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CIVIL ENGINEERING SPECIFICATION

FOR

CREMORNE ESTATE

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Contents

1.	GENERAL REQUIREMENTS	1
1.1	Ground Works Design	1
1.2	Planning of the Site Works	2
1.3	Site Investigation	3
1.4	Ground Works Provisions for Pipe Movement	3
1.5	Maintenance of Existing Works	4
1.6	Building Entry Details	5
1.7	Above Ground Pipework	5
2	CIVIL ENGINEERING MATERIALS	6
2.1	Manholes and Inspection Chambers	6
2.2	Pipe Support Material	6
2.3	Frost Susceptibility	6
2.4	Warning Marker Tapes	6
3	CIVIL ENGINEERING EXECUTION	7
3.1	Setting Out	7
3.2	Clearance	7
3.3	Trenches/Excavations	7
3.4	Building Entry	8
3.5	Access/Installation	8
3.6	Inspection	9
3.7	Placement of Pipe Support Material	9
3.8	Warning Tape	9
3.9	Backfilling	10
3.10	Reinstatement of Surfaces	10
4	DRAWINGS	11

1. GENERAL REQUIREMENTS

This specification covers the civil engineering works associated with the works to prepare, maintain and backfill the trench during the installation of the piping system. The civil engineering works and associated material specification shall be to the approval of the Client or his representative.

The final routes will be determined by the contractor and approved by the client/consultant Contract Administrator before work commences on site. As far as practicable, routes will follow the features of the site such as roadways and building lines. Road crossings will normally be at right angles to the line of the road.

In addition to this Specification, all works shall be carried out in accordance with the requirements of the New Roads and Street Works Act 1991 (NRASWA).

1.1 Ground Works Design

The contractor will be responsible for the design and execution of all ground engineering work, which is necessary to ensure the suitability, compatibility and correct location within the system of components selected by him to meet the specified performance of the installation.

Ground works design will be based upon good working practice and will include the following:

- a) The piping system design requirements of this specification.
- b) The particular ground and site conditions relating to the site.
- c) The location of existing services, building structures and other obstructions, and constraints along the route of the pipework system, through invasive and non-invasive surveys.
- d) The expected ground movement.
- e) A minimum ground cover of 600mm below the base of the road layer or the ground level of grassed areas. Where this cover cannot be achieved reinforced concrete flags placed above the 2 initial 150mm of backfill sand will limit the ground pressure loading on the pipeline to 50 kN/m.

Trenching and bedding will be designed with due consideration of ground conditions, loading requirements, construction requirements, pipe strengths and pipe gradient.

- a) Main Roads -A group of 8 wheels arranged as in BS 5400: Part 2 type HB road loading, each wheel having a static force of 90 kN with an impact factor of 1.3, all acting simultaneously.
- b) Light Roads -A group of 2 wheels spaced 0.9 metres apart, each having a static force of 70kN, with an impact factor of 1.5, both wheels

acting simultaneously.

- c) Grassed Areas -The same wheel arrangement as for (b) but with a static force of 30kN and an impact factor of 2.0.
- d) Construction Areas -As per item (a) using the maximum static force associated with the largest mechanical item of plant to be used on site.

Road areas will include all verges up to 2 metres outside the kerb lines.

1.2 Planning of the Site Works

The sequence of the site operations will be planned so that the work advances steadily and efficiently. Due recognition will be given to the work programme and proximity of other contractors.

The contractor will programme the Works so that they proceed with minimum inconvenience and disruption to the site occupants (and other users).

The sequence of operations will be as follows (where appropriate):

- a) Site investigations and trial digs.
- b) Setting out.
- c) Breaking up of hard places
- d) Excavation, trench supports, support of existing services and de-watering of trenches.
- e) Preparation of trench bottoms.
- f) Initial bedding or other support.
- g) Pipe laying and jointing processes.
- h) Inspection and preliminary testing of pipe integrity.
- i) Completion of sand bedding (including side fill and first 150mm layer of bedding).
- j) Backfilling of trench and withdrawal of trench supports (including laying of warning tapes).
- k) Disposal of surplus soil.
- l) Temporary reinstatement of surfaces.
- m) Final testing and commissioning of the piping network.
- n) Permanent reinstatement of surfaces.
- o) Takeover and defects liability period.

The programme of excavation work will ensure that the opening of trenches, and installation of the piping system, is only carried out over such lengths as can readily be completed in one continuous operation. It will be organised so that there is sufficient labour, plant and material to keep the complete excavation ahead of pipe laying with the smallest possible length of trench standing open at any one time. Excavation of new sections of pipelines will not be connected until an adequate supply of pipe and components are available. A reserve of appropriate materials and equipment will be kept on site for immediate support of unexpected ground conditions.

Where work is likely to be suspended for any appreciable length of time, the construction schedule will be arranged so that lengths of trench are not left open.

The Contractor is responsible for the requirement to serve notices of street opening and closure notices and shall assist the Client in their production. It is the Contractor's responsibility to ensure that the excavation is maintained within the requirements for the served notice including the period of opening and for maintaining the site under the requirements of NRASWA.

Where works are undertaken in land not covered by highways but Local Authority land, the Contractor shall ensure that the Client is aware of the specific demarcation through provision of accurate drawings.

The Contractor shall be responsible for all traffic management and diversions, road and footpath closures for the duration of the works and their production and presentation and all costs associated with these traffic management activities. Parking bay suspensions will be the responsibility of the Contractor to arrange and pay for during the works.

The Contractor shall be responsible for the removal of parked cars that hinder the progress of works.

The Contractor shall be responsible for notifying residents of the intention to start work, the date of the work and the expected duration of the works, to minimise local disruption. The Contractor shall ensure that it has a single point of contact to deal with any queries relating to their works and any disturbances to the local population.

Where the Contractor elects to excavate and install pipe in more than one location, he shall present to the Client a Method Statement for this work which shall include issues such as site safety, site management and resource planning. The Contractor shall then seek permission from the Client, such permission not unreasonably withheld.

1.3 Site Investigation

The contractor will be deemed to have visited the site and to have taken account of the topographical and other features apparent from a visual inspection of proposed piping routes. The contractor will check and verify all information supplied to him, prior to commencing detailed design. The contractor will carry out a site investigation and ground exploration, as necessary to obtain the necessary design information.

The Contractor shall give notice if ground or groundwater conditions encountered are significantly different from information provided in the site investigation report, stated as assumed, or previously measured.

1.4 Ground Works Provisions for Pipe Movement

The contractor will make the necessary provision to fully account for thermal movement of pipe casings within his design and installation.

The maximum allowable movement of at the bends or tees shall be 70mm. If movements are higher precaution should be made by using E-compensators or if possible delay the backfill of the bends/tees with large movements (>70mm) until after the pipes have been filled with hot water.

For expansion at bends and tees foam pads shall be installed.

Pipe sections with axial stresses higher than 190 N/mm² are not permitted. For these sections the stability of the pipes in according to parallel excavation should be considered if the presence of other utility lines nearby (within 1,0-1,5m) are installed in the same depth or lower than the pipes for district heating.

Systems using underground voids, culverts, lubrication and non-bonded techniques, for expansion control, will not be accepted.

Concrete anchor blocks shall not be permitted.

1.5 Maintenance of Existing Works

Before commencing any site operations, the contractor will notify (in writing) the service and utility authorities of the impending installation works and obtain details, and locations, of all installations (whether buried, hidden or visible) existing in the vicinity of the works.

Where ground investigation surveys have been undertaken, they shall be made available to the Contractor prior to commencement of works.

Requests by any such third parties to witness any trench opening(s) will be notified to the client/consultant Contract Administrator and strictly adhered to.

Unless otherwise approved by the client/consultant Contract Administrator, excavations within 600mm of existing services will be by hand digging. All services uncovered, whether expected or not, will be reported immediately to the client/consultant Contract Administrator; they will be supported by slings and other suitable means and be adequately protected. Any damage to services, however minor, will be reported immediately to the client/consultant Contract Administrator; no repairs or replacement will be carried out without approval from the client/consultant Contract Administrator.

A photographic and a written record will be kept of the condition of any drain, manhole or other existing work which may be uncovered. Any defect evident will be brought to the attention of the client/consultant Contract Administrator.

The contractor will not use or interfere with the existing service installations without permission of the service and utility authorities. The contractor will take precautions to avoid damage to existing services and draw his operatives' attention to the attendant risks and dangers.

If damage to existing installations occurs during works, then:

- a) The contractor will immediately notify (in writing) the owner of the apparatus and the Client/consultant Contract Administrator and, where applicable, service and utility authorities. Details of the damage and proposed action the contractor will take will be given. It is the responsibility of the Contractor to liaise with the owner to agree a suitable repair ensuring it is to the satisfaction of the owner.

The contractor will make arrangement for repair to the satisfaction of the service and utility authorities.

- b) In the case of urgent repairs, the contractor will accept any arrangement made by the Client/consultant Contract Administrator. Such arrangement made by the client/consultant Contract Administrator will not affect the extent of the contractor's liability.

1.6 Building Entry Details

The Contractor shall construct chambers at the entry to each block housing the valves and hydraulic separation equipment.

The Contractor shall be responsible for forming and adequately sealing all pipe entry details to each building.

1.7 Above Ground Pipework

All pre-insulated pipework installed above ground will require supports. It is the responsibility of the Contractor to propose suitable pipe support details, taking into consideration the mass and likely expansion of the pipe, to the client for his approval. The Contractor shall be responsible for ensuring safe positioning of pipe work for the pipe installation contractor including lifting, permanent and temporary support.

2 CIVIL ENGINEERING MATERIALS

2.1 Manholes and Inspection Chambers

All manholes, inspection chambers, access covers and frames shall be supplied in accordance with BS EN 124, BS 7158, BS EN 13598-1, BS 5911-3, BS 5911-4, BS EN 1917 and the pipe manufacturers' recommendations. Appropriate manufacturer approved sealant for concrete manhole rings shall be provided.

2.2 Pipe Support Material

Upon request the supplier of the pre-insulated pipes will give an approval of the chosen sand material. Sand layer below pipes be a minimum thickness of 100 mm. If the trench bottom is uneven, increase thickness by 100 mm. The sand material will surround pipes and be placed above pipes to a thickness of 200mm above the outer casing.

2.3 Frost Susceptibility

Except as allowed below, fill must be non frost-susceptible as defined in Transport Research Laboratory Report SR 829 'Specification for the TRRL frost-heave test'. If the following fill materials are proposed, submit a laboratory report confirming they are non frost- susceptible:

- Fine grained soil with a plasticity index less than 20%.
- Coarse grained soil or crushed granite with more than 10% retained on a 0.063 mmsieve.
- Crushed chalk.
- Crushed limestone fill with average saturation moisture content in excess of 3%.
- Burnt colliery shale

2.4 Warning Marker Tapes

Warning tapes or warning net will be of heavy gauge polythene not less than 150mm wide and 0.1mm thick. They will bear the continuously repeated legend "DISTRICTHEATING" in block letters not less than 30mm high. Warning tapes are to be placed upon each pipe. See also Section 4.7.

3 CIVIL ENGINEERING EXECUTION

3.1 Setting Out

Prior to commencing excavation the Contractor shall set out the route of the pipe with appropriate markers and confirm it with the Client/consultant Contract Administrator. The Contractor shall undertake all setting-out, excavations to required invert levels and backfill of trenches to approved drawings.

3.2 Clearance

The Contractor shall clear the route of the rubbish, debris and vegetation. Cut down and grub uproots of shrubs and smaller trees. Fell larger trees as close to the ground as possible. Trees requiring felling will be agreed with the Client/consultant Contract Administrator and shall be taken down carefully in small sections to avoid damage to adjacent trees that are to be retained, where tree canopies overlap and in confined spaces generally.

Ownership of excavated materials, including topsoil, surplus to requirements for filling shall remain the property of the Employer unless the Contractor:

- Is instructed to remove them from the site, or
- Purchases them at a price to be agreed
- The removal and disposal of excavated material and all associated costs shall be the responsibility of the Contractor. The Contractor shall ensure that the excavated material is disposed of at an approved and licensed disposal site. The Contractor shall maintain transfer notices for all excavated material disposed of for a period of at least 7 years.

3.3 Trenches/Excavations

All excavations to be in accordance with relevant British Standards, ACOP's, construction Regulations and drawing numbers 12-30135-DH-SD-01-001..007 including the provision of temporary fencing, scaffolding, bridging, barriers and supervision.

The minimum dimensions, stone less sand layer, distance between the outer casings and the cover of the pipes, required for a correct system function, appear from the trench profile.

The minimum cover of 600 mm allows a maximum surface load of 800-900 kPa (0.8-0.9 N/mm²). The 600 mm dimension should be measured from the top of the pipes to the bottom of the road layer.

In areas with no traffic 600 mm is measured to the finished ground surface. In connection with pipe dimensions larger than \varnothing 609.6/780 mm the necessary installation depth and pipe distance are determined in each case.

The Contractor shall install shoring where required in compliance with Health and Safety regulation requirements. All shoring will be positioned to ensure that it does not obstruct the installation works. If this is not possible,

attendance will be given to remove and replace shoring as necessary during pipework installation (only to be carried out if safety regulations are not contravened).

The excavations will be graded to falls (to ensure the complete removal of air from the newly installed pipework) and the trench floor compacted (without the introduction of sand). If ground conditions require it, a concrete blind should be laid and graded to provide a firm trench bottom. Excavations will be set out to the required invert levels. The client/consultant Contract Administrator may require the contractor to prove the set levels via the use of an adequate levelling device, i.e. Dumpy, Thompson, Cowley etc. The Contract Administrator may request the above checks be made at any stage of the works.

Adequately dimensioned welding pits (bell holes) to provide working space shall be excavated at all locations within the confines of a trench where joints are to receive welds.

Excavated spoil is to be taken away from the trench area. If this is not possible/practical, the spoil may be placed on one side of the trench, leaving a minimum of 1 metre (or the equivalent depth of the trench) between soil and edge of trench. The contractor shall present a risk assessment if this situation arises.

The opposite side of the trench is to be kept clear to allow access for plant and material for the installation of the new pipework. It is the responsibility of the Contractor to dispose of any surplus excavated material to a suitably licensed waste disposal facility. The Contractor shall maintain duty of care notices for at least 7 years and shall make copies available in the final documentation.

The excavations will be kept clear of water at all times from the commencement of works until the backfill is completed. Pumps are to be provided where necessary to ensure this requirement is met.

The Contractor shall ensure that the open trench is maintained in a clean and tidy state i.e. removal of materials due to trench collapse, litter, etc. This will be carried out from commencement of the works until backfill is completed and on a regular basis.

3.4 Building Entry

The contractor shall be responsible for all civil engineering works required to route DH pipes up to each building, providing chambers for the hydraulic separation plant. These works shall include making and forming holes, pits, trenches, etc, making good and ensuring entries are properly sealed against water ingress. As the nature of this work can be varied the details of the required work will be agreed with the Employer and his representative.

3.5 Access/Installation

Access will be provided along the route of the underground mains installation

for distribution of materials and installation plant. When pipes and fittings are transported to the trench site, precautions will be taken to avoid damage. Temporary support can be arranged by means of suitably sized sand bags or styrene blocks. The supports will be able to carry the load of the flooded pipes without damage to the casing pipe or insulation.

3.6 Inspection

Trenches and newly installed pipework are to be closely inspected immediately prior to the sand backfill to ensure that the pipework's outer casing is undamaged in any way. A minimum clearance (as shown on trench details) is required to be provided around the outer casing of the pipework throughout the entire length of the new pipework installation. Any section found not to comply with this requirement will be rectified before sand backfill can commence.

Contractor to advise the client/consultant Contract Administrator of date and time of inspection to allow joint inspection to be made if so required. Notification to be in writing and an allowance of 48 hours to be provided prior to inspection date.

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3.7 Placement of Pipe Support Material

The Contractor shall place sand material and compact over full width of trench in accordance with specified minimum dimensions on drawing. Level and compact the bottom of the trench with a min. 100mm stone free sand layer.

When installing pipes dig pipes slightly into bedding, rest uniformly on barrels and adjust to line and gradient.

Sand backfill shall commence immediately following the successful inspection of both the trenches and newly installed pipework. Care shall be given to ensure no damage is caused to the trench or installation pipework during the backfill process.

The backfill sand is **manually** compacted down (to prevent voids occurring) in layers of 100mm, ensuring that sand is placed across the full width of the trench and a 200mm layer of compacted sand is provided above the pipework's outer casing. Normally, manual compaction is achieved by hand and watering. Each layer is to be completely compacted before the next layer is laid. The compacted sand layer will provide a complete support to the pipes around their entire circumference.

Sand to be placed without any displacement of the underground mains installation.

3.8 Warning Tape

The Contractor shall place a warning tape continuously at 200mm above the crown of each pipeline in accordance with Clause 3.1 of this specification.

3.9 Backfilling

The Contractor shall backfill trenches to the underside of the sub-grade layer below roads and pavements or to an appropriate depth in landscaping areas.

Above the sand surround a backfill comprising Class 6F1 or 6F2 material in accordance with Highways Agency 'Specification for highway works', Table 6/1 shall be placed in 150mm layers. Each layer to be hand tamped and compacted to give a minimum cover of 450mm between the crown of the underground mains and the base of the road layer or the ground level of grassed areas.

Where the specified cover cannot be achieved reinforced concrete flags placed above the initial 200mm of backfill sand will limit the ground pressure loading on the pipeline to 50 kN/m².

Where pipes are installed at a depth where backfilling is required and the cover is in excess of 600mm above the outer casing then material shall be placed and compacted to Highways Agency Specification for highway works, Table 6/1, clause 612 and clause 613.3, 613.9 and 613.10.

All works shall be carried out in accordance with the requirements of the New Roads and Street Works Act 1991 (NRASWA)

3.10 Reinstatement of Surfaces

Those parts of the site (and any areas outside the site) disturbed by the Works will be reinstated to equal the conditions existing before the works commenced. The surface of any road or footpath which has been disturbed by the excavation will be reinstated to the approval of the client/consultant Contract Administrator. Cultivated areas, top soil and turf will be permanently reinstated to harmonise with the adjoining surface.

All sub-grade, improvement layers, base and wearing courses for highways and pavements shall be reinstated to match the civil engineering details existing before the works commenced.

All works shall be carried out in accordance with the requirements of the New Roads and Street Works Act 1991 (NRASWA).

4 DRAWINGS

The following drawing shall be read in conjunction with this specification.
3199M-CONCEPT-001