SEVERN TRENT SERVICES OPERATIONS UK LTD

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Revision history

Revision number	Issue date	Description of revision	Section / pages revised
1.0	23-3-2018	First issue	All
1.1	07-3-2019	Telemetry specification and CAD specification incorporated	Section 6 and 7
1.2		Amendments made to Clauses: • 2.8 – reinstatement of runways and taxiways • 2.9 – added to describe kiosk specification	See left

		• 2.11 – changed to require digital copies of CCTV surveys • 3.4 – Preferred supplier added for chlorine dosing lances • 4.1 – amended to revise requirements for manholes and access chambers • 4.2 – amended to revise requirements for manholes and access chambers	
1.3	18-06-2020	• Preferred supplier for Telemetry outstations updated, including name change from Servelec to Ovarro • Requirement to follow RAMPS policies added • Telemetry signals for sewage ejectors revised.	Section 6
1.32		• Materials section updated to reflect that above ground pipework shall not be constructed from plastics. • Duty / Standby requirements • Valve closure direction	Section 3.1
1.33	01-09-2020	Additional Electrical and Telemetry Specifications	Section 3.3 & 6.0
1.4	12/10/2021	New Section 3.3 Electrical Requirements added New Section 3.5 Standards for assets not covered by WIMES added (FB's, OWI's, EWS tanks) added Meter spec for networks and process control clarified (Section 3.4)	Section 3.3

Control and Authorisation of this document	a	This document is controlled and authorised for use when signed by all Severn Trent Services signatories. Any / all amendments needed shall be requested through the STS Contract Management Team, who will ensure the document is updated by the Technical Author and Checked and Approved for use. Any amended documents will be issued by the STS Contract Management Team to STS Framework Suppliers or by the STS Project Manager to non-Framework suppliers. A checklist of current standards can be requested from the STS Contract Management Team.
Supplier(s)	b	Where this document or any documents referenced in this document refer to a Supplier or Suppliers, this means the party providing the services or works to STS.

Contents

1.0 Introduction

This document represents the minimum standards to be achieved; save where a higher standard is specified by any other document forming part of this contract.

The Severn Trent Services Engineering Specification comprises the following specifications, plus the additional and amended clauses detailed in the sections below.

- Civil Engineering Specification for the Water Industry, 7th Edition (CESWI 7), in section 2.0 below.
- Water Industry Mechanical and Electrical Specifications (WIMES) – in section 3.0 below.
- Sewers for Adoption, 7th Edition, in section 4.0 below.

1.1 Note – Contract Administrator

Where any referenced specification refers to a Contract Administrator this shall be read and construed as reading 'Severn Trent Services'.

2.0 CESWI 7; The Civil Engineering Specification for the Water Industry, 7th Edition

The specification for Civil Engineering shall be The Civil Engineering Specification for the Water Industry, 7th Edition, as published by WRC Plc on behalf of UK Water Industry Research Ltd.

Including the additional and amended clauses below.

2.1 Asset Records CESWI 7 Clause 1.23

Add the following clauses:

2. Prior to handover of the completed works, the Supplier shall submit a full set of electronic 'as-built' drawings. The drawings shall be in sufficient detail to enable safe and efficient repair/maintenance work to be undertaken, and replaceable items to be adequately identified.

3. Drawings shall be supplied in accordance with the Severn Trent Services CAD standards, including the use of Severn Trent Services drawing borders and title blocks.

4. The 'As-Built' drawings shall show plans, elevations and sections, indicating principal dimensions, loadings, foundation and fixing details, and component parts. Drawings to be provided shall include the following:
    a. Process and Instrumentation Diagram(s)
    b. Site Layout.
    c. Layout of all equipment.
    d. General arrangement of all mechanical plant, sufficient to allow dismantling, reassembly and diagnostics.
    e. General arrangement of control panels and cubicles and detail drawings of the following: -
        i. Layout of equipment within cubicles.
        ii. Layout of equipment mounted on doors.
    f. Schematic diagrams of connection for control panels and cubicles.
    g. Control schematic diagrams.

h. Cable routes.
i. Single line diagram of power distribution circuit(s).
j. Cable schedules showing the following details:
    i. Cable references.
    ii. Cable type, size and number of cores.
k. PLC flow and/or ladder diagrams.

5. Copies of all software and configuration files for PLCs, HMI's, telemetry and control systems shall be provided to Severn Trent Services prior to completion and handover.

6. An Operational & Maintenance Instruction Manual (O&M Manual) shall be provided containing the information necessary and specified to enable Severn Trent Services to safely operate, maintain, dismantle, reassemble, re-commission, modify and adjust, all parts of the Subcontract Works or Services (civil, mechanical, electrical and instrumentation). The Subcontract Works or Services shall not be regarded as complete until the full O&M Manual(s) have been provided and accepted by Severn Trent Services.

   The O&M Manual shall contain the following information regarding the site:
   a. Site Protocol
   b. General Safety Procedures
   c. Specific PPE Requirements for tasks
   d. General Description of the works and equipment installed
   e. General Description of Civil Structures
   f. Process Design Parameters
   g. Process Flow Diagram
   h. General Site Layout Drawing
   i. Cable Route Drawing
   j. Operating Instructions & Control Philosophy
   k. Fault Finding & Correction
   l. Schedule of Routine Inspection, Maintenance and Lubrication Tasks
   m. Recommended Spares
   n. Schedule of Recommended Special Tools
   o. Test Certificates (including End to End Testing of Telemetry)
   p. Schedule of Materials in Contact with Potable Water
   q. Site Services Documentation

7. Severn Trent Services Asset Update Request Forms are complete for each installed asset.

8. Severn Trent Services shall be entitled to reproduce all O&M Manuals, and associated documentation for use in connection with its business, in hard copy or electronic format, subject to compliance with the terms of third-party software licences.

2.2 Training CESWI 7 Clause 1.24

Add the following clauses:

2. Training shall be provided to ensure that management, operational and maintenance staff have received detailed training to allow the Subcontract Works to be operated and maintained in accordance with the Health & Safety at Work Act and to optimise the efficient

operation and maintenance of the works in all aspects. Allowance should be made for training on all plant and equipment.

3. Severn Trent Services shall make available selected staff to be trained in the safe operation and maintenance of the installed/modified plant. Allowance shall be made for comprehensive training in separate sessions for each of the following disciplines: -
    a. Management staff
    b. Operational staff
    c. Electrical Maintenance staff
    d. Mechanical Maintenance staff

4. Training shall be performed by specialist personnel including commissioning engineers and software specialists specifically allocated to the task and shall be additional to any 'familiarity' training that would take place during the testing/commissioning period. On individual items of plant/equipment training must be carried out by the manufacturer or nominated specialist. Allowance should be made for both classroom and hands-on training.

5. Tests shall be carried out to measure the effectiveness of the training and certificates of attendance shall be issued.

6. Training shall be provided for management, operational and maintenance staff which covers in detail the following areas. A syllabus of the training to be provided shall be produced, in conjunction with Severn Trent Services. An approved syllabus and a training plan shall be submitted to Severn Trent Services four weeks prior to Tests Before Completion. The syllabus to be provided shall be based upon the following:

    a. Safety Procedures.
        i. Introduction.
        ii. General requirement of Health & Safety at Work Act.
        iii. Site specific safety issues and outputs from risk assessments, including chemical hazards and potentially explosive atmospheres.
        iv. Management Procedures.
        v. PPE Requirements
        vi. Operational & Maintenance General Procedures.
        vii. Electrical Plant/Equipment.
        viii. Mechanical Plant.
    b. Scope of Work.
        i. General Plant Description.
        ii. General process description.
        iii. Process design parameters.
    c. Detailed Description of the Electrical Equipment.
    d. Detailed Description of the Mechanical Equipment.
    e. Detailed Description of the Control Philosophy
    f. Operating Instructions.
    g. Inspection and Maintenance Instructions.
    h. Fault Finding and Correction.
    i. Spares - Strategic and Consumables.
    j. Special Tools.

k. PLC Software.
l. Review of Drawings & O&M Manuals.
m. Specialist training for technicians on plc's MMI's, SCADA, MWCS etc.

7. Each operator shall be issued with a Functional Task Book which shall include a comprehensive schedule of daily tasks to be carried out by the Operator in maintaining satisfactory operation of the plant.
   The Functional Task Book shall contain as a minimum:
   a. Project Brief.
   b. Training Notes.
   c. Site specific safety issues and outputs from risk assessments, including chemical hazards and potentially explosive atmospheres.
   d. Operating Instructions.
   e. Inspection and Maintenance Instructions.
   f. Fault Finding and Correction.
   g. Defects Management System.
   h. Appendices containing site overview, alarm schedule and maintenance schedule.

2.3 Handover CESWI 7 Clause 1.25

This is an additional clause:

1. Notwithstanding the successful completion of any witness tests, tests before completion, trial running periods and proving periods, handover of the daily operation of the Subcontract Works or Services shall not pass to Severn Trent Services until all of the following have been satisfied:
   a. The process units are physically complete.
   b. Permanent access is in place.
   c. Statutory certification has been forwarded to Severn Trent Services.
   d. Asset labelling is complete.
   e. Electronic O&M manuals are complete.
   f. Record information including drawings is complete.
   g. Pre-handover training is complete.
   h. Electrical works and panels have been accepted by Severn Trent Services' Senior Authorised Person (SAP).
   i. Asset Update Request Forms are complete for each installed asset.
   j. Waste materials have been removed from site.
   k. Copies of PLC software and telemetry configuration have been forwarded to the Contract Administrator.

2.4 Ladders CESWI 7 Clause 2.70

Add the following clause:

6. Ladders shall not be installed in manholes.

2.5 Manhole Steps CESWI 7 Clause 2.75

Remove Clause 1 and replace with:

1. Manhole steps shall not be installed.

2.6 Sample Taps CESWI 7 Clause 2.116

Add the following clauses:

4. Sample lines shall be made of copper pipe complying with BS EN 1057 which should neither support microbial growth nor leach metals or organic materials into the water to be sampled.

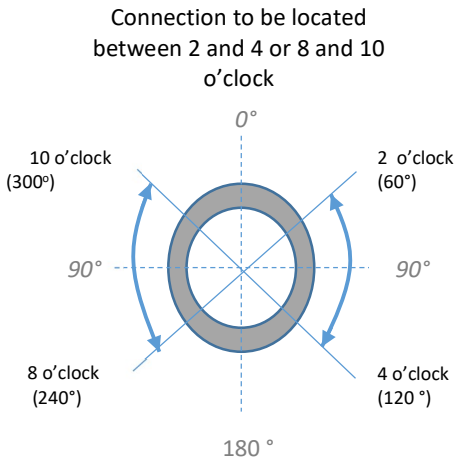
5. Sample lines should be a single dedicated pipe with no off-takes.

6. The method of connecting the sample pipe to the main shall be either:
    a. A standard ferrule
    b. A drilled and tapped pipe band
    c. A BSP socket

7. A WRAS approved quarter-turn isolation valve shall be installed directly downstream of the connection point.

8. The connection point shall be accessible and not buried or submerged.

9. The connection point shall be between the 2 o'clock and 4 o'clock or 8 o'clock and 10 o'clock positions on the pipe



10. The sample line shall be as short as possible and must not exceed 10m in length.

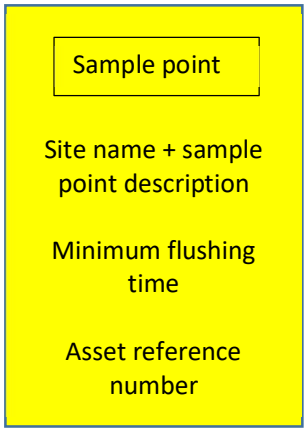
11. The sample line shall be one continuous length of pipe. There shall be no joints, fittings, branches, check-valves or anti-back siphoning devices fitted in the line.

12. All sample lines (regardless of duct) must be lagged with minimum 32mm wall thickness pipe insulation, to reduce the potential risk of freezing and/or the risk of a rise in water temperature.

13. All sample line pipework (including lagged pipework) should be identified by banding with a pipe identification tape and flow direction arrows (pipework installed in ducts does not require to be labelled).

14. Pipework should be labelled at approximately 2m intervals, at entry/exit points and at terminations. The pipe identification label shall be worded 'SAMPLE' with a minimum text size of 12mm and the label text shall be as per the sample tap label colour convention.

15. All sample points must be clearly and unambiguously labelled. The label shall contain the following information:
    a. Site name.
    b. Description of sample, e.g. raw water, post clarification, etc.
    c. Minimum flushing time prior to sampling.
    d. Asset reference number (if applicable).



- Final Water Sample Point labels shall be black lettering on a yellow background (as shown above)
- Raw Water Sample Point labels shall be White lettering on a green background
- Operational Sample Point labels shall be black lettering on a white background

16. Sample taps are to be specifically designed for sampling and shall be a ½" WRAS approved tap.

17. Sample taps must either be
    a. securely mounted to a stainless steel backboard with a minimum clearance of 500mm in height from end of tap to base of the sink, sufficient to fill all sample vessels and designed/orientated to directly fill the receiving vessel.
    b. Incorporated into a purpose built stainless steel sink unit with a minimum clearance of 500mm in height from end of tap to base of the sink, sufficient to fill all sample vessels and designed/orientated to directly fill the receiving vessel.

18. Raw water sample taps and final water sample taps shall be positioned no less than 500mm apart. Physical barriers shall be incorporated to prevent splashing from one tap contaminating another tap.

19. Drainage facilities shall be provided. Waste water shall normally be disposed to foul sewer. Under no circumstances shall untreated waste water be allowed to drain into a water course.

2.7 Water Fittings and Appliances CESWI 7 Clause 2.135

Add the following clause:

2. Water fittings and appliances shall comply with the Water Supply (Water Fittings) Regulations 1999.

2.8 Reinstatement of non-maintainable highways CESWI 7 Clause 3.8

Add the following clauses:

2. Where excavation of runways, taxiways and other areas subject to aircraft movement is unavoidable, reconstruction of the trench shall match the existing construction as a minimum. The surface shall be reinstated to match the original surface to ensure the safe passage of aircraft and vehicles.
3. Reinforced concrete reinstatements must adhere to SROH, Specification for the Reinstatement of Openings in Highways, Fourth Edition.
4. Reinstatements and reinstatement materials will meet legislation requirements as specified under SROH (Specification of Reinstatement of Openings in Highways Forth Edition), HAUCUK Advice notes /agreements to avoid defects, NRSWA, CESWI 7 and the amendments set out in the STS Engineering Specification.

2.9 Kiosks

Add the following clause:

6.38 All kiosks constructed must conform to Sewers For Adoption 7th Edition clauses:

- D6.10
- D6.11 Clauses 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16
- D6.12

2.10 Precautions prior to testing pipelines CESWI 7 Clause 7.2

Add the following clause:

4. Closed valves shall not be used to isolate pipework being commissioned from operational pipework systems

2.11 CCTV Inspection of pipelines CESWI 7 Clause 7.7

Add the following clause:

5. Prior to Handover of any sewerage works, an internal colour closed circuit television (CCTV) inspection of all pipelines, including new connections shall be carried out. A full report shall be submitted, together with the digital recordings of the survey which shall become the property of Severn Trent Services.

2.12 Disinfection of water mains CESWI 7 Clause 7.11

Add the following clauses:

5. Water from existing water mains shall be passed through the bridging pipework by reference to the meter at a predetermined constant rate into the main to be disinfected. The hypochlorite solution shall be injected at a measured rate sufficient to produce a uniform free chlorine concentration of 30 mg/l, until the pipeline is fully charged with chlorinated water. Immediately upon charging the main, the residual chlorine level shall be checked and verified at either end of the main.

6. Chlorine test equipment shall be provided of the approved high range (0-50mg/l) type. Checks for free chlorine concentrations shall be made at the limits of the pipeline and at any sample points. Sample points shall be in accordance with Clause 2.116 and shall be spray disinfected immediately prior to use.

7. Once the pipeline has been successfully filled with the required strength of hypochlorite solution, it shall be isolated and allowed to stand for at least 16 hours.

8. After the standing period, the chlorinated water shall be flushed to waste by introducing further water to the pipeline through the bridging pipework. The water in the main shall be "turned over" at least once.

   The concentration of free chlorine and pH level shall be assessed before test water is discharged. An approved sodium thiosulphate dosing system shall be used to dechlorinate all discharge water. The dosing rate shall be monitored at regular intervals ("timed samples" equivalent to the volume of the pipe between sample points) to ensure that the discharge water is dosed at the correct rate.

9. On commencement of flushing, samples shall be taken from the incoming supply. If flushing takes longer than 24 hours, a further sample shall be taken from the incoming supply at 24-hour intervals.

   The pH and the free and total chlorine levels shall be assessed for each sample and the highest readings used for comparison with the discharge water.

   Flushing shall continue until the pH and chlorine concentration of water being discharged at all points along the length of the pipeline is no higher than the water supplied from the existing main. Furthermore, following cement mortar relining, flushing shall continue until the pH level has been reduced to below the PCV limit of 9.5 (PCV = Prescribed Concentration Value).

10. After completion of flushing, mains ends and all associated fittings shall be securely covered and the main allowed to stand full of water for a further period of at least 16 hours, but not in excess of 24 hours before testing. At the end of this period, samples of water shall be taken from the main at the designated sample points as agreed with Severn Trent Services. These shall be collected and tested to establish the bacteriological, chemical and physical qualities of the water in the section of main under test. The test results shall be supplied to Severn Trent Services.

    Samples shall be taken from the new main as follows:
    - From the incoming supply for chlorine determination (this sample not for submission to the laboratory).
    - The terminal sample point.
    - All legs and at selected points along the new main as described in the table below:

Length of Main	**Recommended Sampling Interval (m)**
< 300m	Not > 100m
300 to 1000m*	Not > 200m and no less than 3 samples.
> 1000m*	Not > 300m and no less than 5 samples.

    * An acceptable alternative is to take an equivalent number of timed samples (flow rate and volume known) from a single or low number of sample points. This method is suitable for large diameter (including trunk mains) or longer mains with few take off points.

11. If any of the samples tested exceeds the values for the parameters set out below, the section of main under test shall be deemed to be unsatisfactory.

Determination	Result	Pass /Fail	Action
Free Chlorine	>0.1 mg/l above incoming supply	Fail	Flush and resample
pH	outside of 6.5 – 9.5	Fail	Flush and resample
Subjective Odour	Unsatisfactory odour	Fail	Flush and resample
Appearance	Colour and solids	Fail	Flush and resample

Samples for laboratory analysis should not be taken unless the on-site results are satisfactory.

Determination	Result	Pass /Fail	Action
pH	outside of 6.5 – 9.5	Fail	Flush and resample
Turbidity	>2NTU ≤4 NTU	Pass	Flush prior to commissioning
Turbidity	<4	Fail	Flush and resample
Subjective Odour	Unsatisfactory odour	Fail	Flush and resample
Subjective Taste	Unsatisfactory taste	Fail	Flush and resample
Coliforms	Presence of coliforms	Fail	Rechlorinate and resample
E. coli	Presence of E.coli	Fail	Rechlorinate and resample
Non coliforms	<100	Pass	Flush prior to commissioning

In the event of the test being unsatisfactory, swabbing, disinfecting, flushing, standing and sampling procedures shall be repeated as necessary until such time as a satisfactory result is obtained from each sample point. Testing shall not be deemed complete until such time as a satisfactory result is obtained from each sample point.

If failures are repeated the process and results should be reviewed with Severn Trent Services to determine the cause of failures and identify further actions.

3 Working days shall be allowed for the samples to be tested and for the production of the results.

It should be noted that the method of odour testing used by the laboratory's scientific staff shall generally follow those required of the pipe and fittings manufacturer.

12. After the sample results have been confirmed in writing by Severn Trent Services to be satisfactory, and when authorised by Severn Trent Services, the new main shall be made fully operational and connections completed to existing pipelines.

    The period between satisfactory bacteriological results being obtained and the making of the main operational should be as short as possible. In the event of this period exceeding 14 days, the main should be flushed to waste, ensuring that the water in the main is 'turned over' at least once, allowed to stand for a minimum of sixteen hours and then resampled.

13. All pipes and fittings used at connections to existing pipelines shall be brushed clean and liberally sprayed internally with a hypochlorite solution with a free chlorine residual of 1000 mg/l (ppm). The assembly shall then be fitted into the main. Awareness of liability in respect of discharges to watercourses is essential.

14. Mains Renewal – Pipe Bursting, Slip Lining – where mains shall be returned to service without time for full new mains commissioning procedures (Sub-clauses 1 to 10):

    a. The length of main to be installed shall have each end capped and be charged with chlorinated water and disinfected in accordance with Sub-clauses 1 to 6. Pressure testing of the new pipe should be carried out simultaneously.
    b. Where coils are used, they shall be laid on their sides to allow air to escape. The pipe ends shall be closed and sealed at all times and the disinfection procedure repeated if a coil is cut or not used until the following day.
    c. Approximately one hour before installation the length of main to be installed shall be drained of super chlorinated water and capped. The procedures for discharging flushed water, described in Sub-clause 7, shall be followed.
    d. Once installed the main shall again be chlorinated. Sodium hypochlorite solution shall be injected at a measured rate sufficient to produce a uniform free chlorine concentration of 50 mg/l, until the pipeline is fully charged with chlorinated water. Care must be exercised in the dosing and charging of the main to ensure an even distribution of the sodium hypochlorite. When charged, the mains must be re-isolated and left to stand for 30 minutes. Immediately upon charging the main, the residual chlorine level shall be checked on site.

       After the 30 minutes chlorination period, thorough flushing, in accordance with Sub-clauses 7 and 8, shall be carried out. The samples shall be assessed on site by Severn Trent Services' staff involved in the valving operations, or by other certified personnel. Where no pollution hazard has been present, the main can be returned to service after approval by Severn Trent Services.

       After completion of flushing, additional samples shall be taken for laboratory testing, in accordance with Sub-clauses 9 and 10. The downstream end of the commissioned section of main shall not be reconnected into the water distribution network until the bacteriological results have been confirmed satisfactory.
    e. Minimum number of Instachlor PR 1000 tablets required (for each 100-metre length of pipe) to achieve stated chlorine concentration.

Pipe Diameter	No. of PR 1000 Tablets 20 mg/l.	No. of PR 1000 Tablets 50mg/l.
63mm	7	17
90mm	13	32
125mm	25	62
180mm	51	128
250mm	99	246
315mm	156	390
355mm	199	496

15. Mains Relining – cement mortar, epoxy and non-structural thin wall linings.
    a. Where time permits, e.g. trunk mains, full new mains commissioning procedure (Sub-clauses 1 to 10) shall be carried out. Where relined mains are to be rapidly returned to service, disinfection procedures in accordance with Sub-clause 14(d) shall be carried out.

b. In certain circumstances a scraped but unlined main may be temporarily recommissioned for up to 48 hours prior to relining. Disinfection procedures in accordance with Sub-clause 14(d) as a minimum shall be required. Additional sampling and disinfection arrangements must be agreed with Severn Trent Services' staff in advance of any operations.

2.13 Disinfection of structures for potable water CESWI 7 Clause 7.15

Add the following clauses:

5. Clean boots and protective clothing etc. shall be provided to personnel solely for use in the structures for potable water. Footbaths shall be provided by each opening into the reservoir which shall be kept filled with a 1000 mg/l sodium hypochlorite solution. All persons entering the reservoir shall do so by passing through the footbath.

   A sign shall be erected and maintained alongside every access: The sign shall show in white lettering on a red background:

   Sterile area

   Entry by footbath only

6. Upon the completion of construction/repair works, hypochlorite solution at 20mg/l shall be sprayed by means of hand, electrical or compressed air driven pumps on all internal surfaces of the reservoir including underside of roof, walls, ladders, pipework and floor etc. No pump using petrol, gas oil, oil or gas as fuel shall be permitted. Any compressed air driven pumps shall be provided with a device to ensure that no oil fumes etc. can be discharged into the reservoir

7. On completion of spraying, the chlorinated water in the reservoir shall be completely de-chlorinated by the addition of sodium thiosulphate, and when de-chlorination has been completed the water shall be discharged to waste at a maximum rate determined by the local requirements of the EA as well as in terms of quality and point of discharge.

8. On completion of flushing with potable water Severn Trent Services shall fill the reservoir with potable water and allow it to stand full of water for a period of at least 16 hours before testing. At the end of this period Severn Trent Services' Representative shall take samples of water from the reservoir and these shall be tested to establish the bacteriological quality of the reservoir.

   Bacteriological samples shall be taken by Severn Trent Services or their delegated representative during the normal working week (Monday to Friday). If any sample tested exceeds the values noted in Clause 7.12.9, in respect of bacteriological quality, the sterilisation shall be deemed to have been unsatisfactory. In the event of the test being unsatisfactory, the whole of the sterilising procedure shall be repeated as required by Clause 7.12.9.

   5 Working days shall be allowed for the samples to be tested and for the production of the results.

9. Following satisfactory disinfection and testing, the water in the reservoir shall remain for use by Severn Trent Services and thereafter, the reservoir shall be regarded as operational. No valves shall be turned, nor shall any other action be taken which might interfere with the use of the reservoir.

3.0 WIMES; The Water Industry Mechanical and Electrical Specifications

The WIMES specifications cover the following equipment:

1.01	Axially Split Casing Pump Units
1.02	Submersible Pump Units
1.03	Dry Well (Volute Casing Type) Sewage / Sludge Pump Units
1.04	Progressing Cavity Pump Units
1.05	Submersible Borehole Pump Units
1.07	Ram Pump Units
1.08	Peristaltic Pump Units
1.09	Single Diaphragm Pump Units
1.10	Double Disc Pump Units
1.11	Rotary Lobe Pump Units
1.12	Packaged Water Booster Sets (Positive Inlet Pressure Applications)
1.14	Pump Unit Repair / Overhaul
1.15	End Suction (Back Pull-Out Type) Pump Units
1.16	Vertically Suspended (Bowl Type) Pump Units
1.17	Vertical Multistage Pump Units
2.01	Rotating Settlement Tank Scrapers
2.02	Grit Removal and Treatment Equipment
2.03	Package Inlet Works for Waste Water Treatment
2.04	Low and High-Speed Vertical Shaft Surface Aerators
3.01	Low Voltage Switchgear and Control Gear Assemblies
3.02	Low Voltage Electrical Installations
3.02 (A)	Profibus Networks
3.02 (B)	Optical Fibre Networks
3.02 (C)	Lightning Protection
3.03	LV 3 Phase AC TEFC Motors
3.04	Low Voltage Electrical Specification for Package Plant
3.05	Electrical Components (For Use in LV Assemblies)
3.06	Diesel Powered Generator Sets and Installations
3.07	Uninterruptible Power Supplies
3.08	Electric Valve Actuators
3.09	MV Ring Main Units (1-22 kV)
3.10	MV Distribution Switchgear Assemblies (1-22 kV)
3.11	MV Distribution and Power Transformers (1-22 kV)
3.12	MV Motor Starter Assemblies (1-7.2 kV)
3.13	HV Electrical Installations (1-22 kV)
4.01	Paints & Polymeric Coatings for Corrosion Protection
5.01	Raw Water Intake Screens
5.02	Coarse Screens for Sewage Treatment
5.03	Fine Screens for Sewage Treatment
5.04	Overflow Screens for Sewerage Systems and Sewage Treatment Works
5.05	Sludge Screens
6.03	Screenings Handling Equipment

7.01	Decanter Centrifuges for Sewage and Water Sludge Thickening and De-watering
7.02	Membrane Bioreactors for Waste Water Treatment
7.03	Gravity Belt and Drum Thickeners for Water and Waste Water Sludge Thickening
8.01	UV Disinfection Equipment for Waste Water Treatment (Open Channel)
8.01(B)	Ultra Violet Disinfection Equipment (Water Treatment)
8.02	Chemical Dosing Equipment (General Requirements)
8.02(A)	Sodium Hydroxide Dosing Equipment
8.02(B)	Sodium Hypochlorite Dosing Equipment
8.02(C)	Sulphuric Acid Dosing Equipment
8.02(D)	Coagulant and Phosphate Removal Chemical Dosing Equipment
8.02(E)	Lime Slurry and Limewater Dosing Equipment
8.02(F)	Orthophosphoric Acid Dosing Equipment
8.02(G)	Polymer Dosing Equipment
8.02(H)	Nitrate Chemical Dosing Equipment
8.02(I)	Sodium Bisulphite Dosing Equipment
8.03	Mechanical Installation
8.04	Air Blowers
8.05	Odour Control Equipment
8.06	Dissolved Air Flotation Plant
8.07	Compressed Air Systems
8.09	Valves
8.09 (Sched)	Valve Schedule
8.10	Penstocks, Stopgates, Stoplogs and Handstops
8.11	Static Mixers
8.12	Submersible Mixers
8.13	Vertical Shaft (Top Entry) Mixers
9.01	CHP Installations

The following clauses and installation types are additional to this specification:

3.1 General Mechanical and Electrical Requirements

3.1.1 Workmanship and Design

The Plant design, workmanship and general finish shall be of sound quality in accordance with good engineering practice. Design shall be robust and rated for continuous service at the specified duties under the prevailing operational site conditions, for the minimum lifetime specified below: -

Item	**Life (Years)**
Rotating/reciprocating plant e.g. pumps, blowers, compressors, screens	20
Generators, transformers, switchgear and cables	30
Control gear, instrumentation and actuators	20
Pipework and valves	20

The general design of mechanical and electrical plant shall be governed by the need for long periods of service without frequent attention and shall afford ready access for maintenance and replacement.

3.1.2 Standby equipment

Mechanical items of plant, including pumps, blowers, compressors shall be supplied with installed standby units which shall start automatically in the event of duty system failure. A telemetry alarm shall be raised upon plant failure.

3.1.3 Safe Operation and Maintenance

The Supplier shall design, layout and install all plant to give safe access to and isolation of all plant and components requiring operational and maintenance attendance (including instrument sensors).

Where the Supplier is responsible for establishing the relative positions of items of plant within a designated site or building then he shall incorporate clear shipping routes in the layout of the site and design of the building to ensure that all components, subassemblies, and fully-assembled items of plant can be safely and conveniently moved onto and off the site for replacement or repair. The shipping routes shall be free of obstructions and shall be clearly marked. All necessary lifting equipment shall be provided to facilitate plant movement along the whole length of the shipping route.

The Supplier may be required to demonstrate that the works can be operated and maintained in safety, before they are taken over.

3.1.4 Materials

All materials shall be new and of the best commercial quality and free from any flaws, defects or imperfections.

Materials shall be selected to eradicate or reduce corrosion to a minimum.

All submerged parts of the Plant shall be of non-corrodible material. Where this is impractical appropriate treatment shall be applied to prevent corrosion. Plant in contact with chemicals shall be resistant to corrosion or abrasion by those chemicals and maintain their properties without deterioration by the passage of time, exposure to light or other cause.

Materials and components shall be stored, handled and installed in such a manner as to preserve their quality and condition to the standards required by the Contract and in accordance with the manufacturer's recommendations.

Materials which come into contact with potable water, or water to be used for potable supply, shall be compliant with DWI Regulation 31.

Above-ground pipework (including pipework laid in ducts and trenches) that is not designed to be buried shall be ductile iron or stainless steel. Plastic pipework (including ABS, PVC, UPVC, MDPE and HDPE) shall not be used for above-ground installations unless specific agreement has been obtained from Severn Trent Services.

3.1.5 Guaranteed Life

The minimum guaranteed life of all wearing parts shall be 2 years, based on the operating conditions and specified duty point.

3.1.6 Name, Rating and Testing

Statutory or Regulatory Testing (for Lifting equipment, pressure vessels, etc.) of new equipment shall be provided by the Supplier who shall also arrange for the appropriate test plates to be supplied, stamped and fixed to the respective items of plant.

The Supplier shall supply and fix name and rating plate(s) to each item of plant. The plates shall be engraved or stamped with the manufacturer's name, the type and serial number of the plant, details of the loading and duty at which the item has been designed to operate and sufficient detail to allow the assembly to be readily identified.

3.1.7 Fitness for Purpose

The Supplier warrants that the Works (other than those Works where the design has been made, furnished or specified by the Client and for which the Supplier has disclaimed responsibility in writing within a reasonable time after receipt of the Client's instructions) shall be fit for the purpose for which they are intended to be used.

3.1.8 Disposal of Existing Plant

The Supplier shall remove all redundant mechanical and electrical equipment. Any redundant items indicated as being required by Severn Trent Services shall be made available to Severn Trent Services personnel and all other equipment shall be disposed of by the Supplier.

The Supplier shall review all equipment to ensure that all hazardous equipment is disposed of in line with statutory requirements.

3.1.9 Valve closing direction

The direction of closure for all valves installed on site shall be agreed with the project manager.

3.2 General Mechanical Requirements

3.2.1 Bearings

The Supplier shall select the most appropriate type of bearing for the Plant being supplied.

Rolling element bearings shall have a minimum calculated L10 life of 40,000 hours at maximum loading. In addition, the Supplier shall provide a guaranteed bearing life for each application that takes account of local environmental conditions.

Re-lubrication intervals shall be a minimum of 4,000 running hours. Sealed for life units are acceptable subject to a grease life of 16,000 running hours at maximum loading.

Plain bearings shall have phosphor bronze or synthetic lubrication impregnated bushes with carbon or stainless-steel journals respectively. Synthetic bearings shall only be used where bearing condition can readily be inspected.

All bearings shall be adequately lubricated by oil or grease and sealed to prevent leakage of lubricant along the shaft or the ingress of dust and water.

3.2.2 Lubrication

Suitable lubrication shall be provided to ensure smooth operation, heat removal and freedom from undue wear. Plant selected shall require minimum lubrication attendance and down time for lubricant change. Plant that requires greasing more frequently than annually shall be fitted with cartridge-type automatic lubrication.

The Supplier shall supply the first fill of oil and grease from approved lubricant suppliers.

All grease nipples; oil cups and dipsticks shall be readily accessible, being piped to a point as near as practicable to the lubrication point.

Gearboxes and oil baths shall be provided with adequately sized filling and draining plugs and suitable means of oil level indication.

Roller chain drives shall have a constant feed of lubricant, when in operation (using an oil bath or auto-lube system).

Drain points shall be located or piped to a position such that an adequately sized container can be placed beneath them. Where a large quantity of oil is involved or drainage to a container impractical, a drain valve and plug shall be provided at the point of discharge.

Bearings equipped with forced fed oil lubrication shall be automatically charged prior to machinery starting up and pressure monitored during operation with automatic shutdown of machinery and alarm on low oil pressure.

Access, without the use of portable ladders, to lubrication systems shall be such as to permit maintenance, draining and refilling, without contamination of the charged lubricant.

The design of breathers shall take into account the humidity and atmospheric contamination at the vent point and measures shall be incorporated to prevent contamination of the lubricant.

Grease application shall be by steel lubrication nipples.

Anti-friction bearings requiring infrequent charging shall be fitted with hydraulic type nipples.

Plain bearings requiring frequent charging shall be fitted with button head pattern nipples.

A separate nipple shall be provided to serve each lubrication point. Where a number of nipples supply remote lubricating points they shall be grouped together on a conveniently placed battery plate, with spacing in accordance with the recommendations of BS 1486, Part I, Tables 9 and 10.

3.2.3 Gearboxes

Gearboxes shall be designed for a minimum life of 100,000 hours at the rated duty. Gearboxes that have to be angle mounted shall have a rating, choice of bearings, seals and lubrication system that is suitable for such mounting. Dependence on splash lubrication alone is not acceptable but it may be used in conjunction with a forced feed method to reach all bearings and gears.

Calibration of the oil dipstick and its position, together with that of the sump drain plug, shall be suitable for the angle of inclination.

3.3 Electrical Requirements

3.3.0 General Requirements

The specifications and details shown within WIMES; The Water Industry Mechanical and Electrical Specifications shall form the basis on which electrical (and mechanical) installations shall be designed, built and commissioned – additional clauses and substitutions to these specifications are detailed below.

3.3.1 Electrical Safety

1. Responsibility for electrical safety on sites under the control of Severn Trent Services shall be dealt with strictly in accordance with the "Severn Trent Water Limited- Electrical Safety Rules and Codes of Practice 2017". When working on STS's electrical systems, all authorised personnel should have a current copy of these rules to hand.
2. The issuing of an ELECTRICAL 'Permit to Work' or 'Site Safety Agreement' does not satisfy the requirement for an OPERATIONAL 'Works Authorisation' which may also be required before work can commence (refer to Clause 1.42).
3. Electrical work of any type shall only be carried out by electrically competent and authorised personnel. Any individual working on STS electrical systems must be formally authorised to do

so, by the STS Authorising Engineer. This authorisation must be in place before work is issued to any company or individuals.

Please Note: -
It is the responsibility of the STS employee ordering this work, not the person receiving the order – to confirm with the STS Authorising Engineer that an individual's electrical authorisation is in place to cover the period of time the work is being carried out.

4. All Electrical work shall comply with BS7671:2018 – Requirements for Electrical Installations, plus all other associated British standards, detailed in WIMES 3.01.

3.3.2 IP Rating

All live electrical components shall as a minimum be protected to the requirements of IP2X (BS EN 60529) unless operating at extra low voltage and also satisfying the specific requirements for prevention against electric shock, contained in Part 4 Chapter 41 of BS 7671 'Requirements for Electrical Installations'. Standard control gear components shall be inherently IP2X protected without the need for additional shrouding.

All electrical and electronic equipment shall comply with the "Electromagnetic Compatibility Regulations 1992, Statutory Instrument No. 2372".

3.3.3 Control panel Cable Colours

Control panel cabling colours and minimum sizes should adhere to the following:

Circuit Type	Colour	Minimum CSA (Size)
All 24vdc control circuits	Pink	1.0mm
All 110vac control circuits	Red	1.0mm
Telemetry Connections	White	1.0mm
<48V AC Control Circuits	Violet	1.0mm
Volt Free	Orange	1.0mm
CT Secondaries	Yellow	2.5mm
I.S. Circuits	Light Blue	1.0mm
Protective Earth	Green/Yellow	1.0mm
Functional Earth	Cream	0.75mm
4-20ma Signal Cable	2 Core Screened	0.75mm

3.3.4 Demarcation Point

In **all** cases on **all** installations a demarcation point between the specific MOD (DIO) site electrical supply and where the Severn Trent Services electrical installation begins shall be agreed by all parties (DIO & STS).

At this point a means of electrical isolation shall be installed - this isolator shall be capable of isolating both the phase and neutral conductors - either fused or unfused dependant on the installation design and must be capable of being lockable in the off position.

This demarcation point forms the origin of the supply for certification purposes, it is also the point where the electrical safety of the installation becomes the responsibility of Severn Trent Services.

A permanent label should be adhered to this isolator, indicating its purpose (Demarcation Point Isolator), the voltage present and the source (including rating) of the supply. Test readings taken during the installation should be clearly shown at this point also, to allow for comparison of results during subsequent condition testing.

3.4 Preferred Suppliers

Equipment in the categories below should be supplied only from the 'Preferred Suppliers'. Severn Trent Services may approve a waiver when submitted for acceptance to Severn Trent Services.

Equipment	Preferred Supplier	Comment
Programmable Logic Controllers	Allen Bradley	
Breakers and panel components	Schneider	
Control relays	Omron	
Inverter Drives	ABB – ACQ580 Range	
Chlorine dosing pumps	Prominent	
Chlorine dosing lances	ProChem	Dosing lances for chlorine injection shall be made from Hastelloy and be capable of being withdrawn whilst in service.
Flowmeters – water networks	Arad	Octave Range
Flowmeters – process control (WTW's, WPS's, FB's, SVR's etc)	ABB	ABB Electromagnetic flowmeters to be used for process monitoring and control
Chlorine analysers	ATi	
Turbidity monitors	Hach	
Nitrate analysers	Hach	
Clean water pumps	Grundfos	
Wastewater pumps	Flygt	
Progressive cavity pumps	Mono	To be specified with Ezi Strip
Borehole pumps	Grundfos	
Telemetry outstations	Ovarro	S2000 (WITS) range only
Ultrasonic Level Measurement	Pulsar	Ultra 5 preferred
Float switches for SPS's	Flygt	ENM10
Oil separator alarms	Afriso	Only the Afriso OSA3 with ES4 Hydrocarbon Sensor and ES8 Silt/Sludge sensor should be used.
Pressure Sensor	IFM	PI series preferred

3.5 Installation types not wholly covered by WIMES

3.5.1 Oil Water Interceptor (OWI)

- OWI Oil, Silt and level alarms will be monitored using the EX rated 'AFRISO OSA 3 SEPERATOR ALARM SYSTEM' the unit has three channels matched to specific sensor types requiring no additional modifications.
- The Oil sensor will be the AFRISO ES4 capacitive sensor probe. The ES4 oil probe tip must be installed at 150mm below the water level across all operational conditions. If water levels are likely to change an OWI AFRISO float adaptor should be to be fitted to the oil probe to allow it to rise and fall with water levels in the OWI, helping it to maintain its position. An assessment of this requirement should be made during the design stage.
- The Silt sensor will be the AFRISO ES8 ultrasonic sludge sensor positioned 600mm above the bottom of the OWI and away from any areas subject to high in rush flow, helping to avoid nuisance alarm generation. If high in-rush currents are present at all levels, an additional baffle may also be required to protect the sensor – this should be decided during the design stage.
- The level sensor is optional and generally not used - unless specified. If fitted it will be the AFRISO R6 thermistor probe set at a suitable high level to provide warning of an overflow issue. **Please note:** The OSA3 has only 2 relay outputs, therefore a decision will need to be made in advance of install based on risk if silt or level monitoring is required.

- Where possible the sensor cables should not be joined. If connections are needed, they shall be located in a visible location (i.e. not inside cable ducting), in an area free from excessive moisture, or risk of mechanical damage.
- Where older OSA units are currently installed using the level input with a pull up resistor to enable the use of an ES8 silt sensor, it is recommended that the resistor and ES8 are disconnected from the OSA unit and an AFRISO ES3 dedicated silt control unit is installed instead and the ES8 connected and recommissioned to this unit.
- Sensor cables entering the OWI should be secured near to the top of the chamber with non-corrosive stainless steel (or similar) hooks, to enable the sensors to be periodically lifted and cleaned by operational staff.
- All cable ducting between the OWI, Kiosk and supply shall be gas sealed at the point of entry
  - Telemetry / beacon relays and power supply.

    A separate appropriately rated 230V Ac to 24V DC power supply is to be installed within the outstation enclosure on its own supply. This power supply is to be used to power 2no. multipole relays and a flashing beacon of the top of the kiosk.

    The 24v DC relays are to be used to provide switching to the outstation inputs for each alarm (Oil and Silt), whilst also providing a common switched circuit for a flashing beacon, for oil or silt - further information and wiring diagrams available on request.
  - Cable colours and protection.

    Single core conductors within the kiosk are to be contained within suitably sized PVC trunking and conduit and terminated with crimped ferrules. Band I & II circuits are to be segregated, as detailed in BS7671:2018.

    Any 24v DC cabling is to be coloured Pink, and identified with cable numbers, for example: - **-24v DC (0)** & **+24v DC (5)**.

    Any steel wire armoured cables are to be glanded with outdoor CW type glands.

- The following information is to be provided at each OWI, as detailed in PPG3, located in a permanent and secure location: -
    - Manufacturer's reference number
    - Oil storage capacity
    - Year of manufacture
    - Volume of separator
    - Bypass/full retention
    - Silt storage capacity
    - Unique identifier for the design of separator
    - Oil level warning device details (name or number)
    - Depth of oil storage
    - Class of separator
    - Closure device details.
    - Nominal Size

  Drawings showing the design / location of the OWI, plus any wiring diagrams are also to be provided and left within the kiosk, plus all Electrical Installation Certificates.

Safety Notes:

- A current DSEAR risk assessment must be available prior to install clearly identifying explosive zones: -

    - Zone 0: An area in which an explosive gas atmosphere is present continuously or for long periods.
    - Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation;
    - Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation

- Installers must be CompEx trained to install and certify work and issue a CompEx certificate on completion
- All equipment within the high-risk zones must be EX rated
- All items within the high-risk zones must be clearly marked, and a register provided with the CompEx certification, and must be maintained for the life of the installation

Any change during the life of the installation must be documented and maintained and re-certified

3.5.2 Fire Booster (FB)

The standard arrangement shall be a duty and standby electric fire booster pump, with a standby diesel generator. Two jockey pumps used in a duty/standby configuration shall provide pressurisation of the main under normal circumstances.

- A Schneider PI series pressure sensor shall be installed to measure pump suction pressure. The pumps shall stop on low suction pressure to prevent from running dry.
- A Schneider PI series pressure sensor shall be installed to measure pump delivery pressure.
- An ABB electromagnetic flowmeter shall be installed in the delivery pipework to measure pumped flowrate.
- The diesel generator shall start automatically on power failure and have a fuel tank sized for a minimum of 24 hours running time.
    - The generator will be programmed to start automatically within 15 seconds of a power failure in line with BS9990. The control panel shall automatically changeover to generator supply.
    - The Generator will have a countdown timer to run on for 15 mins once power is restored. Another power outage needs to cancel the timer so that generator keeps running.
    - The auto-changeover will need to link into the pump control, with a delay-on timer for all the pumps, allowing time for the generator to get up to speed and the correct frequency, also for when it reverses out of the changeover, back into mains power.

3.5.3 Emergency Water Storage (EWS)

- Flow/Level Measurement
    - A flow testing facility (such as a flow meter) will be required to prove the flow rate of the infill.
    - Water supplies must be metered using an ARAD Octave meter, with a bypass system.
    - Provision of accurate water level measurement in the form of pressure or level instruments, capable of providing a visible water level on site plus the required alarms to telemetry (Low Level, High Level & Overflowing), along with an analogue (4-20ma) level signal (for future provision).

- Flyght ENM10 float switches to be installed at appropriate levels to transmit signals to the associated control panel to indicate the high/low level volume of water in the tank and used as a failsafe in the event of level instrument failure.

- Where trace heating is installed it shall have local double pole lockable isolation and protected by a 30ma RCBO, signage shall also be placed at regular intervals along the lagged pipework where trace heating is present to warn of the presence of live cables within.

- Outside lighting shall be provided on walkways around EWS tanks where an appropriate means of illumination does not already exist. Lighting should be automatically controlled via PIR detectors which are located in a suitable position that would prevent nuisance triggering by passers-by.

3.5.4 Service Reservoir (SVR)

- Level Measurement options – to be decided during design stage
  a. Pulsar Twin ultrasonic level measurement system with transducers located in each cell of the reservoir, with the transducers located near to access points on pivoting brackets, to allow for easy maintenance or repair
  b. Individual suitably pressure rated and WRAS approved 4-20ma pressure transducers located in each cell wall, provided with the means of isolation and removal for easy maintenance or repair.

  Both options allow for each reservoir cell to operate independently, should the need arise for a cell to be taken off-line for cleaning or maintenance,

- Flow Measurement
  - ABB Electromagnetic flowmeters shall be installed in the pipework to measure flowrate in and out of the reservoir.
  - Where a connected water pumping station (WPS) requires a flowmeter to measure pumped flowrate, and the Service Reservoir requires a flowmeter to measure flow in or out of the tank, a single flowmeter shall be installed to satisfy both requirements.

4.0 Sewers for Adoption 7th Edition

The specification for sewerage design and construction shall be Sewers for Adoption, 7th Edition, and the modifications described below.

4.1 Sewers for Adoption 7th Edition Part B – Design and Construction of New Foul Sewers and Lateral Drains

B3.2 Access

Remove Clause 3 and replace with:

5. Blind connections shall not be installed without prior discussion and agreement with Severn Trent Services. Access points and sewers should be sited with due regard to public utility services. An access point should be built
   a. At every change of alignment, gradient or pipe material
      - All changes of direction must occur within the confines of the inspection chamber or Manhole.
   b. At the head of all sewers
   c. At every junction
   d. Wherever there is a change in the size of the sewer
   e. At every junction of a public sewer with another sewer serving: -

- Three or more properties where the access point is an inspection chamber; or
- More than ten properties where the access point is a manhole; and

f. At or within 1m of the property boundary at the upstream end of each lateral drain (preferably inside the property boundary).

Delete clause 15 and replace with

15. Figures B.16 to B.23 show typical details of Type 3 and Type 4 inspection chambers. No significant departure from these should be made without approval by Severn Trent Services. Note: the maximum allowable depth of type 3 and type 4 inspection chambers will be 1500mm from ground level.

Delete clause 19 and replace with:

19. As a minimum, Class D 400 covers shall be used in carriageways of roads (including pedestrian streets), hard shoulders, grassed areas and parking areas used by all types of road vehicles. All gully covers located within bin store areas, shall be of metal construction and suitable for the loading of the bins housed within the store and the vehicles which empty the bins.

Delete clause 27 and replace with

27. Step irons and ladders shall not be installed.

4.2 Sewers for Adoption 7th Edition Part C – Surface Water Sewers and Lateral Drains

C3.2 Access

Remove Clause 4 and replace with:

6. Blind connections shall not be installed without prior discussion and agreement with Severn Trent Services. Access points and sewers should be sited with due regard to public utility services. An access point should be built
    a. At every change of alignment, gradient or pipe material
        - All changes of direction must occur within the confines of the inspection chamber or Manhole.
    b. At the head of all sewers
    c. At every junction
    d. Wherever there is a change in the size of the sewer
    e. At every junction of a public sewer with another sewer serving: -
        - Three or more properties where the access point is an inspection chamber; or
        - More than ten properties where the access point is a manhole; and
    f. At or within 1m of the property boundary at the upstream end of each lateral drain (preferably inside the property boundary).

Delete clause 20 and replace with:

20. As a minimum, Class D 400 covers shall be used in carriageways of roads (including pedestrian streets), hard shoulders, grassed areas and parking areas used by all types of road vehicles. All gully covers located within bin store areas, shall be of metal construction and suitable for the loading of the bins housed within the store and the vehicles which empty the bins.

Delete clause 28 and replace with:

28. Step irons and ladders shall not be installed.

4.3 Sewers for Adoption 7th Edition Part D – Pumping Stations

D4.3 Site Layout

Add the following sub-clauses to clause 1:

g. Hardstanding and access is provided around the pump chamber sufficient to allow a standard 'A' frame lifting beam or lifting tripod to be used to remove each pump.
h. There is hardstanding pump lay-down area adjacent the wet well
i. There is hardstanding access between the pump lay-down area and the vehicle parking area to allow pumps to be moved using a trolley.

D6.9 Davit Sockets

Delete clauses 1, 2 and 3 and replace with:

1. Davit sockets shall not be installed.

4.4 Sewers for Adoption 7th Edition Part E – Civil Engineering Specification

E2.32 Manhole Covers and Frames

Delete clause 3 and replace with:

1. As a minimum, Class D 400 covers shall be used in carriageways of roads (including pedestrian streets), hard shoulders, grassed areas and parking areas used by all types of road vehicles.

4.5 Sewers for Adoption 7th Edition Part F – Mechanical and Electrical Specification for Small Pumping Stations

F2.3.14.3 Lifting chains

Delete clauses 1, 2, 3, 4, 5, 6, 7, 8 and replace with:

1. Lifting chains shall not be included in pumping stations. A lifting chain location system adhering to Clause 2.3.14.2 shall be installed.

5.0 Civil Asset Design Life

New assets shall be designed and warranted to achieve in every aspect and without planned replacement the design life stated in the table below:

5.1 Civil assets

Asset description	**Design life (years)**
Above-ground concrete structures	100
Below-ground concrete structures	120
Boreholes	60
Buildings (pumping stations etc.)	60
Fencing	15
Flow measurement structures – weirs, flumes	30
GRP kiosks and enclosures	60
Manholes	40
Meter chambers	40
Sewers	100
Steel tanks (including glass coated steel)	40
Water mains	100

6.0 Telemetry Specification

6.1 Introduction

This section contains the Severn Trent Services Telemetry Signal List.

This is the definitive list of signals that a site should have. Additional signals should not be added to a site unless agreed with the Severn Trent Services Contract Administrator.

The STS Telemetry System has been configured and set up with defined standards for the asset types.

In conjunction with the signal provision, configuration and alarm response standards the telemetry systems are an integral part of the asset management tool set.

6.2 Use of this Specification

This document defines the range of signals for each process, to ensure adequate and consistent remote monitoring is achieved.

This document must be used each time

- A site has telemetry installed for the first time
- A site undergoes alterations, which affects the range of processes monitored or the volume of equipment monitored.

To obtain the required set of signals for a site

1. Separate out the individual processes for the site
2. Consult the relevant sections within this document to obtain the signals for each process
    - Alarms and levels are set based on RAMP, if available, for the process stream
    - In all cases alarms and set points must be approved by the Regional Manager

6.3 RAMPS

Remote Asset Monitoring Policies (RAMPS) have been written for each category of asset. The RAMPS document will state the signals to be provided for each category of asset and the order in which signals shall be connected to the outstation. This will enable standard outstation configurations to be used for each asset category. The RAMPS policy must be read in conjunction with this Engineering Specification to ensure the correct instrumentation is installed for each asset.

6.4 *Blank for future use*

6.5 Assumptions used in this Standard

The following assumptions were made in the development of this standard.

6.5.1 General

1. New assets will be fitted with a ‘Person on site’ switch which will be used by operators at each site visit. This button will inhibit all other alarms from the site for a period of 60 minutes.

6.5.2 Water Treatment and Distribution

1. Delivery pressure on boosters is not required to be reported on telemetry.
2. Chlorine dosing failures are recorded at individual dosing plants.
3. Chlorine residual will be measured to ensure “wholesome” water is being delivered.
4. A strategic flow or pressure monitoring point is a predetermined point of measurement. A collection of processes may have multiple strategic flow or pressure monitoring points.

6.5.3 Sewage Treatment

1. It is not required to monitor dissolved oxygen by telemetry. It is assumed that if the aeration plant is running, the consent is being met.

6.6 Compatibility

6.6.1 Master Station

STS's telemetry system is a WITS certified Scope-X system using PRISM as a browser-based client.

6.6.2 Outstations

Outstations (RTU's) from the Ovarro Seprol S2000 range shall be used, they are available in three sizes:

1. S2000 – this is the largest RTU in the range, and is suitable for larger installations, for example Water or Sewage Treatment works.
2. S2000 Micro – this is a compact unit, which is suitable for smaller installations, for example Oil Water Interceptors and the most pumping stations.
3. S2000 Nano – this is a battery powered unit, generally used on installations that are without power and in need or short-term monitoring.

Outstations shall communicate with the top end system via 4G connection. Where 4G signals are weak, an ADSL line shall be installed. PSTN (landlines) will not be accepted.

The telemetry system outstations are set up to dial in by exception (i.e. to report an alarm). In addition, the top end system calls each outstation three times per day to ensure the outstation is functioning correctly and to download archive information.

6.7 Power Supplies

Telemetry systems and instrumentation must be powered by a mains electricity supply, supplied from their own individual circuit.

In circumstances where a mains power supply is not available, solar powered and wind powered systems are acceptable if the following conditions can be met

- It must be demonstrated that a mains power supply is not available within 50m of the outstation
- The power systems and energy storage systems are designed to power the telemetry outstation, modem and instrumentation for the duration of one week without sunlight or wind and without falling below 50% storage capacity all year round, taking into consideration seasonal variations in daily sunlight.
- It is permitted for the modem to enter the sleep mode but it must wake up when contacted by the STS master station. The STS master station will contact the outstation three times per day.
- It is permitted for the instrumentation to power down for 15 minutes, then power on again for 15 minutes continuous to manage energy consumption, but the instrumentation must maintain continuous power in the event of an alarm condition occurring.
- The power systems and energy storage systems must be guaranteed for a period of three years from the handover to STS.

6.8 Development Projects

Where MoD development projects are taking place, additional telemetry required should be provided by the development project in accordance with this specification.

Outstations that are directly compatible with the STS master station should be supplied. New outstations should not require additional telephone lines, software or other hardware to be installed on the STS telemetry system.

STS will supply a suitable SIM card for any GSM outstation installed once commissioning and handover of the assets is complete.

The telemetry system shall not be considered complete until End to End testing of the system has been completed satisfactorily.

6.9 Signal Operation

6.9.1 Correct Installation and Operation for each Signal is Key

The correct installation and operation for each signal is key to the detection of failed states.

Below are the requirements for each type of signal

- Digital Inputs: digital inputs must be installed such that a closed contact represents a healthy state. If the contact is fed from a relay, this relay must be energised when the equipment is healthy. This configuration ensures that if the circuit becomes disconnected, the alarm will be generated (i.e. fail safe).
- Analogue Signals: analogue signals will be calibrated and commissioned such that 4mA represents a zero measurement and 20mA represents full-scale measurement, this configuration ensures that fault conditions such as a circuit disconnection can be distinguished from a zero measurement.

A maintenance override push button shall be provided to override all alarms on site when routine operations and maintenance is being undertaken. This shall use the 60-minute count down internal function of the RTU and an alarm shall be presented remotely to indicate the function has been initiated. The timer auto resets to enable the alarms, to avoid accidental long term inhibit of the alarms from site. The 60-minute count down interval may be extended by a person on site to a maximum of another 60 minutes.

To allow management of nuisance alarms, the timed outstation bits are configured as a standard to facilitate the option to apply timed delays to manage nuisance alarm volumes risk assessed and approved.

6.9.2 Common Signals Between Processes

Some alarms are contained within more than one process. Where this occurs, the outstation will have one common signal which represents all the individual process states.

For example; the alarm *"Source Shutdown"* appears within a number of processes. However, the outstation has one alarm, which indicates that one or more of the processes has caused the source to shut down. The on-site annunciation systems need to present the actual cause of the failure.

6.10 Signals

All signals are mapped to the timed bit in the RTU configuration, with the option to apply a timed delay by the Operational Manager to reduce nuisance alarms. All delay times are applied once risk assessed and approved by the Regional Manager.

Analogue alarm points are derived from the 4-20mA source and configured in the RTU to provide flexibility and reduction in site wiring and cost. Fail safes are hard wired based on risk and are

identified in the scope of works, based on consequence of failure and approved by the Regional Manager.

Analogue derived alarm outputs may be inhibited for a timed period and / or derived from associated assets where process loop times / responses generate nuisance alarms for the period of the process loop time and / or the associated asset (for example a disinfection dosing pump running / stopped) time delay. Derived alarms must be risk assessed and approved by the Regional Manager.

6.10.1 Standard Signals for all Plant Types

The following alarms shall be installed at **all** plants:

Signal title	Type	Comments	Category	Contact state	
				0	1
Power failure	Digital	Power Failure will be measured by loss of power to the outstation or by phase failure relays installed at the incoming power supply	A	Low	Normal
Intruder Alarm	Digital	Indicates that unauthorised entry to the site has been made	A	Alarm	Normal
Maintenance Mode	Digital	Indicates that a maintainer or operator is on site. A push button shall inhibit all other alarms for 60 minutes to indicate that maintenance is being conducted.	A	Alarm	Normal

6.10.2 Optional Signals

Where additional items of equipment have been installed due to site specific needs, the following signals should supplement the standard ones.

Signal title	Type	Comments	Category	Contact state	
				0	1
Fuel Level	Digital	Indicates that the generator requires a fuel refill	A	Low	Normal
Generator Running	Digital		A	Running	Stopped
Fire Alarm	Digital	Indicates that the fire alarm has been activated – where installed	A	Alarm	Normal

6.11 Water Treatment and Distribution Processes

6.10.1 Water Pumping Station – Borehole / Abstraction / Springs

For sites that have river abstraction, borehole or spring pumping stations the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state		Input number	Alarm Level
				0	1		
Power failure	Digital	Power Failure will be measured by loss of power to the outstation. All other alarms inhibited	Alarm	Low	Normal	Derived in outstation	7
Maintenance Mode	Digital	Indicates that a maintainer or operator is on site. A push button shall inhibit all other alarms for 60 minutes to indicate that maintenance is being conducted.	Alarm	Alarm	Normal	Digital Input 0	3
Borehole Pump Status (Running/Standing)	Digital	Signal obtained from MCC – one signal per pump	Event	Standing	Running	Digital Input 1	-
Borehole Pump Health (Failed/ Healthy)	Digital	Signal obtained from MCC – one signal per pump	Alarm	Failed	Healthy	Digital Input 2	7
Borehole Pump Availability	Digital	Signal obtained from MCC – one signal per pump	Alarm	Unavailable	Available	Digital Input 3	6
Borehole Level Low	Digital	Signal obtained from Level Probe	Alarm	Low	Normal	Digital Input 4	6
Borehole Level	Analogue	Signal obtained from Pressure Transducer – Per Borehole.	Monitor / Alarm	N/A	N/A	Analogue Input 0	-

		Alarm is site specific depending on operational requirements.					
Borehole Total Flow	Analogue	Signal obtained from Flowmeter – Site specific. Common or summated flow for all borehole flows. (4-20mA) Signal	Monitor / Alarm	N/A	N/A	Analogue Input 1	-
Borehole Flow Total	Pulse Count Input (PI)	1 pulse = 100 litres but site specific, Common or summated flow for all borehole flows. Scale to give a minimum of 10 pulses / hr.	Count	N/A	N/A	Pulse Input 0	-
Borehole Delivery Pressure	Analogue	High and low alarms required, (4-20mA) Signal.	Monitor / Alarm	N/A	N/A	Analogue Input 2	-
Borehole Pump Hand /Auto Status	Digital	Signal obtained from MCC – one signal per pump.	Alarm	Hand	Auto	Digital Input 5	6
Borehole Pump Telem/Local Status	Digital	Signal obtained from MCC.	Event	Local	Telemetry	Digital Input 6	-
Borehole Pump Telem/Local Control	Digital	Signal obtained from Telemetry O/S.	Control	Local	Telemetry	Digital Output 0	-
Borehole Pump Start Control	Digital	Signal obtained from Telemetry O/S.	Control	Inactive	Start	Digital Output 1	-
Borehole Pump Stop Control	Digital	Signal obtained from Telemetry O/S.	Control	Inactive	Stop	Digital Output 2	-

6.11.2 Booster Station (Treated Water)

For sites that have on site booster stations the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state		Input number	Outstation mapping	Alarm Level
				0	1			
Power failure	Digital	Power Failure will be measured by loss of power to the outstation. All other alarms inhibited	Alarm	Low	Normal	Derived in outstation	tba	7
Maintenance Mode	Digital	Indicates that a maintainer or operator is on site. A push button shall inhibit all other alarms for 60 minutes to indicate that maintenance is being conducted.	Alarm	Alarm	Normal	Digital Input 0	tba	3
Pump 1 Running	Digital	Per pump - Running / Standing	Event	Standing	Running	Digital Input 1	tba	-
Pump 1 Hand / Auto	Digital	Per pump – selector switch required on control panel	Alarm	Auto	Hand	Digital Input 2	tba	5
Pump 1 Failed	Digital	Per Pump - To include all failure modes, overload, low oil, over temp. etc.	Alarm	Failed	Healthy	Digital Input 3	tba	6
Pump 2 Running	Digital	Per pump - Running / Standing	Event	Standing	Running	Digital Input 4	tba	-
Pump 2 Hand / Auto	Digital	Per pump – selector switch required on control panel	Alarm	Auto	Hand	Digital Input 5	tba	5
Pump 2 Failed	Digital	Per Pump - To include all failure	Alarm	Failed	Healthy	Digital Input 6	tba	6

		modes, overload, low oil, over temp. etc.						
Pump Suction Low Pressure	Digital	Common signal from suction pressure sensor. Pumps shall be inhibited from running.	Alarm	Alarm	Normal	Digital Input 7	tba	7
Pumping Station no flow	Digital	Derived from pump running signal and low flow detected	Alarm	Alarm	Normal	Derived in outstation	tba	7
All pumps failed	Digital	Derived from pump health signals.	Alarm	Alarm	Normal	Derived in outstation	tba	7
Suction Pressure	Analogue	(4-20mA) Signal.	-	Displays on-site value in bar		Analogue Input 0	tba	-
Delivery Pressure	Analogue	(4-20mA) Signal.	-	Displays on-site value in bar		Analogue Input 1	tba	-
Delivery Main Flow	Analogue	(4-20mA) Signal Used to generate alarm for rising main blockage	-	Displays on-site value in litres/second		Analogue Input 2	tba	-

6.11.3 Disinfection Dosing (Liquid)

For sites which use Chlorine, Sulphur or Ammonia based liquids within the disinfection process the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Disinfection Shutdown	Digital	Duty & standby dosing system failed Duty & standby dilution tank Low-Low Duty & standby catch pot high High Bund alarm High-High or Low-Low failsafe alarm 'timeout' from residual analyser	A	Alarm	Normal
Disinfection Equipment Malfunction	Digital	Duty & standby transfer system failed	A	Alarm	Normal
Duty System Failed	Digital	Duty dosing system failed Duty transfer system failed Duty dilution tank low-low Duty catch pot high	A	Failed	Healthy

Chlorine Residual	Analogue	(4-20mA) Signal from monitor	A/M	Displays on site value of Chlorine Residual

6.11.4 Disinfection Monitoring

For sites that use disinfection (gas or liquid) the following signals must be monitored for each stage of the process (Chlorination / de-chlorination):

Signal title	Type	Comments	Category	Contact state	
				0	1
Chlorine Residual	Analogue	(4-20mA) Signal from monitor	A/M	Displays on site value.	Chlorine Residual

6.11.5 Service reservoir (Including Towers and Tanks)

Where a Water Pumping Station feeds in or out of the Service Reservoir, the Water Pumping Station RAMPS policy shall be applied to the pumping assets.

Where the Water Pumping Station requires a flowmeter to measure pumped flowrate, and the Service Reservoir requires a flowmeter to measure flow in or out of the tank, a single flowmeter shall be installed to satisfy both requirements.

Required signals

The signals required for each Service Reservoir are shown in the tables overleaf. Signals must be connected to the outstation in the order specified, such that a standard configuration template can be applied.

Scenario 1 - Service Reservoir with no adjacent Water Pumping Station

Typically used for a water tower supplied by a Statutory Undertaker with no on-site lift pumps

Signal title	Type	Comments	Category	Contact state		Input number	Outstation mapping	Alarm Level
				0	1			
Power failure	Digital	Power Failure will be measured by loss of power to the outstation. All other alarms inhibited	Alarm	Low	Normal	Derived in outstation	tba	7
Maintenance Mode	Digital	Indicates that a maintainer or operator is on site. A push button shall inhibit all other alarms for 60 minutes to indicate that maintenance is being conducted.	Alarm	Alarm	Normal	Digital Input 0	tba	3
Reservoir Low Low Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 25% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	7
Reservoir Low Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 40% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	6
Reservoir High Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 105% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	6
Reservoir High High Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 110% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any	tba	7

						reservoir cell		
Delivery Main Flow	Analogue	(4-20mA) Signal.	-	Displays on-site value in litres/second		Analogue Input 0	tba	-
Supply Main Flow	Analogue	(4-20mA) Signal from incoming flowmeter	-	Displays on-site value in litres/second		Analogue Input 1	tba	-
Reservoir Level	Analogue	(4-20mA) Signal from Pulsar ultrasonic instrument.	-	Displays on site value as %age of working volume		Analogue Input 2	Tba	-

Scenario 2 - Service Reservoir with adjacent Water Pumping Station supplying the reservoir – Required Telemetry Signals for 2-pump setup. Where more pumps are used, the Running / Stopped, Hand / Auto and Healthy / Failed pump signals shall be provided for each pump. Typically used for filling a water tower.

Signal title	Type	Comments	Category	Contact state		Input number	Outstation mapping	Alarm Level
				0	1			
Power failure	Digital	Power Failure will be measured by loss of power to the outstation. All other alarms inhibited	Alarm	Low	Normal	Derived in outstation	tba	7
Maintenance Mode	Digital	Indicates that a maintainer or operator is on site. A push button shall inhibit all other alarms for 60 minutes to indicate that maintenance is being conducted.	Alarm	Alarm	Normal	Digital Input 0	tba	3
Lift Pump 1 Running	Digital	Per pump - Running / Standing	Event	Standing	Running	Digital Input 1	tba	-
Lift Pump 1 Hand / Auto	Digital	Per pump – selector switch required on control panel	Alarm	Auto	Hand	Digital Input 2	tba	5
Lift Pump 1 Failed	Digital	Per Pump - To include all failure	Alarm	Failed	Healthy	Digital Input 3	tba	6

		modes, overload, low oil, over temp. etc.						
Lift Pump 2 Running	Digital	Per pump - Running / Standing	Event	Standing	Running	Digital Input 4	tba	-
Lift Pump 2 Hand / Auto	Digital	Per pump – selector switch required on control panel	Alarm	Auto	Hand	Digital Input 5	tba	5
Lift Pump 2 Failed	Digital	Per Pump - To include all failure modes, overload, low oil, over temp. etc.	Alarm	Failed	Healthy	Digital Input 6	tba	6
Lift Pump Suction Low Pressure	Digital	Common signal from suction pressure sensor. Pumps shall be inhibited from running.	Alarm	Alarm	Normal	Digital Input 7	tba	7
Lift Pumping Station no flow	Digital	Derived from pump running signal and low flow detected	Alarm	Alarm	Normal	Derived in outstation	tba	7
Both lift pumps failed	Digital	Derived from pump health signals	Alarm	Alarm	Normal	Derived in outstation	tba	7
Reservoir Low Low Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 25% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	7
Reservoir Low Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 40% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	6
Reservoir High Level	Digital	Signal obtained from Pulsar	Alarm	Alarm	Normal	Derived in outstation from	tba	6

		Ultrasonic level unit. Level sat at 105% of working volume				analogue signal from any reservoir cell		
Reservoir High High Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 110% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	7
Suction Pressure	Analogue	(4-20mA) Signal.	-	Displays on-site value in bar		Analogue Input 0	tba	-
Delivery Pressure	Analogue	(4-20mA) Signal.	-	Displays on-site value in bar		Analogue Input 1	tba	-
Delivery Main Flow	Analogue	(4-20mA) Signal.	-	Displays on-site value in litres/second		Analogue Input 2	tba	-
Supply Main Flow	Analogue	(4-20mA) Signal from incoming flowmeter	-	Displays on-site value in litres/second		Analogue Input 3	tba	-
Reservoir Level	Analogue	(4-20mA) Signal from Pulsar ultrasonic instrument.	-	Displays on site value as %age of working volume		Analogue Input 4	tba	-

Scenario 3 - Service Reservoir with adjacent Water Pumping Station supplying water network.

Required Telemetry Signals for 2-pump setup. Where more pumps are used, the Running / Stopped, Hand / Auto and Healthy / Failed pump signals shall be provided for each pump.

Typically used for a ground level tank with booster pumps pressurising the delivery network

Signal title	**Type**	**Comments**	**Category**	**Contact state**		**Input number**	**Outstation mapping**	**Alarm Level**
				0	**1**			
Booster Pump 1 Running	Digital	Per pump - Running / Standing	Event	Standing	Running	Digital Input 1	tba	-
Booster Pump 1 Hand / Auto	Digital	Per pump – selector switch required on control panel	Alarm	Auto	Hand	Digital Input 2	tba	5
Booster Pump 1 Failed	Digital	Per Pump - To include all failure modes, overload,	Alarm	Failed	Healthy	Digital Input 3	tba	6

		low oil, over temp. etc.						
Booster Pump 2 Running	Digital	Per pump - Running / Standing	Event	Standing	Running	Digital Input 4	tba	-
Booster Pump 2 Hand / Auto	Digital	Per pump – selector switch required on control panel	Alarm	Auto	Hand	Digital Input 5	tba	5
Booster Pump 2 Failed	Digital	Per Pump - To include all failure modes, overload, low oil, over temp. etc.	Alarm	Failed	Healthy	Digital Input 6	tba	6
Booster Pump Suction Low Pressure	Digital	Common signal from suction pressure sensor. Pumps shall be inhibited from running.	Alarm	Alarm	Normal	Digital Input 7	tba	7
Booster Pumping Station no flow	Digital	Derived from pump running signal and low flow detected	Alarm	Alarm	Normal	Derived in outstation	tba	7
Both booster pumps failed	Digital	Derived from pump health signals	Alarm	Alarm	Normal	Derived in outstation	tba	7
Reservoir Low Low Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 25% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	7
Reservoir Low Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 40% of	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	6

		working volume						
Reservoir High Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 105% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	6
Reservoir High High Level	Digital	Signal obtained from Pulsar Ultrasonic level unit. Level sat at 110% of working volume	Alarm	Alarm	Normal	Derived in outstation from analogue signal from any reservoir cell	tba	7
Suction Pressure	Analogue	(4-20mA) Signal.	-	Displays on-site value in bar	Analogue Input 0	tba	-	
Delivery Pressure	Analogue	(4-20mA) Signal.	-	Displays on-site value in bar		Analogue Input 1	tba	-
Delivery Main Flow	Analogue	(4-20mA) Signal.	-	Displays on-site value in litres/second		Analogue Input 2	tba	-
Supply Main Flow	Analogue	(4-20mA) Signal from incoming flowmeter	-	Displays on-site value in litres/second		Analogue Input 3	tba	-
Reservoir Level	Analogue	(4-20mA) Signal from Pulsar ultrasonic instrument.	-	Displays on site value as %age of working volume		Analogue Input 4	tba	-

6.11.6 Strategic Flow and Pressure Monitoring Points

For flow or pressure monitoring the following signals must be monitored:

Signal title	**Type**	**Comments**	**Category**	**Contact state**	
				0	**1**
Flow	Analogue	Includes Software generated alarms, Low, Low-Low, High and High-High etc.	A/M	Displays on site value	
Pressure	Analogue	Includes Software generated alarms, Low, Low-Low, High and High-High etc.	A/M	Displays on site value	

6.11.7 Fire Boosters (FB)

For sites that have fire booster stations the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Jockey Pump Running	Digital	Per pump Running / Standing	M	Standing	Running
Jockey Pump Failed	Digital	Per pump Failed / Healthy	A	Failed	Healthy
Fire Pump Running	Digital	Per pump Running / Standing – For diesel pumps provide diesel pump running alarm.	M	Standing	Running
Fire Pump Failed	Digital	Per pump Failed / Healthy	A	Failed	Healthy
Flow	Analogue	Includes Software generated alarms, Low, Low-Low, High and High-High etc.	A/M	Displays on site value	
Pressure	Analogue	Includes Software generated alarms, Low, Low-Low, High and High-High etc.	A/M	Displays on site value	

6.11.8 Emergency Water Storage (EWS)

Signal title	Type	Comments	Alarm State		RTU Input	Time Delay	Alarm Banner	Alarm Level
			0	1				
Tank Overflow	Digital	Indicates that the tank is overflowing	Alarm	Normal	Digital Input 01	5 sec	Tank Overflow	7
High Tank Level	Digital	Indicates that the tank is experiencing a high level	Alarm	Normal	Digital Input 02	5 Sec	High Tank Level	6
Low Tank Level	Digital	Indicates that the tank is experiencing a low level	Alarm	Normal	Digital Input 03	5 Sec	Low Tank Level	6

6.12 Sewage Treatment

6.12.1 Pumping Stations

Depending on the type of equipment installed, each pumping station must monitor the following signals:

Signal title	Type	Comments	Category	Contact state	
				0	1
Pump Running	Digital	Per pump - Running / Standing	M	Standing	Running
Pump Failed	Digital	Per Pump - To include all failure modes, overload, low oil, over temp. etc.	A	Failed	Healthy
Wet Well High Level	Digital	High level in well via separate Float Switch or ultrasonic	A	High	Normal

Wet Well High-high Level	Digital	High level in well via separate Float Switch or ultrasonic	A	High	Normal
Wet Well Level	Analogue	(4-20mA) Signal. Includes Software generated alarms, Low, Low-Low, High and High-High etc.	A/M	Displays on site value	
Compressor Running	Digital	Per Compressor - Running / Standing	A	Failed	Healthy
Compressor Failed	Digital	Per Compressor - To include all failure modes, overload, low oil, over temp.	A	Failed	Healthy

6.13.2 Pumping Stations; Chemical Dosing – where applicable

For sewage pumping stations where chemical dosing takes place, the following signals must be monitored:

Signal title	**Type**	**Comments**	**Category**	**Contact state**	
				0	**1**
Duty Dosing Pump Failed	Digital	Duty Pump failure – Include all failure modes	A	Failed	Healthy
Dosing Plant Shutdown	Digital	Alarm to include Main Bund High Alarm Dosing Bund High Alarm Duty & Standby Dosing System Failed PLC Failed Mixer Failed	A	Alarm	Normal

6.12.3 Sewage Treatment Inlet Works

For sites that have inlet works the following signals must be monitored:

Signal title	**Type**	**Comments**	**Category**	**Contact state**	
				0	**1**
Macerator Pump Running	Digital	Per pump Running / Standing Only where failure causes disruption to total works flow & or inlet flooding	M	Standing	Running
Macerator Pump Failed	Digital	Per pump Failed / Healthy Only where failure causes disruption to total works flow & or inlet flooding	A	Failed	Healthy
Screen Running	Digital	Per Screen Running signal for each mechanical screen.	A	Standing	Running
Screen Failed	Digital	Per Screen Failed signal for each mechanical screen.	A	Failed	Healthy

Screening/Grit Removal	Digital	Combined signal to give single alarm indicating the failure of any automated item of Screenings and / or Grit Removal Plant	A	Alarm	Normal

6.12.4 Flow Measurement

For sites that have MCERTS flow meters the following signals must be monitored:

Signal title	**Type**	**Comments**	**Category**	**Contact state**	
				0	**1**
Flow	Analogue	Flow measurement required for ALL MCERTS sites. Note: in the event that the Inlet Flow is defined as the point of measurement in respect of UWWTD for any particular site then the Signal Title shall be 'UWWTD Inlet Flow (l/s)' (Where flow >50m3/D)	M	Displays on site value. Monitors the flow recorded by the MCERTS flowmeter at 15min intervals. Needs to use a serial cable from the MCERTS Instrumentation system to ensure the outstation records exactly the same value as the MCERTS datalogger, at the same time interval.	
Flow Meter Failed	Digital	Signal picked up from the measurement unit	A	Failed	Healthy

6.12.5 Storm / Flow Control Tanks

If storm / flow tanks require monitoring, the following signals must be monitored:

Signal title	**Type**	**Comments**	**Category**	**Contact state**	
				0	**1**
Overflow to Water Course	Analogue/ Digital	Includes Software generated alarms, Low, Low-Low, High and High-High etc.	A/M	Displays on site value	

6.12.6 Primary Sedimentation Tanks

Where rotating scraper bridges are installed, the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Scraper Bridge Running	Digital	Per scraper bridge - Running / Standing	M	Standing	Running
Scraper Bridge Failed	Digital	Per scraper bridge - To include all failure modes, overload, low oil, over temp. etc.	A	Failed	Healthy

6.12.7 Aeration

For sites that have aeration plants the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Aerator Running	Digital	Per Aerator Motor	M	Standing	Running
Aerator Drive Failed	Digital	Per Aerator Motor	A	Failed	Healthy
Blower Running	Digital	Per Blower Motor	M	Standing	Running
Blower Motor Failed	Digital	Per Blower Motor Failed / Healthy	A	Failed	Healthy
Anoxic Zone Mixer Running	Digital	Per Anoxic Mixer	A	Standing	Running
Anoxic Zone Mixer Failed	Digital	Per Anoxic Mixer	A	Failed	Healthy
SAS Thickening Plant Common Alarm	Digital	To indicate the following failure modes within the Surplus Activated Sludge Plant: SAS Thickener Fail Thickened SAS Pump Fail Polymer Plant Fail	A	Alarm	Normal

6.12.8 Sludge Tanks – Thickening and Storage

Where sludge storage exists, the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Tank High Level	Digital	Per Tank, where auto de-sludging is installed, to indicate the tank level is high.	A	High	Normal
Tank High-high Level	Digital	Per Tank, where auto de-sludging is installed, to indicate the tank level is high.	A	High	Normal

6.12.9 Humus Tanks / Final Settlement Tanks

For sites where half bridge scrapers are installed:

Signal title	Type	Comments	Category	Contact state	
				0	1
FST / Humus Tank Sludge Blanket High Level	Digital	Per Final Tank Where auto desludging is installed	A	Alarm	Normal
Scraper Bridge Running	Digital	Per scraper bridge - Running / Standing	M	Standing	Running
Scraper Bridge Failed	Digital	Per scraper bridge - To include all failure modes, overload, low oil, over temp. etc.	A	Failed	Healthy

6.12.10 Chemical Dosing – where applicable

For sites where chemical dosing is installed, the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Duty Dosing Pump Failed	Digital	Duty Pump failure – Include all failure modes	A	Failed	Healthy
Dosing Plant Shutdown	Digital	Alarm to include Main Bund High Alarm Dosing Bund High Alarm Duty & Standby Dosing System Failed PLC Failed Mixer Failed	A	Alarm	Normal
Storage Tank Reorder Level	Digital	Indicates that the dosing tank requires a refill	A	Low	Normal

6.12.11 Inter Stage / Process Pumps (e.g. Sludge Transfer, RAS, SAS, Liquor Returns, etc.)

For sites where inter-stage pumping stations are installed, the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Pump Running	Digital	Per pump Running / Standing	M	Standing	Running
Pump Failed	Digital	Per Pump - To include all failure modes, overload, low oil, no flow, over temp. etc. Macerators (where provided) should generate a common macerator / pump alarm on failure.	A	Failed	Healthy

6.12.12 Rotating Biological Contactor (RBC)

For sites that have RBC the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
RBC Loss of Rotation	Digital	Each RBC is to be monitored for Rotation Fail by a suitable rotation-monitoring device.	A	Failed	Healthy

6.12.13 Submerged Aerated Filters

For sites whose treatment facilities comprise a submerged aerated filter the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Aeration Failure	Digital	Indicates loss of air supply to the process (usually via a single pressure switch mounted on delivery side of blower(s))	A	Failed	Healthy

6.12.14 Biological Filter Beds

For sites that have rotating filter distributors the following signals must be monitored:

Signal title	Type	Comments	Category	Contact state	
				0	1
Filter Distributor Loss of Rotation	Digital	Indicates loss of rotation of the distributor arms. For powered filters this can be derived from the drive system. For unpowered systems, the signal can be obtained by proximity switches on the filter arms. A timer is required to prevent false alarms.	A	Failed	Healthy

6.13 Oil Water Interceptors (OWI)

For sites where OWI's are installed the following signals must be monitored:

Signal title	Type	Comments	Alarm State		RTU Input	Alarm Level
			0	1		
Oil Level	Digital	Indicates that oil is present and requires emptying	Alarm	Normal	Digital Input 02	7
Silt level	Digital	Indicates that silt has settled within the OWI and requires emptying	Alarm	Normal	Digital Input 03	6

7.0 CAD Specification

7.1 Introduction

In order to achieve consistency across the Severn Trent Services business, a specification for CAD drawings has been created.

This specification sets out the programmes, versions, borders, layers, text styles etc to be used on all Severn Trent Services CAD Drawings and formats and methods of issue of those drawings to Severn Trent Services.

Utility drawings other than schematic or process flow diagrams need to be geo-referenced.

7.2 Software

The following list shows the only CAD software packages acceptable to Severn Trent Services. CAD drawings must be created using one of these. Please note the exact version of the software specified:

- AutoCAD Version 2019
- VectorWorks Version 2019
- DesignCAD 3D Max Version 2019

The final drawing must be submitted to Severn Trent in *.DWG format.

7.3 Layout

Severn Trent Services will provide its contractors / subcontractors / suppliers with digital sheet layout templates for producing new CAD drawings when contract is awarded. The following template can be sent electronically:

- Template file = STS_Standards_AsBuilt2.dwt

There are 5 standard sheet sizes used by Severn Trent Services, A0, A1, A2, A3 and A4 to accommodate different drawings designs and scales.

Each sheet size template has a bespoke Title Block incorporated in the border.

7.4 Border: Title Block

The main features of the Title Block are

MoD Logo

- STS Logo
- Services Legend
- Health and Safety Notice
- Revision details
- Caution note (secure information contained within drawing)
- Disclaimer
- Project Annotation Details e.g. Project name, date, drawing no. etc.

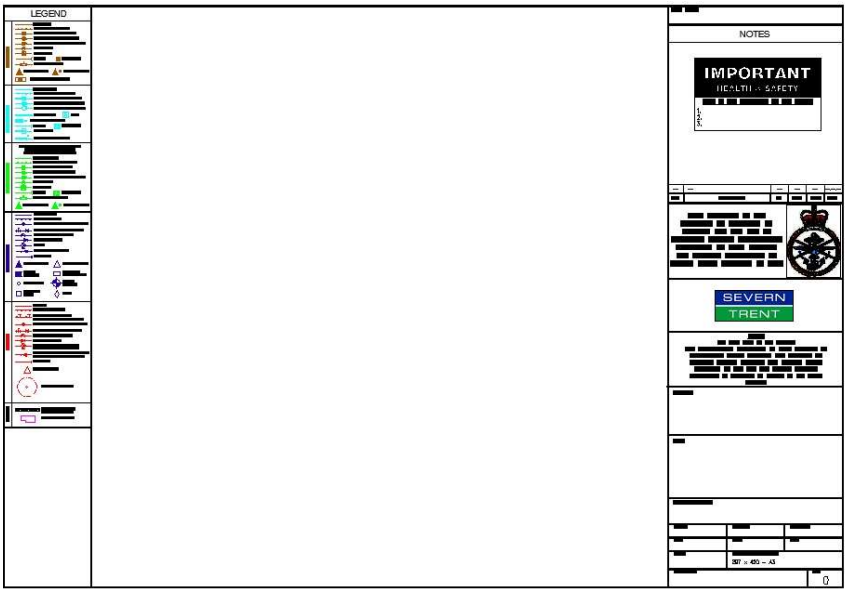


Figure 1 Example of Border; A3 Layout

7.5 Drawing Numbers

Drawings numbers are assigned by Project and drawing type.

Drawing Number format is XXNNN – NNNXN, where

- XXNNN is the site reference number (for example XA032)
- NNN is the drawing number (for example 500 = Water Service Plan)
- XN is the Issue reference.

Contractors, Sub-contractors and suppliers will be given the site reference number and blocks of numbers to use corresponding to the type of drawing to be produced at commissioning stage of the project.

- GA – 001 to 099
- Process Flow Diagrams – 300 to 399
- Electrical Schematics – 400 to 499
- Utility Drawings - 500 to 599
- P&ID – 700 to 799

7.6 Layer Attributes

Standardised layer attributes form a pattern for all the utility drawing layers across STS CAD drawings. These layer attributes are

- Name of the layer
- Line type of the layer
- Line weight of the layer
- Transparency of the layer
- Colour of the layer

7.7 Names of the layers

The following are the standard names of the layers in use for utility drawings:

1) **Background – demolished buildings**; should contain boundary of demolished buildings
2) **Background** – **Building No & Name**; should contain name or number of any building on site
3) **Background – OS**; should contain all of Ordnance Survey background details
4) **Background – text**; should contain text of Ordnance Survey background
5) **Potable Water (R) – redundant**; should contain any redundant water service including cover details and text description
6) **Potable Water (A)** – **abandoned**; should contain any abandoned pipes which have been permanently disconnected from service including cover details and text description
7) **Potable Water – Mains**; should contain clean water network mains including text description e.g. size, material, depth if known
8) **Potable Water** – **Service Pipe**; should contain details of service pipe from main to point of supply including annotation
9) **Potable Water – Tap Pipe;** should contain details of pipe from main line to tap with text description
10) **Portable Water – AV**; should contain air valves details on potable or fire mains network with annotation
11) **Potable Water – SV**; should contain isolation valves details on potable or fire mains network with text description
12) **Potable Water** – **SC**; should contain location details of stop cock or tap at boundary box with text description
13) **Potable Water – PRV**; should contain pressure relief valve details on potable or fire mains network with text description
14) **Potable Water** – **NRV**; should contain non-return valve details on potable or fire mains network with text description
15) **Potable Water** – **WO**; should contain washout details on potable water network with text description
16) **Potable Water – Connections**; should contain hatch box, chemical injection point, water draw point details on potable or fire mains network with text description
17) **Potable Water – Meters**; should contain water meter symbols e.g. zonal, gross, bulk, SU, night meters with text description
18) **Potable Water – Hydrants**; should contain hydrants on potable water network with text description
19) **Potable Water – Fittings**; should contain any water additional fittings like reducer/taper, bend/elbow, flange adapter plate, coupler, Y branch, Cross Piece, Tee Piece on potable or fire mains network with text description
20) **Potable Water** – **End CAP**; should contain End CAP fitting details on potable or fire mains network with text description
21) **Potable Water** – **Discharge Pipe**; should contain discharge pipe details e.g. pipe discharging water from reservoir to a watercourse.
22) **Potable Water – Tanks**; should contain any clean water tank e.g. service reservoir, water tower with text description
23) **Potable Water** - **Pump**; should contain water pumping station details with text description
24) **Potable Water – Joint**; should contain any pipe joint details on potable or fire mains network e.g. metal or plastic joint with text description
25) **Potable Water** – **Sample Point**; should contain location of water quality point with text description
26) **Potable Water** – **Treatment Point**; should contain location detail of water treatment plant with text description

27) **Combined Water (R) – Redundant**; any redundant combined water service with text description
28) **Combined Water – Main**; should contain combined water mains including flow direction and annotation e.g. main size, material or depth
29) **Combined Water – Cover**; should contain cover detail with annotation e.g. manhole number, cover and invert level etc.
30) **Combined Water – Symbol or Text**; should contain any other symbol or text related to combined system with text description e.g. valves
31) **Foul Water (R) - Redundant**; any redundant foul water service with annotation.
32) **Foul Water (A)** – **Abandoned**; any abandoned foul water service with text description
33) **Foul Water – Main**; should contain foul water mains including annotation e.g. main size, material or depth
34) **Foul Water – Service Pipe**; should contain foul water service pipes - connections from properties to main sewer line including annotation e.g. pipe size, material or depth
35) **Foul Water – Effluent Pipe**; should contain details of pipe that carries final effluent from a Sewage Treatment Works including annotation
36) **Foul Water - Overflow Pipe**; should contain details of pipe used to carry overflow discharge from a CSO (Combined Sewer Overflow) to an open watercourse
37) **Foul Water – Pumping Main**; should contain foul water pressurised mains with annotation
38) **Foul Water – Cover**; should contain foul water Manhole details with annotation e.g. manhole number, cover level and invert level etc.
39) **Foul Water** – **SVP**; should contain detail of Service Vent Pipe with text annotation
40) **Foul Water – Tanks**; should contain any Waste Water Tanks (e.g. sludge tank, cess pit, septic tank, any process tank) with annotation
41) **Foul Water** - **Pump**; should contain Sewage Pumping Station and annotation
42) **Foul Water - Valves**; should contain valves details with annotation
43) **Foul Water – Sample Point**; should contain location of Waste Sample Point with annotation
44) **Foul Water – Gully**; should contain location details of Gullies connected to foul water network with text annotation
45) **Foul Water** – **GRE**; should contain details of Grease Trap with annotation
46) **Foul Water** – **End CAP**; should contain End CAP fitting details with text description
47) **Foul Water – Chamber**; should contain details of any chamber e.g. wet well, flushing chamber with text annotation
48) **Foul Water – Bio Disc**; should contain details of Bio Disc location with text annotation
49) **Foul Water – Fittings**; should contain details of any fittings on foul water network e.g. pressurised washout, sewerage chemical injection point, hatch box with text annotation
50) **Foul Water** – **Flow Arrow**; should contain flow arrow symbol on foul water network
51) **Foul Water** - **RE**; should contain rodding/cleaning eyes details on foul water network only with annotation
52) **Foul Water** – **VT**; should contain vent pipes details connected to foul water network only with annotation
53) **Surface Water (R) – Redundant**; any redundant surface water service with annotation
54) **Surface Water (A) – Abandoned**; any abandoned surface water service with annotation
55) **Surface Water – Mains**; should contain surface water mains with annotation e.g. main size, material or depth if known
56) **Surface Water – Service Pipe**; should contain service pipe with annotation
57) **Surface Water – Pumping Main**; should contain surface water pumped mains with annotation

58) **Surface Water – Cover**; should contain surface water cover detail with annotation e.g. manhole number, cover and invert level etc.
59) **Surface Water – Tanks**; should contain any surface water tanks (e.g. attenuation tank, lagoon) with annotation
60) **Surface Water** – **Catch Pit**; should contain Catch Pit details with annotation
61) **Surface Water** – **Hydrobrake**; should contain Hydro brake tank details on surface water with annotation
62) **Surface Water – Outfall**; should contain outfall detail to open watercourse with annotation
63) **Surface Water** – **Pump**; should contain surface water pumping station with text description
64) **Surface Water** – **Flow Arrow**; should contain polygonal shape of flow arrow
65) **Surface Water** – **End CAP**; should contain End CAP fitting details with text description
66) **Surface Water – Fittings**; should contain details of any fittings on surface water network e.g. pressurised washout, hatch box with text annotation
67) **Surface Water – Gully**; should contain gully detail on surface water network including annotation
68) **Surface Water – Channel**; should contain drainage channel runs including ACO, French, Filter, Gatic Drains with annotation
69) **Surface water – Culvert**; should contain culvert run detail with annotation
70) **Surface Water - Valves**; should contain valves details with annotation
71) **Surface Water** - **RE**; should contain rodding/cleaning eyes details on surface water network only with annotation
72) **Surface Water** – **VT**; should contain vent pipes details connected to surface water network only with annotation
73) **Fire – Hydrant**; should contain fire hydrant symbol on fire network with annotation e.g. fire hydrant number
74) **Fire – Main (R) Redundant**; should contain any redundant fire service with annotation
75) **Fire – Mains**; should contain fire network mains with annotation e.g. size, material, depth if known
76) **Fire – Tanks**; should contain fire water tanks: Emergency Water Storage (EWS) with annotation
77) **Fire** - **Pump**; should contain fire booster station details with text description
78) **Fire Water** – **WO**; should contain washout details on fire network with text description
79) **Raw Water – Main**; should contain raw water mains with annotation e.g. size, material, depth if known
80) **Raw Water – Tanks**; should contain raw water storage tanks: reservoirs, lagoon
81) **Raw Water – Valves**; should contain valves details on raw water mains with annotation
82) **Raw Water – Borehole**; should contain boreholes or pumping stations with annotation
83) **Raw Water** – **Pump**; should contain pump details with annotation
84) **MISC – Main**; should contain miscellaneous water mains which are not subject to Aquatrine Contract with annotation e.g. land drainage pipes
85) **MISC – Symbol or Text**; should contain miscellaneous water symbols or text; covers, chambers, attenuation tank, geo cellular structures etc.
86) **OWI or Silt Trap**; should contain Oil Water Interceptors or Silt Traps details with annotation
87) **Soakaway**; should contain soakaway details with annotation
88) **RWP or DP**; should contain rain water pipes or drop pipes details with annotation
89) **Telemetry Cables**; should contain telemetry cables ducting runs details with annotation
90) **Telemetry Electrical Supply**; should contain telemetry electrical supply ducting details to kiosk with annotation

7.8 Additional layers for Layout drawings

Layout drawings have additional layers as shown below

1) **Layout legend**; should contain services and feature legend
2) **Layout logo**; should contain Severn Trent logo, MoD logo and Health and Safety Notice
3) **Layout text**; should contain any text within frames
4) **Layout frames**; should contain lines used for any frames

7.9 Line type of the layers

While most of the layers must be set to "Continuous" line type, the following are exception and need to be set to "Waste Line STS" Severn Trent Services Line Type indicating flow direction:

1) Combined Water (R)
2) Combined Water – Main
3) Foul Water (R)
4) Foul Water (A)
5) Foul Water – Main
6) Foul Water – Service Pipe
7) Foul Water – Effluent Pipe
8) Foul Water - Overflow Pipe
9) Foul Water – Pumping Main
10) Surface Water (R)
11) Surface Water (A)
12) Surface Water – Mains
13) Surface Water – Service Pipe
14) Surface Water – Pumping Main
15) Surface Water – Culvert
16) Surface Water – Channel

7.10 Line Weight of the layers

All layers must be set to "0.00mm" line weight

7.11 Transparency of the layers

All layers must be set to "0" transparency

7.12 Colour of the layers

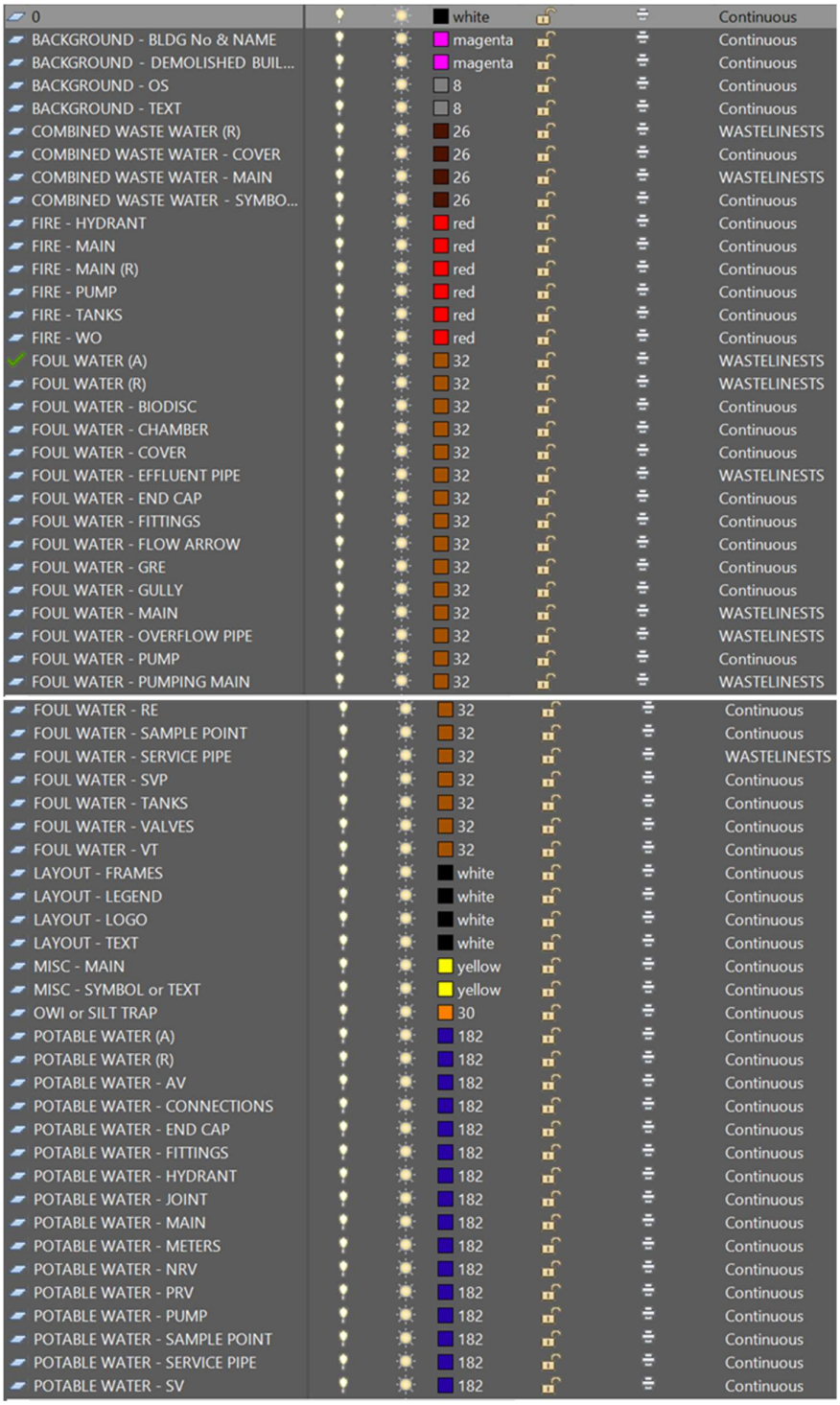
The following are the standard names of the layers in use for utility drawings:

1) Background –demolished buildings; colour code: 6
2) Background – Building No & Name; colour code: 8
3) Background – OS; colour code: 8
4) Background – text; colour code: 8
5) Potable Water (R) – redundant; colour code: 182
6) Potable Water (A) – abandoned; colour code: 182
7) Potable Water – Mains; colour code: 182
8) Potable Water – Service Pipe; colour code: 182
9) Potable Water – Tap Pipe; colour code: 182
10) Portable Water – AV; colour code: 182
11) Potable Water – SV; colour code: 182

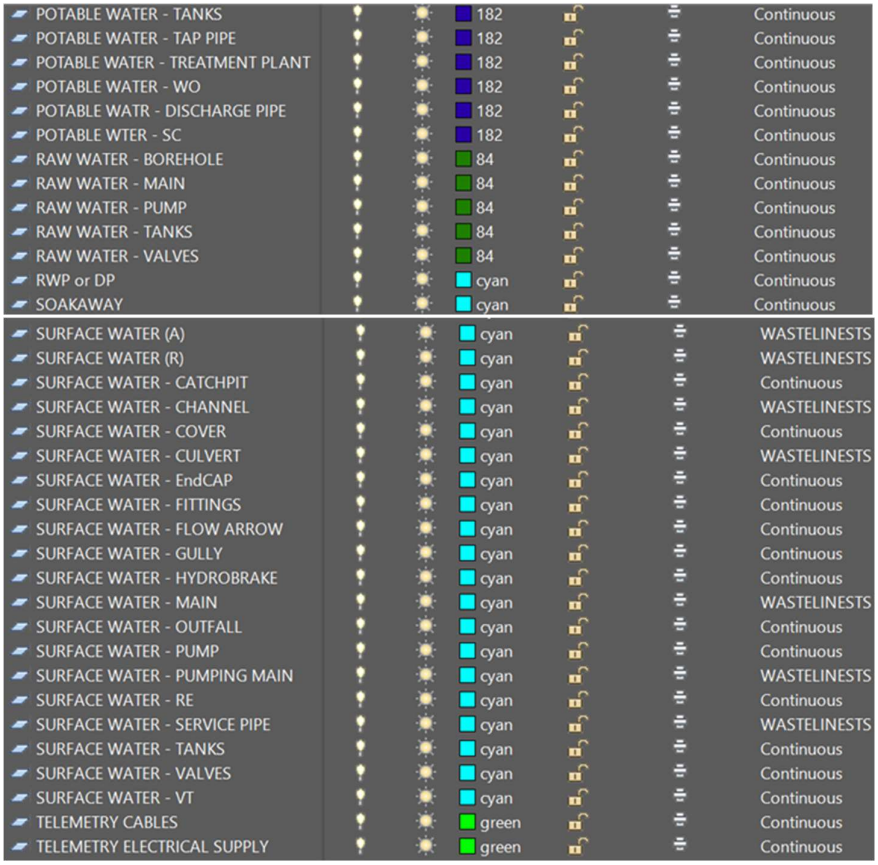
12) Potable Water – SC; colour code: 182
13) Potable Water – PRV; colour code: 182
14) Potable Water – NRV; colour code: 182
15) Potable Water – WO; colour code: 182
16) Potable Water – Connections; colour code: 182
17) Potable Water – Meters; colour code: 182
18) Potable Water – Hydrants; colour code: 182
19) Potable Water – Fittings; colour code: 182
20) Potable Water – End CAP; colour code: 182
21) Potable Water – Discharge Pipe; colour code: 182
22) Potable Water – Tanks; colour code: 182
23) Potable Water - Pump; colour code: 182
24) Potable Water – Joint; colour code: 182
25) Potable Water – Sample Point; colour code: 182
26) Potable Water – Treatment Point; colour code: 182
27) Combined Water (R) – Redundant; colour code: 26
28) Combined Water – Main; colour code: 26
29) Combined Water – Cover; colour code: 26
30) Combined Water – Symbol or Text; colour code: 26
31) Foul Water (R) – Redundant; colour code: 32
32) Foul Water (A) – Abandoned; colour code: 32
33) Foul Water – Main; colour code: 32
34) Foul Water – Service Pipe; colour code: 32
35) Foul Water – Effluent Pipe; colour code: 32
36) Foul Water - Overflow Pipe; colour code: 32
37) Foul Water – Pumping Main; colour code: 32
38) Foul Water – Cover; colour code: 32
39) Foul Water – SVP; colour code: 32
40) Foul Water – Tanks; colour code: 32
41) Foul Water - Pump; colour code: 32
42) Foul Water - Valves; colour code: 32
43) Foul Water – Sample Point; colour code: 32
44) Foul Water – Gully; colour code: 32
45) Foul Water – GRE; colour code: 32
46) Foul Water – End CAP; colour code: 32
47) Foul Water – Chamber; colour code: 32
48) Foul Water – Bio Disc; colour code: 32
49) Foul Water – Fittings; colour code: 32
50) Foul Water – Flow Arrow; colour code: 32
51) Foul Water - RE; colour code: 32
52) Foul Water – VT; colour code: 32
53) Surface Water (R) – Redundant; colour code: 4
54) Surface Water (A) – Abandoned; colour code: 4
55) Surface Water – Mains; colour code: 4
56) Surface Water – Service Pipe; colour code: 4
57) Surface Water – Pumping Main; colour code: 4
58) Surface Water – Cover; colour code: 4
59) Surface Water – Tanks; colour code: 4

60) Surface Water – Catch Pit; colour code: 4
61) Surface Water – Hydrobrake; colour code: 4
62) Surface Water – Outfall; colour code: 4
63) Surface Water – Pump; colour code: 4
64) Surface Water – Flow Arrow; colour code: 4
65) Surface Water – End CAP; colour code: 4
66) Surface Water – Fittings; colour code: 4
67) Surface Water – Gully; colour code: 4
68) Surface Water – Channel; colour code: 4
69) Surface water – Culvert; colour code: 4
70) Surface Water - Valves; colour code: 4
71) Surface Water - RE; colour code: 4
72) Surface Water – VT; colour code: 4
73) Fire – Hydrant; colour code: 1
74) Fire – Main (R) Redundant; colour code: 1
75) Fire – Mains; colour code: 1
76) Fire – Tanks; colour code: 1
77) Fire - Pump; colour code: 1
78) Fire Water – WO; colour code: 1
79) Raw Water – Main; colour code: 84
80) Raw Water – Tanks; colour code: 84
81) Raw Water – Valves; colour code: 84
82) Raw Water – Borehole; colour code: 84
83) Raw Water – Pump; colour code: 84
84) MISC – Main; colour code: 2
85) MISC – Symbol or Text; colour code: 2
86) OWI or Silt Trap; colour code: colour code: 30
87) Soakaway; colour code: 4
88) RWP or DP; colour code: 4
89) Telemetry Cables; colour code: 3
90) Telemetry Electrical Supply; colour code: 3

7.13 Summary of Layer Attributes



0	white		Continuous
BACKGROUND - BLDG No & NAME	magenta		Continuous
BACKGROUND - DEMOLISHED BUIL...	magenta		Continuous
BACKGROUND - OS	8		Continuous
BACKGROUND - TEXT	8		Continuous
COMBINED WASTE WATER (R)	26		WASTELINESTS
COMBINED WASTE WATER - COVER	26		Continuous
COMBINED WASTE WATER - MAIN	26		WASTELINESTS
COMBINED WASTE WATER - SYMBO...	26		Continuous
FIRE - HYDRANT	red		Continuous
FIRE - MAIN	red		Continuous
FIRE - MAIN (R)	red		Continuous
FIRE - PUMP	red		Continuous
FIRE - TANKS	red		Continuous
FIRE - WO	red		Continuous
FOUL WATER (A)	32		WASTELINESTS
FOUL WATER (R)	32		WASTELINESTS
FOUL WATER - BIODISC	32		Continuous
FOUL WATER - CHAMBER	32		Continuous
FOUL WATER - COVER	32		Continuous
FOUL WATER - EFFLUENT PIPE	32		WASTELINESTS
FOUL WATER - END CAP	32		Continuous
FOUL WATER - FITTINGS	32		Continuous
FOUL WATER - FLOW ARROW	32		Continuous
FOUL WATER - GRE	32		Continuous
FOUL WATER - GULLY	32		Continuous
FOUL WATER - MAIN	32		WASTELINESTS
FOUL WATER - OVERFLOW PIPE	32		WASTELINESTS
FOUL WATER - PUMP	32		Continuous
FOUL WATER - PUMPING MAIN	32		WASTELINESTS
FOUL WATER - RE	32		Continuous
FOUL WATER - SAMPLE POINT	32		Continuous
FOUL WATER - SERVICE PIPE	32		WASTELINESTS
FOUL WATER - SVP	32		Continuous
FOUL WATER - TANKS	32		Continuous
FOUL WATER - VALVES	32		Continuous
FOUL WATER - VT	32		Continuous
LAYOUT - FRAMES	white		Continuous
LAYOUT - LEGEND	white		Continuous
LAYOUT - LOGO	white		Continuous
LAYOUT - TEXT	white		Continuous
MISC - MAIN	yellow		Continuous
MISC - SYMBOL or TEXT	yellow		Continuous
OWI or SILT TRAP	30		Continuous
POTABLE WATER (A)	182		Continuous
POTABLE WATER (R)	182		Continuous
POTABLE WATER - AV	182		Continuous
POTABLE WATER - CONNECTIONS	182		Continuous
POTABLE WATER - END CAP	182		Continuous
POTABLE WATER - FITTINGS	182		Continuous
POTABLE WATER - HYDRANT	182		Continuous
POTABLE WATER - JOINT	182		Continuous
POTABLE WATER - MAIN	182		Continuous
POTABLE WATER - METERS	182		Continuous
POTABLE WATER - NRV	182		Continuous
POTABLE WATER - PRV	182		Continuous
POTABLE WATER - PUMP	182		Continuous
POTABLE WATER - SAMPLE POINT	182		Continuous
POTABLE WATER - SERVICE PIPE	182		Continuous
POTABLE WATER - SV	182		Continuous



7.14 Dimension Styles

Dimension styles should match the output scale of a drawing and should match the text styles embedded within a drawing.

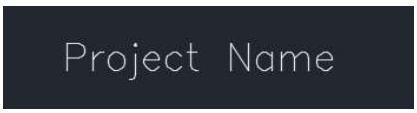
7.15 Text Styles

A number of different text styles have been specified for use on the CAD Drawings, as follows:

Style Name	Font Name	Font Style	Height - paper	Width factor	Annotative
Annotative	romans.shx	Regular	5.0	0.8	Yes
Arial 1.7mm	Arial	Regular	1.7	1.0	No
Arial 2mm	Arial	Regular	2.0	1.0	No
Arial 2.5mm	Arial	Regular	2.5	1.0	No
Arial 3mm	Arial	Regular	3.0	1.0	No
Arial 4mm	Arial	Regular	4.0	1.0	No
Arial 5mm	Arial	Regular	5.0	1.0	No
Romans 1.7mm	romans.shx	Regular	1.7	0.8	No
Romans 2mm	romans.shx	Regular	2.0	0.8	No
Romans 2.5mm	romans.shx	Regular	2.5	0.8	No
Romans 5mm	romans.shx	Regular	5.0	0.8	No
Standard	romans.shx	Regular	0.0	0.8	No
STYLE1	isocp.shx	Regular	0.0	1.0	No

Arial Style

Standard Style

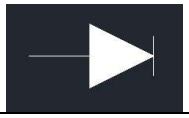


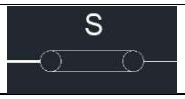
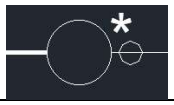
Romans Style

STYLE1

7.16 Standard Symbols

The standard symbols for the features below must be used. The symbol should be inserted into the CAD drawing as a pre-defined block reference with an insertion basepoint.

			
Fire Hydrant	Control Valve Closed: Sluice Valve	Control Valve Open: Sluice Valve	Left Closed Valve
			
Right Closed Valve	Ball Valve	Butterfly Valve	Actuated Valve
			
Gully	Soakaway	Meter	Borehole
			
Pump	Rodding Eye	Telemetry	Tap or Stand Pipe
			
Joints	Catch pit	Hydro Brake	Septic Tank
			
Cess Pit	Sump Chamber	Pressure Relief Valve (PRV)	Non-Return valve (NRV)
			

Air Valve	Sample Point	MCERTS Point	Flow Arrow
			
Washout	Water Boundary Box	Manhole Cover	Asset Reference
			
Differential Pressure	Capped End	Channel Drain	Surface Water Syphon
			
Grease Trap	Oil Water Interceptor	Foul Water Syphon	Sewer Backdrop
			
Access Chamber Backdrop	Outfall	Concrete Protection	Intake
			
Attenuation Tank	Waste Line STS		

7.17 Asset References

The following Asset References must be used for labelling non-infrastructure assets on the CAD Drawings

- Emergency Water Storage Tanks (EWS)
- Oil Water Interceptors (OWI)
- Service Reservoirs (SVR)
- Fire Boosters (FB)
- Water Treatment Works (WTW)
- Sewage Treatment Works (STW)
- Sewage Pumping Stations (SPS)
- Water Pumping Stations (WPS)
- Cess Pits (CP)
- Septic Tanks (ST)
- Lagoons (LAG)
- Spring and Wells (SAW)
- Boreholes (BH)
- Compressors (COM)
- Impounding Reservoirs (IR)
- Silt Traps (SIL)
- Grease Trap (GRE)
- Outfall (OUT)
- Pond (PON)
- Soakaway (SOK)
- Sump (SUM)
- Attenuation Tank
- Tanks (TAN)

- Surface Water Pumping Station (SWP or SWPS)
- Other (OTH)

Figure 2 Example of Asset Reference

7.18 File Naming

The CAD file names must follow the convention given here:

"XXNNN-NNNXN [Site Name] [Description]"

e.g. "XA999-101L6 Topcliffe Barracks Water Service Plan As built"

Where necessary project names and drawing identifiers may be abbreviated to prevent overly long filenames, when a drawing is "As built" and has been accepted as such the file name should include "As built".

7.19 File Submission

Drawing files must be submitted electronically in Native Format and in PDF.

Refer to Security document STS 2600 for restrictions and permitted means to transmit MoD security sensitive material.

This applies to drawings submitted for approval and "As built" drawings.