Sydney WATER

Supplementary design guideline for sewer pressure mains

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Revision details

Version No.	Clause	Description of revision
1	All	New document

Introduction

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Acronyms

Acronym	Definition
ADWF	Average Dry Weather Flow
BOA	Building Over and Adjacent
CAC	Calcium Aluminate Cement
CCTV	Closed Circuit Television
EPA	Environmental Protection Agency
FMECA	Failure Modes, Effects and Criticality Analysis
H_2S	Hydrogen Sulphide
HGL	Hydraulic Grade Line
MH	Maintenance Hole
NRV	Non-Return Valve
PE	Polyethylene
PVC	Polyvinyl Chloride
SPS	Sewage Pumping Station

References

Document ID	Title
CPDMS0023	Sydney Water Technical Specification – Civil
D0000653	Sydney Water Safety in Design Procedure
D0001738	Sydney Water Deviation from Standards Procedure
WSA 03	Water Supply Code of Australia (Sydney Water Edition)
WSA 04	Sewage Pumping Station Code of Australia (Sydney Water Edition)

1. Introduction

1.1 Purpose

This guideline has been prepared for use by planners and designers undertaking planning and design of sewer pressure mains (also known as rising mains) for Sydney Water.

The document provides additional requirements and guidance to supplement other standards and specifications including the Sydney Water Technical Specification – Civil and the Sewage Pumping Station Code of Australia, Sydney Water Edition (WSA 04).

This supplementary guidance is intended to be incorporated into the next Sydney Water edition of WSA 04, at which point this document would be withdrawn.

The guideline has been developed to address identified vulnerabilities with sewer pressure mains, including lessons learned from recent pressure main failure incidents and outcomes from environmental audits. It is aimed at reducing the risks associated with pressure main failures, while balancing performance and cost to ensure value for money for Sydney Water and our customers. Where practical, performance-based requirements and guidance have been nominated to provide flexibility for planners and designers to develop cost-effective solutions.

1.2 Scope

This guideline is aimed at improving resilience for new sewer pressure mains. While there may be some relevance to existing pressure mains, this document is not intended to be directly used as a basis to recommend upgrades to existing assets.

The requirements and guidance are broadly grouped into the following categories:

- Redundancy and duplication
- Pipeline alignment and installation treatments
- Pipeline materials
- Valves and appurtenances
- Operations and maintenance planning
- Internal access for maintenance

1.3 Structure and interpretation

Sections 3 through 8 of this document outline the planning and design requirements and guidance for each category listed in Section 1.2.

Each of these sections begins with a subsection providing context for the relevant category to help the user understand the basis for the requirements and guidance, and the background for the relevant aspect of pressure main planning and design.

The next subsection lists out the requirements and guidance. Each item is identified with a letter, formatted in bold, and classified as either a **requirement** or a **guidance note**.

Requirements are mandatory and must be followed for all new pressure main projects after the publication of this document. Where it is not practical to comply with these requirements, the Deviation from Standards Procedure must be followed.

Guidance notes are recommendations (i.e. not mandatory) that inform planners and designers on best practices, but also allow flexibility based on project specific needs. They must be considered during planning and design in consultation with key stakeholders. Where they are not followed, the planner and/or designer must provide justification for their decisions in the planning documentation and/or design report (similar to other key planning/design decisions). No approval or other formal process is necessary where a guidance note is not followed.

Each item also includes an explanatory statement to help the user understand the specific intent and basis for that requirement or guidance note. The explanatory statements are included for information and generally do not impose new obligations for planners and designers, though in some cases they provide additional guidance or clarify expectations.

2. Characteristics of sewer pressure mains

2.1 General

The following section outlines some of the key characteristics of sewer pressure mains and provides high level guidance on the maintenance activities that must be considered as part of planning and design. This is not intended to be an exhaustive checklist, and planners and designers must use their professional judgment and competence to ensure that their work delivers assets that are fit for purpose.

The fundamental purpose of a sewer pressure main is to transfer pumped sewage flows from a sewage pumping station (SPS) to a discharge point into the receiving system, such as a discharge maintenance hole or treatment plant. Pressure mains are typically designed to be capable of conveying the full SPS design flow without experiencing excessive velocities or pressures (including during transient events).

2.2 Pressure main valves, appurtenances and other ancillary items

Pressure mains generally include some or all of the following ancillary items to enable safe and effective operation and maintenance:

- Air valves to facilitate expulsion of air during filling, admission of air during scouring, and release of air that has accumulated in the main during normal operation. Air valves may also allow admission of air during transient events to attenuate transient pressure spikes, though Sydney Water does not allow the use of air valves as the primary means of pressure relief. Air valves are typically installed at local high points.
- Scour valves to facilitate draining of the pressure main for maintenance purposes. Scour valves either allow the pressure main to drain under gravity to a nearby sewer or facilitate connection of a temporary pump for transfer to a nearby sewer or tanker. Scour valves are typically installed at local low points
- Stop valves to divide large diameter and/or long pressure mains into sections for safe and effective inspection and maintenance. Stop valves are only installed where there is a specific need and are not present on all pressure mains, though they are typically installed on the SPS discharge pipework.
- Non-return valves (NRVs) to prevent reverse flow under specific conditions when deemed necessary. NRVs are typically installed on the SPS discharge pipework and are rarely installed at other locations along a pressure main.
- Discharge maintenance holes (MHs) where the pressure main discharges sewage to the receiving system. Discharge MHs are the downstream end of the pressure main and are typically present for all pressure mains except those which discharge directly to a treatment plant inlet works. Discharge MHs include induct and educt vents to manage air displacement and corrosion risks.
- Pigging facilities, jetting points, and access points to allow cleaning and internal inspection of pressure mains where necessary (e.g. where the risk of sedimentation cannot be effectively controlled through design).
- Barometric loops to create an artificial high point to improve hydraulic performance. This is achieved by elevating the discharge point to keep the HGL above the pressure main for its entire length in order to maintain full pipe flow and provide adequate sealing pressure at air valves. This can also be achieved through the use of control valves, but this adds operational complexity.

Figure 1 shows a conceptual long section of a pressure main (adapted from WSA 04) with some of the above ancillary items (including a non-return valve and stop valve within the valve chamber at the SPS).

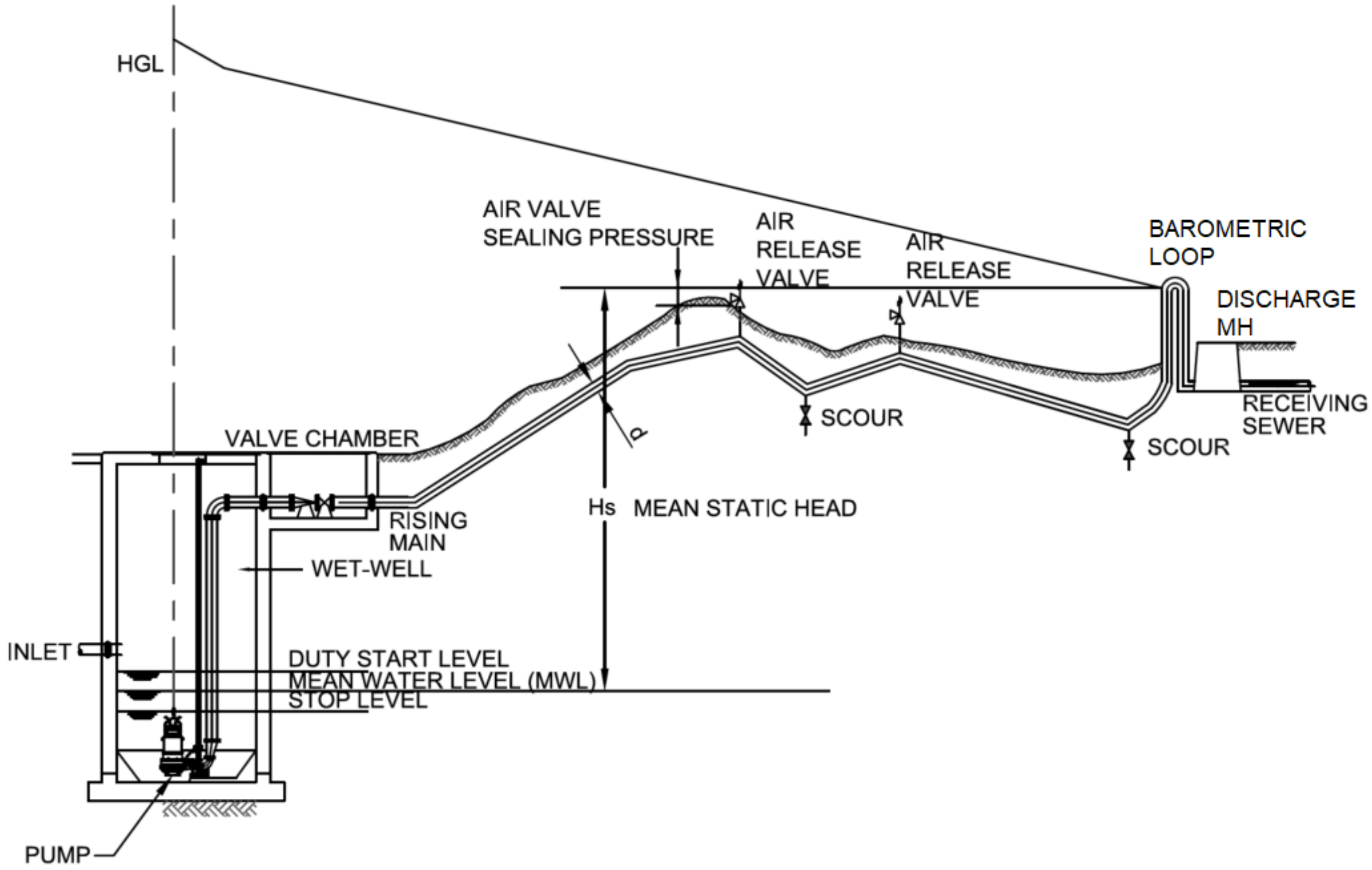

Figure 1 Conceptual long section of a pressure main

2.3 Operation and maintenance of pressure mains

Pressure mains are complex assets that operate in aggressive environments, and therefore inspection and maintenance of these assets is critical to ensure their effective operation for the length of their service life. Inspection and maintenance of pressure mains must be considered during the planning and design of these assets to confirm that anticipated inspection and maintenance activities can be carried out safely and effectively when necessary.

Some common maintenance activities for pressure mains are listed below, however not all activities will be relevant for all pressure mains depending on characteristics such as their design flow/velocity, diameter, length, location, material, etc. Some activities may require the pressure main to be isolated and drained.

- Valve maintenance (e.g. exercising stop valves, inspecting air valves, etc.)
- Internal cleaning and clearing of debris/blockages (e.g. jetting or pigging)
- External condition assessment (e.g. pipe scanning)
- Internal condition assessment (e.g. CCTV/robotic inspection or deployment of leak detection probes)
- Response to leakage or breaks (including shutdown/isolation of damaged pressure main, management of SPS inflows, and repair/reinstatement activities)

2.4 Pressure main risks and vulnerabilities

Pressure main failures typically occur due to one (or more) of the following:

- Internal corrosion and/or abrasion
- External corrosion
- Material and/or construction defects
- Mechanical damage (e.g. directly by third parties or due to settlement and ground movement)
- Excessively high or low pressures during transient events

Pressure main failures typically result in the discharge of raw sewage to the environment. The magnitude of the discharge (and the associated consequence of failure) depends on a range of factors including the diameter and flow of the pressure main, the location of the failure, and whether the failure can be effectively and efficiently repaired to return the pressure main to service. In situations where repairs are problematic and there are difficulties in managing inflows to the SPS, large volumes of raw sewage may be discharged to the environment which can result in environmental harm, public health impacts, regulatory (EPA) sanctions/prosecutions, reputational damage, and financial costs.

To mitigate the risks associated with pressure main failure, SPSs are generally equipped with emergency storage structures to supplement available storage in the upstream network and provide a total storage volume equivalent to the maximum inflow the SPS is capable of receiving in dry weather during a 4 hour period. This storage allows some time to carry out operations and maintenance activities or undertake repairs without SPS inflows discharging to the environment, however this is often insufficient to respond to significant pressure main failures.

It should be noted that WSA 04 (Section 2.4) states that “Pumping stations, pressure mains and associated works shall be designed to … incorporate redundancy so that failure of any one item does not cause total station failure”, however in many cases pressure mains represent a single point of failure without redundancy. Pressure main redundancy is explored further in Section 3.

3. Redundancy and duplication

3.1 Context

In contrast to SPSs which are typically equipped with redundancy measures such as duty/standby pumps, emergency storage, and back-up power supply, pressure mains are often a single point of failure without redundancy. In the case of failure of a single pressure main, the only available contingency plans are to manage inflows at the SPS via tankering (transfer of sewage from the SPS into tankers for vehicular transport to a suitable discharge point) and/or make use of available emergency storage (at the SPS and/or in the upstream network). As a general rule of thumb, tankering is feasible for SPSs with an inflow of ADWF ≤ 30L/s, and beyond this threshold tankering is insufficient to manage dry weather inflows so other redundancy measures must be considered. This upper limit is based on Sydney Water's operational experience and the practical considerations of tankering operations, including mobilisation and deployment of tankers, constraints on tanker vehicle movements (at the tankering location and surrounding public roads), and the activities/time necessary for tanker connections and changeovers. For context, approximately 90% of Sydney Water's existing ~700 SPSs have an inflow of ADWF ≤ 30L/s, indicating that tankering is generally a feasible option for the vast majority of cases.

3.2 Requirements and guidance

Planners and designers must implement the following requirements and consider the following guidance notes related to redundancy and duplication:

a) **Requirement: Contingency plans for pressure main unavailability must be developed as part of the planning and design process for new SPSs and SPS upgrades involving significant increases to design flow. The contingency plan must be capable of managing ultimate ADWF sewage inflows to the SPS (without discharge to the environment) for the length of time necessary to return the pressure main to service. Delivery of infrastructure provided to support the contingency plan may be staged in line with staging of the SPS.**

Contingency planning for pressure main unavailability (e.g. failure or condition assessment and maintenance) is often an afterthought, which eliminates the opportunity to amend the design (e.g. SPS site layout) to facilitate more effective, efficient, and safe response to failure events or maintenance requirements. Developing these plans as part of the planning and design process means that contingency planning can be integrated into the design.

In the context of this requirement, "SPS upgrades involving significant increases to design flow" refers to SPS upgrade projects which include increases to pumping capacity as a primary objective (e.g. growth projects). It does not include projects where there is an incidental increase to pumping capacity (e.g. due to replacement of obsolete pumps as part of an SPS renewal). There is no specific threshold value at which an increase to design flow would be considered "significant", as this classification is based on the project objectives.

A contingency plan for pressure main unavailability should outline the following:

- The proposed methodology (or methodologies) for managing inflows to the SPS (without discharge to the environment), starting from isolation of the pressure main and implementation of the contingency through to reinstatement of normal operation
- Details of any infrastructure provided (at the SPS or any other locations) to facilitate the contingency plan

- The type and number of any resources and equipment that must be deployed to implement the contingency plan
- The maximum duration for which the contingency plan can be reasonably relied upon

The length of time for which the pressure main is anticipated to be unavailable is a key consideration in developing the contingency plan. Preventative maintenance activities, such as jetting or internal condition assessment, typically require the pressure main to be offline for no more than 8 hours (and often significantly less). Reinstatement of a failed pressure main however, typically takes upwards of 24 hours and can be significantly longer if the pressure main is inaccessible (e.g. under a waterway) or if there are other complicating factors. Where access to the pressure main for repair is difficult and/or time consuming, this must be considered in the development of the contingency plan, which may lead to additional contingency measures such as partial duplication of pressure mains in inaccessible locations only.

Forecast growth in the SPS catchment and any planned staged upgrades to the SPS should be considered when developing the contingency plan to ensure that there will be a feasible pathway to developing contingency plans for the upgraded SPS in future and that infrastructure to support the contingency plan is appropriately staged.

It should be noted that in the event of a pressure main failure, discharge to the environment is almost inevitable at the location of the failure, from the time the failure occurs until the pressure main is isolated. This is outside the scope of the contingency plan, since the contingency plan starts with isolation of the pressure main.

b) **Guidance note: For SPSs with ADWF ≤ 30L/s, a desktop investigation should be undertaken to confirm the feasibility of tankering at the SPS to serve as a contingency plan (as outlined in item (a) above). Where this is confirmed (with input from Sydney Water operations and maintenance representatives), tankering may be relied upon for the contingency plan.**

Tankering at the SPS is generally considered feasible for SPSs with ADWF ≤ 30L/s, however difficulties implementing tankering have been observed at SPSs with lower inflows due to issues with location, layout, and accessibility. Consequently, the feasibility of tankering must be validated as part of developing the contingency plan, particularly for SPSs approaching the upper limit of inflow. This will generally involve confirming that there is suitable access (both within the SPS site and neighbouring roads) to accommodate the tanker movements necessary to manage SPS ADWF inflows, that a suitable discharge location is available near the SPS, and that the necessary number of tankers can be deployed to the SPS location when required. There may also be other aspects of tankering operations that require consideration for a particular site (such as the available emergency storage volume), which would be determined in consultation with Sydney Water operations and maintenance representatives.

c) **Guidance note: For SPSs with ADWF > 30L/s, one or more of the following options should be used to provide redundancy for pressure main failures (unless other preferable options are identified):**

   i. **Secondary tankering location in the network upstream of the SPS, subject to validation by desktop assessment**

Where practical, tankering from an additional location in the upstream network (in addition to tankering at the SPS) can be used to manage inflows to SPSs with ADWF > 30L/s. This is dependent on identifying a suitable location for secondary tankering, considering location, accessibility, system hydraulics, etc., and may require the construction of additional infrastructure at this location to facilitate tankering activities. The feasibility of this option should be determined in consultation with Sydney Water operations representatives.

ii. Transfer of SPS inflows to adjacent sewer network or interconnection with other systems

Where practical, transfer of SPS inflows into an adjacent sewer network via a separate pressure main or connection to another pressure main (from another SPS) may be considered as a cost-effective alternative to duplication of the primary pressure main. This is unlikely to be a realistic option in many scenarios but nonetheless warrants consideration. Where transfer via a separate pressure main is proposed, the secondary pressure main must be designed with the same level of detail as expected for the primary pressure main (including consideration of the impact of discharge on the receiving sewer network). Where interconnection with another pressure main is proposed, a hydraulic assessment must be carried out to confirm that flows can be diverted through this pressure main if necessary.

iii. Pressure main duplication

Where there is no other feasible way to manage SPS inflows in the event of pressure main unavailability, duplication of the primary pressure main should be considered. Refer item (d) for more information on this option.

Duplication of the full pressure main length generally provides the most effective and reliable redundancy, however there may be cases where duplication of discrete sections of the pressure main (e.g. inaccessible sections beneath waterways, railways, or major roads) is more appropriate. Where partial duplication is proposed, the contingency plan must still address the scenario where a section of single pressure main (i.e. without duplication) is unavailable.

d) Where pressure main duplication is deemed necessary:

i. Guidance note: Dual pressure mains should ideally be the same size and be capable of conveying the full SPS design flow independently. Where this approach is adopted, the impact on hydraulic retention time must be evaluated to determine any increased risk of odour and septicity.

This approach provides full redundancy and greater operational flexibility than other configurations. However, in some cases this approach may be deemed impractical, undesirable, or uneconomic, in which case the pressure main sizing may be optimised through FMECA and value engineering exercises. Where full redundancy is provided, retention time for sewage within the pressure main is approximately doubled, which can have implications for odour and septicity that must be evaluated.

ii. Requirement: As a minimum, each pressure main must be capable of operating with any duty pumps and conveying at least half of the SPS design flow.

Where the sizing of dual pressure mains is optimised, each pressure main must be capable of operating with any duty pumps to provide operational flexibility in the event of either pressure main being offline or unavailable. Each pressure main must also be capable of conveying at least half of the SPS design flow, which will ensure that there is sufficient capacity to manage dry weather inflows (with some allowance for wet weather) using only one pressure main.

iii. **Guidance note: Dual pressure mains should be designed so that both mains are used approximately equally during normal operation (e.g. operated on alternating pump cycles or in parallel).**

This approach reduces the risk of stagnant sewage in either pressure main and ensures that both mains are available for use if needed with minimal manual intervention. The specific operational philosophy should be determined in consultation with Sydney Water, noting that the approach outlined in this guidance note may not be achievable in some cases (e.g. due to constraints on an existing site).

iv. **Requirement: Cross connections must be provided between dual pressure mains at a maximum spacing of 2000m. Cross connecting valves must be normally closed.**

Cross connection valves provide operational flexibility and enable efficient response to leakage or breaks. Their inclusion allows discrete sections of each pressure main to be taken offline (e.g. for maintenance or repair) without the need to isolate and/or drain the entire pressure main.

e) **Guidance note: Where a new pressure main is being constructed for an existing SPS, relining of the existing pressure main should be considered as a cost-effective way to provide redundancy for the new pressure main.**

While the feasibility of this option is dependent on the condition of the existing pressure main and its suitability for relining, it presents a low-cost opportunity to provide increased redundancy for existing SPSs, particularly where they do not already have effective contingency plans in place. The decision on whether to retain and reline the existing pressure main (and the justification for this decision) should be documented as part of the project scoping.

4. Pipeline alignment and installation treatments

4.1 Context

The vertical alignment of a sewer pressure main is an important aspect of planning and design which significantly affects the performance and reliability of the system. Poor vertical alignment design can result in hydraulic performance issues, odour issues, corrosion due to formation of air pockets, collection of sediment at low points, and excessive numbers of air valves and scours. These can in turn lead to reliability issues, community complaints, pressure main failures, and increased maintenance burden.

The installation treatments used for pressure mains have a significant impact on their robustness and the likelihood of being damaged. Pipelines are typically installed in a trench surrounded by suitably compacted embedment materials to provide support to the pipe. However, in some cases it may be appropriate to use more robust installation treatments (such as stabilised sand embedment or concrete encasement) to reduce the likelihood of maintenance being required or of damage by third parties.

4.2 Requirements and guidance

Planners and designers must implement the following requirements and consider the following guidance notes related to vertical alignment and installation treatments:

a) **Guidance note: Wherever practical, pressure mains should rise continuously from the SPS to the discharge location. Where this is not practical, the vertical alignment must be optimised to limit the number of intermediate high and low points.**

   Limiting the number of intermediate high and low points (or avoiding them entirely) minimises the number of air valves and scours (and reduces the associated maintenance burden). This also reduces the potential for formation of air pockets (which can lead to corrosion and odour issues) and collection of sediment (which can impact hydraulic performance of the pressure main and cause erosion of the pipe interior).

b) **Guidance note: Design grades for pressure mains should be selected considering the tolerances associated with the proposed construction methodology, to minimise the likelihood of creating unintended localised high and low points during construction.**

   Unintended localised high and low points can be created during pipeline installation if the design grade of the pressure main is flatter than can be reliably met by the construction methodology. Designers should seek constructability advice to ensure that their specified design grades are achievable for the anticipated installation techniques without creating accidental negative grades or undulations.

c) **Requirement: Pressure main installations must meet the minimum required installation treatments for water mains as outlined in section SW 7.12 of WSA 03 (SW Edition).**

   The aforementioned section in WSA 03 (Water Supply Code) outlines minimum required installation treatments for water mains depending on the risk level. Descriptions for each risk level are included therein, and predominantly relate to location, depth, and site characteristics. Although this section was developed for application to water mains, the same principles apply to sewer pressure mains.

d) **Requirement: A minimum vertical clearance of 300mm (preferably greater where practical) must be provided to any other services, unless a higher clearance is specified in WSA 04.**

The minimum vertical clearance specified in the current SW Edition of WSA 04 can be as little as 150mm depending on the other service, which is considered too low to appropriately mitigate the risk of third party damage to pressure mains during work on adjacent services. Increasing these clearances provides a greater buffer against accidental damage and aligns with the requirements of Sydney Water's BOA guidelines.

5. Pipeline materials

5.1 Context

Historically, pressure mains have generally been constructed with metallic pipeline materials, including cast iron, ductile iron, and mild steel. With the exception of some older cast iron mains, these metallic pipelines are typically cement lined. Common failure modes for metallic cement lined pipes include obvert corrosion due to H_2S attack, invert scouring due to corrosion and abrasion, and external corrosion due to soil aggressivity. Metallic pipelines make up the vast majority of Sydney Water's existing pressure main asset base.

In the past 20-30 years, there has been a shift towards polymeric pipeline materials, including polyethylene (PE) and polyvinyl chloride (PVC), as these materials have inherent advantages owing to their resistance to corrosion and abrasion. The majority of new pressure main installations use polymeric materials (primarily polyethylene).

5.2 Requirements and guidance

Planners and designers must implement the following requirements and consider the following guidance notes related to pipeline materials:

a) **Requirement: Where a pressure main has an undulating vertical alignment, cement lined pipes (other than pipes lined with calcium aluminate cement/CAC) must not be used at or near high points or other locations where air and sewage gas pockets may be present during normal operation.**

   Intermediate high points along pressure mains resulting from undulating vertical alignments can lead to the formation of air pockets which then create an environment conducive to H_2S attack. H_2S attack is a significant issue for cementitious materials and consequently cement lined pipes must not be used in these scenarios. Calcium aluminate cement is permitted as an alternative to standard cement linings due to its significantly greater resistance to corrosion.

b) **Guidance note: Where the SPS, or any upstream SPS, uses chemical dosing, cement lined pipes (including calcium aluminate cement/CAC) should not be used.**

   Recent research undertaken by Sydney Water and academic partners has identified chemical dosing as a key contributor to invert scouring of pressure mains through chemical and abrasive deterioration of the cement lining. This failure mode has only been observed with cement lined pipes and consequently cement lined pipes should not be used in these scenarios.

c) **Guidance note: Polyethylene (PE) should be considered as a first preference for all new pressure mains, noting that there may be site specific characteristics that support the use of other materials.**

   Polyethylene exhibits greater chemical and abrasion resistance than cement lined pipes and also attenuates transient pressures, making it well suited for pressure main applications. It should be considered as a first preference, however other materials may be used where polyethylene is not suitable (e.g. where there is a risk of hydrocarbon contaminated soil) or where another material is considered more suitable for project/site specific reasons.

6. Valves and appurtenances

6.1 Context

Valves and appurtenances play an important role in the operation and maintenance of pressure mains. As outlined in Section 2, pressure mains generally include some combination of air valves, scour valves, stop valves, and non-return valves, each of which serve a different purpose. The design of pressure main valves and appurtenances (including the location, spacing, and configuration) must consider the operational and maintenance scenarios under which they will be used to ensure that they perform as intended when required.

6.2 Requirements and guidance

Planners and designers must implement the following requirements and consider the following guidance notes related to valves and appurtenances:

a) **Requirement: Stop valves must be included on long pressure mains to facilitate isolation and draining of sections of the main where it is impractical to isolate and drain the entire main if necessary. The need for stop valves, as well as the spacing and location if deemed necessary, must be determined in consultation with Sydney Water operations representatives.**

   Stop valves enable isolation of discrete sections of pressure main. This is useful when a section of pressure main must be drained for maintenance as it reduces the volume that must be drained. It is also useful when a section of pressure main is damaged or leaking, as the impacted section can be isolated for repair without the need to isolate and drain the entire main. Stop valves on pressure mains should only be used where it is deemed impractical to isolate and drain the entire main when necessary. This determination must be made in consultation with Sydney Water operations representatives. Note that stop valves are also used in other applications such as isolating air valves from the pressure main for maintenance, but this requirement only relates to stop valves on the pressure main itself (e.g. not on branches or offtakes).

b) **Requirement: Where there is a risk of backflow into the pressure main from the receiving system, facilities must be provided to enable isolation of the pressure main at the discharge point.**

   Pressure mains generally rise towards their discharge point, so in some cases sewage from the receiving system can flow back into the pressure main in the event of a leak or break along the pressure main, making it difficult to carry out repairs. Accordingly, facilities to enable isolation (such as a stop valve, non-return valve, or slots/guides for insertion of stop boards) must be provided at the discharge point if backflow could occur in this scenario.

c) **Guidance note: Pump scours should be avoided unless absolutely necessary and opportunities should be investigated instead for a gravity scour to a nearby gravity sewerage system.**

   Pump scours require significant additional manual intervention to drain the pressure main compared to gravity scours. Pressure mains are typically drained for inspection and maintenance or in the event of a break, and in either case there is already a significant maintenance burden without the added complexity of managing tankers for pump scouring. Pump scours should only be used where there is no practical option to use a gravity scour, and it should be noted that even a long gravity scour may be preferable to a pump scour.

d) **Guidance note: Where pump scours cannot be avoided, the use of a combined gravity/pump scour should be investigated to reduce the required pump out volume.**

In many cases where a pump scour is proposed, this is due to the invert level of the nearest potential gravity discharge point being at too high a level to allow complete scouring of the pressure main under gravity. In these circumstances, it may be preferable to design an arrangement where the pressure main scours to a pit that then facilitates partial discharge of the scour volume to the gravity sewer and retains the remainder in the pit for pump out (similar to a scour chamber on a water main). The feasibility of this option should be determined in consultation with Sydney Water operations representatives.

e) **Requirement: Scours must be designed so that the pressure main (or section of pressure main) can be drained in 4hrs or less. Multiple and/or high-capacity scours may be necessary to achieve this (particularly for pump scours).**

Pressure mains are typically drained for inspection and maintenance or in the event of a break, and in either case the work must be completed urgently to minimise downtime and/or environmental impacts. Accordingly, it is important to limit the time spent draining the main so that other activities can commence. In some instances, (e.g. pump scours on large pressure mains), this may require multiple scour points to facilitate tanker connection and movements or high-capacity scours to increase the flow through scour valve. Complex scour arrangements (e.g. those involving multiple or high-capacity scours) should be developed in consultation with Sydney Water operations representatives.

f) **Guidance note: Where practical, a DN15 tapping point and ball valve should be provided at any locations where the pressure main is accessible (e.g. in valve chambers) to facilitate pressure monitoring.**

The inclusion of tapping points at accessible locations allows for the connection of instrumentation to conduct pressure monitoring in sewer pressure mains. Pressure monitoring is a useful investigative technique that provides information on transient pressures within the main and can help predict and prevent failures due to pressure surges. Incorporating these tapping points within chambers for other valves and appurtenances (e.g. air valve chambers) allows monitoring points to be provided at minimal cost.

7. Operations and maintenance planning

7.1 Context

As outlined in Section 2, maintenance of pressure mains is critical to ensure their effective operation for the duration of their service life. Maintenance requirements are often not adequately considered during the planning and design phase, which leads to difficulties in planning and execution of maintenance activities due to a lack of appropriate facilities (e.g. access, laydown areas, connection points, etc.). Note that other sections of this document also include recommendations relevant to operations and maintenance planning.

7.2 Requirements and guidance

Planners and designers must implement the following requirements and consider the following guidance notes related to operations and maintenance planning:

a) **Requirement: All-weather vehicle access (including for maintenance vehicles such as tankers where necessary) must be provided to pressure main appurtenances such as air valves, stop valves, and pump out scours.**

   Effective operation of pressure main valves and appurtenances typically requires the use of maintenance vehicles for access to and/or operation of equipment. Examples include vehicle mounted gearboxes for stop valves and tankers for pump scours. It is therefore important that any necessary maintenance vehicles can access the valve or appurtenance, including during wet weather.

b) **Requirement: Clearance between dual pressure mains must provide adequate space for safe excavation and maintenance of one main while the other remains in service.**

   An important characteristic of dual pressure mains is that they can operate independently of each other if necessary. Accordingly, the spacing of dual pressure mains must facilitate safe excavation and maintenance of one main without needing to isolate the other, otherwise this benefit of duplication is negated. Refer to C10.14.5 of the Sydney Water Technical Specification – Civil for further guidance on spacing of parallel pipelines. This requirement does not apply to inaccessible pipelines (e.g. trenchless installations), since excavation of these pipelines for maintenance or repair is not anticipated.

8. Internal access for maintenance

8.1 Context

Pressure mains typically show signs of distress prior to failure, but unfortunately these signs are rarely observed. Significant failures are typically preceded by small leaks or deterioration of the internal surfaces or joints, which can be identified through internal condition assessment. Accordingly, the ability to proactively carry out internal condition assessment is a key part of effective asset management for pressure mains.

The vast majority of Sydney Water's existing pressure mains were installed without any practical means of internal access for condition assessment, which means that condition assessment for these assets is typically limited to soil sampling and external scanning (unless destructive investigation is carried out). Internal condition assessment is generally significantly more reliable for failure prediction, and infrastructure to facilitate this activity must be considered in the design of new pressure mains. Internal access to pressure mains also facilitates other maintenance activities such as pigging and jetting.

8.2 Requirements and guidance

Planners and designers must implement the following requirements and consider the following guidance notes related to operations and maintenance planning:

a) **Requirement: Full bore launch facilities must be provided at all new or upgraded SPSs where the pressure main is DN300 or larger. This launch facility must connect to the pressure main at a 45-degree angle and include a blank flange and stop valve to enable operation during live flow. An example arrangement is shown in Figure 2.**

Full bore launch facilities at the SPS enable the use of tethered full bore inspection tools for the section of pressure main immediately downstream of SPS, which is generally the section at highest risk of failure. Detailed inspection of this section of pressure main can serve as a representative condition assessment for the entire pressure main length. These launch facilities also enable launching of pigs and other tools to carry out cleaning or maintenance of the pressure main.

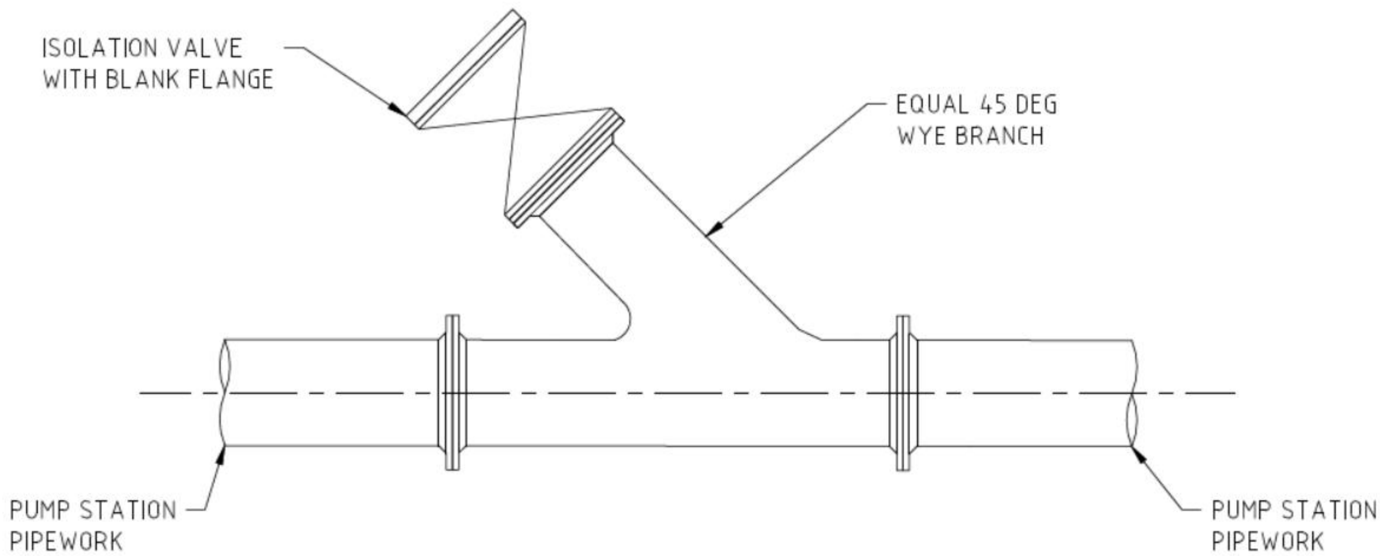

Figure 2 Example of full bore launch facility (Plan view)

b) **Requirement: Access points must be provided on all new pressure mains DN300 or larger at a maximum spacing of 500m. These access points must include a vertical equal tee, DN100 isolation valve, and blank flange to facilitate the deployment and retrieval of small sensor-type condition assessment tools during live flow, as well as the deployment of CCTV equipment with the pressure main offline. An example arrangement is shown in Figure 3.**

Access points along the pressure main will enable internal condition assessment along the full pipeline length using leak detection probes and other small sensor-type condition assessment tools. These tools can be deployed in live flow and have significantly reduced infrastructure requirements compared to full bore launch facilities. These tools may be deployed by connecting a launching device to the DN100 isolation valve (once the blank flange is removed) which then injects or plunges the tool into the flow within the pressure main. The incorporation of an equal tee allows for deployment of CCTV equipment when the pressure main is offline and allows the access point to be used for other maintenance activities such as jetting. These access points may be located with the same chamber as other valves and appurtenances, and opportunities for integration with other fittings (e.g. air valves) should be explored where possible. The design of these access points must minimise the potential for air accumulation and consider the associated corrosive environment (unless provided with an air release valve). For trenchless installations longer than 500m, the maximum spacing requirement may be waived (to avoid installing access points on the trenchless section) provided that access points are installed at the upstream and downstream ends of the trenchless section.

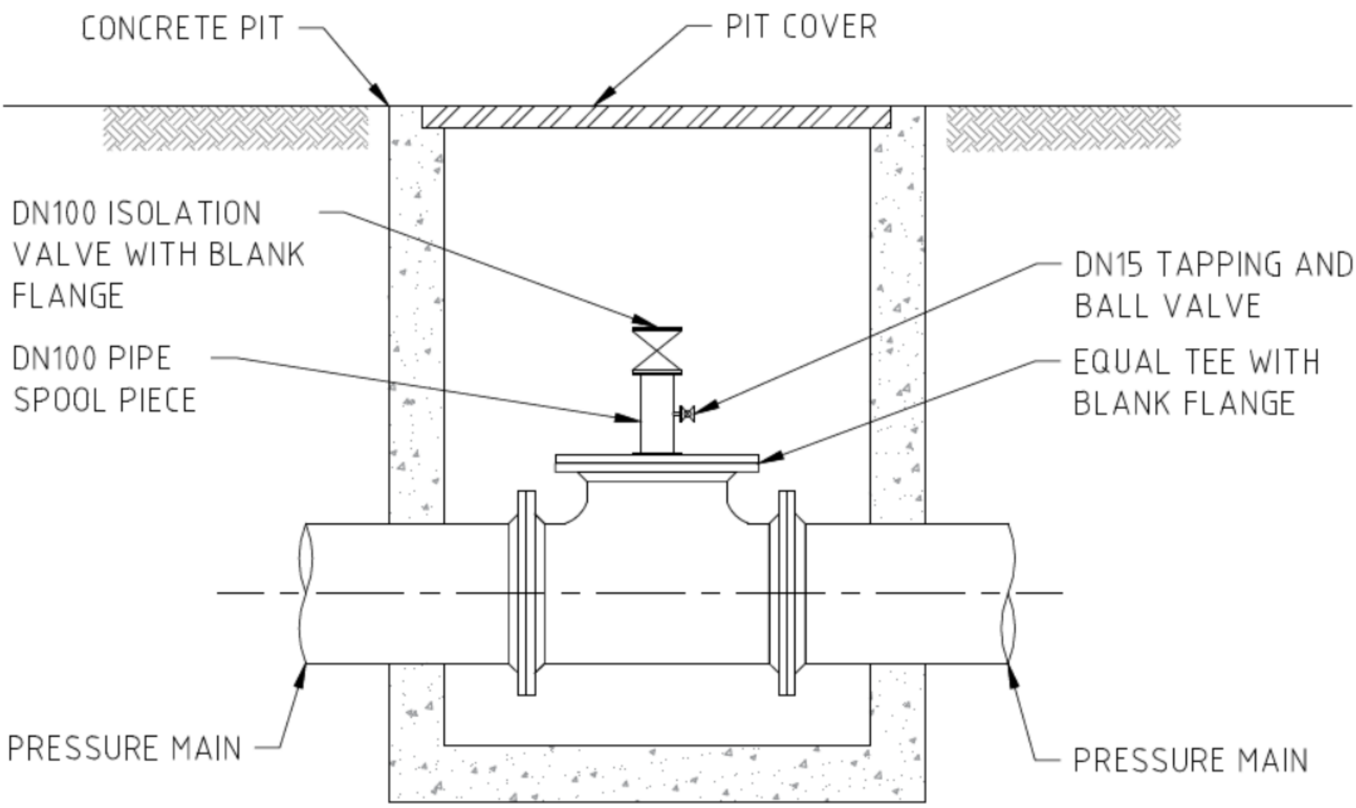

Figure 3 Example access point arrangement (Elevation view)

Ownership

Ownership

Role	Title
Group	Engineering and Technical Support
Owner	Norbert Schaeper, Engineering Modernisation Senior Manager
Author	Dan Leong-Scott, Principal Civil Engineer

Change history

Version No.	Prepared by	Date	Approved by	Issue date
1	Dan Leong-Scott	13/08/2025	Ashley Smith	29/08/2025