

**Standard for
Producing CAD and Geospatial
Drawings**

**No. 7363
Ver. 8.2**

Date: 15 December 2017

Revision	Description	Issued By	Date
5	Page 9, section 3.1 - Minor amendments to wording, and sentence 'For Mangere Wastewater Treatment Plan special requirements refer to Appendix E' added. Page 11, section 3.9 - 'Electrical CAD Plan Requirements' paragraph added. Page 25, section 6.2 - Sentence 'For Mangere Wastewater Treatment Plan special requirements refer to Appendix E for plan titling' added.	I Moses / G Stewart	24/04/15
6	Page 45, DTMAN group listing amended (71 Alkaline Stabilisation and Biosolids Storage).	I Moses / G Stewart	08/05/15
7	Page 17, section 4.3.5 - 'As Built Red Line drawings' new section added. Page 30, section 8 - 'As Built and GIS Data' now references AI-01 and AI-06.	I Moses / J De Villiers	25/08/15
8	Major changes to document format and layout. Included 3D, Geospatial and P&ID requirements. Standard template layout changes.	Jean de Villiers – Principal Engineer, Standards	10/02/2017
8.1	Minor changes to drawing frame, clarifications to unused external references and superseded drawings	Jean de Villiers – Principal Engineer, Standards	3/07/2017
8.2	Minor update to clarify final changes to drawings	Jean de Villiers	15/12/2017

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Summary of changes

Version	Section	Description of revision
8.1	3.2 and 4.2.1.2	Sample illustrations that include Title 3 block replaced to show correct approvals
	3.4	Clarify removal of unused references
	4.1	Plan title 1, clarification of line entry designation
	4.2.1.4	Clarify markings to identify superseded drawings
	8	QA/QC include check in item 23 to remove superfluous cross references
8.2	Title	Included geospatial drawings in title
	4.12	Clarify to remove cloud on as-built drawings
	8	Added QC line to remove clouds for as-built drawings

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Definitions

Cad File Number: A unique number that designates the AutoCAD file and its origin. The number shall be the same as the drawing number (i.e. 2001234.001B).

Drawing Number: The drawing number is allocated by Watercare’s record management system through the Watercare Asset Information department (AssetInfo@water.co.nz). The drawing number comprises of two numbers. The first number is a 7 digit base number (e.g. 2001234). The second number is a 3 digit sheet number starting with .001 and continuing sequentially. **There shall be no gaps in the sheet numbering.** The full number is e.g. 2001234.001. *NOTE: Full stop, not underscore between plan number and sheet number. (The full file name will be 2001234.001.dwg)*

Drawings completed by developers or their agents, are assigned an “R” number as soon as the development or sub-division application is lodged. The drawing numbering conventions follow the same requirements as otherwise described in this standard.

Abbreviations

2D	Two dimensional
3D	Three dimensional
A1, A3	Paper size
AC	Asbestos cement (pipe)
BIM	Building information modelling
CAD or AutoCAD	Computer aided design
CI	Cast iron (pipe)
CLS	Concrete lined steel (pipe)
DN	Nominal diameter
GIS	Geographic information system
GL	Ground level
IL	Invert level
LL	Lid level
LOD	Level of design
NB	Nominal bore (internal diameter of PE and CLS pipe)
P&ID	Piping and instrumentation diagram
PE	Polyethylene
PVC	Polyvinyl chloride (pipe)
Xref	External reference

1. Introduction

This manual defines the standards and procedures to be followed by consultants, contractors and Watercare for the production of:

- Design drawings (3D and 2D) and drawing based models (e.g. BIM)
- As-built drawings
- Survey drawings

Watercare standardises on the drawing and model output so that the quality of the work is consistent with its data requirements.

This standard shall be read with Watercare's Data and Asset Information standards.

2. Copyright

Where provided by Watercare, all software, drawings, symbol libraries, drawing setup and support files remain the property of Watercare and must be returned on completion of the project.

The use of unlicensed software on Watercare projects is not permitted.

3. Drawing setup

All drawings are to be registered in Watercare's record management system which is used to issue a drawing number for inclusion in the drawing title block. This number includes the sheet number.

The process for drawing registration is described in the Watercare Data and Asset Information standards¹.

The CAD file number is always displayed on the drawing. Template drawings may be copied but must be allocated a new drawing number by Watercare Asset Information, and the CAD file reference on the drawing amended accordingly.

The Watercare CAD file number shall be the same as the drawing and sheet number, including the revision from issue A onwards e.g. 2001234.001A.

Refer to section 4.2 for details of the drawing and CAD file numbering requirements.

3.1. Menus

The standard AutoCAD menu is used. All customised menus shall be based on the standard AutoCAD menu. Any non-standard shape files, scanned images or company logos must be provided with the drawing files.


3.2. Support files

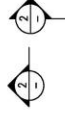
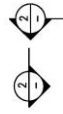
To standardise the production of drawings Watercare provides the files for the standard planform template, north point and section marks, electrical symbol libraries and P&ID symbols.

The standard title block template drawing in use throughout Watercare is **WSL-A3-2017.dwg** (A3 sized drawing). The standard template shall not be amended. Approval from Watercare is required to use the **WSL-A1-2017** planform (A1 sized drawing). The standard planform is shown:

¹ At the time of publishing this version of the CAD standard, the Watercare Data and Asset information is not a single document. This standard will be consolidated in the near future.

SAMPLE PLAN FORM



SECTION 2
SCALE: 1:50

DETAIL A
SCALE: 1:50

TITLE 1

TITLE 2

DRAFT

FACILITY GROUP/LOCATION

TITLE

DATE	201XXX.YY	DATE OF REV. BY	---	CONTRACT No.	---
ORIGINAL SCALE	A3	REF No.	AMA-BB-C-DDD	DWG No.	201XXX.YY
ISSUE					

Watercare

The drawing, the design, the copyright and any other intellectual property in this drawing are the property of Watercare Services Limited and may not be used or reproduced without approval. Copyright reserved.

DESIGNED	DATE	BY	DATE	BY	DATE
DESIGN APPROVED	DATE	BY	DATE	BY	DATE
DRAWN	DATE	BY	DATE	BY	DATE
DESIGN APPROVED	DATE	BY	DATE	BY	DATE
WFL DESIGN MGMT.	DATE	BY	DATE	BY	DATE
WFL PROJ. LEAD	DATE	BY	DATE	BY	DATE
AUTOCAD					

Watercare

The drawing, the design, the copyright and any other intellectual property in this drawing are the property of Watercare Services Limited and may not be used or reproduced without approval. Copyright reserved.

DESIGNED	DATE	BY	DATE	BY	DATE
DESIGN APPROVED	DATE	BY	DATE	BY	DATE
DRAWN	DATE	BY	DATE	BY	DATE
DESIGN APPROVED	DATE	BY	DATE	BY	DATE
WFL DESIGN MGMT.	DATE	BY	DATE	BY	DATE
WFL PROJ. LEAD	DATE	BY	DATE	BY	DATE
AUTOCAD					

Ver.8.2

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3.3. Paperspace / Modelspace on drawings

The template **WSL-A3-2017** or **WSL-A1-2017** (in AutoCAD's paper space) must be re-saved with the drawing number issued by Watercare (e.g. 2001234.001). Basic layers and styles are included in the file. Engineering detail drawings shall be prepared in model space at full size in millimetres and with viewports in paper space. Plan and layout drawings shall be prepared in model space at full size in metres and with viewports in paper space.

3.3.1. Viewports

All rectangular viewports in paper space shall have the display 'LOCKED' and the viewport layer 'TURNED OFF'.

Non-rectangular viewports in paper space shall have the display 'LOCKED' and the viewport layer may be 'TURNED ON', and shall be colour 250 when the as-built AutoCad drawing is submitted to Watercare.

3.4. Blocks/Xrefs

Inserting blocks are preferred, but external referencing (Xrefs) may be used on condition that all external references are bound into the drawing file on completion of the project, or at the end of a consultant/contractor's tenure with Watercare when the as-built plans are submitted.

All unreferenced files and superfluous xref's must be removed at as built stage.

Where large size 3D models are developed the relevant Xref files may be supplied separately on approval from Watercare.

Create each design element or discipline as a separate Xref file on its own AutoCAD layer. The Xref type must always be an 'OVERLAY' and not an attachment. Xref's shall not be nested by the circular attachment method i.e. Xref's within an Xref within another Xref, are not acceptable.

4. Drawing conventions and standards

Unless noted otherwise, drawing standards shall comply with AS1100. This standard shall take precedence where there is variance to AS1100.

Watercare requires all drawings to be drawn to full size in AutoCAD model space and the planform on the layout tab (paper space). A3 output governs minimum text size, ensuring a high quality hardcopy. The drawing file when supplied needs to be zoomed to the extents on the layout tab. The paper size must be set to A3 or A1 in the "Page Setup" manager.

All text shall be in UPPER CASE (with the exception of standard abbreviations e.g. kW).

Text on the full size **A3 Watercare planform** hardcopy shall be a minimum of **1.25mm** high (width factor **0.8mm**).

Text on approved **A1 sized drawing planform** shall be a minimum of **2.5mm** (width factor **0.8mm**)

4.1. Plan titles

The standard Watercare planform has three attribute blocks included in the .dwg file. The attributes are edited as required. The three blocks are:

Block **Title 1** –the main title comprising: line 1 - the name of the facility, line 2 – group location and line 3 - title or description. Consultants may use the right-hand end of **Title 1** to insert their logo.

Block **Title 2** – Cad file, date, scale, contract number, drawing number and version.
Block **Title 3** – Amendment details, version, date, amendment by and approved.

The platforms are available from Watercare Asset Information on request.

4.2. Drawing numbers

Drawing numbers are entered in the drawing number box on the right-hand side of the title block drawings and inserted as an attribute within the **Title 2** block. (Similar for A1 size planform)

For subsequent revisions to the drawings, electronic copies (pdf) are to be forwarded to Watercare for updating the entries in the record management system. (Refer **Amended drawings** in section 3.6.1.3).

Where drawings are prepared by external parties, drawing numbers are obtained from Watercare Asset Information. The consultant’s CAD file number or reference number may be shown on the drawing (in the box reserved for Process Numbering where non Process plans are involved). The CAD file box is reserved for the Watercare CAD file number.

Where drawings are collated into project sets, sequential numbering of sheets is mandatory. Spare drawings within the set not allowed.

4.2.1. Drawing development process

Drawings follow the below sequence during drawing development:

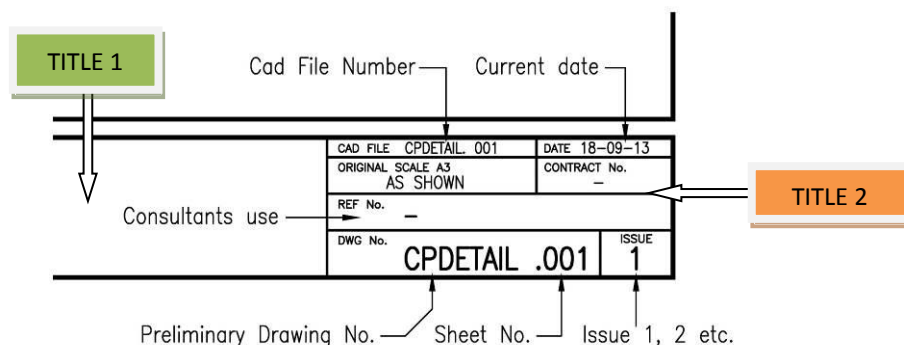
1. **PRELIMINARY** Preliminary versions when the concept or details are being developed - prior to entry into the record management system. (**Issue 1,2,3** etc.) The preliminary version entries may be removed from the plan at the approved issue.
2. **APPROVED** First entry into Watercare’s record management system. This may be a signed or unsigned Issue – e.g. issued for Tender (**version “-“hyphen in the Issue box**).
3. **AMENDED** Amendments to approved plans (**version A, B, C, etc.**).
4. **AS-BUILT** As-built amendments (**the next available version A, B, C, etc.**).

Note – version letters *I* and *O* are not to be used for issuing

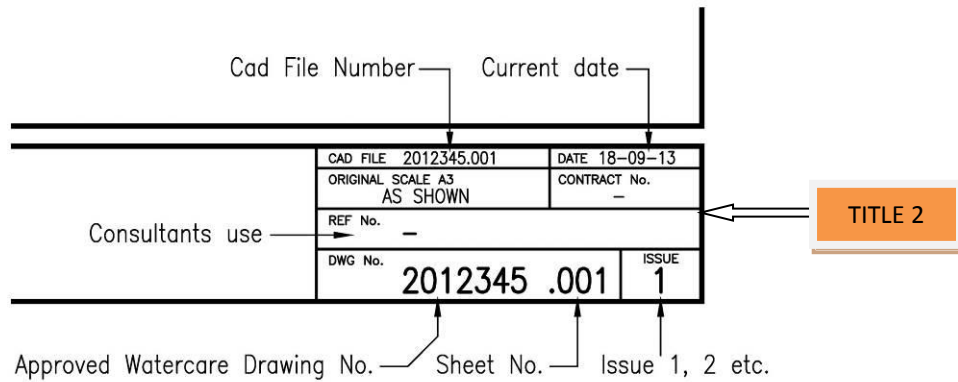
All plans from approved stage up to the as-built stage must be submitted to Watercare for record keeping in pdf or CAD format. The as-built stage drawings must all be in CAD format.

4.2.1.1. Preliminary drawings

Prior to allocating a drawing number by Watercare, an “identifier” may be used in the ‘Drawing No.’ attribute in the **Title 2** block.



For **preliminary issue** external parties may use their own convention for revisions but must use a Watercare drawing number. In example, Watercare uses version numbers 1, 2, 3 etc. for preliminary revisions. These revisions are for production record only and are not to be offered for record keeping. The version identifiers (e.g. 1,2,3) must be removed at the approved issue.

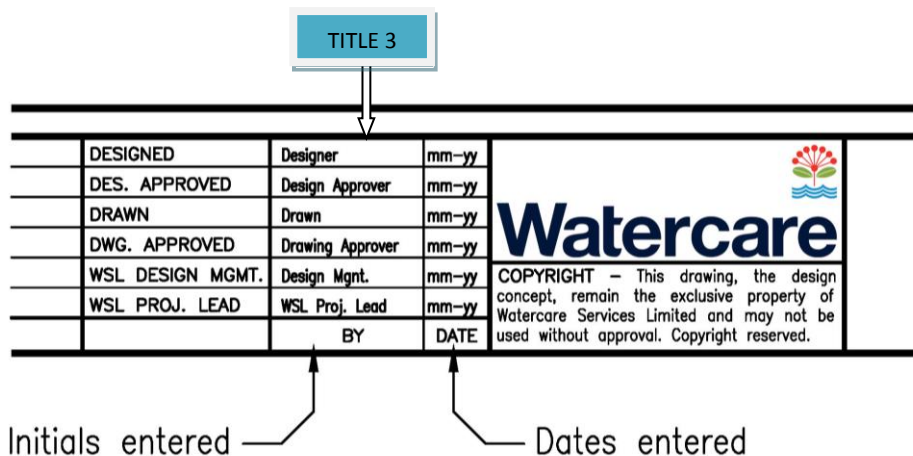


4.2.1.2. Approved drawings

The allocated drawing number shall be displayed in the ‘Drawing No.’ area of the **Title 2** attributes block on approved drawings.

At tender stage the **Title 2** block is edited to issue “-” hyphen (and the amendment attributes **Title 3** attributes block edited to “ISSUED FOR TENDER”).

Drawings for tender must have been reviewed by the relevant stakeholders before release. The approval sections in **Title 3** must be completed and the review process in accordance with Watercare’s Project Management Framework followed.



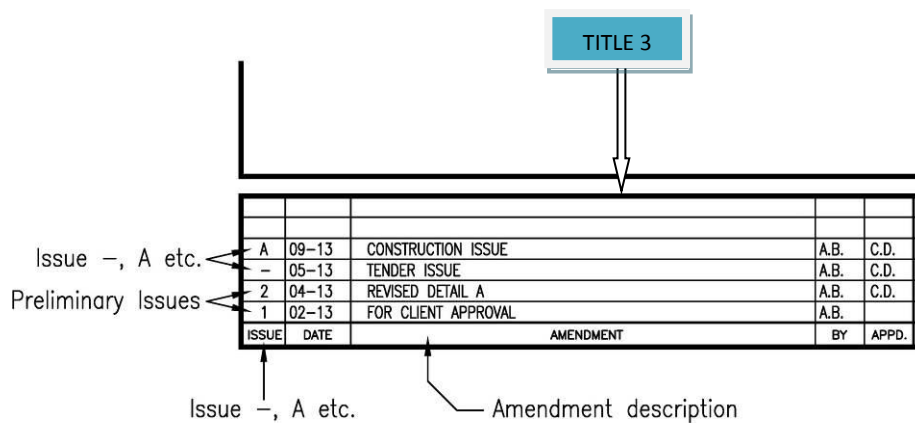
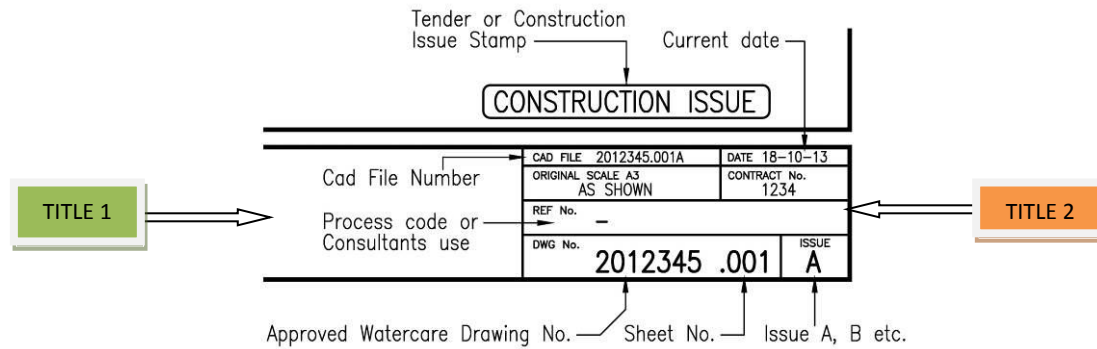
For land developers this drawing set must be accepted and stamped by Watercare. A “Tender issue” stamp must be added above the **Title 2** block when ready for issuing.

4.2.1.3. Amended drawings

An amended drawing is any approved change to a drawing that has previous approval for release. (i.e. Tender Issue, Construction Issue). The amendments need to be indicated by an 8mm triangle containing the revision

version e.g. \triangle . Where practical, a cloud (refer section 4.12) shall be drawn around the amendment. The clouds must be removed with subsequent issues. No clouds or new triangles shall be added for the as-built issue and any existing clouds are to be removed. A "Construction issue" stamp must be added above the **Title 2** block when ready for issuing.

Edit block **Title 2** with the new CAD file number (i.e. 2001234.001A), insert the current date and new version (A). Amendment details are entered in the appropriate attribute within the **Title 3** block. Where amendments are numerous an overall description such as "Minor revisions" or "Reinforcement amended" will be sufficient.



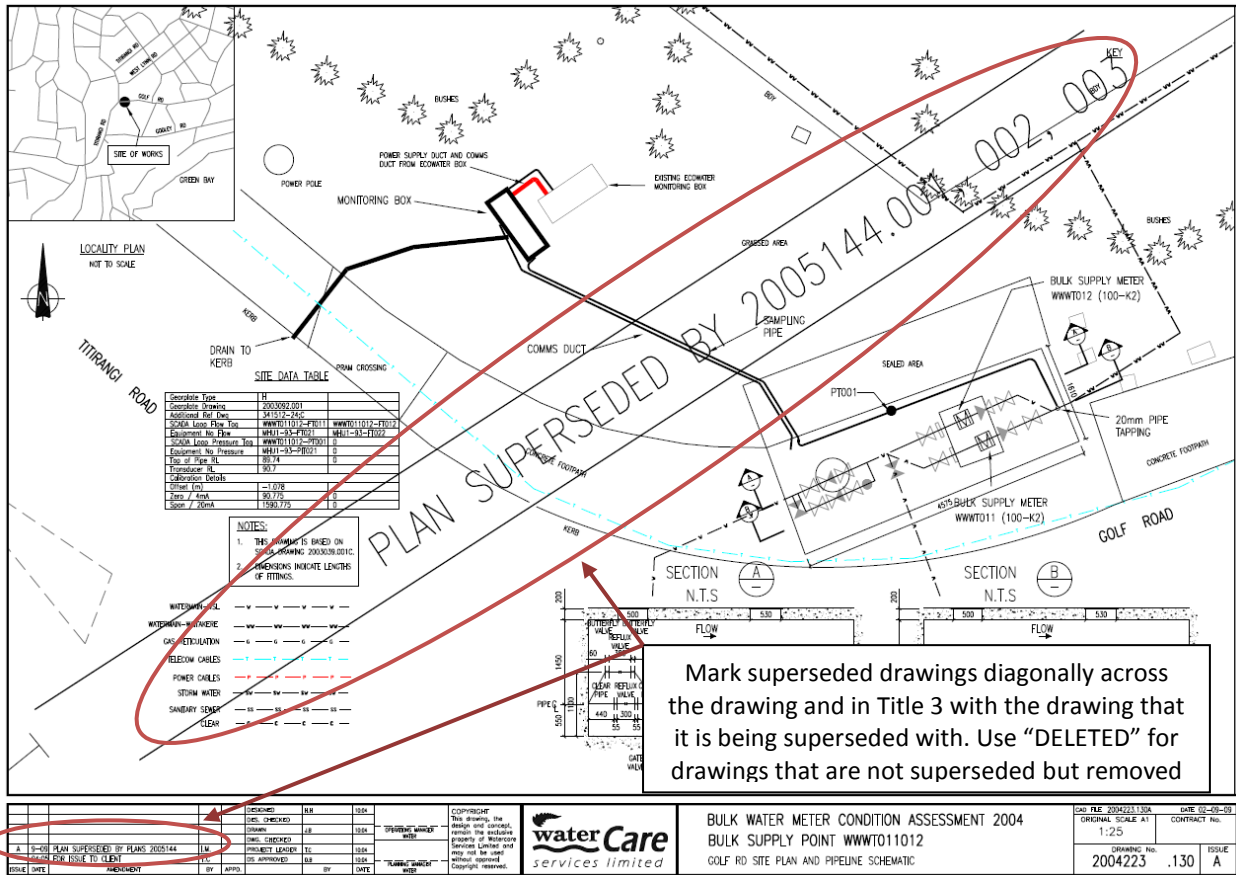
For review of plans a hard copy will be distributed. Watercare has an internal review process described in its Project Management Framework.

For every issue of the drawing an electronic copy must be forwarded to Watercare Asset Information for record keeping.

4.2.1.4. Cross references and superseded drawings

Drawings must be cross referenced to other drawings or information that it must be read in conjunction with, including relevant drawings of existing facilities adjacent to it. Where plans and long sections are on separate sheets, they must be cross referenced.

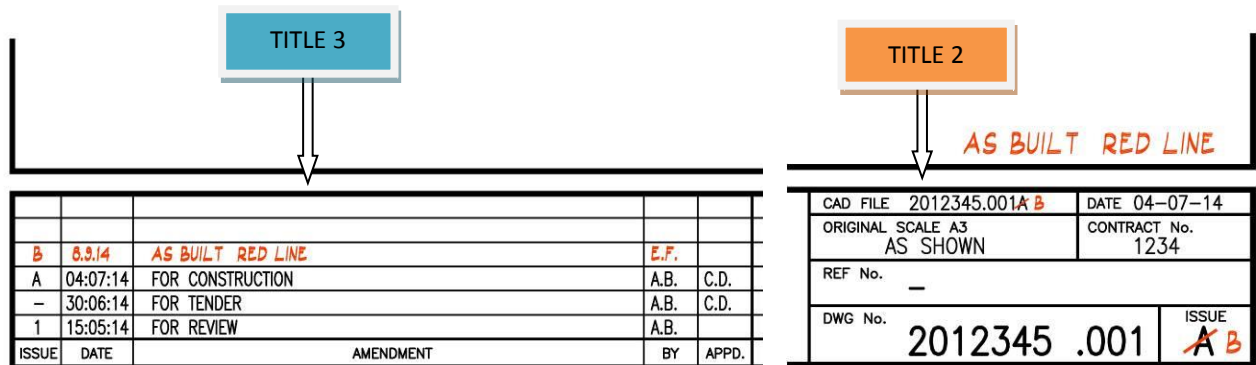
Where new works are added or amendments made to facilities on existing drawings, the original and superseded drawings shall be marked diagonally across the drawing and updated in **Title 3** with the cross reference of the drawings that it is being replaced with. When the drawing is not superseded but deleted, "DELETED" shall be written diagonally across the drawing and noted in **Title 3** and the amended update. See below example.



4.2.1.5. As-built red line drawings

Red line mark-ups may only be used when constructed sections are being placed into operation and the final as-built drawings are being prepared. Watercare's preference is for the final as-built drawings in CAD to be available before placing assets into service. For developers installing linear assets the final CAD version is a requirement and redline drawings won't be accepted.

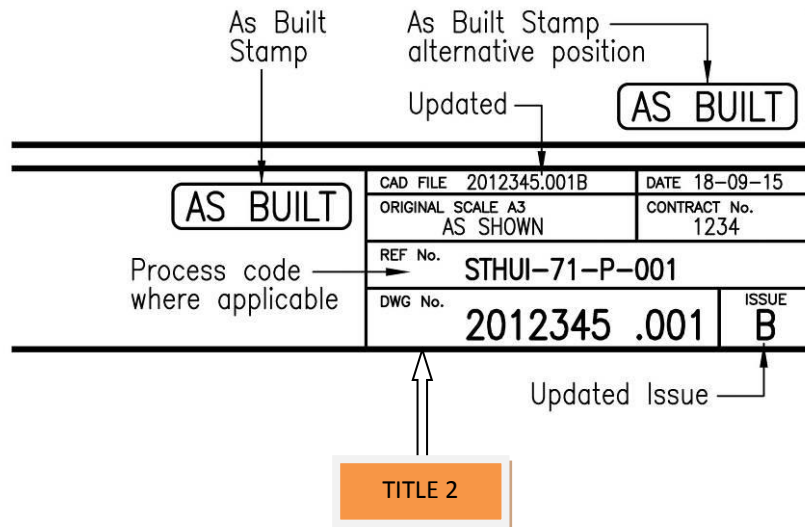
As-built red line drawings are to be hand marked-up to the next amendment letter and identified as "As-built red line" in the amendment box **Title 3** and on the drawing pane above **Title 2**. The issue number in **Title 2** is also amended and an "As built redline" stamp added above the title block. As shown in the example below, if the preceding issue noted on the drawing is issue 'A', then the "As-built Red Line" version to be issued as a 'B', and the final as-built in CAD will become issue 'C'.



As-built red line drawings are to be provided as a high quality scanned colour pdf. Any additional vendor drawings, notes or sketches required to produce the final as-built drawing shall be included as additional pages to the corresponding as-built red line drawing.

4.2.1.6. As-built drawings

When drawings are recorded as as-built records, the drawing is updated with the next amendment issue regardless of any physical changes to the drawing or not. An "AS-BUILT" stamp is added to the **Title 3** block, next to the **Title 2** block. The **Title 2** block has the CAD file name, date and issue updated as shown below:

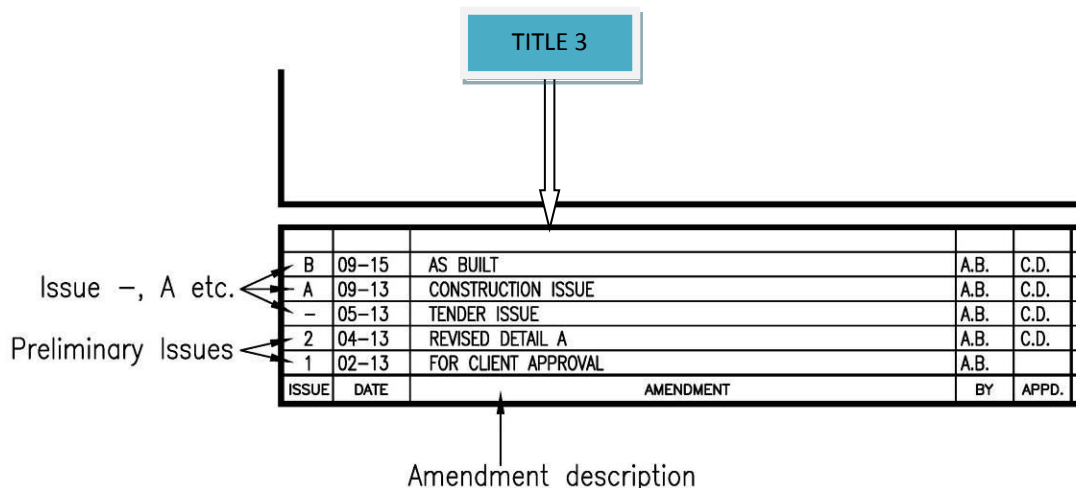


All amendment clouds are removed and existing amendment triangle symbols remain. Amendments triangles are not required to identify as-built changes.

All Xrefs are to be unstacked and bound into the CAD file where possible. Any unreferenced files must be removed.

All Xrefs, image files, plot styles, shape files and non-standard fonts shall be supplied to Watercare. Where tabbed CAD files are used, pdf copies of all sheets must be supplied as well.

The amendment box, **Title 3** on the title block drawing is also updated to reflect the "As-built" amendment as shown below:

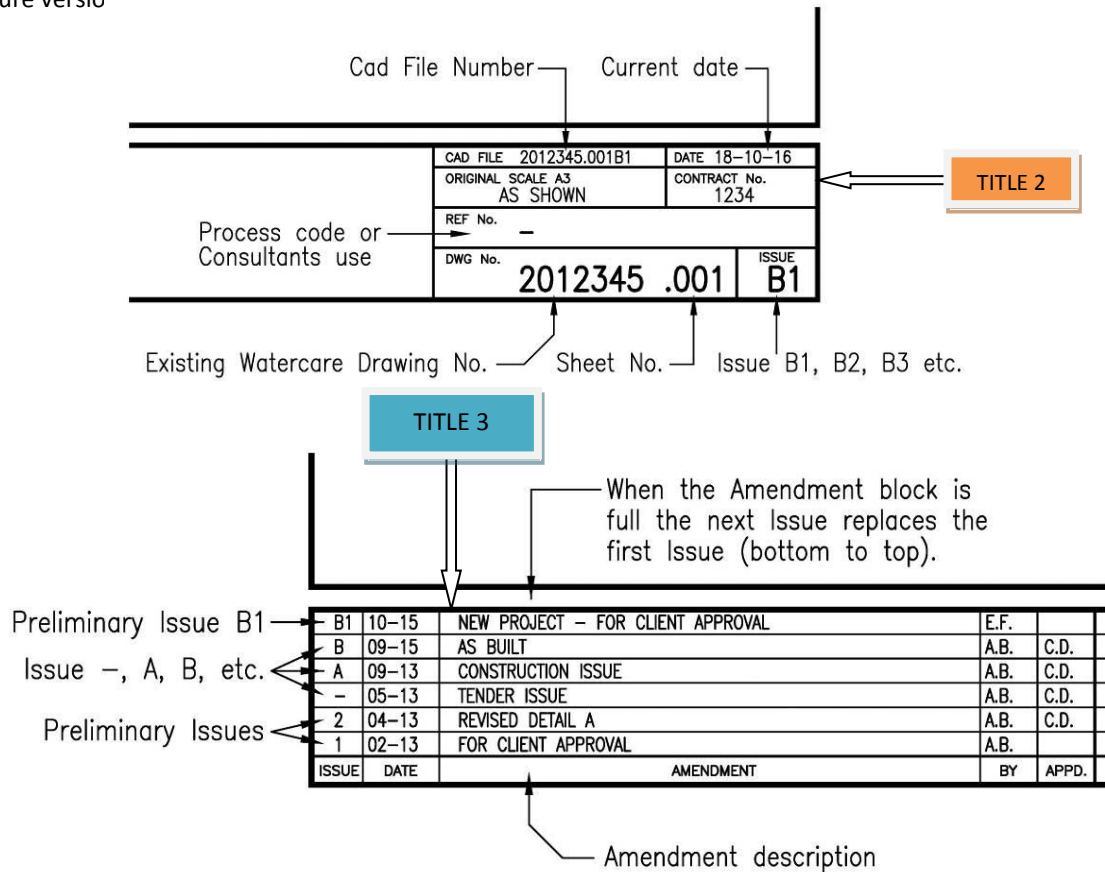


The quality of as-built drawings needs to be considered for clarity of the output drawing. The assets and services must be dominant over any background image.

4.2.1.7. New projects using existing plans

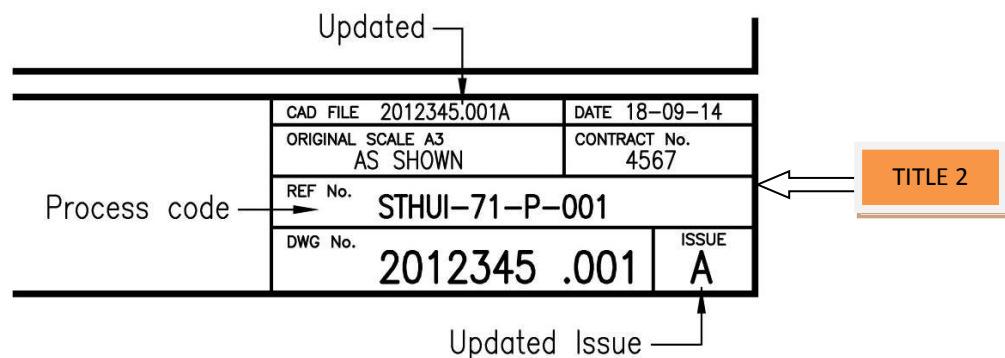
When existing plans are used for a new project and requires a round of preliminary revisions before being approved for tender, the drawings and records must be amended. Old logos may be removed and replaced with the logo of the latest party to complete the drawing.

The existing as-built plan for example may be 2001234.001B. The preliminary versions as they are being developed shall be 2001234.001B1, 2001234.001B2, etc. See **Title 2** block below for version update and **Title 3** for the description update. These issues are not required for Watercare’s record management. When the preliminary development of the plan is completed the plan must be versioned up and the tender version will be 2001234.001C. A pdf copy shall be forwarded to Watercare Asset Information for updating the record. Future versio



4.2.1.8. Process/Facility drawings

When plans are prepared for infrastructure that is created as part of a facility, the title block **Title 2** is to be completed as below. Refer to Watercare’s Data and Asset Information standards for information on how the functional location is created. The process code will be supplied by the Watercare process engineer.

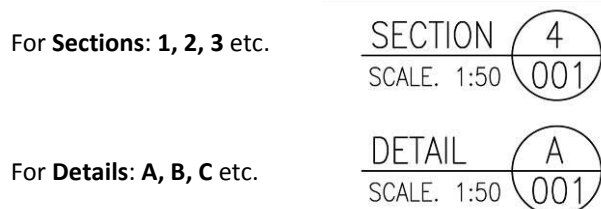


4.3. Section marks and titles

Section marks on drawings are standardised and included in the planforms. There are separate section marks for the four directions (up, down, left & right)

Plans, sections, details and elevations may be identified using the examples included on the A3 and A1 planforms.

The alpha/numeric convention to be followed for identifying sections and details on the plan are as follows:



4.4. North points

The standard North Point, **A1NP** is located on layer NP in the planforms. It may be re-scaled to suit the required output, or the layer frozen-off where not required for long sections. Plan drawings should be orientated with the north point towards the top of the drawing page.

4.5. Symbol libraries

Only standard symbol libraries are to be used in the preparation of Watercare drawings. Commonly used blocks and diagrams are incorporated into the Watercare symbol library. The symbol library includes two disciplines: Electrical and Piping & Instrumentation Diagrams (P&ID).

For Standard P&ID Symbols (ISA-5) refer to section 5.3.

For Standard Electrical Symbols (IEC-617) refer to section 5.4.

4.6. Hatching

Solid Hatching shall not be used unless demonstrated not to be affected with monochrome printing.

4.7. Pipeline long sections

The fluid flow direction of pipelines must be shown on the drawings.

For water projects – Drawings are to have the plan and longitudinal section on the same sheet at a suitable scale (1:500 on an A3 sheet) with the direction of flow on the sheet from **left to right**.

For wastewater projects – Drawings are to have the plan and longitudinal section on the same sheet at a suitable scale (1:1000 on an A3 sheet) with the direction of flow from **right to left**.

4.8 Layers

The A3 title block template drawing has the following layers defined. Additional layers may be added as required:

S..	Name	O..	Fre...	L...	Color	Linetype	Lineweight	Plot Style	Plot
✓	0	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰
☹	CENTRE	☹	☀	☰	red	CONTINUOUS	Default	Color_1	☰
☹	CONS	☹	☀	☰	green	CONTINUOUS	Default	Color_3	☰
☹	D1.25	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰
☹	D1.75	☹	☀	☰	yellow	CONTINUOUS	Default	Color_2	☰
☹	D2.5	☹	☀	☰	cyan	CONTINUOUS	Default	Color_4	☰
☹	D3.5	☹	☀	☰	mage...	CONTINUOUS	Default	Color_6	☰
☹	Defpoints	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰
☹	Dimensions	☹	☀	☰	yellow	CONTINUOUS	Default	Color_2	☰
☹	DRAFT LOGO	☹	☀	☰	254	CONTINUOUS	Default	Color_254	☰
☹	Hatch	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰
☹	LOGOTXT	☹	☀	☰	yellow	CONTINUOUS	Default	Color_2	☰
☹	North Point	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰
☹	T1.25	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰
☹	T1.75	☹	☀	☰	yellow	CONTINUOUS	Default	Color_2	☰
☹	T2.5	☹	☀	☰	cyan	CONTINUOUS	Default	Color_4	☰
☹	T3.5	☹	☀	☰	mage...	CONTINUOUS	Default	Color_6	☰
☹	TITLEBLK	☹	☀	☰	cyan	CONTINUOUS	Default	Color_4	☰
☹	Viewport	☹	☀	☰	8	CONTINUOUS	Default	Color_8	☰
☹	Xref-1	☹	☀	☰	white	CONTINUOUS	Default	Color_7	☰

The A1 title block template drawing has the following layers defined. Additional layers may be added as required:

S..	Name	O..	Fre...	L...	Color	Linetype
✓	0	☹	☀	☰	w...	CONTINUOUS
☹	CENTRE	☹	☀	☰	red	CENTER
☹	CONS	☹	☀	☰	gr...	CONTINUOUS
☹	D2.5	☹	☀	☰	w...	CONTINUOUS
☹	D3.5	☹	☀	☰	ye...	CONTINUOUS
☹	D5	☹	☀	☰	cy...	CONTINUOUS
☹	D7	☹	☀	☰	m...	CONTINUOUS
☹	Defpoints	☹	☀	☰	w...	CONTINUOUS
☹	Dimensions	☹	☀	☰	ye...	CONTINUOUS
☹	DRAFT LOGO	☹	☀	☰	254	CONTINUOUS
☹	Hatch	☹	☀	☰	w...	CONTINUOUS
☹	LOGOTXT	☹	☀	☰	ye...	CONTINUOUS
☹	North Point	☹	☀	☰	w...	CONTINUOUS
☹	T2.5	☹	☀	☰	w...	CONTINUOUS
☹	T3.5	☹	☀	☰	ye...	CONTINUOUS
☹	T5	☹	☀	☰	cy...	CONTINUOUS
☹	T7	☹	☀	☰	m...	CONTINUOUS
☹	TITLEBLK	☹	☀	☰	cy...	CONTINUOUS
☹	Viewport	☹	☀	☰	8	CONTINUOUS
☹	Xref-1	☹	☀	☰	w...	CONTINUOUS

4.9 Fonts and text styles

Four defined text styles are loaded with the standard A3 template. These text styles use the **RomanS** font. Any additional styles created must use standard AutoCAD fonts.

Style	A3 Plot Size (mm)	Width Factor	Layer
T1.25	1.25	0.8	T1.25
T1.75	1.75	0.8	T1.75
T2.5	2.5	0.8	T2.5
T3.5	3.5	0.8	T3.5

Four defined text styles are loaded with the standard A1 template. These text styles use the **RomanS** font. Any additional styles created must use standard AutoCAD fonts.

Style	Plot Size (mm)	Width Factor	Layer
T2.5	2.5	0.8	T2.5
T3.5	3.5	0.8	T3.5
T5	5.0	0.8	T5
T7	7.0	0.8	T7

Non-standard AutoCAD fonts must be supplied to Watercare where required for areas such as logos.

4.10 Line types

Standard AutoCAD line types and hatch patterns are to be used.

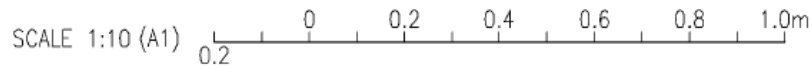
Standard line types:

Border, Border2, BorderX2
Center, Center2, CenterX2
Dashdot, Dashdot2, DashdotX2
Dashed, Dashed2, DashedX2
Divide, Divide2, DivideX2
Dot, Dot2, DotX2
Hidden, Hidden2, HiddenX2
Phantom, Phantom2, PhantomX2
The Ltscale should be set to 10X Plot Scale

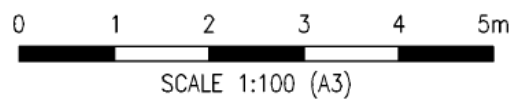
4.11 Bar scales

Bar scales shall be used on all drawings except for electrical and Piping and Instrumentation Diagram drawings. The scale bars must be located on the right hand side of the drawing sheet, directly above the title block.

For drawings (with appropriate scale):

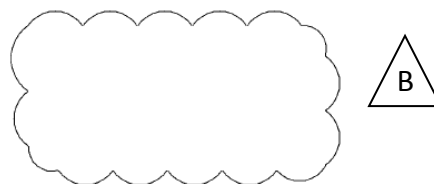


For sketches or aerial overlays (with appropriate scale):



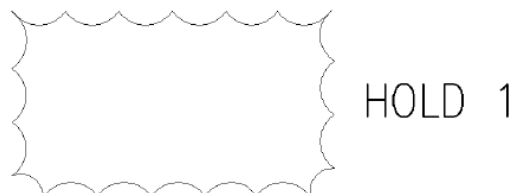
4.12 Drawing revisions / clouds

Drawings issued with revisions shall where practical be clouded and identified with a triangular flag placed immediately adjacent to the cloud. Clouds must be removed for the as-built issue, refer to section 4.2.1.3.



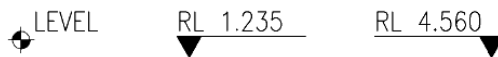
4.13 Drawing holds

Where drawing information cannot be checked against certified data, or areas on the drawings are considered incomplete, then these areas should be clouded and labelled HOLD with a hold number. The drawing cannot be issued for external or formal use. Holds may only be removed and the drawing issued once the outstanding information is available.



4.14 Levels

Show elevations in metres and decimals of a metre. Reduced levels (RL) shall be used when dealing with actual surveyed levels derived from a regional height datum. RL's shall be expressed to the nearest multiple of 5mm or 0.005m and to 3 decimal places.



4.15 System and dimensioning variables

The system variables set within the standard template drawings may be reset to suit individual users provided that the hardcopy output is not affected.

It is preferred that PSLTSCALE = 0. This allows the view in paperspace to look the same as the portion of the drawing in modelspace.

Watercare system variables are:

PSLTSCALE = 0.0

LTSCALE = 10.0

DIMSCALE = 1.0

4.16 Plot styles

Two Watercare plot styles are available. Contact Watercare Asset Information for the latest plot style version.

5 Design drawings

5.1 General requirements

5.1.1 Datum Levels

- Generally all levels indicated on metric drawings refer to LINZ, Auckland 1946 MSL Datum.
- The vertical datum for all dams shall be to New Zealand Vertical datum 2009 (NZVD2009).
- Projects at the Mangere Wastewater Treatment Plant are to adopt a local datum that is 50m below the Auckland Datum.

Relationship with Other datum's

The relationships between many of the Auckland datum's is given on the drawing "Level Chart, Auckland Regional Authority", plan number 0114131.002E.

Use of Drawing Datum

The level measurements given on all existing drawings must be verified by site measurement.

Imperial Measurement Drawings

The datum for all existing drawings which were produced prior to metrication was to 3.94ft (1.2m) above Lands and Survey Department Auckland Datum 1946.

5.1.2 Survey co-ordinate systems

The survey co-ordinate system currently in use by Watercare (post 1 July 2012) is the New Zealand Transverse Mercator (NZTM) co-ordinate system documented in the LINZ Geographic Standards.

5.1.3 New drawings and Watercare standard designs

Watercare standard design drawings shall take precedence. Where impracticable due to specific constraints or as required by the designer, specific drawings detailing the work shall be completed. Reproduction of Watercare standard detail is not accepted. Electronic copies of standard P&ID symbols, abbreviations and legend sheets are available from Watercare.

5.1.4 Deliverables

- **Electronic** copies of all versions of approved drawings (electronic pdf copies for all versions up to as-built are acceptable).
- **Signed hardcopy and annotated electronic** copies of all as-built amendments. Electronic copies of as-builds are to be AutoCAD files.
- **Red line mark-ups.** Only to be used in anticipation of final AutoCAD files. Red line drawings are for interim use when works are placed in operation. A CAD as-built set must follow.
- **As-built amendments**, refer to section 4.2.1.6.
- A **drawing register** in MS Excel is to be completed when more than 10 drawings are submitted.
- **QA/QC** template completed – refer to section 8.

5.2 Drawings in 2D

All drawings shall be prepared on the Watercare planform to the standards and conventions as detailed in section 4.

5.2.1 Compatibility

AutoCAD 2014 is the software currently in use by Watercare for 2D drawings. All electronic drawing files prepared with any other software shall be compatible with this version.

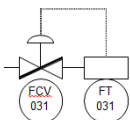
5.2.2 Specific requirements

- Obtain from Watercare Asset Information a block of drawing numbers to cover the disciplines of drawings produced for the project (i.e. Civil, Structural, Mechanical, Electrical & Control). As a minimum one base number is required for each discipline (with up to 999 sheets available for each base number). Contact AssetInfo@water.co.nz
- All plans shall be prepared using licenced AutoCAD software. The AutoCAD Tools-Options-Open/source shall be set to save to AutoCAD 2013. Alternative software may be used when approved by Watercare. The planform templates are obtainable from Watercare.

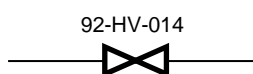
5.3 Piping and Instrumentation Diagrams (P&ID) and process drawings

The facility code and process area is not required to be shown on the equipment numberings if a drawing covers a specific facility and process area. However these should be covered in the drawing notes and title. Where more than one process is covered by the drawing, the process code shall be included in the number. In text the full number including the facility code and process area code shall be used.

- Primary equipment number shall be underlined e.g.: 05-TK-03
- Instruments or controlled valves (part of a loop) shall be enclosed with a circular border



- Other equipment shall have no borders or underlining:



Drawings shall show the process flow and services running **left to right** across the page. Flow direction shall be indicated by arrows.

Where process flows and services enter or leave a sheet links to related drawings shall be given. The related drawing shall be by indicated in arrow boxes with descriptive texts above the boxes.

The indication arrow boxes shall be vertically aligned at the left hand side of the sheet for flows and services entering the page and at the right hand side of the sheet for those leaving the sheet.

Drawings shall be overlain with a grid for referencing purposes. Numbers 1 to 9 spaced at 40 mm intervals at the top border and letters A to J spaced at 25 mm intervals shall be used down the left hand border.

The drawing layout shall be:

Location on drawing	Requirement
Above grid line A	Shall indicate the primary equipment items in text form, e.g. description, equipment no., capacity.
Between grid lines A and B	Shall indicate the electronic control interface to the DCS/PLC.
Between grid lines B and J	Shall show the process piping, instruments etc.
Below grid line J	Shall be for notes.
0 to 1	Inputs to sheet
9 to 10	Outputs from sheet

The standard P&ID symbol library is available on drawing 2009193.003 available from Watercare. Contact Asset Information to obtain the latest AutoCAD file version.

5.4 Electrical CAD plan requirements

All electrical drawings must be drawn with a snap setting of 2.5 and a grid setting of 10. Cross references shall be with Watercare's line reference of numbers 1 to 39 across the top of all drawings. All single line diagram drawings shall be lined up under reference numbers across the top of the drawing.

Electrical symbols are generally to IEC-617 and as amended in drawing 2004219.002, the latest AutoCAD file version is obtainable from Watercare Asset Information.

5.5 Advanced drawing models and 3D drawings

Modelling and BIM (building information modelling) systems:

- All models are to be prepared using industry standard software and best practice protocols as set out in BS 1192 and to BIM Level of development (LOD) 3. For more information refer to the New Zealand BIM Handbook, July 2014 (ISBN 978-0-473-29223-2)
- The model shall be structured around the Watercare Data and Asset Information standards to allow the data outputs to be captured by Watercare’s current systems.
- The model must demonstrate compliance with Watercare’s design criteria and referenced standards.
- A Project BIM Execution Plan shall be prepared by the engaged professional to formalise the integration into the project.

Three dimensional (3D) drawings:

- 3D entities must be set to “Colour ByLayer” and “Linetype ByLayer” where the software allows.
- All 2D plans using 3D modelling techniques shall comply with the other sections of this manual.
- Electronic copies of any 3D modelling shall be supplied along with all 2D documentation files that have been derived from the model for future use.
- The software’s “Object Enabler” for the current version of Watercare’s AutoCAD software shall be supplied.
- All 3D and associated files shall be provided to Watercare Asset Information for record keeping.

6 Geospatial drawings (GIS)

6.1 General requirements

Drawings shall show the whole of the works as completed. The minimum accuracy shall be to 0.05m in the X, Y, and Z direction, but additionally for pipe inverts to 0.01m in the Z direction.

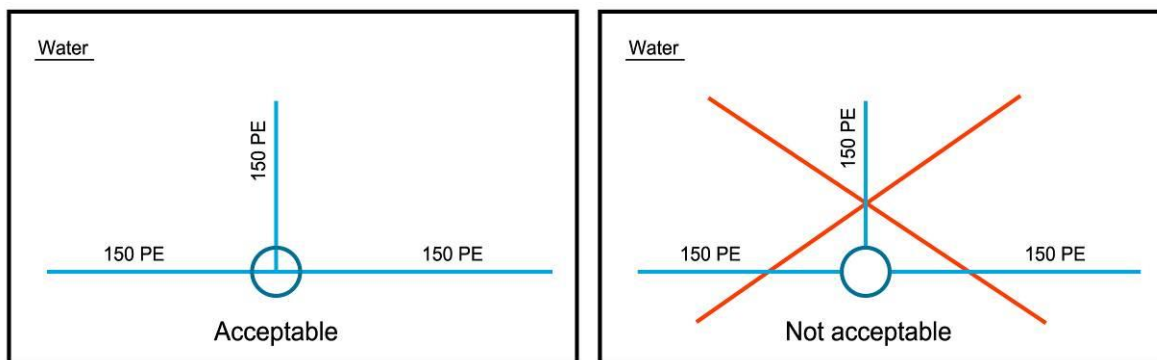
For Watercare local network capital works, Blackbox22 is compulsory. Watercare provides the licence, training and support for its use on Watercare projects. Contact Watercare Geospatial Services for assistance GIServices@water.co.nz.

6.1.1 Primary geospatial data

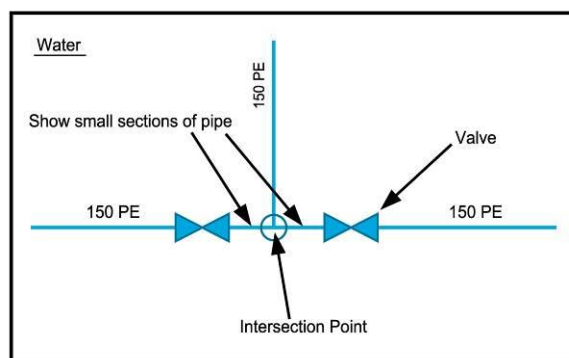
The following minimum general information and requirements apply:

- Project name or plan title.
- Drawing number.
- North point.
- Legal boundaries, legal descriptions of parcels, road names and property address numbers.
- Produce plans at a suitable scale for clarity. Show a separate service per plan if necessary. Use general notes to reduce clutter on plans.
- All levels are to be in Orthometric Heights related to Auckland 1946 Height Datum.
- Assets should be classified as Point, Line or Polygon features.
- Each DWG file should represent a continuous network of an area of interest and should not be split into multiple files.
- Wastewater – coloured red.
- Water – coloured blue.
- Existing assets to be identified as “Existing”.
- Private assets to be identified as “Private”.
- Removed assets to be identified as “Removed”.
- Abandoned assets to be identified as “Abandoned”.

- Found assets (not shown on existing records) to be identified as “Found” e.g. power, gas, telephone that cross over or run parallel to within 1m of a Watercare pipe or chamber and that has been exposed during construction.
- Connections to existing networks.
- Topographical features, fences kerbs etc. (at least one).
- Date of installation.
- Certification of accuracy and completeness by a Registered Professional.
- To ensure connectivity between networks, all features must be snapped to the object that they intersect by using CAD snapping tools. Pipes must snap to the center of a point and not to the edge of an asset. Refer to the diagram below.

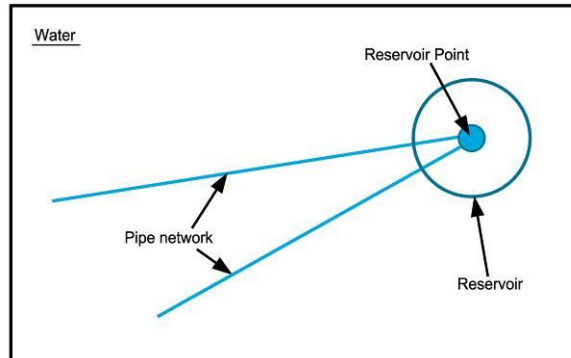


- Where two separately categorized point assets are joined together, e.g. a Tee with a valve or blank/end cap on its connections, a very small section of pipe must be drawn so that both assets can be represented in the GIS and maintain network connectivity. Refer to the diagram below.

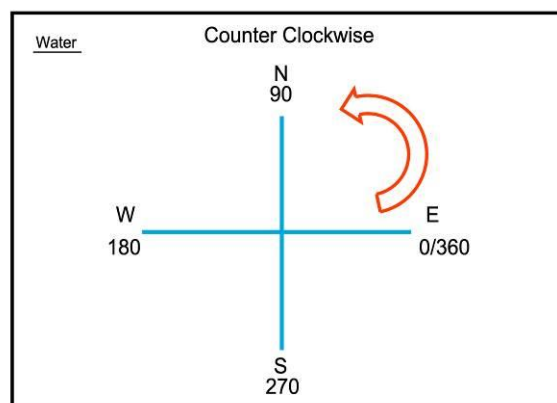


- Pipes must be represented as a single continuous line or polyline which represents the pipe centerline. There shall be no other line types used such as dotted, dashed etc.
- Pipes must be continuous between intersections with point assets. At these points they must be split into new pipes, except for main pipes that should not be split at the intersection with service connections.
- Pipes should not be broken at bends or any other places where point features are absent.
- The pipe line representation is drawn to the centre of the manhole lid, upstream and downstream. Invert levels for the pipe represent the **z values** of the pipe at the point of exit and entry at the manhole.

- Structures like pump stations, reservoirs, treatment plants, chambers etc. are to be represented as a point feature as well as a polygon feature. For polygon features (squares, rectangular, circular etc.) the point must be the centroid (centre) of the facility. For irregular shaped structures, this shall be where the inlet and outlet pipe network intersect. Refer to the diagram below.



- Any inset drawn in a CAD file must be on a separate layer.
- Every point asset must rotate **counter clockwise** and the rotation value must be recorded in the CAD file under "Rotation Field". Refer to the diagram below.



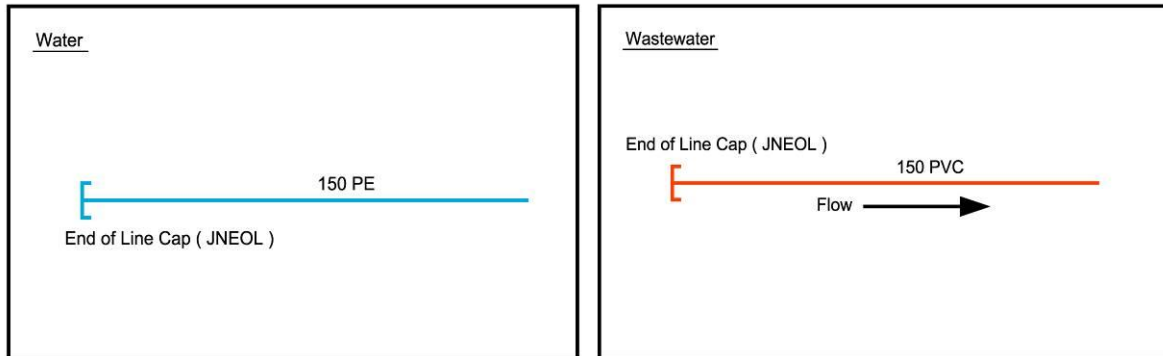
- All relevant attributes such as diameter, materials etc. shall be shown for each pipe.

6.1.2 Diagrams

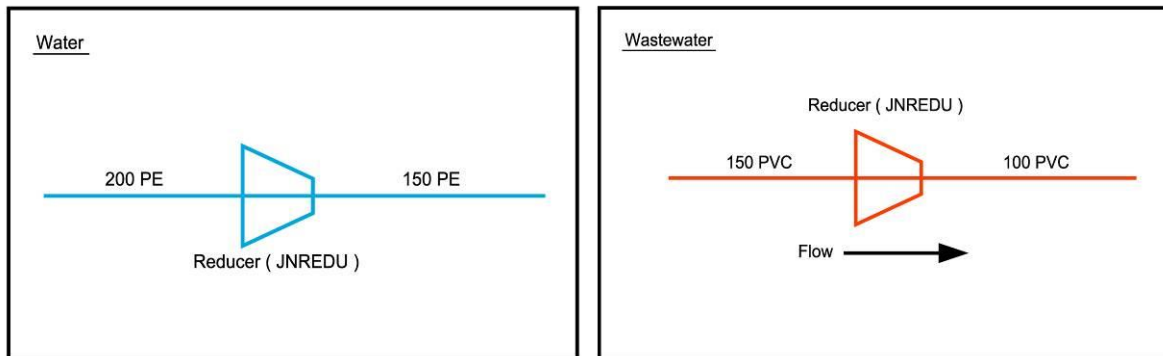
This section shows diagrams for water and wastewater assets and their snapping requirements.

6.1.2.1 General assets for both water and wastewater

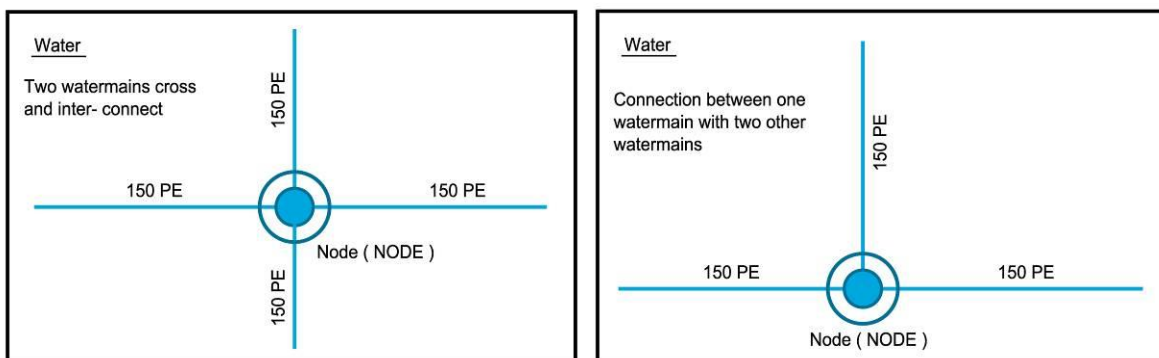
- Diagram 1: End cap.

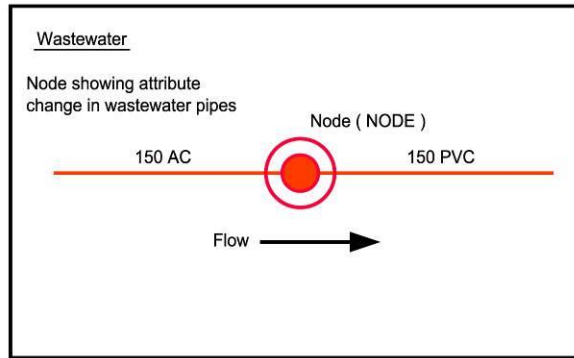
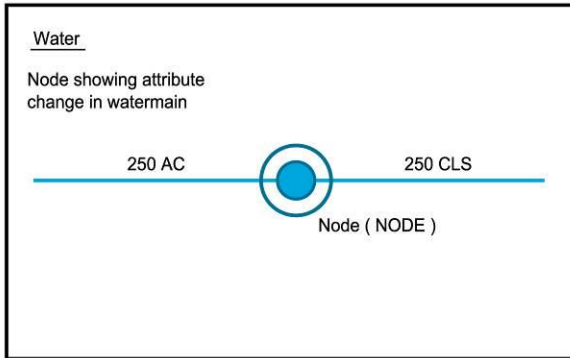


- Diagram 2: Showing pipe reducer.

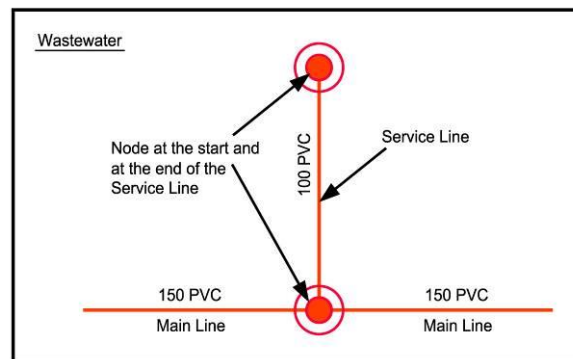
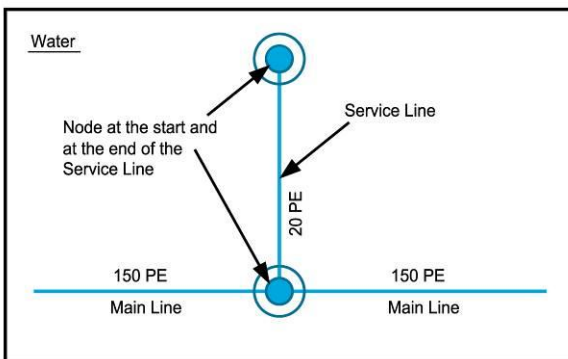
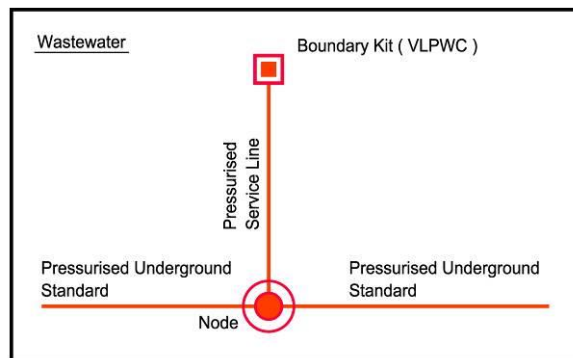
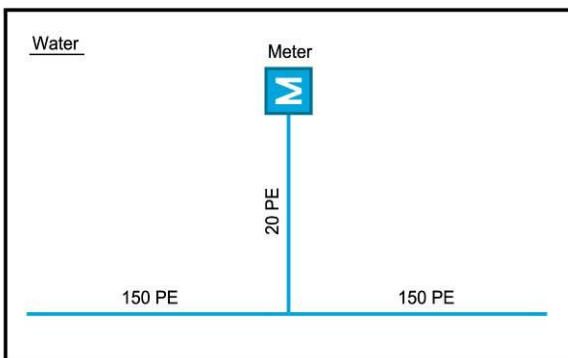


- Diagram 3: Showing nodes

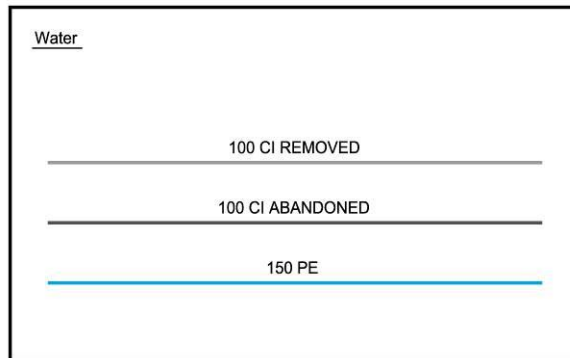




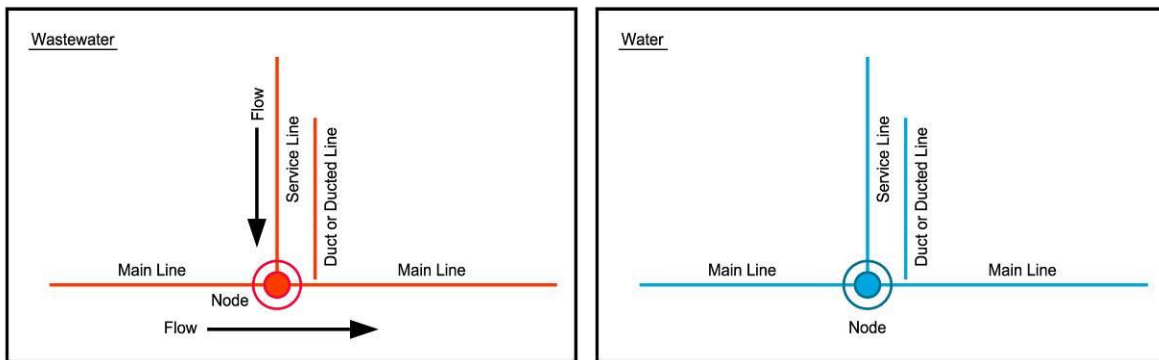
- Diagram 4: Service connections for water and wastewater.



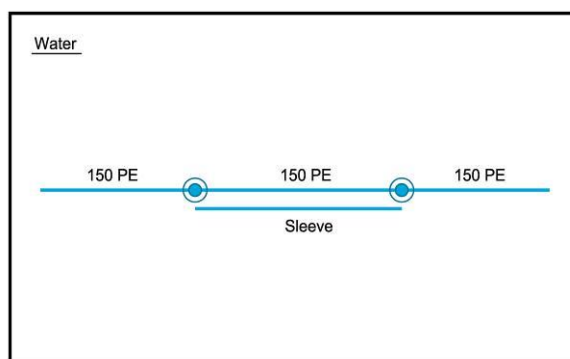
- Diagram 5: Abandoned or removed pipe.



- Diagram 6: Showing Ducted Connection.

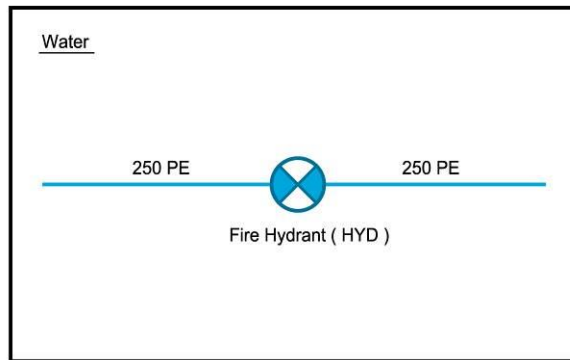


- Diagram 7: Showing sleeved or protected pipe.

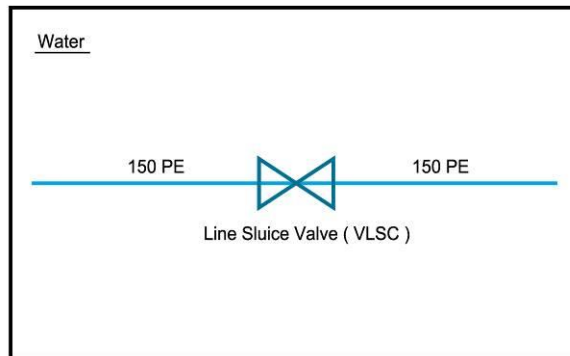


6.1.2.2 Water specific assets

- Diagram 8: Showing fire hydrants.

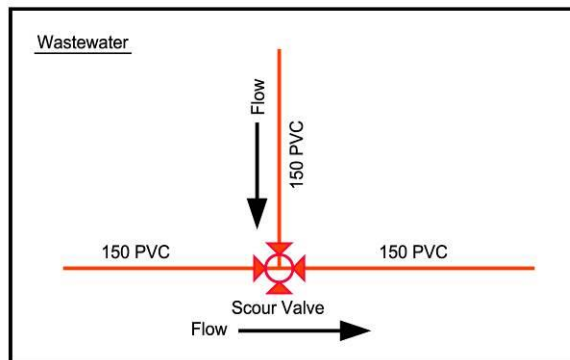


- Diagram 9: Showing isolation valves.

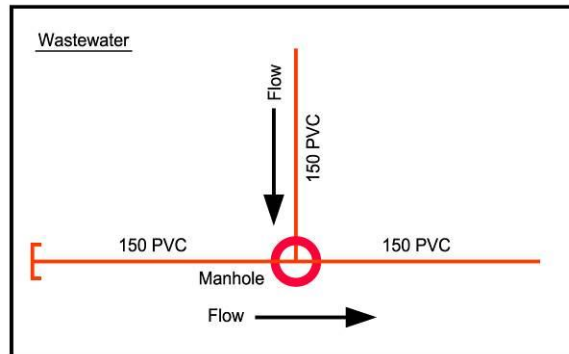


6.1.2.3 Wastewater specific assets

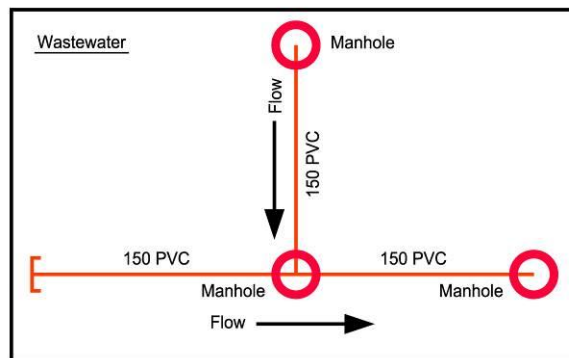
- Diagram 10: Wastewater Scour Valve.



- Diagram 11: Showing Wastewater Network Flow.



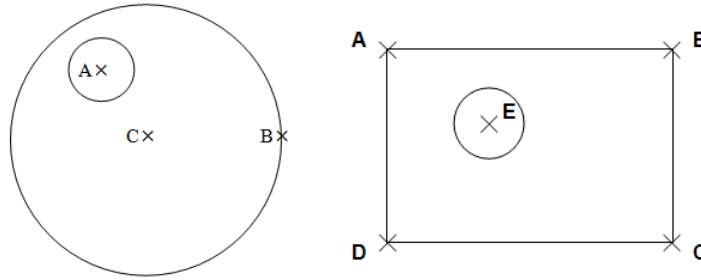
- Diagram 12: Showing Wastewater manholes.



6.2 Transmission linear systems specific requirements

6.2.1 Structures including chambers and manholes

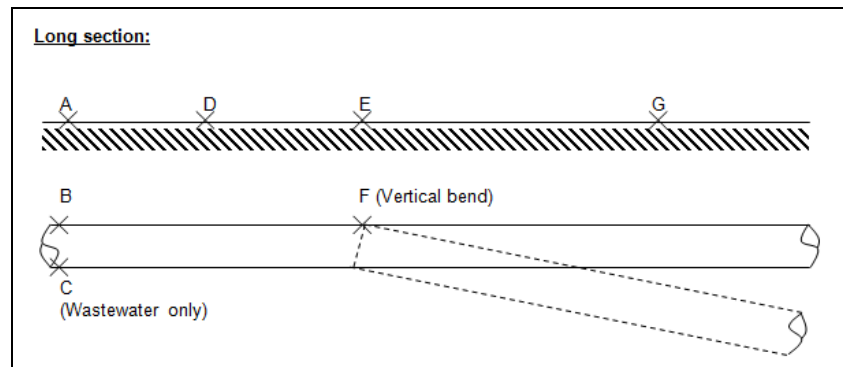
- Position, dimensions, construction details, and equipment information.
- Coordinates and general information for all connected pipework and services.
- Floor levels and soffit levels.
- Chamber and manhole position (external extends), dimensions, and lid coordinates:
 - for straight edged chambers, the external walls and corners.
 - for circular chambers, the centre and one point on the circumference.
 - The centre of chamber access lids.



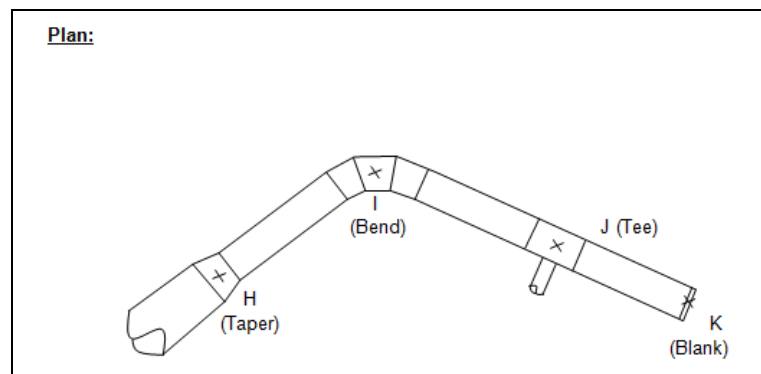
- Ground levels and cover over underground services.
- Abandoned or decommissioned structures associated with the contract works.
- External extents of any other structure above or below the ground that is deemed to be part of the construction.

6.2.2 All pipelines

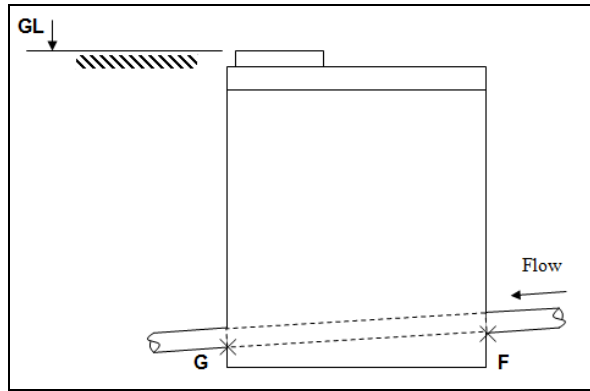
- Pipeline plan and longitudinal section, including ground levels between significant changes in grade.



- Reduced level of top of pipe.
- Invert level – wastewater only.
- Location of pipe centre line by coordinates.

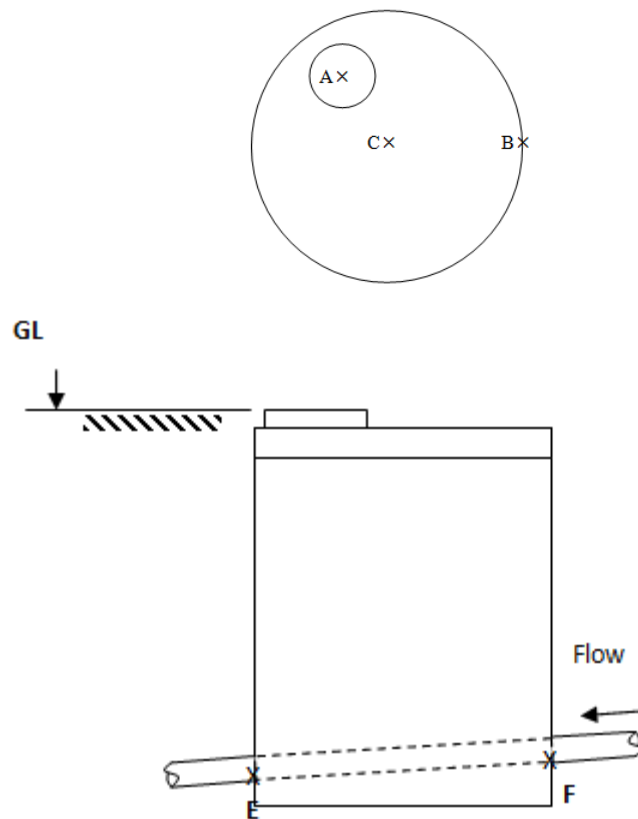


- Pipe sizes and wall thickness.
- Valve and other fitting positions and functions.
- Pipe bend positions and angles.
- Thrust block dimensions.
- Position, size and level of all connections into and out of manholes.
- Pipe invert levels inside chamber.



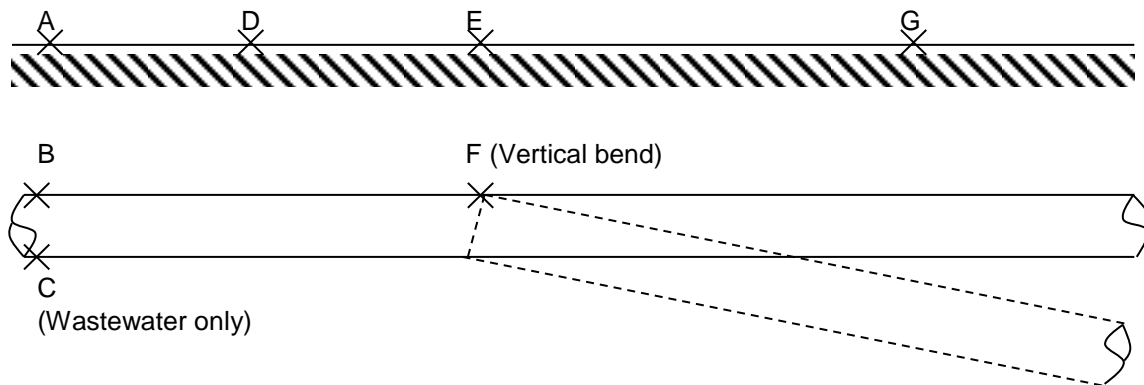
- Depth from ground level to top of pipe.

6.2.3 Example of wastewater manhole survey

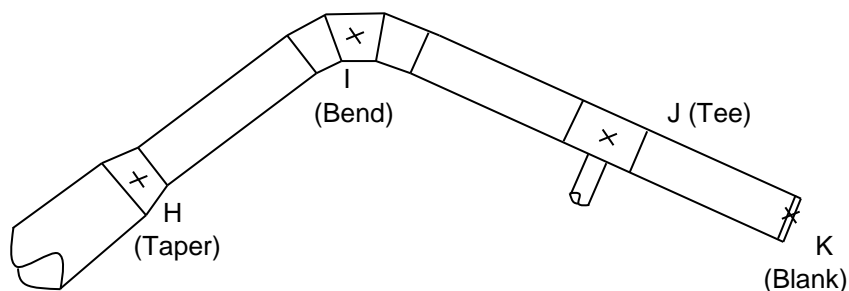


6.2.4 Example of survey for pipework

Long section:



Plan:



6.3 Local networks specific requirements

As-built drawings shall show the following minimum information:

6.3.1 Water supply

Pipes:

- Nominal bore (NB) for all PE and steel pipe or Nominal diameter (DN) for other pipe material, material type, length and class of pipes laid including road crossings and house connections.
- Note: For labelling of pipes use general notes where possible e.g. "All Water Supply pipes are 110 PE100 PN12.5 SDR13.6 unless noted otherwise".
- Bends (angle) or change of direction to be coordinated.
- Pipes removed, abandoned or found.

Fittings:

- Valves (noted for type), hydrants, tees, branches, reducers, backflow devices, thrust blocks, blank caps, meters etc. Show enlarged details where necessary.

- Fittings removed, abandoned or found.

Service connections:

- Nominal diameter, material type, length and class of pipes laid.
- Service connections removed, abandoned or found.

6.3.2 Wastewater

Pipes:

- Nominal bore (NB) for all PE and steel pipe or Nominal diameter (DN) for other pipe material, material type and class of pipes laid, length, direction of flow, bedding & backfill type and if directional drilled.
- Note: For labelling of pipes use general notes where possible e.g. All Wastewater pipes are PVC SN16 unless noted otherwise. Alternatively use this format: 150 PVC SN16 “and length” 160 PE80B SDR17 “and length”.
- Pressure/rising mains and siphons (nominal diameter, material type, class of pipes laid, length, position, bends, levels, anchor/thrust blocks, flushing valves & air valves).
- Encased protected pipes (position, length & type of protection).
- Pipes removed, abandoned or found.

Structures and Fittings:

- Manhole cover/lid level (LL) and invert level of inlet and outlet pipe (IL); invert level of drop connections.
- Label manholes with diameter and material type.
- Location and extent of pump stations, inspection chambers, dry chambers, blank caps/plates and any other node point e.g. valves (PWC systems).
- Structures removed, abandoned or found.
- Fittings removed, abandoned or found.

Service connections for gravity pipe:

- Nominal diameter, material type, length and class of pipes laid.
- Show connection length of pipe to main in accordance with the point of supply.
- A connection greater than 5m in length should be coordinated and invert levels provided.
- Service connections removed, abandoned or found.

Service connections for pressurised pipe:

- Nominal diameter, material type, length and class of pipes laid.
- For connection boundary kits connecting to a pressurised system show the distance from the centre of the boundary kit box cover to the connection point on the main pipe. Provide length of pipe.
- For connection boundary kits connecting into a gravity system show the distance from the centre of the downstream manhole cover to the centre of the boundary kit box cover. Provide length of pipe.
- For connection into a vacuum system show the distance from the vacuum valve in the onsite vacuum vault to the main pipe.
- Service connections removed, abandoned or found.

6.4 Electrical and control

- Electrical cable and fitting positions and functions including cathodic protection and telemetry.
- Pipeline electrical isolation points such as insulated flanges.

- Cabinetry positions, dimensions and coordinates.
- Duct size, wall thickness and reduced level of top of duct/cable.
- Location of ducting/cable centre line by coordinates.

6.5 Plants, pump stations and associated electrical – All areas

Details shall comply with requirements as set out for transmission, see section 6.2 and 6.4.

6.6 Vested assets

Where any external party constructs new developments or subdivisions not contracted by Watercare the final survey as-builds in CAD shall be supplied before the assets are connected and vested to Watercare.

7 As-built metadata

Refer to section 5.5 when this data is included in the drawing model.

8 QA/QC template

The quality control checks shall be completed before submitting drawings to Watercare to prevent re-work and delays in drawings being accepted.

No.	Description	Not Required	Completed
1	Current Watercare CAD manual, planforms and associate files – obtained from Watercare.		
2	Project No. obtained from Watercare.		
3	Contract No. obtained from Watercare.		
4	Drawing No. obtained from Watercare.		
5	Project Wise Project Vault – Watercare to advise if required.		
6	Plan Title and Group Code received from Watercare.		
7	Facility Code provided by Watercare and added to the top line of the plan title.		
8	DRAFT Planform forwarded to Watercare for approval.		
9	North point shown on all plan views.		
10	Sheet 001 – Location plan, drawing register with revision issues.		
11	Sheet names and numbers to all plans.		
12	Sheet joining lines shown.		
13	CAD File number on the plan to be the same as the drawing number including the revision issue (e.g. 2010123.001A)		
14	Sheet numbers start at 001. The series has no gaps unless approved by Watercare.		
15	Preliminary issues of the plans to be issue 1, 2 etc. – Not required for Watercare capture.		
16	First approved issue is the dashed issue (“-“)		
17	Local reference number added to plans where required.		
18	3 rd Party reference number added to plan where required.		
19	Provide copies of all approved issues to Watercare as they are produced. Pdf copies for all issues up to as-built stage. At the as-built stage a CAD file is required.		
20	Watercare plot styles used		
21	Watercare standard symbols library used to prepare the plans.		
22	Electrical drawing setup to Watercare requirements		
23	Xref’s to be bound into the drawing and unused references and superfluous xref’s removed.		
24	All Xref’s to be supplied with the CAD file.		
25	All plans drawn in model space to NZTM.		
26	Page paper size set to A3 or A1		
27	Other/adjacent Watercare assets labelled.		
28	Manhole numbering as approved by Watercare.		
29	Asset identification added to plans where required.		
30	Survey point codes supplied to Watercare where appropriate (all non-process).		
31	For water and wastewater longitudinal sections the direction of flow shall be indicated as: water pipework – flow left to right on		

No.	Description	Not Required	Completed
	the sheet; wastewater pipework – flow right to left towards. Flow directions are shown on the plans.		
32	Bar scales to be shown on all plans.		
33	Service plans have a legend on each sheet.		
34	Text sizes as called for in the CAD Manual – minimum sizes to be checked.		
35	Any manufacturer’s drawings to be forwarded to Watercare.		
36	An asset upload spreadsheet to be completed where required – (Refer Watercare Data and Asset information standard)		
37	Where CAD plans are required from Watercare, edit rights returned to Watercare when the project has been completed.		
38	Any associated and historic plans updated as required.		
39	Any red line mark-ups forwarded to Watercare for temporary holding set as required.		
40	When the construction issue CAD files are amended to as-built: Any additional survey as-built plans (created by the surveyor) shall be provided with the as-built set.		
41	Where tabbed CAD files are used for as-builts, pdf copies of all sheets are required.		
42	Remove “clouds” from as-built drawings; no new triangles to be added		
43	As-built CAD files – Viewport’s to be ‘ Display Locked ’ and turned off except for polygons. Viewport colour to be dark grey and set to ‘ Non plot ’		
44	AutoCAD files saved to AutoCAD 2013		
45	As-built set supplied to Watercare		
46	All GIS requirements supplied to Watercare.		