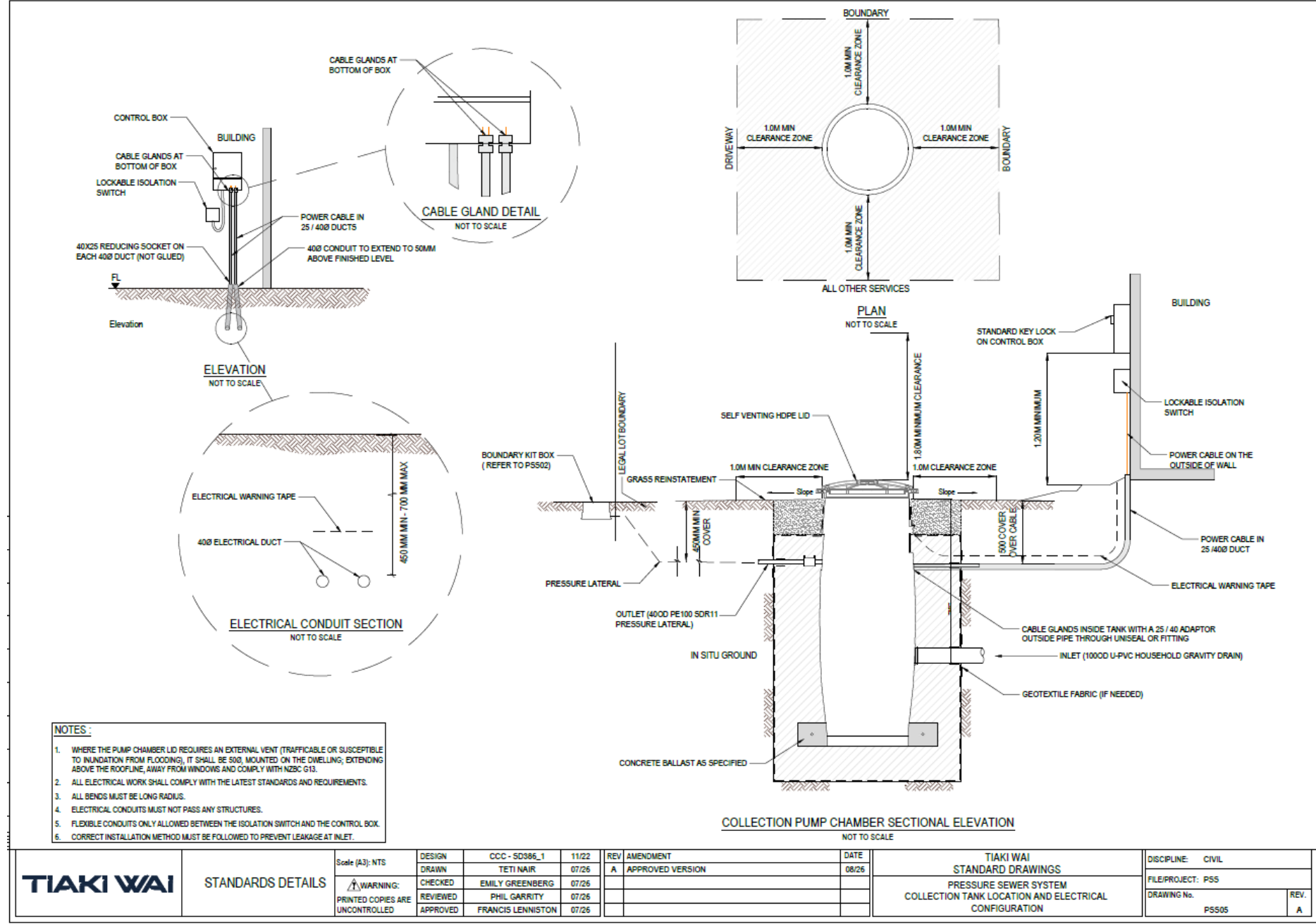
TIKI WAI	STANDARDS DETAILS	Scale (A3): NTS WARNING: PRINTED COPIES ARE UNCONTROLLED	DESIGN	CCC - SD384_1	11/22	REV	AMENDMENT	DATE	TIKI WAI STANDARD DRAWINGS PRESSURE SEWER SYSTEM BOUNDARY KIT DETAILS	DISCIPLINE: CIVIL	
			DRAWN	TETI NAIR	07/26	A	APPROVED VERSION	08/26		FILE/PROJECT: PSS	
			CHECKED	EMILY GREENBERG	07/26					DRAWING No.	
			REVIEWED	PHIL GARRITY	07/26					PSS02	
			APPROVED	FRANCIS LENNISTON	07/26					REV.	A



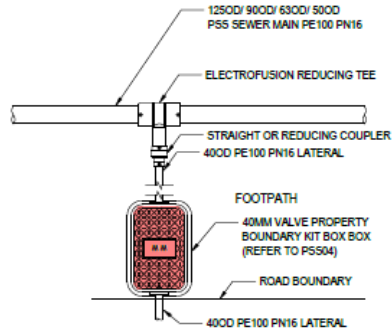


- NOTES:
1. ALL BACKFILL IN ACCORDANCE WITH THE REGIONAL SPECIFICATION FOR WATER SERVICES.
 2. SERVICE COVER TO BE IN RED.

TIAKI WAI	STANDARDS DETAILS	Scale (A3): NTS	DESIGN	CCC - SD385	11/22	REV	AMENDMENT	DATE	TIAKI WAI STANDARD DRAWINGS	DISCIPLINE: CIVIL
		WARNING: PRINTED COPIES ARE UNCONTROLLED	DRAWN	TETI NAIR	07/26	A	APPROVED VERSION	07/26		
			CHECKED	EMILY GREENBERG	07/26					
			REVIEWED	PHIL GARRITY	07/26					
			APPROVED	FRANCIS LENNISTON	07/26				PRESSURE SEWER SYSTEM ISOLATION VALVE	REV. A
									DRAWING No. P5504	

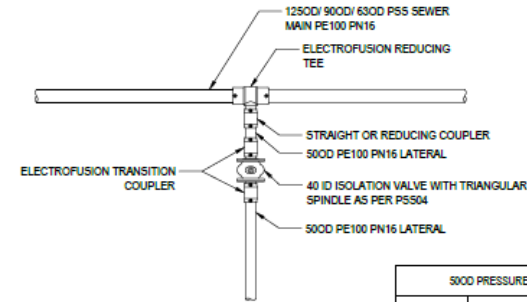


- NOTES:**
1. SADDLE JOINTS SHALL NOT BE USED ON PIPES THAT ARE SUPPLIED IN COLLS.
 2. NO BRASS FITTINGS ARE TO BE USED IN ANY PART OF A PRESSURE SEWER SYSTEM.



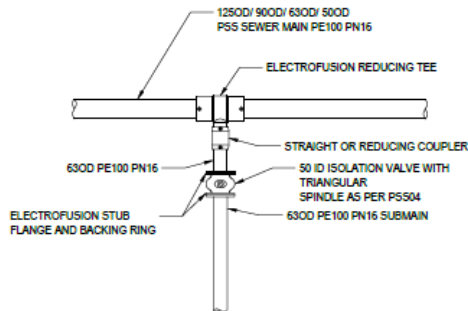
**PSS MAIN / 400D PSS DWELLING
CONNECTION DETAILS**
NOT TO SCALE

PE TEE AND REDUCER SUMMARY				
400D PRESSURE SEWER SYSTEM DWELLING CONNECTIONS				
MAIN	TEE	REDUCER	REDUCER	
1250D	125 / 90	+90 / 50	+50 / 40	
900D	90 / 50	+50 / 40		
630D	63 / 50	+50 / 40		



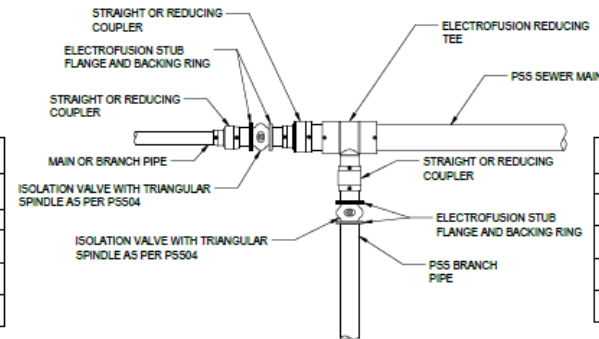
**PSS MAIN / 500D PSS SUBMAIN
CONNECTION DETAILS**
NOT TO SCALE

500D PRESSURE SEWER SYSTEM SUBMAIN CONNECTIONS				
MAIN	TEE	REDUCER	VALVE	
1250D	125 / 90	+90 / 50	+40 ID ISOLATION VALVE	
900D	90 / 50		+40 ID ISOLATION VALVE	
630D	63 / 50		+40 ID ISOLATION VALVE	



**PSS MAIN / 630D PSS SUBMAIN
CONNECTION DETAILS**
NOT TO SCALE

PE TEE AND REDUCER SUMMARY				
630D PRESSURE SEWER SYSTEMS SUBMAIN CONNECTIONS				
MAIN	TEE	REDUCER	VALVE	
1250D	125 / 90	+90 / 63	+50 ID ISOLATION VALVE	
900D	90 / 63	---	+50 ID ISOLATION VALVE	
630D	63 / 63	---	+50 ID ISOLATION VALVE	



**ISOLATION VALVE
CONNECTION DETAILS**
NOT TO SCALE

PE PIPE / VALVE SIZING	
PE PIPE	VALVE SIZE
1250D	100ID
900D	75ID
630D	50ID
500D	40ID

TIAKI WAI	STANDARD DETAILS	Scale (A3): NTS	DESIGN	CCC - SD387_18_2	11/22	REV	AMENDMENT	DATE	TIAKI WAI STANDARD DRAWINGS PRESSURE SEWER SYSTEM RETICULATION DETAILS	DISCIPLINE: CIVIL	
		WARNING: PRINTED COPIES ARE UNCONTROLLED	DRAWN	TETI NAIR	07/26	A	APPROVED VERSION	08/26		FILE/PROJECT: PSS	
			CHECKED	EMILY GREENBERG	07/26					DRAWING No.	
			REVIEWED	PHIL GARRITY	07/26					PSS06	
			APPROVED	FRANCI LENNISTON	07/26					REV.	A