Tooreen Aghamore GWSS
Water Meter Upgrade and Network Improvement Works Phase 2

Client: **Tooreen Aghamore GWSS**

VOLUME A:
WORKS REQUIREMENT

General Specification

occe
Ó Conaire Consulting Engineers

Ó Conaire Consulting Engineers
Main Street – Ballindine – Co Mayo
T + 353 94 938 5020 F + 353 94 938 5021
info@occengineers.ie www.occengineers.ie

Client	Tooreen Aghamore GWSS
Project No.	26053
Project Title	Tooreen Aghamore GWSS - Water Meter Upgrade and Network Improvement Works Phase 2
Report Title	Volume A – Works Requirement

Date	Version	Status	Author	Rev by	Apd by	Comment
02/11/26	1.0	Tender	CC	CC	CC	

Contents

1.0 GENERAL SPECIFICATION 4
1.1 General Definitions 4
1.2 Traffic Management & Temporary Traffic Signs. 4
1.3 Compliance with Road Transport Act 5
1.4 Reference Points and Levels 5
1.5 Working Area 6
1.6 Tidiness of Site 6
1.7 Site Clearance 7
1.8 Site Fencing 7
1.9 Privately Owned and Public Utility Services 7
1.10 Procedures for Complaints and Claims for Damages 8
1.11 Work Outside Normal Working Hours 8
1.12 Noise Control 8
1.13 Pollution of Watercourses 8
1.14 Emergency 24 Hour Cover 9
2.0 MATERIALS 10
2.1 Use of Materials 10
2.2 Proprietary Names 10
2.3 Approved Samples 10
2.4 EC Directive on Materials, Pipes and Fittings 10
2.5 Storage of Explosives and other Dangerous Substances 10
2.6 Storage and Handling of Materials 10
2.7 Surplus Materials 11
2.8 Definition, Classification and General Use of Earthworks Materials 11
2.9 Grass Seed 12
2.10 Fertilizer 12
2.11 Submission of Samples and Test Certificates 12
2.12 Concrete 12
2.13 Precast Concrete Manholes and Valve Chambers 13
2.14 Manufacture of Precast Units off the Site 13
2.15 Chamber – Covers 13
2.16 Boundary Box 14
2.17 Requirements for Boundary Box. 14
2.18 Bricks and Blocks 14
2.19 Cement Mortar Lining for Pipes And Fittings 14
2.20 Mortar and Grout 14
2.21 Sand 15
2.22 Steel Reinforcement 15
2.23 Stainless Steel 16
2.24 Fencing Wire 16
2.25 Galvanising 16
2.26 Gates 16
2.27 Handrails and Ladders 16
2.28 Gullies, Gully Gratings and Frames 16
2.29 Nails 17

2.30 Pipes, Valves & Fittings and Joints and Pipe Bedding Material 17
2.31 Ductile Iron Pipelines and Fittings For Watermains 17
2.32 Pressure Pipes of Synthetic Materials 18
2.33 Non Pressure Pipes of Synthetic Materials 18
2.34 Flanged joints 19
2.35 Flange Adaptors 19
2.36 Joint Rings and Lubricants 19
2.37 Pipe Bedding Material 19
2.38 Underground Warning Tape 19
2.39 Valves and other Fittings 19
2.40 Air valves 20
2.41 Fire Hydrants 20
2.42 Butterfly Valves 20
2.43 Marker Plates and Baseboards 20
2.44 PTFE Tape 20
2.45 Swabs 20
2.46 Geotextiles used in Earthworks 21
3.0 PIPELAYING & JOINTING 22
3.1 Types of Pipes 22
3.2 Pipelaying – General 22
3.3 Polyethylene Pipe Specification 23
3.4 Excavation for Pipelines. 24
3.5 Pipelines in Fields 25
3.6 Excavations to be kept Free from Water 25
3.7 Supports 26
3.8 Bedding and Protecting Pipes 26
3.9 Concrete Bedding and Surround 26
3.10 Concrete Anchorage. 27
3.11 Plugs 27
3.12 Gaps for Valves. etc 27
3.13 Jointing Pipes General 28
3.14 Cast Iron Joint Fittings 28
3.15 Flanged Joints 28
3.16 Polyethelene Pipe Joints 28
3.17 Testing of Polyethylene Pipe Joints 29
3.18 Protection of Pipes and Joints 30
3.19 Laying to Curves 30
3.20 Backfilling of Trenches 30
3.21 Restoration of Trenches 31
3.22 Soiling, Grassing and Turfing 31
3.23 Road Reinstatement 32
3.24 Water Service Connections 32
3.25 Setting Valves etc 32
3.26 Stream Crossings. 33
3.27 Existing Land Drains 33
3.28 Insulation of Watermains 34

3.29 Chambers 34
3.30 Testing - Pressure Pipelines 34
3.31 Swabbing and Scouring of Pipelines 35
3.32 Sterilisation of Water Mains 36
3.33 Assistance in Sampling and Testing 36
3.34 Testing of Pipe Bedding Material 36
3.35 Testing of Materials for Concrete 36
3.36 Testing of Concrete 37
3.37 Inspection and Testing of Precast Concrete Units 37
3.38 Air-Entrained Concrete 37
3.39 Failure to Meet Specified Requirements 37
3.40 Records 37

1.0 GENERAL SPECIFICATION

In addition to the stated specifications and details provided in these documents, the following documents shall also be deemed to be included in the General Specification and to form part of the Contract.

"NRA Specification for the Reinstatement of Openings in National Roads (December 2013")

"Guidelines for Managing Openings in Public Roads (Guidelines for the Opening, backfilling and Reinstatement of Openings in Public Roads, September 2015)"

Where discrepancies arise between the General Specifications and the "*NRA Specification for the Reinstatement of Openings in National Roads (December 2013)"* or the *"Guidelines for Managing Openings in Public Roads (Guidelines for the Opening, backfilling and Reinstatement of Openings in Public Roads, September 2015)"*, the General Specification shall be deemed to apply unless otherwise directed by the engineer.

"*Civil Engineering Specification for the Water Industry"* (CESWI). Where discrepancies arise between the General Specifications and CESWI, the General Specification shall be deemed to apply unless otherwise directed by the engineer.

Where discrepancies arise between the General and Particular Specifications, the Particular Specification shall be deemed to apply unless otherwise directed by the engineer.

1.1 General Definitions

"Employer" is as identified in the Form of Tender & Schedule
"Employer's Representative" is defined in the Conditions of Contract
"Approved" means approved by the Employer's Representative.
"Approved in writing" means approved by the Employer's Representative in writing.
"Directed" means directed by the Employer's Representative.
"Consent" means consent of the Employer's Representative.
"Permitted" means permitted by the Employer's Representative.

1.2 Traffic Management & Temporary Traffic Signs.

A fully developed traffic management plan will be required to be prepared by the Contractor prior to commencement of the Contract.

The following documents shall be taken to apply:-

"Traffic Signs Manual — Chapter 8" published by and obtainable from:-

Department of Transport, Transport House, 44 Kildare Street, Dublin 2.
Telephone: Locall 1890443311 or (01) 670 744511
www.transport.ie

"Guidance for the Control and Management of Traffic at Road Works" published by and LGMSB / Dept. of Transport / National Roads Authority and available from:-

Department of Transport, Transport House, 44 Kildare Street, Dublin 2.
Telephone: Locall 1890443311 or (01) 670 744511
www.transport.ie

Where the proposed works are on or adjacent to a public road, the Contractor shall, after consultation with Local Authority, submit in writing to the Roads Authority for their approval, with copy to the Employer's Representative, a Traffic Management Plan in accordance with the above documents. This plan shall be submitted prior to commencement of the Contract. Any such further details as the Employer's Representative may require shall be submitted thereafter.

For works on or adjacent to single carriageway roads the proposals shall be in accordance with the "*Guidance for the Control and Management of Traffic at Road Works"* published in October 2007 by LGMSB / Dept. of Transport / National Roads Authority. The Contractor shall provide, erect and maintain such traffic signs, lighting, barriers and other control measures as may be required, in accordance with the recommendations contained in Chapter 8 of the "*Traffic Signs Manual (2010)"* as published by the Department of Transport. Where exceptions to the Manual occur, the Contractor shall submit proposals for dealing with such exceptions to the Employer's Representative for comment. Compliance with this clause shall not relieve the Contractor of any of his other obligations.

The Contractor shall not commence any work, which affects the public road until all necessary traffic safety measures are fully operational. In no case shall excavations and/or temporary obstructions exceed a continuous length of 100 metres in urban areas and 250 metres in rural areas.

Traffic signs shall comply with BS 873 and road danger lamps with BS 3143 except that the flashing rate for flashing lamps shall be within the range 125-150 flashes per minute. The minimum luminous intensity of the lamps shall be 0.5 candela for steady lamps, 1.0 candela for ripple lamps at their peak and 1.5 candela for flashing lamps at their peak.

The Contractor shall keep clean and legible at all times all traffic signs, lamps barriers and traffic control signals and he shall position, re-position, cover or remove them as necessary during the progress of the work.

Compliance with the above requirements shall not relieve the Contractor from his obligations under the Road Traffic Acts 1961 to 2006 and any subsequent amendments thereof.

1.3 Compliance with Road Transport Act.

It is a requirement of the Contract that the Contractor must comply with the provisions of the Road Transport Act of 2011. The Contractor is to confirm compliance with this legislation for all haulage operators and authorized vehicles to be used in association with these works. The Employer is entitled to and may check that all operators and vehicles are listed on the register of licensed operators and authorized vehicles as published by the Department of Transport Tourism and Sport. Proof of compliance must be provided when requested, this may include the presentation of the original licence and a transport disc is to be displayed on all relevant vehicles.

The Contractor is to note that the licensing requirement for operators is in addition to the usual requirements that every vehicle they operate must be appropriately taxed, insured, have a working tachograph, have a certificate of road worthiness (and a PSV Licence for passenger vehicles) and be operated and maintained in a safe and roadworthy manner.

1.4 Reference Points and Levels

The Contractor shall supply to the Employer details of the value and location of the temporary bench marks and reference points which he proposes to use.

The Contractor shall satisfy himself that the existing ground levels as indicated in the Contract Drawings which are per Malin Head Datum are correct. Should the Contractor wish to dispute any levels he shall submit to the Employer a schedule of the position of the levels considered to be in error and a set of revised levels. The existing ground relevant to the disputed levels shall not be disturbed before the Employer's decision as to the correct levels is given.

1.5 Working Area

The Contractor shall for the purposes of the Contract have free and temporary use of working areas and accesses thereto as may be shown in the Contract. Should the Contractor require any further working areas or accesses during the progress of the Work he may arrange for the use of these, subject to the approval of the Employer. Where pipelines are routed through private property a wayleave width has been obtained by the Employer.

Unless specifically stated in the Contract, the Contractor shall assume that no permission has been given to enter or interfere with any private property, including any boundaries to same.

Prior to the commencement of operations the Contractor will be supplied with the names and addresses of all landowners and tenants. The Contractor shall give at least 7 days (but preferably longer) notice in writing to all landowners and tenants of his intention to start work within each area and shall copy such notice to the Employer's Representative.

During the currency of the Contract the Contractor shall attend promptly to any complaints intimated by landowner or tenants.

Where permission to enter has been provided, the Contractor shall keep records of the dates of his entry onto and departure from all property and lands of each owner occupier, together with the dates of the erection and removal of all enclosures, and he shall furnish copies of these records when required by the Employer. He shall keep and furnish similar records in respect of roads, footpaths and thoroughfares.

The Contractor shall arrange for surveys to be carried out with the Employer's Representative and owners or occupiers, of the portion of all properties, lands and crops which may be affected by the works. Before any work is commenced, the Contractor shall confirm in writing to the Employer that the relevant survey is a true and accurate record of the condition of all lands and properties inspected.

The Contractor shall be liable for compensation and costs resulting from trespass or from his failure to vacate or to reinstate any portion of the Site in accordance with the Contract.

Subject to any unavoidable disturbance which may be necessitated by the execution of the Contract, the Contractor shall not interfere with any fishing or other rights which may be enjoyed on or near the Site.

1.6 Tidiness of Site

The Contractor shall be responsible for the proper up-keep: and maintenance of the site and the works. Materials and equipment shall be positioned, stored and stacked in an orderly manner, having particular regard to safety.

When safety requirements dictate or when instructed by the Employer, the Contractor shall remove spoil to approved tip provided by the Contractor.

The Contractor shall maintain the site in a tidy and workmanlike fashion. All spoil heaps, loose pipes and stocks of bedding and backfill materials in the public roads shall be removed as promptly as possible. Grass margins shall be cleared of spoil heaps as promptly as possible. A suction road sweeper shall be used to clean the road of any dirt or debris on a daily basis at the minimum.

1.7 Site Clearance

Only as required under the Contract, the Contractor shall demolish, break up and remove any buildings, structures and superficial obstructions on the Site in the way of, or otherwise affected by the Permanent Works. He shall clear each part of the Site at times and to the extent required or as directed.

Underground structures and chambers shall be demolished to the depths shown in the Contract or as directed. They shall be properly cleaned out and filled with suitable material, as defined in the Specification, compacted in compliance with the Specification.

Subject to the provisions of the Contract all materials (other than top soil materials) arising from Site clearance, which are surplus to or unsuitable for use in the Permanent Works, shall become the property of the Contractor and shall be disposed of by him either off the Site to an approved landfill or disposal facility, or if approved, on the Site in an approved manner. Surplus or unsuitable soil materials shall be dealt with as required by the Specification and in accordance with the Contractor's Waste Management Plan.

The Contractor is responsible for obtaining a Tree Felling Licence where it is required for trees which are proposed to be removed. Where required in the Contract or directed by Employer's Representative, trees shall be uprooted or cut down as near to ground level as possible. Where a Tree Felling Licence has been issued the Contractor shall comply with the conditions specified herein. All felled timber shall be removed from the Site unless directed by the Employer's Representative (Landowner). Prior to any tree felling work being started those trees to be felled shall be surveyed, marked, measured and recorded by the Employer and the Contractor.

Stumps, tree roots, bushes and undergrowth shall, unless otherwise directed, be grubbed up and deposited off the Site in accordance with the Contractor's Waste Management Plan. Holes left by the stumps or roots shall be filled with suitable material, as defined in the Specification. The Contractor shall comply in all respects with the provisions of the Waste Management Act, 1996 and all associated legislation.

1.8 Site Fencing

As soon as the Contractor is given (temporary) possession of any lands, he shall erect any site fencing of the type and at the location as shown in the Contract. The Contractor shall regularly inspect and maintain all such fencing, any defects being made good without delay. Access shall be provided in temporary site fencing as necessary for the use of the occupiers of adjacent lands. Temporary site fencing shall remain in position until either it is replaced by permanent fencing or the Works are completed on that part of the Site. Any Cattle fencing required shall be in accordance with the Department of Agriculture, Food and the Marine Minimum Specification for Farm Fencing.

1.9 Privately Owned and Public Utility Services

If any privately owned service for water, electricity, drainage etc. passing through the Site will be affected by the Works; the Contractor shall provide a satisfactory alternative service in full working order to the satisfaction of the owner of the service and of the Employer before cutting the existing service.

The approximate location of known existing public utility services will be provided for information to the Contractor. If any other public utility services passing through the site is subsequently found to be affected by the Works the Contractor shall not carry out work in close proximity to the service until the Contractor's method of carrying out the work has been approved.

The Contractor shall determine the precise location of services by probing, using a suitable locator, excavating pits or excavating slit trenches.

Facilities are available from Eircom, ESB, and Local Authorities to assist in the location of their respective existing services. The Contractor shall obtain from all such authorities detailed records of existing services and amenities in proximity to the works, whether temporary or permanent, and shall obtain copies of conditions, avoid damage, pollution or danger to health, and shall engage the Authority, with the prior approval of the Employer, to plot and mark the service.

The Contractor shall supply the Employer with copies of all records and conditions provided by such bodies and shall comply with all conditions laid down by these bodies.

In the event that compliance with the conditions of such bodies is contrary to Contract instructions the Contractor shall notify the Employer in writing at least 14 days in advance of commencement of such work and receive instructions from the Employer before proceeding with the Works.

1.10 Procedures for Complaints and Claims for Damages

Details of all claims or warnings of intended claims, which the Contractor may receive in respect of matters against which he is required by the Contract to indemnify the Employer, shall be notified without delay to the Employer who shall likewise pass to the Contractor any claims or warnings which may be submitted directly to the Employer.

A similar exchange of information shall also be made in relation to all complaints which may be received.

The Contractor shall notify the Employer in writing immediately following any damage or injury arising out of the execution of the works.

1.11 Work Outside Normal Working Hours

The Contractor shall, as far as practicable, confine his hours of work within the following times

Monday to Friday 08.00 -19.00

Works outside these hours shall not be undertaken without the prior written permission of the Employer.

Work on -site will not normally be permitted on Sundays or Bank Holidays.

If it becomes necessary, in order to safeguard the Works or for any other emergency, the Employer or the Employer's Representative may order the contractor to work continuously by day or night.

1.12 Noise Control

The Contractor shall carry out the works in such a manner as not to cause a nuisance due to noise and that all plant is adequately silenced to conform to the requirements of BS 5228. The Contractor shall also comply with SI 140 of 2006, *Environmental Noise Regulations 2006, Safety Health and Welfare at Work (Construction) Regulations.* Compressors used on the Site shall be silenced either by using only fully silenced models fitted with effective exhaust silencers and properly lined and sealed acoustic covers, all to the design of the manufacturers of the compressors or by the use of effective acoustic screens to enclose the noise source. Ancillary pneumatic percussive tools used on the Site shall be fitted with silencers of a type recommended by the manufacturers of the tools. Compressors, silencers or other equipment shall be maintained in good and efficient working order and shall not have been altered in such a way that the noise caused in operation is made greater by the alterations.

1.13 Pollution of Watercourses

During the period of execution of the Works, the Contractor shall take all necessary precautions to prevent the pollution of rivers, streams, lakes, watercourses, surface water drains, groundwater or the surface of the ground by poisonous, noxious or polluting matter arising from his operations. The Contractor is required to submit to the Employer a detailed Method Statement prior to the Date of Commencement clearly setting out the pollution control measures he intends to implement. The pollution control measures put forward by the contractor will be subject to the approval of the Employer.

1.14 Emergency 24 Hour Cover

Throughout the Time for Completion the Contractor shall ensure the staff, plant and materials are available at all times to deal effectively, whether within normal working hours or not. with any situation which arises in connection with his work and as promptly as the circumstances warrant.

Before the start of the Contract, the Contractor shall deposit with the Employer a list of names, addresses and telephone numbers of members of his staff who have the authority to take charge in such circumstances at any time. This information shall also be provided to the Gardaí, Local Authority and Statutory Undertakers and other persons who may have need to contact the Contractor outside working hours.

2.0 MATERIALS

2.1 Use of Materials

Unless otherwise described in the Contract, the use, installation, application or fixing of materials and components shall be in accordance with all applicable recommendations of the manufacturers. Where appropriate, the Contractor shall make use of any technical advisory services offered by the manufacturers.

2.2 Proprietary Names

In every case, in the Specification or Drawings, where materials, appliances or fittings of special design, manufacture or otherwise are described or the names of manufacturers or agents are given, it is to be clearly understood that such references are only inserted for the guidance of the Contractor with respect to the nature and quality of the materials, articles or services required, which must, in all cases be subject to the approval of the Employer. If such manufacturers or proprietary names are referred to, the words “or equivalent” shall be deemed also to apply, whether present alongside such proprietary name or not.

2.3 Approved Samples

If requested to do so, the Contractor shall provide at his own cost, and prior to commencement, samples of any trade, samples or materials and workmanship for inclusion into works, for approval by the Employer.

2.4 EC Directive on Materials, Pipes and Fittings

Nothing stated in this Specification shall be construed as discriminating against products and materials that are manufactured in any of the member states of the European Community. Where items to an Irish Standard Specification, British Standard Specification or any other standard specification of a member state of the European Community are called for, this requirement shall be read as including items to a relevant international or the relevant national standard of any member state of the European Community, which provides an equivalent guarantee of safety and suitability.

2.5 Storage of Explosives and other Dangerous Substances

Unless otherwise directed in the Contract, the storage and use of explosives on site is not permitted. Dangerous or inflammable materials and gases shall not be brought onto or used for any purpose without approval in writing or unless account of their use and the risks of same is fully detailed in the Construction Stage Safety & Health Plan to be prepared by the Project Supervisor for the Construction Stage.

The location of stores for explosives, dangerous or inflammable materials or gases on the site must be approved in writing.

2.6 Storage and Handling of Materials

Materials and components shall be stored in such a manner as to preserve their quality and condition to the standards required by the Contract. The quantity of materials and components stored on the Site shall be consistent with that necessary for efficient work. Materials and components shall be handled in such a manner as to avoid any damage or contamination, and in accordance with all applicable recommendations of the manufacturer

2.7 Surplus Materials

Surplus material which may be required by the Employer shall be delivered by the Contractor to a place designated by the Employer. These items shall be paid for at the invoiced rates, delivered to site,

and an allowance being made for loading and haulage from the Site. The cost of all surplus materials not required by the Employer shall be borne by the Contractor.

2.8 Definition, Classification and General Use of Earthworks Materials

"Top Soil" shall mean the top layer of soil that can support vegetation. It shall include all turf which is not approved for turfing under the Specification.
"Suitable material" shall comprise all that which is acceptable in accordance with the Contract for use in the Permanent Works.
"Unsuitable material" shall mean other than suitable material and shall include:-

- material from swamps, marshes or bogs;
- peat, logs, stumps and perishable material;
- material susceptible to spontaneous combustion;
- material in a frozen condition or material which after being frozen is not approved for use;
- clay of liquid limit exceeding 90 and/or plasticity index exceeding 65;
- materials having a moisture content greater than 1.2 times the Optimum Moisture Content unless otherwise approved

'**Rock**' shall mean those geological strata or deposits, indicated in the Contract Documents to be regarded as such, and individual boulders exceeding 0.25m^3 in size or other masses of hard material outside those strata or deposits which can only be removed by blasting or approved pneumatic tools or by recognised methods of rock quarrying.

The use of topsoil as a fill material shall be restricted to surface layers in positions not subject to loading by pavements or structures.

Fill material with a soluble sulphate content exceeding 2.5 grams per litre when tested in accordance with Part 3 of BS 1377 shall not be used within 500 mm of concrete structures or cement-bound materials unless special approved precautions are taken to protect the concrete or cement-bound material.

No excavated suitable material other than that surplus to requirements of the Contract shall be removed from the Site except when directed or permitted. The Employer may require material which is unsuitable only by reason of being frozen to be retained on Site when in that condition.

Should the Contractor be permitted to remove suitable material from the Site to suit his operational procedure, then he shall make good at his own expense any consequent deficit of filling. If any suitable material excavated from within the site is, under permission, taken by the Contractor for purposes other than the forming of embankments and other areas of fill, then sufficient suitable filling material to occupy, after full compaction, a volume corresponding to that which the excavated material occupied shall, unless otherwise directed, be provided by the Contractor from his own resources.

Suitable material and topsoil surplus to the total requirements of the Permanent Works and all unsuitable material from general excavations shall be disposed to an approved landfill or disposal site in accordance with Contractor's Waste Management Plan.

2.9 Grass Seed

Grass seed shall be a tested blend of named varieties, and certificates of purity and germination shall be provided. The sowing rate of the blend shall be 40g/m^2. The blend shall consist of the following –

50% Dwarf Ryegrass
45% Strong Creeping Red Fescue 5% Chewings Fescue

2.10 Fertilizer

Unless otherwise specified fertilizer shall consist of a compound containing not less than 10% Nitrogen, 15% Phosphoric Acid and 10% Potash.

2.11 Submission of Samples and Test Certificates

As soon as possible after the Contract has been awarded, the Contractor shall submit to the Employer a list of suppliers from whom he proposes to purchase the materials necessary for the execution of the Permanent Works. Each supplier must be willing to admit the Employer, or his representative, to his premises during ordinary working hours for the purpose of obtaining samples of the materials in question. Alternatively, if required by the Employer, the Contractor shall deliver the samples of the materials to a specified address supplied by the Employer. Samples shall be taken in accordance with the relevant Irish, British or European Standard where applicable. Materials subsequently supplied shall conform within any specified tolerances to the quality of samples which have been approved.

The information regarding the names of the suppliers may be submitted at different times, as may be convenient, but no sources of supply shall be changed without prior approval.

When any material or article is required to comply with an Irish, British or European standard, such material or article or its container shall bear the stamp of the registered certification trademark of the relevant Standard Authority. Alternatively, the Contractor shall submit to the Employer test certificates furnished by the supplier or manufacturer of the material or article indicating compliance with the relevant Irish, British or European Standard.

Any Irish, British or European Standard or Code of Practice referred to in the Documents relating to the Contract or any other Irish, British or European Standard or Code of Practice that may be substituted therefore shall be held to be the latest edition published 3 months prior to the last date for submission of Tender unless otherwise stated in the contract. All relevant particulars and conditions in Irish, British or European Standards or Code of Practice relating to a standard of material, quality and workmanship, shall be complied with unless otherwise specified. In cases where no particular specification is given for any article or material to be used under the Contract, the relevant Irish, British or European Standard or Code of Practice, where one exists, shall apply.

2.12 Concrete

Reinstatement of concrete roads shall comply with Series 1000 of NRA Specification for Roadworks except where stated otherwise.
Reinstatement of concrete footpaths shall comply with Clause 1106 of NRA Specification for Roadworks except where stated otherwise. Grade C25/30 concrete shall be used on footpath reinstatement.

Concrete Kerbs and Channels shall comply with Clause 1101 of NRA Specification for Roadworks except where stated otherwise.

Where it is specified that a trench shall be backfilled with leanmix (10 Newton) then the mix shall be ST2 in compliance with IS EN 206-1 or Grade C8/10 concrete and in compliance with NRA Specification for Roadworks Clause 2602.

Concrete used in anchor blocks, thrust blocks, chamber floor slabs and chamber roof slabs shall be Grade C25/30 and shall comply with the Series 1100 of NRA Specification for Roadworks.

Precast concrete marking posts shall comply with the National Roads Authority Drawing RCD/2700/13 ‘Marker Posts and Plates’ or as detailed in the Contract in accordance with IS 162.

Precast concrete paving blocks shall be to BS 6717 (1986) Part 1.

2.13 Precast Concrete Manholes and Valve Chambers

Pre-cast concrete manholes shall be reinforced and shall comply with the requirements of BS 5911, IS EN 1917 and IS420 except for any special requirements for cement described in the Contract.

All precast concrete rings shall be surrounded with 150mm thickness of C25/30 concrete.

Precast concrete valve chambers shall be of reinforced interlocking sections capable of adjustment for height, and shall comply with the requirements of BS 5911 IS EN 1917 and IS420 except for any special requirements for cement, as detailed in the Contract.

The relevant absorption tests required by BS 5911 shall be carried out on materials from 1 section in every 50 of those required under the Contract.

2.14 Manufacture of Precast Units off the Site

The details of the method of manufacture shall be approved before work is started. When the method has been approved, no changes shall be made without fresh approval.

Copies of all 28 day cube tests results relating to the work shall be sent to the Employer as they become available.

2.15 Chamber – Covers

All covers & frames shall be in accordance with IW-TEC-SPEC-WNM-01 (standard details for water network management contracts)

Covers and frames shall be fixed generally as shown on the drawings with the following additional specification:-

- Covers and frames shall conform to IS 261, BS 5834 and 750. The load rating for the frames and covers shall be selected using the following:

R A	APPLICATION AREA
G r a	Carriageways of roads (including pedestrian streets), hard shoulders, footpaths and parking areas for all types of vehicles
G r	Areas not accessible to vehicles.

- Where there is any doubt about the required load rating, the stronger class shall be selected;
- A third party test report showing compliance with the standard must be made available in English for each frame and cover if requested by the Employer.

2.16 Boundary Box

New Boundary boxes shall be provided at all properties apart from those where a boundary box has already been installed.

Any existing Boundary boxes that do not comply with the should be replaced with one that does.

2.17 Requirements for Boundary Box.

The boundary boxes shall comply with the Boundary Box Specifications supplied in Appendix E & F.

2.18 Bricks and Blocks

Clay bricks and blocks shall comply with the particular requirements of BS 3921 where indicated on the drawings or in the Bill of Quantities.
Concrete bricks shall comply with IS 189 or BS 6073; crushing strength 17.5 Nlmm$^{2.}$
Concrete blocks shall comply with BS6073; or IS 20, crushing strength not less than 5 N/mm$^{2.}$
Calcium silicate bricks shall comply with IS 190 or BS 187.
Bricks for the construction of manholes, inspection chambers, catchpits etc., shall be to BS 3921 Class B engineering bricks.

2.19 Cement Mortar Lining for Pipes And Fittings

The cement mortar lining to pipes and fittings shall comply with the requirements of EN 545. EN 588 and EN 969.

2.20 Mortar and Grout

Mortar and grout shall be mixed in the proportions given in. **Table 9** according to the mortar Class described in the Contract.
For work in which a Class 6 mortar is required, the Contractor shall select the appropriate mortar from one of the mixes for this Class given in Table 9. If this work is to be carried out in frosty weather and the bricks are wet when laid, then a 1: 5-6 cement, sand mortar with an approved air entraining plasticiser shall be used. The plasticiser shall be free from calcium chloride or similar salts.

Table 9—Mortar Mixes

	Proportions by Volume		
Cl	**Portla**	**Portland C**	**Portland Ceme**
1	1	--	-
2	1	--	-
3	1	--	-
4	-	1 :	-
5	-	1 : 0.5	-
6	-	1 : 1 :	-

The inclusion of lime in Class 4 mortar is optional. The proportions of lime given in **Table 9** are for lime putty. If the lime is measured as the dry hydrate, the amount may be increased up to 1.5 volumes for each volume of lime putty. Where a range of sand contents is given in **Table 9** the higher shall be used for sand that is well graded and the lower for coarse or uniformly fine sand.

Sand shall be a natural sand or crushed natural stone or a combination of both as specified in BS 1200.

Mortar shall be mixed thoroughly either by hand or mechanically until its colour and consistency are uniform. The constituent materials shall be accurately gauged, allowance being made for bulking of sand. Mortar shall be made in small quantities only as and when required. Mortar which has begun to set or which has been mixed for a period of more than 30 minutes in the case of a Class 3 mortar, more than 1 hour in the case of a Class 4 mortar, or more than 2 hours in the case of other classes shall be discarded.

An approved water proofing agent shall be added to mortar used in jointing which will be exposed to weather or moisture.

2.21 Sand

Plaster and rendering sand shall comply with the requirements of BS 1199-1200. If instructed by the Employer, the sand shall be passed through a 3 mm square mesh sieve.

Sand for cement/sand tile bedding mix shall be clean, moderately sharp, not too fine and free from clay, organic and soluble matter. Sand shall comply with BS 882 and shall be in grading zones 1 to 3.

2.22 Steel Reinforcement

Steel reinforcement shall comply with the relevant requirements of appropriate British Standard as set

out in the following **Table 16**:-

Table 16— Standards for Steel Reinforcement

Type	B
Hot Rolled	4
Cold	4
Hard Drawn	4
Steel Fabric	4

Steel fabric reinforcement shall be welded at the inter-sections and, unless otherwise required by the Contract, shall be delivered on site in flat sheets. Tying wire shall be 1.6 mm diameter annealed soft iron wire.

The Contractor shall procure and furnish to the Employer certificates from the manufacturers that all steel supplied is in accordance with these conditions.

2.23 Stainless Steel

Stainless steel for mechanical and allied engineering purpose shall comply with the requirements of BS 970.

2.24 Fencing Wire

Fencing wire shall comply with the requirements of:- 1.BS 4102
2. IS 121 Galvanised barbed wire
3. IS 126 Galvanised fencing wire

2.25 Galvanising

Hot dip galvanising shall be carried out in accordance with BS 729.

2.26 Gates

Metal entrance gates shall comply with the requirements of IS 179 or BS 4092 Part 1 and as detailed in the Contract. Field gates shall comply with the requirements of IS 155 or BS 3470.

2.27 Handrails and Ladders

Manhole ladders and fixings where required shall be of mild steel complying with the requirements of BS 5395 galvanised after manufacture.

Unless otherwise stated in the Contract, ladder dimensions shall be as follows. The stringers shall be 64mm by 19mm section and the rungs 25mm diameter. The stringers shall be placed not less than 380mm apart with approved fixing brackets of material equal to the stringers located at centres not exceeding 2 metres (minimum of two per ladder). The brackets shall be of sufficient length to give a clearance of not less than 210mm behind the rungs. The rungs shall be at 230 mm centres and fixed to the stringers in accordance with BS 4211.

Manhole step irons where required shall be aluminium and comply with the requirements of BS 1247.

For brick manholes, step irons, where required, of the galvanized malleable cast iron general purpose pattern shall have 230 mm long tails.

For pre-cast manholes, where required step irons shall be galvanized malleable cast iron precast concrete manhole pattern with 80 mm long tails, and shall be fixed into the units during manufacture.

2.28 Gullies, Gully Gratings and Frames

Gullies shall be constructed in accordance with the NRA's *Manual of Contract Documents for Roadworks*, Volume 1, Clause 508 Gullies & Pipe Junctions and in accordance with Volume 4, Road Construction Details, RCD 500 / 14 or RCD 500 / 15.

Road gully gratings and frames shall conform to IS EN 124. The load rating for the frames and grates shall be selected using the following:

L O	**APPLICATION AREA**
D 4	Carriageways of roads (including pedestrian streets), hard shoulders and parking areas

The minimum classification for gully gratings and frames shall be D400. The frame shall have a minimum depth of 100mm.

A third party test report showing compliance with the standard must be made available in English for each frame and cover if requested by the Employer's Representative.

Gullies shall be located in accordance with NRA's Manual of Contract Documents for Roadworks, Volume 4, Road Construction Details, RCD 500 / 16.

Gullies shall be hinged at right angles to the kerb line, so that they close with the direction of traffic. The frame and cover shall be installed so that no part of the unit is raised or sunken in a way that could create a hazard to pedestrian or vehicular traffic.

Gullies used are to be parallel bars. The direction of the bars shall be perpendicular to the kerb line.

All installations shall fall within the vertical tolerance of minus 5mm and minus 10mm of the surrounding surface and shall be no more than 25mm from the kerb face.

Both grating and frame shall be clearly marked with

- The name of manufacturer
- The standard to which it is certified (IS EN 124)
- The certifying authority for the standard (NSAI, BSI, NP)
- The load classification of the frame and cover
- The direction of traffic

Gully gratings shall provided with a stainless steel M16 locking nut and bolt, which shall be locked after installation.

The locking nut and bolt shall be replaceable. Drilling and tapping of the frame is not acceptable.

2.29 Nails

Nails shall comply with the requirements of BS 1202.

2.30 Pipes, Valves & Fittings and Joints and Pipe Bedding Material

All pipes and joints described in the Contract shall comply with the requirements of this Clause unless otherwise approved. All pipes, fittings and joints shall be fit for purpose.

2.31 Ductile Iron Pipelines and Fittings For Watermains

Ductile Pipes, fittings and joints shall be Class K9 of IS EN 545 for potable water pipelines. They are to have approved compression ring flexible joints or flanged joints where indicated on Drawings.

All pipes and fittings shall be lined internally with sulphate resisting cement mortar to the requirements of IS EN 545 and shall have a factory applied epoxy seal coat to the cement mortar lining.

All pipes and fittings shall have a standard external protection of metallic zinc to a minimum of 200g/m^2 and a minimum of 70 um bitumen.

The pipes shall be sleeved, where specified for aggressive soils, with a factory applied polyethylene external sleeving system with a film thickness of not less than 200 um for corrosion protection.

Ductile Iron Pipelines shall, where specified for highly aggressive soils, be protected with a factory applied Heavy Duty Tape Wrap incorporating a bituminous layer with a PVC carrier. The joints shall be protected with a site applied Heavy Duty Hand Tape Wrap incorporating a bituminous layer with a PVC carrier. The Tape Wrap (both factory applied to Pipes and site applied to joints) shall be applied with a minimum 55% overlap. The minimum PVC thickness of these Tape Wraps shall be 0.75mm with a minimum bitumen thickness of 0.75mm. The total tape thickness of these Tape Wraps shall be not less than 1.6mm. The Tapes shall be supplied on interleaved paper to minimum width 25mm wider than the Tape Wrap.

Split Puddle Flanges on Ductile iron pipes are to be used only in locations where they are not required to provide an anchorage for the pipe. The flanges are to be fitted to the pipe using suitable non toxic metallic sheeting to provide a packing between flange and pipe body and caulked after fixing.

Puddle flanges which are required to provide anchorage for the pipe are to be integrally cast on welded Puddle Flanges.

All pipes and fittings shall have BSI Kitemark accreditation or equivalent.

2.32 Pressure Pipes of Synthetic Materials

Polyvinyl chloride alloy **(PVC-A)** pipes and bends shall comply with BS PAS 27 and shall be Blue in colour. Manufacturers or suppliers shall produce evidence from NSAI that their pipes conform to this specification.

Medium Density Polyethylene **(MDPE)**, High Performance Polyethylene **(1-IPPE)** and High Density Polyethylene **(1-IDPE)** pipes shall comply with the requirements of EN 12201 and all relevant Water Research Council Specifications. Joints shall be made strictly in accordance with the manufacturer's instructions and with approved equipment. Fusion welding equipment shall be tested at minimum six monthly intervals for alignment, pressure and temperatures.

Manufacturer's or Supplier's Certificates of Compliance with the relevant Standard shall be provided when requested by the Employer.

Where required, suitable adaptors shall be provided for connections between HPPE or MDPE pipework and pipework in other materials.

Jointing shall be carried out only by suitably trained and experienced personnel. Evidence of any certification required shall be furnished to the Employer in advance of any jointing work.

Pipes shall be of the class detailed in the contract.

2.33 Non Pressure Pipes of Synthetic Materials

Unplasticised PVC pipes and fittings for underground drains or gravity sewers shall comply with the requirements of BS 4660 for small diameters or BS 5481 for diameters of 200mm and upwards.

2.34 Flanged joints

Gaskets for flanged pipe joints shall be of the inside bolt-circle type. Gaskets shall be manufactured from material complying with requirements of BS 2494 for Type 1 rings. Unless otherwise stated in the

Contract, flanges shall be to NP 16 Table 11 of BS 4504.

Bolts, nuts and washers for flanged joints shall comply with the requirements of EN 1092 Part 2 and BS 4504 Section 3.1 except that spheroidal graphite iron bolts for use with ductile iron pipes and fittings shall be manufactured from metal complying with the requirements of BS 2789 for Grade 500/7. Bolts shall have a minimum ultimate strength of 433 N/mm2. Bolt lengths shall be sufficient to ensure that nuts are full threaded when tightened in their final position.

Steel pipe ends, flanged specials and fittings shall be supplied complete with protective bolsters, caps or discs.

2.35 Flange Adaptors

Flange adaptors shall be suitable for use with uPVC & ductile iron pipes and shall have a body, end ring and gasket containment ring of cast SG iron with a coating of blue epoxy resin to 250µm.
The grip ring shall be of aluminium anodized LM6 aluminium.
The sealing ring shall be of EPDM Elastometer with nuts and bolts to Grade 4.6 Steel zinc plated.
Washers shall be mild steel zinc plated.

2.36 Joint Rings and Lubricants

Rubber joint rings for watermains and drainage purposes shall be comply with the relevant requirements of BS 2494, and shall be obtained from the pipe manufacturer, and shall be manufactured from approved synthetic rubber.

Joint lubricants for sliding joints shall have no deleterious effects on either the joint rings or pipes and be unaffected by the liquid to be conveyed. Lubricants to be used for jointing water mains shall not impart to water taste, colour or any effect known to be injurious to health and shall be resistant to bacterial growth.

Compressible filler for interrupting concrete protection to pipelines shall consist of bitumen impregnated insulating board to BS 1142 or other equally compressible material. The thickness of compressible filler shall be:-

18mm for Pipes of Nominal Bore < 450mm
36mm for Pipes of Nominal Bore 450mm — 1200mm

2.37 Pipe Bedding Material

All pipe bedding and surrounds are to comply with STD-WNMP-13 of IW-TEC-SPEC-WNM-01

2.38 Underground Warning Tape

Underground plastic warning tape shall be placed over the centreline of all pipelines, sewers and cable ducts, positioned on top of the pipe surround material, in accordance with STD-WNMP-13 of IW-TEC-SPEC-WNM-13

2.39 Sluice Valves

Sluice valves shall comply in all respects with BS 5163 and BS EN1074 and shall be double flanged and drilled to BS EN 1092-2. All sluice valves shall have an overall length to BS5163:1986 (PN16 dimensions) and shall open clockwise. Stem cap shall be grey cast iron BS EN 1561 GJL-HB-195 complete with bolt BZP Gr 8.8 to BS 4168: Part 1. Valve stems shall be Stainless Steel to BS EN 10088 -1.Gr 1.4021 and fitted with an integral collar. Gland assembly shall be ductile iron to BS EN 1563, EN-GJS-500-7 complete with polyamide bushing containing 1 wiper ring and 3 0- rings of NBR and 2 cadmium plated Grade 8.8 bolts to BS 3692:1967. Thrust collar shall be DZR brass to BS EN 12164, CW602N. The body/ bonnet O ring seal shall be EPDM rubber, WBS listed. The wedge assembly shall be ductile iron to BS EN 1563, EN-GJS-500-7 fully encapsulated with EDJ-70 rubber complete with wedge nut of DZR brass to BS EN 12164, CW602N.

Valves shall be suitable for buried in ground service. Valve bonnets shall be fitted with integral lifting eyes with the body fitted with integral feet. Valves shall have working pressure ratings of 16 bar. Valves shall be fitted with an integral nodular top works as standard to facilitate ancillary items such as gearboxes. An Air plug shall be fitted to the valve bonnet to facilitate installation of the valves. The valves shall be coated internally and externally with an electrostatically applied blue epoxy to the WK Water Industry Specification Number 4-52-01 Class B (WIS 4-52-01 Class B). Extension spindles shall be provided, where necessary, to ensure that the valve key is not more than 300mm below the finish surface and these shall be deemed to be included in the Contract Sum.

Valve chambers shall be as set out in the standard drawings. Chambers shall be built on a 150mm base in 225mm concrete blockwork or in approved precast concrete sections to suit standard surface boxes and covers. Surface boxes for sluice valves shall comply with the relevant provision of I.S. EN 124 and shall be of cast iron, set in concrete as detailed on the drawings.

2.40 Air valves (AV's)

Air valves for potable water application shall be double orifice air valves and shall have bodies, covers and cowls of ductile iron to BS EN 1563, EN-GJS-500-7 with flanged inlets of the size specified. Valves shall be flanged and drilled to BS EN 1092-2. The float, float guides and float lever shall be Acrylonite Butadiene Styrene (ABS) plastic. The seal shall be EPDM rubber, WBS listed and the seal support ring shall be ABS plastic. Fasteners (bolts) shall be stainless steel 316 Grade A4.

Valves shall have a working pressure rating of 16 bar with the seat tested to 17.6 bar and the body tested to 24 bar. The air valve shall be coated internally and externally with an electrostatically applied blue epoxy to the WK Water Industry Specification Number 4-52-01 Class B (WIS 4-52-01 Class B). Valve chambers shall be as set out in the standard drawings.

Chambers shall be built on a 150mm base in 225mm concrete blockwork or in approved precast concrete sections to suit standard surface boxes and covers. Surface boxes for air valves shall comply with the relevant provision of I.S. EN 124 and shall be of cast iron, set in concrete as detailed on the drawings.

Each air valve shall have a large and small air escape orifice with an isolating valve. The isolating valve shall have a resilient seated gate valve to BS 5163 Type B (BS EN 1074) and shall be of the boltless bonnet design. The isolating valve shall open clockwise. Air valves with integral isolators shall not be accepted. The bearing faces shall be accurately machined and ground to a watertight finish.
The inlet diameter shall be in accordance with the following table:

Diameter of Mains	A.V. inlet Diameter
Up to 350mm	75mm
375mm to 525mm	100mm
550mm to 700mm	150mm

Small orifice single Air Valves, with screwed brass isolating cock shall be used on bridges and culverts

2.41 Fire Hydrants (FH's)

Hydrants shall comply with B.S. 750 (Type 2). They shall be 80mm nominal bore inlet, streamlined screw down spindle hydrant complete with gunmetal working parts, inlet flanged faced and drilled to BS 10 Table E. The hydrant outlet shall be either a 63mm diameter male threaded outlet or a 63mm bayonet lug outlet with loose cast iron cap. The outlet cap shall be attached to the hydrant by W.I. chain. The type of outlet used and the threading of the valve spindle shall comply with the requirements of the local Chief Fire Officer.

The hydrant shall be coated internally and externally with an electrostatically applied blue epoxy to the WK Water Industry Specification Number 4-52-01 Class B (WIS 4-52-01 Class B). Extension spindles shall be provided, where necessary, to ensure that the outlet is not more than 200mm below the finish surface and these shall be deemed to be included in the Contract Sum.

Valve chambers shall be as set out in the standard drawings. Chambers shall be built on a 150mm base in 225mm concrete blockwork or in approved precast concrete sections to suit standard surface boxes and covers. Surface boxes for hydrants shall comply with the relevant provision of I.S. EN 124 and shall be of cast iron, set in concrete as detailed on the drawings.

Scour valves shall be installed as per drawings. Sluice valves used for scouring purposes shall be fitted on a Tee-branch as near as possible to the main. Scour valves shall be downsize from the host main as follows.

Host Main Size	Size of Scour Valve
50mm	50mm
75mm	50mm
100mm	75mm
150mm	100mm
200mm	100mm
250mm	150mm,

2.42 Butterfly Valves

Butterfly valves shall be cast iron tight shut off type to BS 5155. The valve bodies shall be cast iron with stainless steel shafts, disc seats, clamp ring and other trim items. Valve actuators shall have adjustable stops which shall prevent overstressing of the seats. Body Brushes shall be self lubricating and a stuffing box with provision for packing replacements shall be included on valve shafts.

Penstocks and flap valves shall be as detailed in the Contract.

2.43 Pressure Control Valves

Pressure Reducing Valves and Pressure Sustaining Valves with a diameter greater or equal to 50mm shall be pilot operated, all valves shall have strainers installed up-stream of the valve. The contractor shall construct a chamber and all associated fitting as per the standard details water drawing. The Contractor shall supply Bermad 700 Series valves of similar approved valves. where 13/19mm PRVs are required under the contract, the contractor shall construct a chamber as per the standard details-water drawing including stop-cock.

2.44 Pressure Reducing Valves

Pressure reducing valves shall comply in all respects with B.S. EN 1561. The contractor shall use Glenfield 1310 piston operated automatic control valves or similar approved. Pressure reducing valves shall be suitable for working pressures up to 16 bar nominal pressure, or the working pressure of the pipework, whichever is greater. Valve chambers shall be as set out in the standard drawings. Chambers shall be built on a 150mm base in 225mm concrete blockwork or in approved precast concrete sections to suit standard surface boxes and covers.

The lid shall be triangular multi-leaf access covers. The contractor shall use Cavanagh T145 120.075 or similar approved.

2.45 Individual Pressure Reducing Valves

Pressure reducing valves shall be UKWFBS listed (WRc) and comply with BS 6283 part 4 requirements. Individual pressure reducing valves to be of the in-line, spring loaded type complete with pressure balanced piston. Valves shall have EPDM diaphragms, bronze body, stainless steel seat ring, having DZR components in contact with the fluid and glass reinforced noryl plastic spring cover. Adjustment to be made by a non-rising brass screw.

Outlet pressure must be adjustable within the 2 – 6 bar range. Pressure reducing valves must be serviceable inline, with a removable stainless steel strainer and two pressure gauge connections. Pressure reducing valves shall be accommodated in an approved boundary box with/without the meter as per standard drawings.

2.46 Ball Float Valves

The contractor shall use Glenfield Series 1000 Ball float valves or similar approved valves. Balanced single beat valves (1005) shall be used on short gravity lines, Balanced double beat valves (1041) shall be used on long gravity lines, while 1048 valves shall be used on pumped lines.

2.47 Valve Keys

Valve keys shall be of 25mm square aluminium, finished bright, fitted with eye to take 25mm diameter bar. Keys shall be supplied complete with bar suitably formed for opening valve cover lids etc.

2.48 Bulk Meters and Chambers

Meters shall be installed in chambers at positions of easy and safe access, i.e. in footpaths or verges, final location of meter chambers shall be determined by the engineer. Construction of the meter chambers shall be from block or pre-approved pre-cast sections, in accordance with the drawings. The contractor shall supply the correct covers as required by the relevant local Authority. The meter shall be a Mag Water Meter or Aqua-Mag Meter. The Mag Water Meter shall be of the battery operated magnetic flow-meter type, fitted in-line and housed in a suitable chamber as detailed below. A permanent flow and pressure dada logger is to be fitted to the water meter. The display unit and controls are to be housed in a galvanised Kiosk.

A chamber with minimum internal dimensions 1m x 1m x 1.3m deep with reinforced pre cast concrete cover slab and 600mm x 600mm square heavy duty lid shall be constructed to house the meter. A minimum of 300mm clearance is to be provided between the meter and the floor of the chamber. An isolating sluice valve shall be fitted at the inlet and outlet side of all in-line Mag water meters and these valves must be sufficiently anchored to facilitate complete removal of the Mag water meter at any time in the future. All tapers and additional fittings are deemed to be included in the rates for Bulk Meters and chambers.

All meters shall be installed with strict adherence to the manufactures recommendations i.e. 10 times the meter's diameter of straight pipe up stream and 5 times the meter's diameter downstream of the meter. The meter is to wrapped in a protective membrane before installation and the protective membrane is to be removed after commissioning. The contractor shall ensure that all mains are fully scoured out prior to the installation of the meter. The contractor shall remove and replace any meter deemed "damaged" by the engineer during the construction stage.

A 100mm diameter uPVC drain pipe shall be laid from the chamber to a suitable near by drain or watercourse. The contractor shall allow in his rates for laying of a 100mm uPVC (or other approved pipeline) up to 30metres from the chamber to a suitable watercourse. The Contractor shall agree all exact bulk meter positions on site with the Engineer.

2.49 Domestic Meters

The contractor shall supply and install 15mm domestic meters in all water control units. Aquadis meters or similar approved are to be supplied; only volumetric, pulse compatible, class D meters shall be used. The contractor shall provide in his rates for the provision of the correct apparatus for installation and removal of meters, supplied at the rate of one number per 100 meters supplied. The Contractor shall insure that all service pipes shall be correctly scoured before meters are installed. Any meters found to be blocked shall be cleaned. Any meters found to blocked twice or more before the end of the maintenance period shall be replaced.

2.50 Ferrules and Saddles

Ferrules and saddles for house service pipes shall be of cast brass or bronze to the latest edition of

B.S. 1182 and of 12mm or 20mm diameter as required. Plastic saddles may be used subject to approval. Ferrules used in Asbestos Cement mains shall be of the thread less type with plug type seating piece and rubber seal to B.S. 2494.

2.51 Marker Posts

Only Indicator marker posts of approved type shall to be provided to mark the position of all air valves, scour valves, sluice valves, hydrants and where pipelines are in fields. Indicator Marker Posts shall not be located where they can ease a traffic or trip hazard. All final marker post locations shall be agreed with the Engineer. Marker posts shall be set in a concrete block of 0.05m3 of Mix "B" Marker plates to B.S. 3251 are to be provided to all marker post. In urban locations marker plates are to be fixed to convenient adjacent walls. Concrete marker posts with the lettering inscribed into the post shall not be permitted.

2.52 PTFE Tape

Polytetrafluoroethylene (PTFE) tape for thread sealing applications shall comply with the requirements of BS 7786.

The tape shall be supplied on spools and shall be approximately 12mm wide by 0.075mm thick. The tape shall be wound from the unscrewed portion of the bolt or pipe in a direction counter to the thread, with a 50 per cent overlap, to completely cover the threads without protruding at the end, and using sufficient tension for the tape to assume the form of the thread. Wrapping shall be done immediately prior to assembly of the joint.

2.53 Swabs

Swabs for water mains shall be made from polyurethane foam with a density of 21 to 23 kg/m2 and a hardness {at 50% deflection to BS 4443} of 19-23 kgs, and a tensile strength of 0.1 N/mm2 minimum.

Swab sizes shall be as set out in the following **Table 18**:-

Table 18— Swab Sizes

Pipe	**Swab**	
	Diameter	**Length**
Up to 300mm	1.25 x Pipe Diameter	2 x Pipe Diameter
Over 300mm	Pipe Diameter + 75mm	1.5 x Pipe Diameter

2.54 Geotextiles used in Earthworks

Geotextiles required as part of the Permanent Works to separate earthworks materials and for drainage, as shown on the drawings, shall be manufactured from 100% polypropylene. Geotextiles must be non woven continuous filament, needle punched or similar approved.

The supplier must demonstrate that the manufacturer operates their plant in accordance with BS 5750 Part 2. The geotextile must be sufficiently durable with a service life of 100 years.

The geotextile when tested in accordance with BS 6906 shall exhibit the following properties:-

1. sustain a strip tensile strength of 15.1 kN/m at an elongation break of 80%;
2. allow water to flow through it at right angles to its principal plane at a rate of not less than 220 litres/sq.mlsec under a constant head of water of 100mm. The geotextile should not exhibit any significant breakthrough head;

3. have a size distribution of pore openings such that the pore effective opening size is greater than 0.07mm and less than 0.13mm;
4. have maximum cone drop hole diameter of 11 mm and CBR puncture resistance of

7500N. The geotextile shall be overlapped as following:

Drainage - 300mm (minimum) overlap; Separation - 300mm (minimum) overlap.

The layer of material on which the geotextile is to be placed shall not have protrusions or sharp projections which are likely to damage the geotextile during installation or in service. The method of installation shall ensure that the geotextile is in continuous contact with the surface on which it is to be placed and the geotextile shall not be stretched or bridged over hollow or lumps. Operation of construction plant directly on the installed geotextile will not be permitted and its covering with fill material shall take place immediately after its laying.

3.0 PIPELAYING & JOINTING

3.1 Types of Pipes

The Contractor shall construct the pipelines using the designs of pipe bed, haunch and surround shown in the Contract.

Where the Contractor wishes to use a type of pipe not manufactured in the minimum internal diameter indicated in the Contract, he may, subject to approval, substitute the next larger diameter manufactured. The Contractor shall not use pipes and fittings supplied by more than one manufacturer without approval.

"Rigid pipes" shall mean pipes of cast or spun iron, concrete, asbestos cement, clay or similar materials.
"Flexible pipes" shall mean pipes of steel, HDPE, PVC or other plastic, pitch fibre, ductile iron or similar materials.
"Rigid joints" shall mean joints made by bolting together flanges integral with the barrels of the pipes, by welding together the barrels of the pipes, by caulking sockets with non-deformable material, such as cement mortar, or by similar techniques.
"Flexible joints" shall mean joints made with factory-made jointing materials loose collars, rubber rings; etc., and which allow some degree of flexing, however small, between adjacent pipes.

3.2 Pipelaying – General

Slings of canvas or other non-abrasive material of width not less than 300 mm or special fittings shaped to fit the pipe ends shall be used to lift and lower coated pipes so as to eliminate the risk of damage to the coating.

Subject to the requirements of inspection before acceptance, protective bolsters, caps or discs on the ends of flanges of pipes, specials or fittings shall not be removed until the pipes, specials, or fittings are about to be lowered into the trench.

Before pipes, specials and fittings are lowered into the trench, they shall be thoroughly examined to ensure that the internal coating and lining and outer coating or sheathing are undamaged. Where necessary the interiors shall be carefully brushed clean. Any damaged parts of the coatings and linings shall be made good as directed. The Employer may instruct the Contractor to carry out a Holiday test at the Contractor's cost on any pipe with damage to lining or external coating after repairs have been carried out. Injurious gouges or grooves to the pipe metal shall have the damaged section removed or may be rejected by the Employer. Any pipe with surface dent of 2% of the pipe diameter or greater shall be rejected and removed from the site.

Pipelaying shall not commence until the bottom of the trench and the pipe bed has been approved. Flexible pipes rigidly jointed may be joined on the ground surface before lowering into the trench. All joints shall be supported by slings as the pipes are lowered and the pipeline shall not be deformed to a greater extent than that recommended by the manufacturer.

Pipes shall be brought to the correct alignment and inclination concentric with the pipes already laid. All pipes less than 600 mm in diameter with flexible joints shall be accurately marked prior to laying to ensure that the correct gap is left in the joint.

PVC pipes shall be stored and handled carefully and shall not be subjected to stresses which will induce permanent set or ovality. PVC pipes shall be protected from the effects of temperature in accordance with the manufacturer's recommendations and shall not be laid in freezing temperatures. Bell holes if used for welding shall be refilled with bedding material as specified for the pipe bed compacted to 95% Proctor density. No provision for excavation and refilling bell holes has been made in the Pricing Document and if utilised should be included in the Contractor's rates.

3.3 Polyethylene Pipe Specification

Polyethylene pipes and fittings shall be jointed using the following techniques:

Adjacent lengths of pipes shall be butt fused using only automatic butt fusion equipment with integral data retrieval detailing values of parameters for fusion welding pertinent to each completed joint. The conditions of the Water Research Council specification WIS-4-32-08 for site butt fusion jointing should be strictly adhered to except that the heater plate temperature should be increased to 230°C with a tolerance of +5° and
-10°C. It is essential that heating plate surfaces are kept clean at all times. The first two joints of each welding session shall be considered dummy joints to be discarded to ensure that the heater plate has been cleansed of any grease, dead materials or dust before being used to make a permanent joint.

Coupler fittings shall be electro fused at branch tee connections and in-trench joints and for saddle fittings at house connections. The equipment and methods shall strictly adhere to the conditions of the Water Research Council Specification WIS-4-32-08 for site electrofusion jointing. The packaging containing these electrofusion couplers and saddles shall not be removed until immediately prior to jointing so as to prevent contamination of jointing surfaces.

Wherever possible, butt fusion jointing of high performance polyethylene pipe shall be carried out in advance of the trench excavation stage of the contract and subsequently lowered into the excavated trench. This sequence of jointing and laying pipe will help reduce contamination of pipe to be tooled and fusion jointed. Where fusion jointing has to be undertaken in an excavated trench for tie-in purposes, particular care shall be taken to prevent similar contamination when using either butt fusion or electrofusion techniques. Fusion jointing procedures can be greatly affected by inclement weather and especially strong cold winds. Sturdy portable shelters shall be provided and used for protection in these adverse weather conditions.
Butt fusion of high performance polyethylene shall not commence until the Contractor submits to the Employer's Representative's satisfaction:
a list of relevant parameter values, from the pipe as listed in Appendix F of WIS-4- 32-13, which must be attained for correct fusion welding procedure;
completed servicing and calibration records (similar to those contained in WIS-4-32-08) for each item of fusion equipment to be used on the Contract. These records shall show that the equipment was serviced and calibrated immediately prior to dispatch to site by an independent laboratory. Calibration shall be carried out in accordance with BS 5781 Part 1;
the names of persons, employed by the Contractor and/or any specialist subcontractor, who will undertake and supervise the butt fusion and electrofusion of pipes and fittings;
certification from the pipe manufacturer and/or an approved training organisation that the persons nominated in (iii) above have been trained in the techniques of buff fusion and electrofusion in accordance with the training objectives as set out in WIS-4-32-08. The certification shall also state that the persons nominated are proficient to joint high performance polyethylene in accordance with the procedures as set out in WIS-4-32- 08.
In advance of laying polyethylene pipe the Contractor shall make available, to the Employer's Representative, for inspection purposes, a satisfactory fusion data record for each joint completed on the automatic butt fusion equipment together with the internal fusion bead removed from each joint. Each joint record and the removal bead shall be submitted together in a plastic envelope as evidence of correct fusion procedure bead size, joint alignment and cleanliness of fused surfaces. Care shall always be taken to ensure that no undue strain is put on any joint until it has completely cooled. When it is necessary to abort an unsuccessful joint or carry out rejointing of two adjacent pipes, a pipe fitting or an area of pipe which has been previously heated should never be reheated. A minimum pipe length of 300mm either side of the unsatisfactory joint shall be cut out and the operation restarted.
The minimum permitted distance between any two fusion joints shall be 4 times the outside diameter of the pipe.
Testing and Sampling: Tensile test pieces shall be tooled from chosen working welds cut from the welded polyethylene string. The sampling of test working welds shall be at a rate of one working weld from each day's pipe welding programme undertaken by each butt fusion welding machine employed on site. The particular weld to be tested from each day's welding programme shall be selected by the Employer's Representative's Representative. Four test pieces, in accordance with dimensions detailed in International Standard ISO/FDIS 13953, are to be tooled from each selected test weld at

locations 90° relative to each other for pipes of diameter less than or equal to 225mm. For pipes of diameter greater than or equal to 250mm, six test pieces, in accordance with dimensions detailed in International Standard ISO/FDIS 1 3953, are to be tooled from each selected test weld at locations 600 relative to each other. These tensile test pieces shall be tested individually, in accordance with International Standard ISO/FDIS 13953, at an approved testing laboratory to ascertain the failure mode and the stress recorded across each weld at tensile failure.

The criteria for acceptance of each day's welding shall be:

The average of the stress results recorded for the four or six tensile test pieces, as the case may be, at tensile failure shall not be less than 90% of the failure stress for the parent material.
Test results for each test weld shall fail in a ductile manner. A brittle failure mode for any of the test pieces shall deem that the test weld has failed the test.
Before any approved butt fusion welding machine can be used for undertaking working welds to be incorporated into the works, the first six welds undertaken by a particular machine shall have passed the criteria for acceptance of test welds as outlined in section 3.34. Testing of all sampled welds shall be carried out in accordance with International Standard ISO/FDIS 13953.
The incorporation of welded pipework into the works shall comply with the instructions of the pipe manufacturer. The first two welds undertaken by a particular machine each day shall be discarded and shall not be incorporated into the works. The Contractor shall be deemed to have included in his rates for the cuffing out and discarding of these first two dummy welds each day.
Slotted or perforated drainage pipes shall be dry jointed, open jointed or butt jointed as may be specified subject to the manufacturer's recommendations

3.4 Service Pipes.

House service pipes may be of the:
(i) Copper tube as to the latest edition of I.S. 238.
(ii) High density polyethylene to latest edition of I.S. 135.
(iii) Low density heavy gauge polyethylene to the latest edition of I.S. 134.
(iv) 16mm PE80 SDR9 Blue MDPE to BS EN 12201-2:2003
House service pipes to be tested to the same pressure as the mains and of 12mm diameter or 20mm as required.

3.5 Excavation for Pipelines.

The definitions relating to earthworks read in conjunction with the particular requirements of this Section shall apply to pipe trenches. In regard to rock excavation, the volume payable shall be that which protrudes into the profile of the trench at the maximum specified width.

Trenches for pipes, other than those forming part of a field or French Drain, shall be excavated to a sufficient depth and width, subject to the restriction set out below, to enable the pipe and the specified or other approved joint, bed, haunch and surround to be accommodated.

The width of trenches shall be within the units of width shown on the contract drawings, or such other width shown in the Contract, up to a point 300 mm above the top of the pipe barrel. Battering the sides of trenches shall only be permitted above this level where approved and shall be at the contractor's own cost.

The Contractor shall provide whatever additional pipe protection is necessary should the specified maximum width be exceeded due to his method of working.

The minimum width is that width between the faces of the soil required to ensure the correct placing and compaction of bedding materials equally on either side of the pipe. All sheeting and supports are to be outside this width. The maximum width is that width between the faces of the soil which has been used in the structural design of the pipeline and it includes an allowance for sheeting and tolerance.

The maximum trench width shall be the payment width.

Where the trench formation is in ground that, in the opinion of the Employer is too soft to afford proper

support to the pipes, either;

- the trench shall be excavated down to solid ground and the extra depth shall be refilled with Grade C8/10 concrete or approved granular bedding material, gravel or broken stone, as the Employer directs, well compacted to form an even bed; or

  the pipes shall be supported by fascines, piles or such other means as the Employer directs.

The Contractor shall avoid unduly disturbing the finished trench formation and shall make good disturbed areas and excavate any wet or puddled material which might result from his failure to do so. Voids shall be made good as specified above.

Where directed, trenches close to existing structures shall be opened in short lengths and refilled or partly filled with Grade C8/10 concrete or other approved material as the Employer directs.

Unless required elsewhere in the Contract, the minimum depth of cover from ground surface to the top of the pipe shall be 900mm in roads, hard shoulders, footpaths grass margins and fields. In the case of pipes laid in hard shoulders, footpaths and grass margins the depth of cover pipe shall be measured from the level of the adjoining road surface. The levels representing the pipeline, shown on longitudinal section drawings are the level of the invert of the pipeline and the allowable tolerance shall be +/- 25mm.

The Contractor shall fill up with well compacted approved granular bedding material complying with this Specification, or with concrete Grade C8/10 where ordered by the Employer, any excessive depth of trench arising from his method of working.

The material excavated in forming pipelines shall, if unsuitable as defined in this Specification, be disposed off site in accordance with the contract and replaced with suitable material as so defined. If the excavated material is suitable material then it shall be set aside for use as backfill.

Where trench excavation is in roads or in verges within 1m of the road edge, or in other areas as may be specified in the contract, the excavated material shall be disposed off site in accordance with the contract and the trench shall be backfilled with Clause 804 material or other material as may be specified.

For all pipes, unless specified otherwise, the trench shall be excavated to minimum of 150mm below the bottom of the pipe barrel. Where rock is present in bottom of the pipe trench the bed of the trench shall be trimmed to ensure that no rock is protruding within 150mm of the bottom of the pipe.

Where directed turf shall be stripped by hand and carefully stacked. Road surfacing shall be lined and cut through each side of trench.

3.6 Pipelines in Fields

Where pipelines are laid in fields the Employer will have agreed a wayleave with the landowner and the Contractor will be provided with drawings showing the extent of the wayleave. Topsoil shall be stripped to its full depth over the full width of the wayleave before any other operation is carried out. The topsoil shall be deposited in spoil heaps and kept separate from other excavated materials. Topsoil stripping will not be permitted in excess of 400 metres ahead of excavation for pipelines.
Following completion of pipelaying, testing and commissioning, and given suitable ground conditions, the subsoil shall be deep ploughed to a depth of 400 mm or loosened with a ripper to a depth of 400 mm at centres not greater than 400 mm depending on the intensity of previous traffic, as directed by the Employer. The sub-soil surface shall be broken up with a disc harrow and leveled. On completion of the above operations the topsoil shall be evenly spread over the subsoil. Reinstatement shall be completed in accordance with the Specification.

3.7 Excavations to be kept Free from Water

The Contractor shall provide and maintain and operate pumping plant, and shall construct such gripes, drains, sumps as may be necessary to remove water from the excavations or to prevent its entrance thereto. Water in the excavations shall be dealt with in such manner as will prevent the surfaces, on or

against which foundations or other work will be constructed, from any deterioration of their natural condition.

The Contractor shall take all necessary precautions to prevent any adjacent ground from being adversely effected by loss of fines through any dewatering process. The Contractor shall take all necessary precautions to prevent ground water/surface water from entering mains to be used for the conveyance of potable water.

3.8 Supports

Excavations shall be supported to the extent necessary to secure the surrounding ground and to ensure the safety of persons, the Works and adjacent structures. During the placing of bedding, haunching, surrounding or anchoring material temporary side supports and sheeting shall be removed except where directed to be left in and the full width of the trench shall be infilled with bedding, haunching, surrounding or anchoring materials. Unless otherwise required by the Contract no timber or other supports shall be left in excavations without consent.

3.9 Bedding and Protecting Pipes

Bedding, haunching, surrounding and anchoring pipes shall be of the arrangements and dimensions shown in the contract drawings. A cavity of adequate size shall be excavated in the sides and bottom of the trench or left in the pipe bed at each joint and at each sling position.

The bottom of the trench or surface of the bed shall be finished to a smooth even surface at the correct levels to permit the barrel or the pipe to be solidly and evenly bedded throughout its whole length.

The preparation of the trench bottom or surface of the bed shall be completed for at least one full pipe length in advance of the pipelaying, except where in exceptional circumstances another arrangement is approved.

No bedding materials shall be placed in trenches containing water.

Where granular bedding is to be used, stones, bricks or similar materials shall not be used below or against the pipe to locate them in position in the trench or to level the pipe. Sufficient of the infill materials shall be placed around the barrels of pipe to prevent movement.

Where directed, puddle clay dams 500 mm thick shall be constructed around the pipe and across the trench as haunching and surrounding proceeds. The dams shall be at intervals not exceeding 30 metres or as directed, and their height shall be determined by the Employer.

Where dictated by the requirements for testing pipelines the method of haunching and surrounding pipes shall be modified to leave pipe joints exposed.

3.10 Concrete Bedding and Surround.

Concrete for bedding, haunching or surrounding pipes shall be Grade C16/20 and no back filling of the trench shall be done, nor internal pressure applied until the concrete has reached a strength for 15 N/sq mm.

Before placing concrete, pipes shall be supported near each joint on a precast concrete block or engineering bricks with padding of two layers of hessian based damp proof course or material of similar yield between the barrel of the pipe and the supporting block. The surface of the support shall be perfectly smooth for at least 75 mm by 75 mm under the pipe, and the size of the block shall be as directed.

Concreting of bedding, haunching or surrounding shall not be done until the pipes have been jointed, and inspected. The concrete shall be vibrated into place under the pipe and the concrete shall be in full contact with the underside of the barrel of the pipe throughout its length. The concrete shall be placed in one operation and shall be well worked to form a homogeneous mass. There shall be no horizontal construction joint in the concrete below the level of half pipe. The pipe shall be carefully anchored against flotation.

Concrete bedding, haunching or surrounding pipes shall be discontinuous at flexible pipe joints. Shaped formwork made from fibreboard or other equally compressible material of the thickness stated in the Specification and of size and shape equal to the net section of the concrete protection to the pipes shall be used and left at the pipe joints as shown in the Contract. The formwork shall be neatly cut and properly supported by temporary struts and rails where necessary.

Where the concrete is not carried up to the crown of the pipe the spaces between the barrel of the pipe and the sides of the trench shall be filled as specified with carefully compacted fill material. Fill material at least 300mm deep after compaction and the full width of the trench shall be placed in two equal layers over the crown of the pipe, each layer being lightly tamped by hand.

Rapid hardening or high alumina cement shall not be used for concrete in contact with PVC pipes. PVC pipes shall be wrapped in polythene sheet or roofing felt about 2 mm thick before being haunched or anchored in concrete.

Concrete surround is to be used when crossing under a drainage ditch. The haunching is to be 150mm thick around the pipe and 200mm of excavated material to be placed on top of haunching and shaped to match the original drainage ditch. Details are shown in the contract drawings.

3.11 Concrete Anchorage.

Concrete pipe anchorages and thrust blocks in trench shall be in accordance with the contract drawings.

3.12 Plugs

Immediately after laying, the open end of the pipe shall be sealed with a wooden plug or approved stopper of appropriate size to prevent the entry of material which might contaminate the pipeline damage the linings, obstruct the waterway or affect the working of valves, meters etc. Plugs shall be unperforated and shall be shaped to fit neatly so that water from the trench excavations shall not be allowed to gain access to the pipeline.

Water pipes and fittings 150 mm and under in diameter shall have a brush equal in diameter to the internal bore of the pipe drawn through them as the work proceeds. The brush shall not be removed from the pipeline from commencement until completion. For pipe diameters greater than 150 mm a gauging or proving disc shall be utilised as directed in the Specification.

The plugs in sewers may, with the Employers approval be provided with small holes for drainage purposes, but water from the trench excavation which is heavily charged with silt shall not be allowed to gain access to the pipe.

Where work is interrupted for a period, the plugs left in position shall be regularly inspected for their fixing to ensure that there has been no tampering by unauthorised persons.

Whenever any plug is removed the immediate length of pipe shall be examined for dirt or obstructions and shall be cleaned as required.

Adequate precautions shall be taken by way of backfilling or other means to anchor each pipe securely to prevent flotation of the pipeline in the event of the trench being flooded.

3.13 Gaps for Valves. etc.

Work will not be allowed to commence on pipelaying until there are adequate supplies of valves and fittings on site to enable the pipeline to be laid in one continuous operation without gaps.

3.14 Jointing Pipes General

Joints shall be made strictly in accordance with the manufacturer's instruction, which shall be obtained by the Contractor from the manufacturer when seeking quotation. The Contractor shall make use of the technical advisory services offered by manufacturers for instructing pipe jointers in the methods of assembling joints. Where manufacturers recommend the use of special joint tackles, the Contractor

shall use these for the assembly of all joints to pipes.

Jointing, including welding, shall only be carried out by suitably trained and experienced personnel.

Suitably trained and experienced personnel include, as a minimum, welders who hold a City & Guilds Certificate of Unit Credit towards the Certificate for Utility Operators- Water Distribution- 1 Module "Mainlaying – Polyethylene Pipes Butt Fusion Joints (Single Pressure).

Where certification for personnel engaged in special jointing procedures are required, these shall be in place and made available to the Employer on request.

Before making any joints, all jointing surfaces shall be thoroughly cleaned and dried and maintained in such condition until the joints have been completely made or assembled. Notwithstanding any flexibility provided in the pipe joints pipes must be securely positioned to prevent avoidable movement during and after the making of the joint.

The space between the end of the spigot and the shoulder of the socket of flexibly jointed pipes when jointed shall be as recommended by the manufacturer or ordered by the Employer.

After flexibly jointed pipes other than PVC pipes have been jointed the gaps between the barrel of the pipes and the internal face of the socket shall be sealed with puddle clay, uncaulked rope yarn or other approved materials.

Where loose collars are used to join pipes cut for closers, special tools shall be employed to keep the inside of the pipes flush and the collar concentric with the pipe while the joint is being made.

3.15 Cast Iron Joint Fittings

Cast iron detachable joint collars and flanges shall be tested by striking lightly with a spanner immediately before they are placed and if they fail to ring true shall be set aside and not incorporated in the work until proven sound.

3.16 Flanged Joints

The flanges shall be correctly positioned and the component parts including any insertion ring cleaned and dried. Insertion rings shall be fitted smoothly to the flange without folds or wrinkles. The faces and bolt holes shall be brought fairly together and the joints shall be made by gradually and evenly tightening bolts in diametrically opposed positions. Only standard length spanners shall be used to tighten the bolts. The protective coating, if any, of the flange shall be made good when the joint is completed.

Where directed bolt threads shall be wrapped with PTFE tape in accordance with the Specification before use.

3.17 Polyethelene Pipe Joints

Adjacent lengths of pipes shall be butt fused using only automatic butt fusion equipment with integral data retrieval detailing values of parameters for fusion welding pertinent to each completed joint. The conditions of the Water Research Council specification WIS-4-32-08 for site butt fusion jointing should be strictly adhered to except that the heater plate temperature should be increased to 230°C with a tolerance of +5° and -10°C. It is essential that heating plate surfaces are kept clean at all times. The first two joints of each welding session shall be considered dummy joints to be discarded to ensure that the heater plate has been cleansed of any grease, dead materials or dust before being used to make a permanent joint.

Coupler fittings shall be electro fused at branch tee connections and in-trench joints and for saddle fittings at house connections. The equipment and methods shall strictly adhere to the conditions of the Water Research Council Specification WIS-4-32-08 for site electrofusion jointing. The packaging containing these electrofusion couplers and saddles shall not be removed until immediately prior to jointing so as to prevent contamination of jointing surfaces.

Wherever possible, butt fusion jointing of high performance polyethylene pipe shall be carried out in

advance of the trench excavation stage of the contract and subsequently lowered into the excavated trench. This sequence of jointing and laying pipe will help reduce contamination of pipe to be tooled and fusion jointed. Where fusion jointing has to be undertaken in an excavated trench for tie-in purposes, particular care shall be taken to prevent similar contamination when using either butt fusion or electrofusion techniques. Fusion jointing procedures can be greatly affected by inclement weather and especially strong cold winds. Sturdy portable shelters shall be provided and used for protection in these adverse weather conditions.

Butt fusion of high performance polyethylene shall not commence until the Contractor submits to the Employer's Representative's satisfaction:

- a list of relevant parameter values, from the pipe as listed in Appendix F of WIS-4- 32-13 (superseded by WIS-4-32-17), which must be attained for correct fusion welding procedure;
- completed servicing and calibration records for each item of fusion equipment to be used on the Contract. These records shall show that the equipment was serviced and calibrated immediately prior to dispatch to site by an independent laboratory. Calibration shall be carried out in accordance with BS 5781 Part 1;
- the names of persons, employed by the Contractor and/or any specialist subcontractor, who will undertake and supervise the butt fusion and electrofusion of pipes and fittings;
- certification from the pipe manufacturer and/or an approved training organisation that the persons nominated in (iii) above have been trained in the techniques of buff fusion and electrofusion. The certification shall also state that the persons nominated are proficient to joint high performance polyethylene.

In advance of laying polyethylene pipe the Contractor shall make available, to the Employer's Representative, for inspection purposes, a satisfactory fusion data record for each joint completed on the automatic butt fusion equipment together with the internal fusion bead removed from each joint. Each joint record and the removal bead shall be submitted together in a plastic envelope as evidence of correct fusion procedure bead size, joint alignment and cleanliness of fused surfaces. Care shall always be taken to ensure that no undue strain is put on any joint until it has completely cooled. When it is necessary to abort an unsuccessful joint or carry out rejointing of two adjacent pipes, a pipe fitting or an area of pipe which has been previously heated should never be reheated. A minimum pipe length of 300mm either side of the unsatisfactory joint shall be cut out and the operation restarted. The minimum permitted distance between any two fusion joints shall be 4 times the outside diameter of the pipe.

The incorporation of welded pipework into the works shall comply with the instructions of the pipe manufacturer. The first two welds undertaken by a particular machine each day shall be discarded and shall not be incorporated into the works. The Contractor shall be deemed to have included in his rates for the cudding out and discarding of these first two dummy welds each day.

Slotted or perforated drainage pipes shall be dry jointed, open jointed or butt jointed as may be specified subject to the manufacturer's recommendations.

3.18 Ferrules and Saddles

Ferrules and saddles for house service pipes shall be of cast brass or bronze to the latest edition of B.S. 1182 and of 12mm or 20mm diameter as required. Plastic saddles may be used subject to approval. Ferrules used in Asbestos Cement mains shall be of the thread less type with plug type seating piece and rubber seal to B.S. 2494.

3.19 Testing of Polyethylene Pipe Joints

The Contractor shall provide for testing of the PE butt fusion Joints as follows –

- Short term burst test (Appendix A of WIS 4-32-08)
- Joint toughness test (Appendix C of WIS 4-32-08)
- Joint ductility test (Appendix B of WIS 4-32-08)

The Contractor shall also provide for PE electrofusion joint testing of the saddles and electrofusion joints as follows –

- Joint toughness test (Appendix C of WIS 4-32-08)

The cost for replacing test joints is to be at the Contractor's expense. Failed joint tests will require suspension of operator and equipment pending successful completion of a site audit.

Prior to Contract Start Date and prior to laying of PE pipes, the Contractor's staff and equipment involved in jointing of PE pipes will have to undergo an audit by an accredited site auditor and laboratory to the approval of the ER. The Contractor's Contract Sum is to include for 2 no. site audits. No claim to be allowed by the Contractor should their personnel or equipment fail the initial site audits and require further audits.

Butt fusion jointing machines to be used during the Contract to be in accordance with WIS 4-32-16

3.20 Protection of Pipes and Joints

Internal fettling and completion of the external protection of steel pipes and specials shall be carried out in accordance with standard procedure as laid down by the pipe supplier. The contractor shall obtain from the pipe manufacturer suitable moulds and a supply of bituminous and other materials where appropriate for the use in completing the internal and external protection of the pipes at the joints.

Blowlamps shall not be used on bituminous coatings of steel pipes or specials, and only soft flamed gas torches shall be used.

At flanged joints on steel pipes the lining shall be completed with material supplied by the pipe manufacturer and applied after the joints have been made, where possible, by a workman entering the pipes and filling the gaps between the pipe ends with the repair material.

After erection and testing, all exposed surfaces of steel pipes and joints shall be given two coats of approved bitumen asbestos paint applied in accordance with the pipe manufacturer's recommendation.

3.21 Laying to Curves

Where flexibly jointed rigid pipes are to be laid to curves, the outside of spigots in the joints shall not butt hard against the inside of the socket. At least one-quarter of the total movement in the joint shall be left in any direction.

3.22 Backfilling of Trenches

Backfilling shall, wherever practicable be undertaken immediately after the specified operations preceding it have been completed. No backfill material shall be placed in trenches containing water. All trenches shall be backfilled with suitable material as specified in the Contract. Where excavated material is specified to be used as backfill material it should be placed and compacted as soon as practicable after excavation in layers of thickness appropriate to the compaction plant used in accordance with Clause 612 of NRA Specification for Roadworks.

If the Contractor allows material to become unsuitable (as defined in the Specification) which, when excavated was suitable for reuse, and it is unsuitable when required for backfilling, he shall make good by running it to spoil and replacing it with suitable material at his own expense.

Where granular backfill material is specified, such as Clause 804, it shall be placed and compacted in accordance with Clause 802 of NRA Specification for Roadworks.

Trenches, in roads, hard shoulders and verges and where directed in the Contract, above the level of the specified surround to the pipe, shall be backfilled with Clause 804 material in layers each not exceeding 225mm and compacted as specified. The material shall be as specified in the "Guidelines for Opening, Backfilling and Reinstatement of Openings in Public Roads (Sept 2015)".

In trenches in fields or open country backfill material above the level of the specified surround to the pipe may be placed by machine, provided the method of operation ensures that the material slides or rolls into position and does not drop from a height.

Sufficient space shall be left to receive the original thickness of soil, turf or other materials removed from the surface. The surfaces shall be restored by replacing the materials in their proper order and form, and by compacting them to such a level as will ensure that after settlement is complete the surface level or refilled trenches shall be within 30mm of that of the adjacent undisturbed ground. Where directed, trenches shall be backfilled with lean mix concrete C8/10.

3.23 Restoration of Trenches

Reinstatement of trench surfaces in fields for full width of wayleave and lands and in grass verges shall be carried out in accordance with the requirements for Soiling, Grassing and Turfing contained in this Specification.

Reinstatement of roads, hard standing areas, footpaths, and kerbs shall be carried out in accordance with the "*Guidelines for Opening, Backfilling and Reinstatement of Openings in Public Roads* (Sept 2015)".

3.24 Soiling, Grassing and Turfing

Before placing topsoil, the subsoil shall be loosened by deep ploughing to a depth of 400mm or loosened with a ripper to a depth not greater than 400mm depending upon the intensity of previous traffic, as directed by the Employer. The surface shall then be broken up with a disc harrow. Except where otherwise specified, the areas to be grassed shall be covered with top soil which shall be reduced to a fine tilth free from stones and other debris with any dimension greater than two thirds the thickness of the topsoil layer. Any remaining stones or other debris shall not be upstanding more than 30mm. The topsoil shall be then lightly compacted to the thickness described in the Contract.

The spreading of fertilizer and lime on topsoil shall be carried out in accordance with **Table 2**.

Table 2— Spreading Rates for Seed, Fertilizer & Lime

Area to be re-seeded	**Seeding**		**Fertilizer**	**Lime**
	Level Surfaces	**Sloped Surfaces (>10% slope)**		
	g/sq m	g/sq m	g/sq m	g/sq m
Site Works & Agricultural	25	35	40	2.5
Lawns	60	80	40	2.5
Roadside Verges	6	10	40	2.5

The Contractor shall have due regard for the season and weather conditions before sowing grass and shall take all reasonable measures to promote its growth. Immediately prior to sowing grass seed the topsoil shall be reduced to a fine tilth. Sowing of grass seed shall be carried out by an even distribution using the blend of seed as described in the Specification, and at the rate of application given in **Table 2.**

Where hydraulic mulch seeding is specified, the proprietary process must be approved by the Employer and must contain types and quantities of seed, mulch material, fertilizer and other necessary additives to produce a covering sward on sub soil.

Where turfing is specified it shall be carried out on topsoil using turfs to BS 3969. Suitable turf which before stripping is available on site shall be used wherever possible. Turfing shall be undertaken with clean strong turfs well bonded and lightly beaten and which shall be laid diagonally across side slopes.

All turfs shall be used within one week of cutting during the period 1st April to 31st August or within two weeks of cutting during the remainder of the year. Turfs not used within these periods shall be regarded as topsoil.
Top soil shall comply with the requirements of BS 3882.

3.25 Road Reinstatement

Temporary and permanent reinstatement shall be carried out as specified herein and in accordance with "Guidelines For The Opening, Backfilling and Reinstatement of Openings in Public Roads" (Sept 2015) and shall be in accordance with the road opening licence conditions as required by the relevant Roads Authorithy.

3.26 Water Control Units

Water Control Units shall be supplied and installed as per standard details-water drawings. The units shall be adequately supported on concrete base, back filled with Cl 804 material, compacted in layers of 150mm, finished with 150mm reinforced concrete slab. The contractor shall supply the correct boxes as required by the relevant local Authority. Stop cocks shall be to the latest edition of B.S. 1010 where a separate stop cocks are required.

3.27 Setting Valves etc.

Care shall be taken to prevent damage to all valves, fire hydrants and the like, and their ancillary equipment. Valves etc. and ancillary apparatus shall be stored in clean conditions and in a manner that excludes all water. Where directed, headstocks, motors, gearing or indicators shall be removed, adequately labeled for identification, stored carefully in weatherproof premises and be reconnected after erection of the valves. Frost plugs shall be kept clean and free from obstruction. Electrical equipment shall be protected from damp and the damp-proofing seals shall remain intact until the electrician is ready to connect up the equipment.

The gunmetal faces and seats of all valves shall be kept clean. No valves shall be closed without first wiping the faces with a clean cloth. The cavity beneath the valve door shall be thoroughly cleaned by hand. If fouling matter is deposited accidentally, it shall be either dissolved or carefully removed by methods that do not involve scraping of the gunmetal faces.

Where valves are supplied fitted with mud doors and starting bolts in the bottom of the body, the starting bolt shall be left out, when the door is shut for the first time on the Site. When the door has been set down on the seat the starting bolt shall be run up to make contact with the door and shall then be turned back to clear the door. In no case shall a starting bolt be inserted without ensuring that the door on closing shall clear the starting bolt.

All valves shall be set so that operating spindles are truly vertical unless otherwise shown in the Contract or directed. All valves shall close in an anti-clockwise direction.

Before each valve is put into service all gears, bearings and spindles shall be oiled with an approved oil as recommended by the valve maker. Oil baths shall be topped up to the appropriate levels and all grease nipples charged with grease of approved manufacture. No deleterious matter shall be allowed to come into contact with the working faces and oil sumps shall be maintained clean.

No air valves shall be stored before erection in the open sunlight, or upside down to expose the balls and air cavities. Air valves shall be checked before the main is charged to ensure that the balls and faces are not scored or split and that there is no dirt or other deleterious material in the cavities of the body. All air nozzles should be probed to see that they are clean. Fire hydrants, frost plugs and similar fittings shall be checked before being incorporated in the line and before the main is charged to ensure that all passageways are clean.

The installation of special types of valve and metering equipment shall be strictly in accordance with the manufacturer's instructions.

3.28 Existing Land Drains

Existing land drains permanently severed by the works shall be located and connected into new drains as required by the Contract. Existing land drains shall be cleaned out from the new drain trench face and any disturbed pipe re-laid to ensure a free discharge into the new drain. The disused end of the intercepted land drains shall be sealed with puddle clay or other approved materials.

Where an existing land drain is exposed and temporarily severed by trench excavation, the position of the drain shall immediately be marked and recorded. The normal functioning of the drain until permanent restoration is made shall be maintained by the construction of a watertight conduit adequately supported across the trench.

Without limiting the Contractor's liability for restoration of damage, the Contractor shall notify the Employer of any land drain which is blocked or is otherwise patently defective when the drain is first exposed.

When the line of an existing drain fouls the line of the pipeline the Contractor shall deal with the drain as directed.

Drains shall be reinstated on their original line, unless the Employer orders otherwise, using new tiles for existing agricultural tile drains and pipes for existing stone drains.

When backfilling is being carried out the temporary conduit shall be removed and the ground below the line of the drain well compacted. The positions of the ends of the drain shall be marked and the trench reinstatement completed. The trench for the drain shall be re-excavated and the drain reinstated with suitably sized pipes for a distance of 500mm into undisturbed ground on each side of the trench and bedded in suitable bedding material. The line level and grade of the original drain shall be maintained. The trench for the drain shall be sealed with puddle clay at each end of the drainage pipe.

3.29 Insulation of Watermains

Where watermains are exposed at bridge and culvert crossings or where they are laid above ground level, two coats of bitumastic paint shall be applied, to the pipeline which shall then be wrapped in two layers of 6mm thick glass wool held in position by tarred roofing felt wound with chicken wire and firmly tied in position. The finished surface shall then be painted with bitumastic paint. The whole assembly shall finally be painted with a coat of silver reflective paint.

3.30 Chambers

Chambers for access to valves and fittings on pressure pipelines for water or sewage unless otherwise directed, shall be as follows

1. Chambers to fittings shall be as detailed on the drawings and shall be complete with cast iron surface boxes, covers etc.
2. The base and roof slabs shall be in Concrete Grade C25/30. Cable junction chambers shall be as detailed on the drawings;
3. Where the chamber required is such that precast concrete units cannot conveniently be used, the construction shall be done in in-situ concrete in the manner described for Manholes - In- situ concrete.

3.31 Testing - Pressure Pipelines

Pipeline Testing shall be carried out in accordance with the following:

Pipelines shall be tested hydraulically in sections during the course of construction. Testing shall follow immediately after pipelaying.

Testing shall be applied to prove the structural soundness of the various units in the line, including pipes, valves and anchorages and to prove the water tightness of the line.

The Contractor shall provide pumps, gauges, jacks, struts and all apparatus necessary for carrying out the tests and shall keep them in good order. The gauges shall be not less than 100 mm diameter,

calibrated in metres head of water and a dated certificate of its accuracy shall be provided.

The Contractor shall provide for transmitting the unsupported end thrusts to solid ground at the ends or into the sides of the trenches. Before testing he shall ensure that the anchorage of bends are complete and that all branch outlets taking end thrust are properly stayed.

Testing shall not be permitted against a closed valve. In-line valves shall be left open. Terminal valves, hydrants, scour valves and the isolating valves of air valves shall be open, and shall be fitted with blank flanges except that where air valves are already fitted they shall be in service during the test. Scour tail pipes shall be connected only after pipeline testing is complete.

Water required for filling and testing the main shall be obtained from an approved source. The Contractor shall give the Employer not less than twenty four hours notice of his intention to test a section of main.

The trench is to be backfilled prior to testing. The Contractor is to provide pipe restraint (including longitudinal restraint to prevent pull-out of PE pipe from unrestrained joints) during pressure testing.

The test pressure shall be as in the following **Table 19** for the various sections of the Permanent Works.

Table 19 - Test Pressures for Pressure Pipelines

Pipe Type	Class	Test Pressure
PVC-A	10 Bar 12.5Bar 16 Bar	15 bar 18.75 bar 24 bar
Ductile Iron	Class K9 Diameter 80— 300mm Diameter 350mm — 1200mm	1.5 x working pressure (subject to a max. of 25 bar) 45 bar 30 bar
Steel & HPPE		1.5 x working pressure

When testing the pipeline shall be charged with water and all air released. Care shall be taken during the charging of the mains to provide free outlets for air to prevent surging and water hammer. The pipeline shall be brought up to and maintained at operating pressure and left for a period of 24 hours to allow for absorption and to achieve stable conditions.

Thereafter water shall be added by pumping until the test pressure is reached in the lowest part of the section. The pump shall then be disconnected and no further water shall be pumped into the pipeline for a period of two hours for interim test and four hours for final test. At the end of each of these periods the original pressure shall be restored by pumping, and the loss measured by drawing off water from the pipeline until the pressure as at the end of the test is reached. The permissible loss shall not exceed 0.1 litres per millimetre nominal bore per kilometre length per 30 metre head (calculate as the average head applied to the section) per 24 hours.

Interim tests shall be applied to sections of all continuous pipelines in lengths not exceeding 500 metres and subject to the conditions set out regarding the length of excavations.

Testing of consumer service connections to be in accordance with Appendix 5 of IGN 4-01-03

On completion of each continuous length of pipeline and completion of all service connections and connections to existing mains, the pipeline shall be subject to a final test as a whole or such parts of the whole as the Employer may require. The final test shall be undertaken at the actual working pressure plus 2.5 bar. The Employer shall specify the working pressure which shall not exceed the specified working pressure of the pipe.

If in the course of any test, the amount of make-up water in the specified test period exceeds the specified quantity, the Contractor shall locate and remedy the leaks causing such exceedance and shall repeat any such test until the specified degree of water tightness shall have been obtained. Remedial

measures to stop leakage shall not infringe or be inconsistent with any relevant part of the Specification.

The Contractor shall ensure that no erosion or silting occurs in water courses from the discharge of test water.

On completion of the interim test the pipeline shall remain full of water and a minimum pressure of 1 bar shall be maintained until the pipeline is handed over to the Employer.

3.32 Swabbing and Scouring of Pipelines

After filling of pressure pipelines with water the Contractor shall thoroughly swab the line with foam swabs in sections as directed. The length to be swabbed shall not exceed 1500 metres. Swab velocity shall not exceed 1.1 metres/sec.

Swabbing shall be continued until the wash water runs clear and the Contractor shall ensure that no erosion or silting occurs in the watercourses into which the wash water is discharged.

3.33 Sterilisation of Water Mains

Mains shall be sterilised after testing, swabbing and scouring. Chlorine solution shall be applied at the charging point as the main is being filled and dosing shall be continued until the main is full and at least 20 mg/l of free chlorine has been made available. Chlorine gas shall not be injected direct to the main from a cylinder other than through an approved chlorinator and care shall be taken to ensure that there is no flow back into the preceding sections of main.
The treated water shall be left in the main for a period as directed but not exceeding 24 hours and all valves in the system shall be operated at least once during this period.

Chlorine residual tests shall then be taken at the end of the main furthest from the point of injection. The sterilisation process shall be repeated until the chlorine residual is not less than 10 mg/l.

The Contractor shall dispose of the waste chlorine solution in such a manner as to avoid the pollution of natural waters and of reservoirs and artificial watercourses. The Contractor shall comply with any directions which the Employer makes in respect of such disposal.

On completion of the requirements above the Contractor shall fill the mains with water from an approved source. He shall assist the Employer in taking water samples for bacteriological analysis. In the event of unsatisfactory results, the Contractor shall repeat the process outlined above until a satisfactory bacteriological, result is obtained.

3.34 Assistance in Sampling and Testing

The Contractor shall supply all samples of materials for testing and shall render such assistance as may from time to time be required in taking and packing them into containers, provided by the Contractor, and dispatching them for test or in making, examining and testing them.

3.35 Testing of Pipe Bedding Material

The following apparatus shall be used:

- Open ended cylinder 254mm long and 150 mm diameter;
- Metal rammer with a striking face 38mm diameter and of total weight 1 kg.

(a) Stand the cylinder on a firm flat surface.
(b) Using a sample of material having a moisture content equal to that of the material at the time of use, pour the sample of material into the cylinder without supplementary compaction and strike off the material level with the top of the cylinder.
(c) Lift the cylinder clear of its contents and place on a fresh area of flat surface. Replace about one quarter of the material in the cylinder and tamp vigorously until no further compaction is evident. Repeat this process quarter by quarter until the whole of the material measured

loose in the cylinder is compacted.

(d) The final measurement from the top of the cylinder to the compacted surface divided by the height of the cylinder is the Compaction Factor value.

3.36 Testing of Materials for Concrete

The sampling and testing of the constituent materials for concrete shall be carried out in accordance with the appropriate Standards.

3.37 Testing of Concrete

The sampling, curing and testing of the concrete, fresh or hardened, shall be carried out in accordance with BS 1881.

The rate of sampling shall be as specified in the Specification. Four test specimens shall be prepared from each sample and specimens shall be laboratory cured under water at 20 degrees C. On completion of curing, two specimens shall be tested at seven days and two specimens at twenty eight days.

3.38 Inspection and Testing of Precast Concrete Units

The inspection and testing of precast concrete units shall be in accordance with BS 8110.

3.39 Air-Entrained Concrete

In air-entrained concrete the air content shall be checked at least twice during each pour by an approved air meter. Slump and compaction shall be done on the same batch of air-entrained concrete as that from which the concrete for the test cubes is taken but the cubes shall not be made from concrete used in the slump and compaction tests.

3.40 Failure to Meet Specified Requirements

If the specified requirements have not been met, the Contractor shall take such remedial action as the Employer may order and shall, before proceeding with the concreting, submit for the Employer's approval details of the action proposed to ensure that the concrete still to be placed in the Works will comply with the Specification.

3.41 Records

The Contractor shall keep records of the positions in the Works of all batches of concrete, of their grade, and of all tests on concrete or its constituent material. Copies of these records shall be supplied to the Employer.