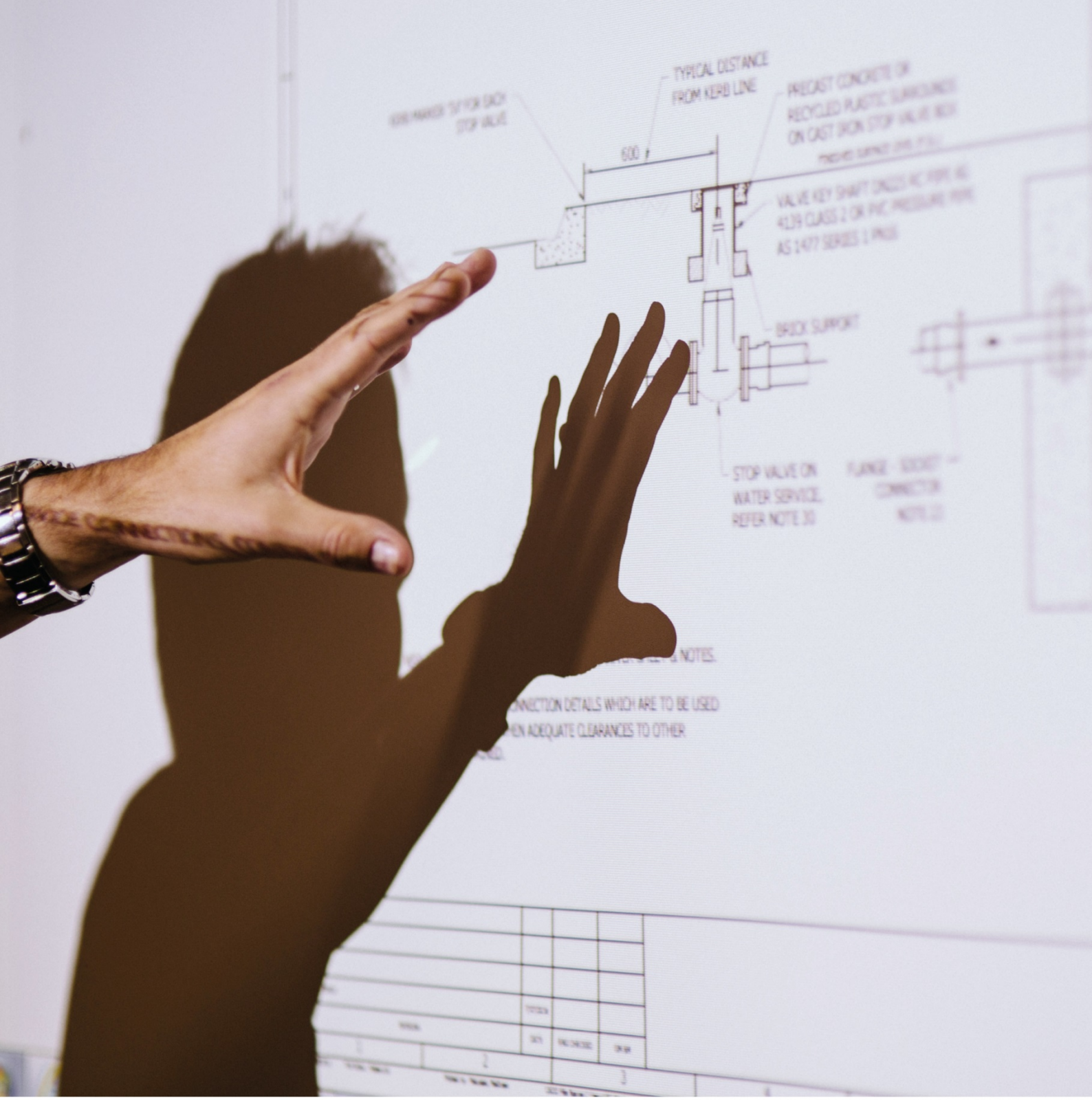

STD-SPE-C-004
TECHNICAL SPECIFICATION
SURVEY AND TOLERANCING REQUIREMENTS

icon
WATER

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Document management

Document authorisation table

Issue	Date	Author	Reviewer	Approver
1	02/07/18	K. Danenbergsons	T. Sparks	D. Eager

Version control table

Issue	Date	Reason for issue
1	02/07/18	Issued for mandatory use

Document applicability table

Asset area	Applicable (Yes/No)	Asset area	Applicable (Yes/No)
Dams (DAM)	**Yes**	Water Network (WAT)	**Yes**
Bulk Water Supply (BWS)	**Yes**	Sewerage Network (SEW)	**Yes**
Water Treatment Plants (WTP)	**Yes**	Sewage Pump Stations (SPS)	**Yes**
Water Pump Stations (WPS)	**Yes**	Sewage Treatment Plants (STP)	**Yes**
Reservoirs (RES)	**Yes**	Recycled Water Systems (REC)	**Yes**

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Abbreviations

ACT	Australian Capital Territory
AGD66	Australian Geodetic Datum, 1966
AHD	Australian Height Datum
CL	Centreline
DBYD	Dial Before You Dig
GDA94	Geocentric Datum of Australia 1994
GDA2020	Geocentric Datum of Australia 2020
IL	Invert Level
Ipad	Investment Planning and Delivery
LMWQCC	Lower Molonglo Water Quality Control Centre
MGA	Map Grid of Australia (based on GDA94)
MGA2020	Map Grid of Australia 2020 (based on GDA2020)
MH	Maintenance Hole
ML	A now defunct level referencing system. Refer to the definition over-the-page.
NSW	New South Wales
RL	Reduced Level
SWMS	Safe Work Method Statement
TCCS	Transport Canberra and Community Services
WAE	Work as Executed
WSA, WSAA	Water Services Association of Australia

Definitions

ACT Standard Grid	The standard survey grid based on the AGD 66 Datum used within the ACT in lieu of Map Grid of Australia coordinates. Refer to the ACT Government's *Department of Environment, Planning and Sustainable Development* for further details.
Buried service	For the purpose of this specification, buried services shall be taken to have the same meaning as buried utilities. Refer to "buried utility" for a definition.
Buried utility	Shall have the same meaning as "Utility" as defined in AS 5488.
Contractor	The person or organisation responsible for construction of the works including testing, commissioning and handover.
Chartered Engineer	A Professional Civil Engineer with chartered (CPEng) membership of Engineers Australia.
Developer	As per the definition provided in *STD-SPE-G-019 Asset Creation and Approval.*
Icon Water	The owner and operator of the constructed works.
Icon Water Representative	The nominated person or organisation that has written authority to act on Icon Water's behalf. This may be an Icon Water employee (or employees) such as an Icon Water Inspector or Icon Water Site Surveillance Officer, or a third party engaged to act on Icon Water's behalf.
Ipad	Icon Water's internal process and procedures for investment planning and delivery (i.e. capital expenditure).
ML	Refers to the original construction level datum/system used at Icon Water's LMWQCC in the early 1970s. These levels are based on the now defunct "Canberra Precise Datum" and were determined by converting the Canberra Precise Datum levels (expressed in imperial units) to metric units. To convert between ML and RL values: *RL = ML – 0.326 metres*
Qualified Surveyor	A person who meets or exceeds the qualifications and practical experience criteria detailed in Section 5.3 of this specification.
Quality Level	As per the definition provided in AS 5488.
Superintendent	As per the definition provided in *WSA 02, WSA 03* or *WSA 04* as applicable.

1 Introduction

Government departments and Developers regularly require utility owners to now plan for the construction of buried assets on the basis that less space is available compared to the practices of years gone by. This means that buried utilities such as water, sewer, gas, electric and communications must be accurately planned, designed and constructed to not only avoid "clashes" during the construction phase, but to also know where such buried utilities are at a later date if maintenance, relocation or augmentations are required. For the end-users (e.g. property owners) there will be greater certainty when planning for connection to Icon Water's water supply and sewerage services.

Within the ACT and other jurisdictions across Australia, it is well known that WAE records may not always be a true and accurate reflection of what is "buried beneath the surface". This is causing more and more issues within the ACT as we enter a new and unprecedented stage of urban infill development. Such issues include:

- Contractors damaging existing buried utilities during construction even though DBYD has been contacted to determine the scope of the existing buried services at the construction location.
- Designers being forced to amend designs at additional cost and considerable delay due to existing buried utilities not being accurately recorded.
- Safety issues for utility maintenance teams when (say for example) electrical cables are found to not meet agreed separation distances with water or sewer mains; or situations when electrical cables are in contact with water mains.
- Metallic pipelines suffering reduced asset life due to the cathodic protection system of another buried utility causing accelerated corrosion.

With less space now available for buried utilities to be located as well as co-exist, it is necessary to ensure that construction tolerances are appropriate for the amount of space utility owners have to operate with. It is also necessary to ensure that the constructed utilities are accurately recorded (surveyed) so that utility owners, Developers, designers, Contractors and property owners can all benefit from lower costs and higher safety outcomes in the future.

As at the time of writing, Icon Water, in collaboration with TCCS and the ACT Government's *Office of the Surveyor-General & Land Information*, are working together with the aim of harmonising construction tolerances and surveying requirements for buried utilities such as water mains, sewer mains and stormwater mains. It is hoped that other utility owners will join with these entities to ensure that the accurate construction, recording and location of subsurface utilities within the ACT achieves best practice for the future benefit of all stakeholders.

Given that Icon Water will be encouraging other ACT utility owners and government departments to harmonise construction tolerance and surveying requirements and given that there is a willingness to implement MGA2020 in the not too distant future, it is expected that the specification you are reading now will undergo some changes within the first twelve to eighteen months of implementation.

Should you have any comments or wish to provide feedback on this new specification, please do so via talkingiconwater@iconwater.com.au

Yours sincerely,

On behalf of Icon Water

Karl Danenbergsons
Principal Mechanical Engineer
Engineering Services Team

18 June 2018

2 Scope

2.1 In scope items

This specification shall apply to:

a) The construction, renewal or augmentation of all buried utilities (e.g. water mains, sewer mains and property service connections) intended to be owned and operated, or already owned and operated by Icon Water.

b) The construction, renewal or augmentation of all above-ground pipelines, whether they be pressurised or gravity flow, which are intended to be owned and operated by Icon Water.

c) The construction, renewal or augmentation of all surface fittings, maintenance structures and other appurtenances associated with the buried utilities and pipelines detailed in points (a) and (b) above.

d) The determination of the location and attributes of existing buried utilities.

2.2 Exclusions

This specification **shall not** apply to;

a) The construction of any other Icon Water asset type (e.g. buildings, structures, plant and equipment) not directly forming part of a buried maintenance structure or appurtenance for a buried utility or pipeline.

b) The collection and monitoring of survey information required for dam deformation surveys.

c) Storm water assets and any other road furniture located within Icon Water leased land unless specifically directed otherwise by Icon Water.

d) The location of natural features including vegetation, drainage lines etc., within Icon Water leased land.

e) Any other item not specifically detailed in Section 2.1 of this specification.

The user is directed to the relevant Icon Water Standards, such as but not limited to referenced items 5 and 13 of Table 4.1, for specific guidance and compliance requirements.

3 Purpose

The purpose of this specification is to provide requirements for construction and survey accuracies associated with the construction (or location) of buried utilities and above-ground pipelines meeting the scope requirements of Section 2.1 of this document.

4 Referenced documents

The documents listed in Table 4.1 are either referenced by this specification, or shall be read in-conjunction with this specification and be complied with.

Table 4.1 Referenced Documents

Item	Document number	Title
Australian standards		
1	AS 5488	Classification of Subsurface Utility Information (SUI)
WSAA codes and publications		
2	WSA 02	Gravity Sewerage Code of Australia
3	WSA 03	Water Supply Code of Australia
4	WSA 04	Sewage Pumping Station Code of Australia
Icon Water standards		
5	STD-SPE-C-001	Technical Specification, Civil & Structural Works
6	STD-SPE-C-005	Technical Specification, Pipelines
7	STD-SPE-G-008	Technical Specification, Design Requirements for Safe Access, Egress and Working at Heights
8	STD-SPE-G-010	Supplement to WSA 04 Sewage Pumping Station Code of Australia
9	STD-SPE-G-011	Supplement to WSA 02 Gravity Sewerage Code of Australia
10	STD-SPE-G-012	Supplement to WSA 03 Water Supply Code of Australia
11	STD-SPE-G-018	General Specification, Drafting Standards
12	STD-SPE-G-019	Developer Provided Assets, Water Supply and Sewerage, Asset Creation and Approval Process
13	STD-SPE-M-001	Technical Specification, Mechanical Works
14	Various	SD Series Drawings

Note: The documents shall be the latest publication at the time of award of contract for execution of the works unless noted otherwise in the project specific documentation.

5 General requirements

5.1 Datum and Map Grid

Icon Water's datum and map grid requirements are detailed in Sections 5.1.1 and 5.1.2.

5.1.1 Vertical datum

Levels (expressed as RL) shall reference AHD. This requirement also includes all works at LMWQCC.

The use of the term "ML" is defunct and "ML" shall not be shown on any drawing or survey record.

5.1.2 Map Grid

The ACT Standard Grid (based on AGD66) shall be referenced for all works located within the borders of the ACT.

For works which straddle both the ACT and NSW or for works which are fully located within NSW, the designer shall contact Icon Water as early as possible in the design phase to determine the requirements if not already shown in the project specific documentation.

Although it is not Icon Water's preference to receive any survey information on a local grid, it is acknowledged that a local grid may be required in some circumstances. The designer shall contact Icon Water as early as possible in the design phase to determine the such requirements if not already shown in the project specific documentation.

Commentary: It is Icon Water's intention to supersede the use of the ACT Standard Grid with MGA2020 once there is consensus amongst the ACT government departments which interface with Icon Water regarding the use of MGA2020. Therefore, the requirements for works located (i) within NSW (ii) at dams, or (iii) which straddle the ACT and NSW, have been left unspecified at this particular time as it is predicted that all works, regardless of their location, will ultimately reference MGA2020.

5.2 Design tolerances

Icon Water's buried utilities and aboveground pipelines shall be designed in accordance with the design tolerances specified in referenced items 2, 3, 4, 6, 8, 9 and 10 of Table 4.1 as applicable.

5.3 Surveyor requirements

A Qualified Surveyor is required for the following works:

a) Determination of the location and attributes of existing buried utilities when Quality Level A to AS 5488 (or a more stringent tolerance such as A^{+} or A^{++} as described in this specification) is required.

b) Construction set-out for all works within the scope of this specification.

c) Validation and checking of locations/positions in both the vertical and horizontal planes (i.e. X, Y and Z) for all works within the scope of this specification.

d) Recording of WAE locations/positions in both the vertical and horizontal planes (i.e. X, Y and Z) for all works within the scope of this specification.

A Qualified Surveyor is a person who has both the education/qualifications and practical experience that meet at least one of the criteria types detailed in Table 5.3.1.

Table 5.3.1. Qualifications and Practical Experience Requirements of a Qualified Surveyor

Criteria Type	Education/Qualifications	Practical Experience
1A	2 years of tertiary level study in the field of "Surveying" from a recognised tertiary institution with attainment of a formal qualification.	At least 24 months of approved practical experience in surveying.
1B	A "Diploma of Surveying" from a recognised tertiary institution.	
2A	3 years of tertiary level study in the field of "Surveying" from a recognised tertiary institution with attainment of a formal qualification.	At least 18 months of approved practical experience in surveying.
2B	An "Advanced Diploma of Surveying" from a recognised tertiary institution.	
3A	4 years of tertiary level study in the field of "Surveying" from a recognised tertiary institution with attainment of a formal qualification.	At least 12 months of approved practical experience in surveying.
3B	A "Bachelor's Degree of Surveying" from a recognised tertiary institution with a minimum duration of 4 years full-time study.	
4A	A Registered Land Surveyor	As per the requirements of ongoing registration.
4B	A Registered Mining Surveyor	

From 2 July 2018, Icon Water will require the detailed Curriculum Vitae (CV) of all Qualified Surveyors engaged for the works detailed in Section 5.3 of this specification (points (a) through (d) inclusive). This requirement is only necessary for the first project post 2 July 2018. That is, the CV of the Qualified Surveyor need only be submitted once for review and acceptance as Icon Water will keep the submitted details on file for future works.

Icon Water reserves the right to reject the use of a proposed surveyor if Icon Water does not believe that the proposed Surveyor meets the Qualified Surveyor requirements detailed in Table 5.3.1. In the event of any dispute with Icon Water regarding surveyor suitability, Icon Water will defer to the ACT Government's *Office of the Surveyor-General & Land Information* to adjudicate on the qualifications and practical experience of the proposed surveyor and to provide a formal ruling as to whether the proposed surveyor meets the Qualified Surveyor requirements.

Given Icon Water is reliant upon a third party to provide a formal ruling in the event of any potential dispute, Icon Water does not take any responsibility for any time delays associated with obtaining such a ruling and will not accept any liability for any loss or damages arising. It is therefore advisable that Developers, designers or Contractors (as applicable) propose a surveyor for review/acceptance by Icon Water as early as possible in the design process or well in advance of construction commencement (as applicable).

Qualified Surveyors shall comply with all relevant ACT legislation as well as the relevant *Survey Practice Directions* and *Guidelines* as issued and updated from time-to-time by the ACT Government's *Office of the Surveyor-General & Land Information*.

The Qualified Surveyor shall provide the raw data file from the survey equipment used if requested by Icon Water. For example for Trimble" branded equipment, the ".ssf" shall be provided.

When a Qualified Surveyor is used for the location of existing buried services, the Qualified Surveyor shall comply with the work plan and SWMS requirements detailed in Section 5.4 of this specification. This shall occur regardless of the Quality Level required.

Commentary: The requirements detailed in Table 5.3.1 have been proposed by the Deputy Surveyor-General of the ACT. It is proposed that ultimately, qualification requirements will be determined and administered by the ACT Government's *Office of the Surveyor-General & Land Information*. If this eventuates, it is expected that a pre-vetted list of Qualified Surveyors approved for works within the ACT will be made available and the potential for any dispute with Icon Water relating to surveyor qualifications and experience will be eliminated.

5.4 Requirements for the location of existing buried services

A Qualified Surveyor (as per the requirements of Section 5.3) shall be used for the determination of the location and attributes of existing buried services when Quality Level A (or a more stringent tolerance such as A^{+} or A^{++}) is required. There is no requirement to engage a Qualified Surveyor for the determination of the location and attributes of existing buried utilities when a Quality Level lower than Quality Level A is required (i.e. Quality Levels B through D inclusive). That is, a reputable "buried services locator" may be used in lieu of a Qualified Surveyor. However, the service provider must show evidence of:

- Suitably experienced and qualified personnel
- Suitable locating equipment with in-date calibration records

Furthermore, a detailed work plan and SWMS shall be submitted for review and acceptance by Icon Water prior to commencing works. It should be noted that Icon Water does not allow the covers/hatches of structures such as maintenance holes to be opened/lifted by anyone other than suitably trained and equipped Icon Water employees. This is for reasons of both safety (e.g. dangerous sewer gases) as well as network security. Therefore, the requirement to have Icon Water in attendance should be determined well in advance of any site works that require access to maintenance holes and other maintenance structures.

The service provider shall provide the raw data file from the equipment used upon request from Icon Water. For example for Trimble" branded equipment, the ".ssf" shall be provided.

6 Survey requirements

6.1 Icon Water amendments to AS 5488

Icon Water has adopted AS 5488 as a basis for specifying survey tolerances and attribute information for the construction of new utilities and pipelines as well as for the location of existing buried services. However, Icon Water has some amendments to AS 5488. Designers, Contractors, surveyors and other parties such as buried services locators shall interpret AS 5488 in-conjunction with the amendments detailed in Table 6.1.1. The amendments detailed in Table 6.1.1 take precedence over the requirements of AS 5488.

Table 6.1.1 Icon Water Amendments to AS 5488

AS 5488 Page Ref.	Amendment and/or addition
Page 4	**SECTION 1 SCOPE AND GENERAL** **1.1 SCOPE** Delete the 2nd paragraph and insert the following content in its place: This Standard applies to: a) Subsurface utilities and associated surface features owned and operated or intended to be owned and operated by Icon Water. These features may include but not be limited to access chambers, stop valves, surface fittings and other surface related facilities. b) Aboveground water and sewer mains and other aboveground pipelines owned and operated or intended to be owned and operated by Icon Water. This includes features such as but not limited to stop valves, scour valves, air valves and maintenance structures. Add a final paragraph directly after the existing 4th paragraph as follows: Where the term "subsurface" is encountered in this Standard, the word "aboveground" may also be substituted as applicable to avoid having to repeat the same requirements for both buried and aboveground utility and pipeline applications as the requirements for both are identical unless noted otherwise.
Page 10	**SECTION 2 QUALITY LEVELS** Modify the title of Clause 2.7 and replace the content in Clauses 2.7.1 through 2.7.2 inclusive in their entirety as follows: **2.7 QUALITY LEVELS A, A+ and A++** **2.7.1 General** Quality Levels A, A+ and A++ are the highest quality levels and consist of the positive identification of the attribute and location of a subsurface utility at a point to an absolute spatial position in three dimensions. Quality Levels A, A+ and A++ are the only Quality Levels that define a subsurface utility as "validated". Quality Levels A, A+ and A++ have identical maximum horizontal tolerances but increase in order of "tighter" maximum vertical tolerances with Quality Level A++ being the most stringent. Refer to Table IW. 2.7.2.1 for details. **Achieving Quality Level A**: The whole line segment shall be deemed to satisfy Quality Level A when the maximum distance between survey location points is no greater than 25 metres for gravity sewer mains, other gravity flow pipelines and any pressure or gravity main/pipeline constructed of polyethylene pipe; and 50 metres for water mains and other pressurised pipelines which are not constructed of polyethylene pipe. Furthermore, survey location points shall be validated at every (i) entrance and exit at each maintenance structure, including window sill levels on MHs with external drops (ii) valve and hydrant (iii) junction (iv) change of direction, and (v) surface fitting. Cover levels also require validation at the same maximum distances (i.e. 25 metres or 50 metres) as stated above.

AS 5488 Page Ref.	Amendment and/or addition

Achieving Quality Levels A⁺ and A⁺⁺: The service must be exposed (i.e. backfill removed or backfill not yet installed) for the line segment to be attributed Quality Level A⁺ or A⁺⁺. Furthermore, survey location points shall be validated along the line segment at no greater than 5.0 metre intervals and at every (i) entrance and exit at each maintenance structure, including window sill levels on MHs with external drops (ii) valve and hydrant (iii) junction (iv) change of direction, and (v) surface fitting. Cover levels also require validation at the same maximum interval (i.e. 5.0 metres) as stated above.

2.7.2 Attribute information

Refer to *STD-SPE-G-018 Drafting Standard* for the attribute information required for Icon Water WAE records. Otherwise, Quality Levels A, A⁺ and A⁺⁺ attribute information shall include:

a) The utility owner (if not Icon Water)
b) The utility
   i. Type
   ii. Status
   iii. Material (e.g. DICL, PE100, SCL, PVC-U, PVC-M, PVC-O, GRP for Icon Water pipes)
   iv. Size (DN) and pressure (PN) rating for pressure pipes or size (DN) and stiffness rating (SN) for non-pressure pipes; otherwise basic size details for non-Icon Water utilities
   v. Configuration
c) The date of installation (if known)
d) Feature codes of surface and subsurface features including but not limited to pits, access chambers, valves and hydrants etc. as per the Icon Water *SD Series* of drawings or as per Appendix B Table B3 if Icon Water's *SD Series* of drawings are "silent".
e) The location of points surveyed and subsurface features measured in terms of absolute spatial positioning with a maximum horizontal and vertical tolerance in accordance with Table IW.2.7.2.1.

Table IW.2.7.2.1 Maximum Horizontal and Vertical Tolerances for Quality Levels A, A+ and A++

Quality Level	Max. Horizontal Tolerance (mm)	Max. Vertical Tolerance (mm)
A	± 50	± 50
A⁺		± 20
A⁺⁺		± 10

AS 5488 Page Ref.	Amendment and/or addition
	2.7.3 Metadata Quality Level A, A+ and A++ metadata shall include: a) The Quality Level acronym conveyed as QL-A, QL-A+ or QL-A++ b) The date that the data was captured c) The source of the information d) The survey and locating methods used to obtain the attribute information e) Survey control information used to determine the absolute spatial position of the utility
Page 19	**APPENDIX B** **TABLE B2** **PRIMARY CODE AND LINE COLOUR** Delete Table B2 and insert the following text: Refer to the Icon Water *SD Series* of drawings for the Primary Code and Line Colour details to be used for Icon Water projects.
Pp 20 - 21	**APPENDIX B** **TABLE B3** **EXAMPLES OF DESCRIPTOR AND FEATURE CODES** Insert the following text directly beneath Table B3: Refer to the Icon Water *SD Series* of drawings for Descriptor Codes and Feature Codes. Table B3 may be used when the Icon Water *SD Series* of drawings is "silent" with regards to a particular feature.

6.2 Integrated construction and survey methodology

When constructing new services, it is a mandatory requirement that surveying occurs concurrently with the construction of new line segments and associated structures and appurtenances unless such infrastructure can be left exposed (e.g. not backfilled above the top of the pipe, encased or otherwise made inaccessible) without any quality, practicability or safety issue arising.

In the event that the newly constructed infrastructure is no longer exposed (e.g. backfilling has been completed) and a Qualified Surveyor has not yet validated the construction to the required Quality Level detailed in this specification, Icon Water has the right to reject the works and seek remedies in accordance with (i) the executed *Hydraulic Services Deed* with the Developer – in the case of Developer provided assets, or (ii) the executed contract between Icon Water and the Contractor – in the case of projects delivered by Icon Water's Project Delivery Teams as part of the Ipad process.
Note: Such remedies may include demolition and excavation activities at the cost of the Developer or Contractor as appropriate.

6.3 Quality level requirements

Table 6.3.1 summarises the AS 5488 Quality Levels (as amended by this specification in Table 6.1.1) and the methods that may be used to validate these levels as well as the survey tolerances required.

Table 6.3.1 Quality Levels, Maximum Tolerances and Methods of Validation

Quality Level	Validation Method and/or Survey Requirements	Max. Horizontal Tolerance (mm)	Max. Vertical Tolerance (mm)
D	Existing records, site inspection or anecdotal evidence.	N/A	N/A
C	As for Quality Level D. However, a survey of surface features is also required to determine relative spatial positioning. The survey need not be undertaken by a Qualified Surveyor (e.g. a reputable services location contractor may be used).	± 300	N/A
B	As for Quality Level C. However, a survey is required of both the surface features and buried features to determine relative spatial positioning. The survey need not be undertaken by a Qualified Surveyor (e.g. a reputable services location contractor may be used).	± 300	± 500
A	As detailed in Table 6.1.1 of this specification. The work shall be performed by a Qualified Surveyor.	± 50	± 50
A^{+}			± 20
A^{++}			± 10

The Quality Level required for survey-related information varies according to the project stage and the type of infrastructure. Icon Water requires a higher Quality Level (i.e. a “tighter” tolerance) as the project progresses through planning, design and construction. Table 6.3.2 details Icon Water’s minimum Quality Level requirements by project stage and infrastructure type.

Table 6.3.2 Minimum Quality Level Requirements by Project Stage and Infrastructure Type

Infrastructure Type	Project Stage or Survey Purpose	Minimum Quality Level Required
Existing buried infrastructure	Design Submission 1 (Note 1)	D
	Design Submission 2 (Note 2)	C or A (Note 3)
	WAE Records	A or A^{+} or A^{++} and C (Note 4)
Existing surface features	Design Submission 1 (Note 1)	C
	Design Submission 2 (Note 2)	B
	WAE Records	A
Proposed/Designed/As-Constructed water and sewerage infrastructure	Design Submission 1 (Note 1)	Note 5
	Design Submission 2 (Note 2)	Note 5
	WAE Records – water mains, water supply property service connections and other pressure pipelines as well as associated structures and appurtenances (e.g. valves, valve chambers and surface fittings etc.)	A
	WAE Records – gravity sewer mains and other gravity flow pipelines excluding sewer ties, associated structures and appurtenances: Grade ≤ 1.0 % Grade > 1.0 %	 A^{++} A^{+}
	WAE Records – Property service ties for sewer, structures and appurtenances associated with sewer mains and other gravity flow pipelines (e.g. MHs, valves and surface fittings)	A
	WAE Records – interconnecting (buried) pipework forming part of a sewage pumping station or water pumping station (unless project specific documentation states otherwise)	A^{++}

Notes:

1. "Design Submission 1" refers to the asset creation and acceptance process for Developer provided assets as per *STD-SPE-G-019*. For the purposes of complying with this specification, Icon Water Project Delivery Teams and external services providers shall interpret this stage as being equivalent to the completed/accepted "Concept Design" for projects executed by Icon Water Project Delivery Teams as part of the Ipad process.
2. "Design Submission 2" refers to the asset creation and acceptance process for Developer provided assets as per *STD-SPE-G-019*. For the purposes of complying with this specification, Icon Water Project Delivery Teams and external services providers shall interpret this stage as being equivalent to the completed/accepted "Detailed Design" for projects executed by Icon Water Project Delivery Teams as part of the Ipad process.
3. When the existing buried infrastructure requires connection to the proposed/new infrastructure, or when the existing buried infrastructure requires validation (e.g. to ensure that the proposed design can be built ensuring clash avoidance or maintaining minimum separation distances with existing utilities) then Quality Level A is required. Otherwise, Quality Level A at the point of exposure (e.g. maintenance hole) and Level C along the asset is the minimum Quality Level requirement.
4. When additional/updated attribute and location information is gathered during construction for existing buried infrastructure, this shall be included in the WAE records (e.g. drawings) at the more stringent Quality Level (i.e. Quality Level A, A^{+} or A^{++} at a point/location of access (maintenance hole, service tie, etc.) with Quality Level C as the minimum Quality Level required between survey points/locations.
5. Use the design tolerances specified in the relevant Icon Water Standard when proposing or designing new water and sewerage infrastructure. Refer to Section 5.2 and Table 4.1 for details.

7 Tolerances on as-constructed work

All water mains, gravity sewer mains, property service connections, gravity and pressurised pipelines etc. and associated structures and appurtenances shall be constructed in the positions shown on the project specific construction drawings in accordance with the construction tolerances specified in Tables 7.1, 7.2, 7.3 and 7.4 ensuring that (i) the minimum depth of cover, and (ii) the minimum clearances to other services are complied with. For gravity flow pipelines such as but not limited to sewer mains, reverse grades (i.e. backfalls) are prohibited. Refer to the relevant WSAA code, Icon Water supplement to the relevant WSAA code or the Icon Water pipeline specification (i.e. reference items 2, 3, 4, 6, 8, 9 and 10 in Table 4.1 of this specification) as applicable.

During construction, if it is found that (i) the minimum clearances to other services, or (ii) the minimum depth of cover, or (iii) positive grades cannot be maintained by complying with the project specific construction drawings, the Superintendent (for Developer provided assets) shall propose an alternative alignment/location or alternative remedy for review and acceptance by Icon Water. Alternative remedies may include (i) the re-alignment/relocation of the existing services, or (ii) the use of protection slabs, pipe sleeves or encasement. For projects executed by the Icon Water Project Delivery Teams as part of the Ipad process, the Contractor shall contact the Icon Water Representative in lieu of the Superintendent. Construction shall not proceed without written Icon Water approval of either the new alignment/location or alternative remedy.

Table 7.1 General Construction Tolerances by Infrastructure Type

Infrastructure Type	Construction Tolerances (Note 2)	
Pressurised pipelines (Notes 1 and 4)		
Pressurised pipelines such as but not limited to: a) water mains, b) water supply property services (i.e. mains-to-meter) pipe runs, c) sewer rising mains, and d) all other pressurised pipelines	Horizontal Location:	± 75 mm (applied to pipe CL)
	Vertical Location:	± 50 mm (applied to pipe IL) subject to achievement of a continuously rising grade between the design position of high and low points proceeding in the direction of the high point.
Gravity flow pipelines (Notes 1 and 4)		
Gravity flow pipelines such as but not limited to: a) gravity sewer mains, b) sewerage property services (i.e. mains-to-tie) pipe runs, and c) all other gravity flow pipelines	Horizontal Location:	± 75 mm (applied to pipe CL)
	Vertical Location:	10 mm higher and 25 mm lower (applied to pipe IL) on the proviso that the grades specified in Table 7.2 are complied with and no localised low points exist.
Structures, surface fittings, risers and associated appurtenances etc.		
Junctions/branches of gravity or pressurised mains and pipelines. Maintenance holes, Sewer Maintenance Shafts and Rodding Points. Enclosures, cabinets, boxes, pits and chambers containing water supply related items such as but not limited to: water meters, RPZDs, valves and pumps. Surface structures and fittings such as but not limited to: surface boxes, hydrants, hydrant risers, shrouds and valves.	Horizontal Location:	± 75 mm
	Vertical Location of Surface Element(s): (Note 5)	For the top surface of a buried structure or hatch/cover of a buried structure or surface fitting or surface box designed to finish at or above the finished surface level, apply a tolerance at any point on the top surface as follows: 0 to + 20.0 mm in garden beds, grassed areas and other unsealed areas where only occasional pedestrian or vehicular traffic is likely; otherwise: ± 5.0 mm for all other applications and locations.
	Other Tolerances: (e.g. formwork, plumb, wall thickness and other geometric dimensions etc.)	As per the tolerances detailed in Icon Water specification: *STD-SPE-C-001* (*Civil and Structural Works*)

Notes:

1. The horizontal and vertical location tolerances shown for “pressure pipelines” and “gravity flow pipelines” are not applicable to the interconnecting (buried) pipework forming part of a sewage pumping station or water pumping station. For such applications, compliance with Table 7.3 is required.
2. The horizontal tolerances stated are for the lateral position across, as well as axial position along the main or pipeline (i.e. X and Y).
3. It is acceptable to determine the as-constructed vertical location of the pipe CL or IL by accurately surveying the position of the pipe crown and then performing a calculation based on the known pipe thickness (including internal lining if applicable) and diameter (outside or inside as applicable).
4. Angularity construction tolerances for property service connections and other branch lines shall be in compliance with Table 7.4.
5. Regardless of the vertical tolerance applied to the top surface of covers, hatches and the top surface of buried structures etc., the trip hazard requirements specified in Icon Water specification *STD-SPE-G-008 Design Requirements for Safe Access, Egress and Working at Heights* take precedence over the tolerances provided herein. That is, if a “flush fit” condition is required as per *STD-SPE-G-008* then the design element must have a top surface located flush with, or no higher than 5.0 mm above the surrounding finished surface(s).
6. Minimum depth of cover and minimum clearances from other services shall also be achieved within the construction tolerances provided in Table 7.1.

Table 7.2 Construction Tolerances on Grade – Gravity Flow Pipelines

Design Grade	Minimum Acceptable Construction Tolerance on Grade
≤ 1.0 %	0% flatter, 10% steeper
> 1.0 %	0% flatter, 15% steeper

Notes:

1. Localised low points (not specifically included as part of the accepted design) are prohibited.
2. Minimum depth of cover and minimum clearances from other services shall also be achieved within the construction tolerances provided in Table 7.2.

Table 7.3 Construction Tolerances – Interconnecting (Buried) Pipework for Pump Stations

Infrastructure Type	Construction Tolerances	
Pump station interconnecting (buried) pipework	Horizontal Location:	± 15 mm (applied to pipe CL)
	Vertical Location:	± 15 mm (applied to pipe IL)
	Angularity:	± 1.0° angularity on branches
	Grade:	As per Table 7.2

Notes:

1. The construction tolerances to be applied for all other elements of sewage and water pumping stations shall be as per Table 7.1.
2. Localised low points (not specifically included as part of the accepted design) are prohibited.
3. Minimum depth of cover and minimum clearances from other services shall also be achieved within the construction tolerances provided in Table 7.2.

Table 7.4 Construction Tolerances – Angularity - Branches and Service Connections

Infrastructure Type	Angularity Tolerance
Pipe/pipeline branches Property service connection branches (excluding pump station interconnecting pipework)	± 2.0° subject to the horizontal and vertical location tolerances specified in Table 7.1 being achieved.

8 Requirements for the production of WAE drawings

The requirements for the production of WAE drawings are detailed in Icon Water specification *STD-SPE-G-018 Drafting Standard*. It should be noted that the engagement of both a Qualified Surveyor and a Chartered Engineer is a requirement for all new works meeting the scope requirements detailed in Section 2.1 of this specification.

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