

Hunter Water Corporation A.B.N. 46 228 513 446
Standard Technical Specification for:

CONSTRUCTION OF SEWER RISING MAINS

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AMENDMENTS

| New Clause | Old Clause | Amendment |
|--|--------------|---|
| AMENDMENTS TO THE NOVEMBER 2002 VERSION | | |
| 4.1 | 4.1 | Reference to Approved Products and Manufacturers on web site added. |
| 4.9 | 4.9 | Class of ductile iron pipe and fittings changed to PN35 |
| 4.9 | 4.9 | FBPE coating required for ductile fittings used with PVC pipe |
| - | 4.10 | Clause "Grey (cast) Iron Fittings" deleted |
| 4.10 to 4.20 | 4.11 to 4.21 | Clauses renumbered due to deletion |
| 7.6 | 7.6 | Ownership of surplus material deleted |
| 13.3 | 10.2 | Clause "Compaction and Density Testing" deleted |
| 13 | 13 | Clause "Acceptance Testing" renamed "Testing" |
| 13.1 | 13.1 | General requirement to test all pipelines deleted and dealt with in individual test clauses. |
| 13.1 | 13.1 | General requirement to submit test results added. |
| 13.2 | 13.2 to 13.6 | Old clauses made sub-clauses of new clause "Hydrostatic Pressure Test" |
| AMENDMENTS TO THE JANUARY 1997 VERSION | | |
| All | All | General formatting, rewording and referencing changes to improve clarity but no change to technical requirements |
| Various | Various | Deletion of various clauses, paragraphs and sentences already covered or more appropriately covered in Preliminaries or considered unnecessary. |

1. GENERAL

1.1 Scope

This Standard Technical Specification details requirements for the construction of sewer rising mains of nominal diameter DN 50 to DN 600 including associated works such as vents and pump out and gravity scours.

1.2 Interpretation

Headings are for the convenience of the reader and shall not be used in the interpretation of this Standard Technical Specification.

Unless the context requires otherwise any expression such as "give notice", "submit", "approval", or "directed" means give notice to, submit to, approval by, or directed by the person nominated by the Principal or Purchaser.

2. REFERENCED DOCUMENTS

The following Hunter Water Corporation drawings are deemed to form part of this Standard Technical Specification:

SCP-1000 Pipe Support and Trench Fill for Sewer Rising Mains up to DN 600

SCP-1001 Pipe Support and Trench Fill in Bad Ground for Sewer Rising Mains up to DN 600

SCP-1002 Discharge Access Chambers for Sewer Rising Mains up to DN 500

SCP-1003 Educt Vent Stack and Holding Down Bolt Details

SCP-1004 Air Release Valve for DN 100 to 600 Sewer Rising Mains

SCP-1005 Pump Out Scour for DN 100 to 600 Sewer Rising Mains

SCP-1006 Gravity Scour for DN 100 to 600 Sewer Rising Mains

SCP-1007 Driveway / Roadway Crossings for Sewer Rising Mains up to DN 600

WCP-203 Mainlaying - Trenchstops and Bulkheads for DN 100 to 750 Mains

WCP-204 Mainlaying - Trench Drainage for DN 100 to 750 Mains

3. ORDER OF CONSTRUCTION

Undertake and complete all work including fittings before connection is made to the existing sewerage system.

4. MATERIALS

4.1 General

Select materials from Hunter Water Corporation's lists of Approved Products and Manufacturers which can be accessed on the internet at:

www.hunterwater.com.au/services.asp

Where suitable equipment is not listed, submit full technical details of alternative items and obtain written approval prior to use.

Comply with all recommendations of the manufacturers regarding the storage and handling of the materials. Undertake all handling, transport and storage such that no damage occurs to the materials including coatings and linings.

4.2 On-site Stockpiles

Only store sufficient materials on site as are necessary to allow timely and efficient progress of the work. Locate stockpiles of excavated or imported material where they cause no interference to the public, drainage routes or vehicular or pedestrian traffic. Clear lines of sight for drivers must not be obstructed. Do not stack materials against structures, fences, trees or other property improvements. Leave a clear path at least 600 mm wide between the edge of any excavation and the inner toe of any stockpile or spoil banks.

4.3 Bedding Sand

Supply bedding sand embedment material in accordance with Standard Technical Specification STS101.

4.4 High Grade Compaction Sand

Supply high grade compaction sand embedment material in accordance with Standard Technical Specification STS101.

4.5 Select Fill

For select fill use excavated material, free from organic matter and having a particle size no larger than 20 mm. The material shall be suitable to allow compaction as specified without causing damage to the pipeline. If material excavated during excavation does not comply, import non-cohesive material.

4.6 Trench Fill

Where the trench is not subject to traffic loading use excavated material for fill in the trench fill zone provided it has a particle size no greater than 75 mm across the largest dimension, is free from organic matter and can be placed into a dense mass free of voids and cavities.

For trafficable areas use:

- cement stabilised trench fill for all existing roads; or
- crushed rock dust in accordance with Standard Technical Specification STS101; or
- crushed rock in accordance with Standard Technical Specification STS102; or
- as directed by the authority responsible for the trafficable area.

4.7 Cement Stabilised Trench Fill

Cement stabilised trench fill shall comprise a 14:1 sand:cement mix.

4.8 UPVC Pressure Pipes and Fittings

Supply UPVC pressure pipes manufactured in compliance with Section SP4 of the Water Services Specification (WS-Spec). Contrary to the Table of Water Agency Practices only use series 2 (Cast Iron Outside Diameters) flexible jointed pipes to the class nominated in the Drawings. WS-Spec is available from Standards Australia. Do not use UPVC pressure pipes exceeding 6 months of age from the date of manufacture.

4.9 Ductile Iron Pipes and Fittings

Supply ductile iron pipes and fittings manufactured in compliance with Section SP2 of the Water Services Specification (WS-Spec) and as indicated for Hunter Water Corporation in the Table of

Water Agency Practices. WS-Spec is available from Standards Australia. Use pipes and fittings to Class PN35.

All Ductile Iron fittings used in UPVC pressure pipelines shall be fusion bonded polyethylene coated internally and externally to relevant standards.

4.10 Steel Pipes and Fittings

Supply steel pipes and fittings manufactured in compliance with Section SP1 of the Water Services Specification (WS-Spec) and as indicated for Hunter Water Corporation in the Table of Water Agency Practices. WS-Spec is available from Standards Australia.

4.11 Polyethylene Pipes and Fittings

Supply Polyethylene pipes and fittings manufactured in compliance with Section SP6 of the Water Services Specification (WS-Spec) and as indicated for Hunter Water Corporation in the Table of Water Agency Practices. WS-Spec is available from Standards Australia. Use pressure pipe and fittings of PE 80 Type B to the class nominated in the Drawings in sizes DN 63 and DN 110 only.

4.12 Joint Seals

Supply elastomeric seals manufactured in compliance with Section SP15 of WS-Spec. Use seals of either ethyl propylene-diene (EPDM) or nitrile-butadiene rubber (NBR).

4.13 Concrete

Supply concrete from plant(s) with third party certified Quality Systems for the manufacture and supply of concrete. Do not use any admixtures in the concrete. Use only one of the following cements:

- Fly Ash Blended Cement conforming to the requirements of Type SR to AS 3972 and containing 20% fly ash to AS 3582 Part 1, "fine grade" only, or
- Blended Cement, other than fly ash, conforming to the requirements of Type SR to AS 3972.

4.14 Reinforcement

Supply reinforcement which complies with AS 1302 Steel reinforcing bars for concrete, AS 1303 Steel reinforcing wire for concrete, and/or AS 1304 Welded wire reinforcing fabric for concrete.

4.15 Polyethylene Sleeving

Use cream coloured polyethylene sleeving, adhesive tape, strap and buckle in accordance with AS 3680. Supply rolls with protective end flanges and perforated at 6.1 metre intervals.

4.16 Geotextile Filter Fabric

Geotextile filter fabric shall be approved inert material, BIDIM A14, manufactured by Geofabric Australia Pty Limited.

4.17 Timber Piles

All piles are to be treated hardwood, strength group F14, and in accordance with "Koppers - Standard Specification, Hardwood Foundation Piling". The CCA treatment shall be to the requirements of AS 1604 Hazard Level 5 protection and the further requirements of the NSW Timber Market Act.

4.18 Fasteners

Supply all nuts, bolts and washers in accordance with AS 2528. All exposed boltheads and nuts shall be hexagonal and the length of all bolts shall be such that tightened bolted connections shall have a minimum of 2.5 threads and a maximum of 5 threads protruding from the nut.

All anchors, bolts, nuts and washers embedded in concrete shall be of Grade 316 stainless steel to AS 2837. All bolts, nuts and washers used in the fabrication and/or installation of stainless steel items shall be of Grade 316 stainless steel to AS 2837. All other steel anchors, bolts, washers and nuts shall be hot dip galvanised in accordance with AS 1650. Grade 316 stainless steel to AS 2837 is an acceptable alternative to hot dip galvanised steel. Passivate all stainless steel components in accordance with STS100.

4.19 Valves

Supply valves in accordance with Standard Technical Specification STS103.

5. EXISTING SERVICES

5.1 Location of Services

Any details of services shown on the Drawings are not to be taken as indicating all existing services or exact locations. Irrespective of any information on the Drawings, verify the exact location of all services which may be affected by construction activities. If services are located which are not shown on the Drawings or are not in the location shown on the Drawings, give notice at least three (3) working days prior to commencement of any construction activity that may affect the service.

5.2 Protection and Maintenance of Services

Take all actions and provide all things necessary to protect and maintain existing services to the satisfaction of the relevant authority or owner. This may include arranging or performing relocation, temporary diversion or support of the service.

5.3 Repair of Services

If a service is damaged during construction, arrange or perform repair to the satisfaction of the controlling authority or owner. Obtain from the authority or owner, a certificate stating that the repair has been carried out to their satisfaction.

If the service is not under the control of an authority and the owner cannot be located within a reasonable time, report the damage, and arrange or perform repair to an approved standard. Do not backfill, cover up or make the repair inaccessible prior to obtaining approval.

6. CLEARING

Do not destroy, remove or clear vegetation or surface improvements to an extent greater than necessary for the execution of works.

Obtain the approval of the Council for the removal of any trees. Take any steps necessary to prevent damage to trees that are not to be removed.

Dispose of all rubbish and surplus material within 24 hours of clearing.

Stockpile topsoil separate from other excavated material and use the topsoil to make good the surface after backfilling.

7. EXCAVATION

7.1 Limits of Excavation

Keep the extent of excavation to the minimum possible to allow efficient construction of the Works while meeting the minimum requirements shown on the Drawings and the relevant Standard Drawings. Keep pipe trench widths within the maximum widths recommended by the pipe manufacturer.

Keep the sides of excavations vertical to at least 150 mm above the pipe.

Ensure that the minimum cover requirements shown on Standard Drawing SCP-1000 will be satisfied following any earthworks which may occur in the area of the pipeline. This is particularly relevant in new subdivisions or developments where earthworks are to be expected to form roads, driveways, footpaths and for general shaping of the surfaces. Preferably lay mains after formation of footways to finished levels. If minimum cover requirements cannot be achieved submit a proposal to overcome the problem.

7.2 Improved Surfaces

Where excavation is required under improved surfaces such as pavements, driveways and kerb and gutter, use tunnelling or boring where the surfaces cannot be satisfactorily reproduced and under existing concrete footway areas and concrete driveways. Ensure backfilling is to a standard to fully support the surface and any likely applied load.

If open excavations are used in improved surfaces, keep the trench width to the minimum allowed. Saw cut neat straight lines at the outer limits of the excavation through bitumen, asphalt and concrete. Remove pavers, blocks or brick pavements by hand, clean them and set them aside for later replacement.

7.3 Drainage and Dewatering

Keep all excavations free of water. Provide, maintain and operate intercepting works to prevent surface water from entering the excavations; and all equipment necessary for dewatering the excavations and keeping the Works free from water.

Lowering of the water table by well points or other external dewatering methods may only be used if no damage is likely to be caused to adjacent structures and services.

Ensure that all downstream sewer system works that are under construction, completed or in use are protected at all times against the effects of any drainage which is discharged or likely to be discharged from the work.

7.4 Extra Depth Excavation

If extra excavation is required to reach a firm foundation or if excavation has extended deeper than necessary to meet the requirements of this Standard Technical Specification, refill to the required level with an approved non-cohesive material complying with STS101. Place and compact the material in accordance with clause "Backfilling".

Where material has been disturbed to a level deeper than necessary under this Standard Technical Specification, compact the disturbed material to density index not less than 70% for granular (non-cohesive) material or to dry density ratio not less than 95% for non-granular (cohesive) material. If satisfactory compaction of the disturbed material cannot be achieved, remove the material and refill to the required level with an approved non-cohesive material complying with STS101. Place and compact the material in accordance with clause "Backfilling".

7.5 Foundations and Foundation Stabilisation

Where the bottom of an excavation is soft or considered to provide an unacceptable foundation produce a stable foundation by one of the following:

- (a) Use of geotextile surround as shown on Standard Drawing SCP-1001 for pipework. For other structures place geotextile fabric across the full excavation width and extending up the sides to minimum level of 600 above the base of the excavation.
- (b) Extra depth excavation in accordance with clause "Extra Depth Excavation".
- (c) Ram ballast into the soft ground until an approved firm foundation is obtained at the design depth. Use ballast comprising clean hard rock of 150 mm nominal size having no less than 85% retained by a 150 mm sieve and no less than 95% retained by a 100 mm sieve, Remove and dispose of any excess material.
- (d) Timber piles as shown on Standard Drawing SCP-1001. Piles spaced, unless specified otherwise, at 1.2 metre centres for Type 8 and Type 9 or 5.5 metre centres for Type 7 along the centre line of pipe, shall be driven to nominal refusal. Only use piling, where ballast, geotextile and / or extra depth excavation are considered unsuitable. Do not use piling unless approved in writing by the Superintendent. Use only DICL or steel pipes with piling support.

Give notice prior to commencing any foundation stabilisation.

7.6 Surplus Excavated Material

Promptly remove and dispose of excavated material which is not required for reuse. Do not dispose of the surplus material without the prior written consent of the dump site's owner, owner's agent, lessee or controlling authority.

8. PIPE BEDDING

8.1 General

Provide underlay of the type shown on the Drawings and in accordance with Standard Drawing SCP-1000, and/or SCP-1001 as appropriate. Place and compact the bedding to support the pipe uniformly along the whole length of the barrel with chases provided for sockets and couplings.

8.2 Concrete Encasement

In addition to where shown on the Drawings, provide concrete encasement of pipes in accordance with Standard drawings SCP-1000 where rising mains have less than the minimum cover over the top of the pipe barrel as shown on Standard Drawing SCP-1000 or where a building approval has been given to construct a structure over the pipeline.

The length of concrete encasement shown on the Drawings is a minimum. Extend encasement to finish at the face of pipe joints.

Concrete is to be of the grade shown on the Drawings. Set pipes to line and level on either bags filled with sand and cement mix or on concrete saddles cast to the outside diameter of the barrel and located near the socket. Ensure that pipes do not move, float or deform while pouring concrete.

Provide a 1500 mm long pipe immediately upstream and downstream of the concrete encasement to allow for differential movement.

9. PIPE LAYING AND JOINTING

9.1 Accreditation

For laying of DICL or UPVC pipes use only those installers who have completed an approved training and accreditation program.

9.2 Method

Clean and examine all pipe system items before laying. Do not use any UPVC pressure pipe which is scratched or scored to a depth greater than 1mm. Inspect each joint seal for flaws before making the joint.

Reinstate witness marks on the unmarked length of any cut pipes. Do not score pipes when reinstating the witness mark.

Whenever possible commence laying at the downstream end. Lay the pipes with their sockets at the upstream end and their barrels firmly and evenly embedded on the bedding material. Form holes in the bedding to accommodate the pipe sockets or couplings to allow even bearing along the full length of the pipe barrel.

Restrain pipes already laid before the next joint is made to prevent movement of the pipe. Prevent flotation of pipes during laying, backfilling and initial testing.

Lay the pipeline on continuously rising grades between design low and high points. Make gradual changes in alignment or grade by deflecting at flexible joints after the joints have been made. Comply with the manufacturer's recommendations in respect of maximum deflection for each joint provided that no joint is deflected to such an extent as to impair its effectiveness.

When jointing UPVC pipes to ductile iron pipes and fittings, do not joint a ductile iron spigot to a UPVC socket.

At the end of each day's laying, seal the end of the pipe to prevent ingress of trench material or water. Do not leave tools in the pipe overnight.

9.3 Pipe Laying Tolerance

Construct pipelines to the following tolerances:

- (e) Horizontal departure from the design position of any point on the pipeline shall not exceed 50 mm.
- (f) Departure from the design level of any point on the pipeline shall not exceed 30 mm.
- (g) Unless stated otherwise, the depth from final ground surface level to the top of the pipe shall have or exceed the minimum cover stated on Standard Drawing SCP-1000.
- (h) All pipes in a length between design high and low points to have a continuously rising grade towards the high point

9.4 Pressure Main Thrust and Anchor Blocks

Provide concrete thrust / anchor blocks at all valves, flexibly jointed bends, tees, enlargers and reducers or any other point where unbalanced forces resulting from internal pressures will occur.

The thrust / anchor blocks shall bear against undisturbed material normal to the direction of the thrust over the specified bearing area.

Cure concrete thrust and anchor blocks for a minimum of seven (7) days before subjecting to any thrust load.

Provide temporary anchorage adequate to restrain the pipe when under test.

9.5 Trench Stops

Construct trench stops at the locations shown on the Drawings and in accordance with Standard Drawing WCP-203.

Seal the bags in such a manner as to prevent ingress of water or leakage of the contained material.

9.6 Bulkheads

Construct concrete bulkheads in accordance with Standard Drawing WCP-203 where shown on the Drawings and at road crossings under each kerb and gutter or at each road shoulder. Take care to avoid deformation of the pipe during concrete placement.

Concrete bulkheads may be used as an alternative to trench stops on mains of grade greater than 10%.

9.7 Corrosion Protection of Ductile and Cast Iron

Sleeve buried ductile and cast iron items polyethylene fixed with PVC tape. Install sleeving in accordance with AS 3681. Do not allow the polyethylene to be exposed to ultra-violet light for more than seven (7) days.

Sleeving may be omitted for items which have a thermal bonded external coating complying with Section SP30 of WS-Spec.

9.8 Flanged Joints

Select bolting in accordance with AS 4087 Appendix C.

Assemble flanged joints in accordance with AS 4087 Appendix D and the following requirements.

Fit 3 mm thick insertion rubber gaskets to all flanged joints except where 'O' rings are fitted.

Use washers under all nuts. In addition, use washers under bolt heads for connection to items with protective coatings.

Where dissimilar metals would otherwise be in contact, supply and install high strength phenolic insulating washers and sleeves to all connections.

Coat all nuts and bolts, except Grade 316 stainless steel, on all flanged joints with Denso 300 Primer and 400 Mastic/440 Cord, then wrap the entire joint in Denso 600 Tape (double thickness) and over wrap with Denso 931 Overwrap (minimum 55% overlap), all in accordance with the Manufacturer's recommendations.

Apply "Loctite" nickel anti seize thread lubricant or equivalent to all stainless steel fasteners prior to fitting nuts.

9.9 Metal Detector Tape

For UPVC rising mains, lay metal detector tapes -"Terratape Sentry Line Detectable 620", on top of the pipe embedment material before backfilling. At valves and other surface fittings connect the tape to the metal surface fitting.

9.10 Air Release Valves, Stop Valves, Scours and Surface Boxes

Do not construct any valve, scour chamber or surface fitting in a roadway, driveway, paved area or any other area the Corporation considers may restrict access for maintenance purposes or may endanger the pipeline when in service, unless written approval has been given by the Corporation.

Use stop valves and scour tees with the same nominal diameter as the through rising main unless shown otherwise on the project drawings.

9.11 Bored Pipes Under Roads, Driveways and elsewhere

Construct bored pipelines under roads, driveways, footpaths and elsewhere to Standard Drawing SCP-1007.

For roads and lengths greater than 5.0 metres use an encasing pipe of sufficient strength to withstand all expected loading conditions.

Fully cement grout the annulus between the encasing pipe and the rising main commencing from the downhill end of the bore. Use a stable grout mix of water/cement ratio 1 to 0.67 by weight with fine well rounded sand added to the grout mix at a ratio of 100 kg sand for every 100 kg of cement. Adjust the consistency of the mix by the addition of a superplasticizer such as "Daracem 100". Ensure full penetration and complete filling of the void.

9.12 Marker Plates

Provide 250 mm x 80 mm x 1.5 mm thick aluminium marker plates bearing red reflectorised lettering "SGE AV" for air valves, "SGE SV " for stop valves and "SGE Sc V" for scour valves opposite and facing each surface fitting.

Where the distance from any existing wall, fence or post to which the marker plate could be conveniently fixed is greater than 10 metres, provide and set firmly in the ground a 100 x 100 x 1600 mm hardwood post. The top of the post is to be 1000 mm minimum above finished surface level. Below ground, apply two coats of tar paint or hot applied tar to the post. Above ground, prime the post and then paint with two (2) coats of white exterior enamel. Drive the posts 600 mm into the ground. In rock set the posts in a 200 mm diameter hole filled with Grade 20 concrete to a minimum depth of 300 mm.

Mark distances to the surface fitting, on the marker plate accurate to a tolerance of 100 mm when measured from the centreline of the surface fitting with 12 mm high die stamps.

Additionally mark surface fittings by stencilling 100 mm high letters on the adjacent kerb using yellow road marking paint.

9.13 Abandoned Surface Fittings and Marker Plates

Remove and dispose of all abandoned surface fittings and marker plates.

9.14 Corrosion Protection of Educt Vent Stack

Following fabrication, hot dip galvanise the vent stack in accordance with AS 1650. Do not weld after galvanising.

Prior to galvanising, clean the vent stack surface of all dirt, weld spatter, grease, slag, oil, paint or other deleterious matter and chemically descale in accordance with AS 1627 Part 5, or abrasive blast clean in accordance with AS 1627 Part 4 to Class 3 standard.

The zinc coating shall consist of a uniform layer of commercially pure zinc free from abrasion, cracks, blisters, chemical spots or other imperfections and shall adhere firmly to the surface of the steel. The thickness of zinc coating shall not be less than 100 microns at any point.

Any surface damage to the galvanising shall be shot or grit blasted clean and given two coats of Amercoat No 62 primer. Apply the second coat after the first coat is touch dry and within twenty-four hours of application of the first coat.

Where site welding of galvanised steelwork has been approved, the resulting weldment is to be chipped and cleaned to bare metal and painted with Galment zinc enriched paint.

Subsequent to galvanising, powder coat the educt vent stack to the following specification:-

- (a) Apply a conversion coating of iron phosphate, through a three stage pretreatment, as follows:-
 - (i) Combined iron phosphate/cleaner.
 - (ii) Fresh water rinse.
 - (iii) Acidulated rinse.
- (b) Ensure the removal of all moisture prior to powder coating, by passing the conveyorised metal through a drying oven.

- (c) Apply, in accordance with the manufacturers recommendations, a cured oxysalt PR23 Polyester powder of Hawthorne Green colour by electrostatic spray to a minimum thickness of 50 microns, and cured at temperatures recommended by the powder manufacturer.

Supply and install a bird proof cowling manufactured of powder coated (Hawthorn Green) galvanised steel mesh to each vent stack.

10. BACKFILLING

Provide and install side-support, overlay and trenchfilling to pipelines of the type shown on the Drawings and in accordance with Standard Drawing SCP-1000, and/or SCP-1001 as appropriate. Place backfill evenly on either side of pipelines to prevent uneven lateral loading.

Backfill containing boulders, large rocks, logs, stumps, tree loppings, builders refuse, broken concrete and other like material is expressly forbidden.

Keep all dewatering systems operating during backfilling so that no fill material is placed or compacted under water. At all times ensure that the pipes are not damaged or moved during placement and compaction of fill.

Place and compact pipe embedment in layers not greater than 150mm thick and trench fill in layers not greater than 300mm thick, except in roadways use layers not greater than 100mm thick. Compact to the degree noted on Standard Drawing SCP-1000.

Compact fill material by manual or mechanical tampers. Compact non-granular fill at a moisture content within plus or minus 2% of optimum and granular fill at a moisture content within plus or minus 3% of optimum. Flooding of the fill is not permitted.

11. RESTORATION

11.1 General

Restore as near as practicable to their pre-existing condition, all surfaces, services and/or improvements disturbed, destroyed, removed or damaged during construction of the Works and during installation of temporary works such as access roads. Improvements shall be deemed to include trees and shrubs, mulched areas, gardens, paving, flagging, proprietary finished areas such as 'pebble crete' and the like, retaining walls, fences and all other structures.

When necessary for the restoration of surfaces, stockpile existing topsoil separately and replace it over the areas where it was previously located when completing backfilling operations. Where there is a shortfall of existing topsoil use approved imported topsoil.

11.2 Timing of Restoration

Undertake restoration to surfaces, services and improvements progressively as the work proceeds. At all times ensure that services are maintained. Complete restoration and repair work within five calendar days after completion of backfilling of each section of the Works unless specifically stated otherwise elsewhere.

Undertake any maintenance of the restoration within two calendar days of the need for such maintenance becoming apparent.

11.3 Pavements

Immediately after backfilling of a trench excavated through a pavement, temporarily restore the surface and maintain it in a trafficable condition until final restoration is completed. Where the original pavement was bitumen or asphalt use a pre-mixed asphaltic material for the temporary

restoration. Otherwise use crushed metal or gravel. Complete final restoration of pavements within one month of temporary restoration.

11.4 Turf

Restore areas of established well maintained lawns to the full limits of the disturbed area with approved imported turf. Restoration using sods removed prior to construction will only be approved if the sods are of equivalent standard to imported turf. Also use turf to restore areas where there is significant risk of erosion such as on steep or long slopes.

Following backfilling and initial settlement spread and grade topsoil to achieve a smooth surface free from lumps, stones or other debris and blending into the levels and shapes of the adjoining undisturbed ground allowing for the turf. Mix an approved fertiliser of N:P:K ratio of 10:4:6 (equivalent to "Mulitgro") into the topsoil at a rate of 40g/m².

Lay the turf without gaps on the prepared topsoil surface and lightly top dress and compact. Water regularly until regrowth is established.

11.5 Grassed Areas

For grassed areas not requiring restoration with turf, restore by replacing the pre-existing topsoil or approved imported topsoil, to a minimum thickness of 50 mm. Seed the affected area with grass seeds of the varieties prevalent in the immediate area. Water and maintain the disturbed area until regrowth is established.

If regrowth fails to occur within six weeks of restoration, reseed and maintain until regrowth is established.

11.6 Trees

Where Council or private landowners require replacement trees to be planted, provide suitable trees. Where such replacement trees will be adjacent to a sewer, provide trees suitable for planting adjacent to the sewer as detailed in Hunter Water Corporation's publication entitled "Tree Roots".

11.7 Provision for Settlement

Make good any settlement of the trench during the Defects Liability Period by placing additional approved fill such that the finished surface level conforms with the adjacent surface.

For trenches through other than pavements, turf areas, grassed areas or other improved surfaces, backfill may be placed sufficiently high to compensate for expected settlement unless it would create a hazard or inconvenience to the public. At the end of the Defects Liability Period, trim back such excess material to conform with the adjacent surface and dispose of the surplus.

11.8 Tunnelling

Where tunnelling has been used in lieu of trenching to avoid improved surfaces, backfill such as to restore full support to the surface. Repair any damage to the improved surface which occurs at anytime due to subsidence of the backfill.

11.9 Maintenance of Restored Surfaces

Maintain all restored surfaces and improvements in a satisfactory condition until expiry of the Defects Liability period notwithstanding that any deterioration, and the need for their maintenance, may or may not be due to defects which become apparent or arise from events which occur during that period.

11.10 Certification

Submit certificates issued by the relevant public authorities certifying that all roads, footpaths and surfaces in public places under their control have been satisfactorily restored. Notwithstanding any other provision, the Defects Liability Period shall not be completed until such certification is submitted unless it is agreed that the public authority has unreasonably withheld issue of the certificate. The issue of such certificates shall not relieve any responsibility for any defect.

12. CONNECTION TO EXISTING SEWERAGE SYSTEM

Only undertake connection to existing live sewerage system on completion of all other Works. Give written notice, including full details of the proposed connection procedures, 10 working days prior to making the connection and comply with any directions regarding the method and timing of the connection which are necessary to meet operational needs of the existing sewer system.

Perform the connection on the approved date and at the approved time. Do not commence the connection work unless all necessary materials and equipment are available on site. Undertake all work so as to minimise interruption to the operation of the existing sewer system and to prevent overflow of sewage. Escape of sewage from the live system shall not be tolerated. If necessary pump sewage around the point of connection.

13. TESTING

13.1 General

Testing may be done progressively, but must be no earlier than 7 days after completion of the section to be tested. Give 48 hours notice before commencement of testing.

Submit written records of all test results as soon as possible after the test is performed.

If any test produces an unsatisfactory result, locate and repair the fault and then re-test. Continue to repair and re-test until a satisfactory test result is obtained. Even if testing produces satisfactory test results, repair any structure, pipeline or conduit in which there is a visible or detectable leak or blockage.

13.2 Hydrostatic Pressure Test

13.2.1 General

Perform hydrostatic pressure testing of all lengths of pipeline constructed. Ensure that pipes are clean before any test is performed. Do not pressure test during wet weather.

13.2.2 Test Pressure

The hydrostatic test pressure is taken as the design pressure and shall not exceed this by more than 25%.

13.2.3 Allowable Loss Rate

The maximum loss rate is given by;

$$(0.14 \times N \times L \times H) / 1000 \text{ (litres per hour)}$$

where: N = nominal size of pipe (mm)

L = length of pipeline under test (km)

H = average value of test pressure (m)

13.2.4 Test Procedures

Testing is to be carried out using a testing rig which has two calibrated pressure gauges. Use pressure gauges which have been calibrated within three months of the testing. Both gauges must read within 5% of the test head and 5% of each other. Use the gauge reading the lower for the readings. Before testing a pipeline section, it should be cleaned and then slowly filled with water, ensuring that air has been completely expelled.

Perform testing as follows:

- (a) Pressurise the line to 75% of the test pressure and leave for a minimum of twelve hours.
- (b) Provided there is no obvious leak in the pipeline, steadily raise the pressure in the pipeline until the specified test pressure is reached.
- (c) Maintain this pressure for a minimum of four hours. Measure and record, at half hour intervals, the quantity of water added in order to maintain the pressure during the period of testing.
- (d) During the pressure testing of the pipeline, ensure each valve sustains at least once the full test pressure on one side of the valve closed position with no pressure on the other side for at least fifteen (15) minutes.
- (e) Visually inspect the line for leaks. If a leak is suspected but is not visible use aural or electronic assistance.

13.2.5 Satisfactory Pressure Test

The pressure testing on a section of pipe is deemed to be satisfactory if:

- (f) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component.
- (g) There is no visible leakage; and
- (h) The average measured leakage rate during the last four hours of the pressure testing does not exceed the maximum loss rate as determined in accordance with clause "Allowable Loss Rate".

[END OF STS403]