

Schedule B to Subdivision Water Regulation Bylaw

**KEMP LAKE WATERWORKS DISTRICT
DESIGN STANDARDS, ENGINEERING SPECIFICATIONS
AND
STANDARD DRAWINGS**

Date Issued: June 15, 1998

Revised to: November 15, 2004

REVISIONS

All persons using these Specifications are advised to contact the offices of the Kemp Lake Waterworks District to ensure that all Specifications are current.

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Revision Date	Revision
May 18, 1999	Appendix A, Page 2: Service Saddles
July 5, 1999	19 mm domestic services changed to 25 mm
April 26, 2000	Warranty security changed to 10%
September 19, 2002	Storz Quick Connect nozzles required on fire hydrants
November 15, 2004	Specification A – 2: 2.05 Liability: New section added 2.06 Qualification: New section added 2.07 New 5.01 and 5.03: Revised to submission of “four” copies 6.04 New 8.02 Revised
	Specification B – 2: 4.01 a): Correct typo error (comer = corner)
	Specification W – 1: 3.02: 19 mm changed to 25 mm 5.10 and 6.11: Text added
	Specification W – 2: 2.04 and 2.06: Reference to 19 mm deleted 2.10: Text added/revised Former 2.11: Deleted Current 2.11: New 4.01: Text added 4.02: Deleted
	List of Standard Drawings: 2800-5: Revised to 2800-5A and 2800-5B
	Drawings revised: 2800-1, 2800-2, 2800-4, 2800-5A, 2800-5B, 2800-10, 2800-11

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**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION A – 1**

GENERAL INTRODUCTION

1.0 Scope

- 1.01** The attached specifications shall apply to the design and installation of services within the area served by the KEMP LAKE WATERWORKS DISTRICT. They apply to the design and installation of water mains, together with their respective connections and appurtenances and any other associated works such as pump houses, reservoirs, vaults, etc. which are required to be designed and/or installed.
- 1.02** These specifications are applicable unless superseded by a more recently issued specification.
- 1.03** The District’s Standard Drawings shall form an integral part of these specifications and shall apply throughout.

2.0 General

- 2.01** The following specifications and conditions shall apply to all or any of the respective services:
 - Specification A: 1 – General introduction and specific exceptions to The Kemp Lake Waterworks District Specifications.
 - 2 – The Kemp Lake Waterworks District Water Main Connection/Extension Procedures and Policy.
 - Specification B: 1 – Preparation of Design Drawings
 - 2 – Preparation of “As Constructed” Drawings
 - Specification W: 1 – Design of Water Mains and Water Services
 - 2 – Installation of Water Mains and Water Services
 - Specification T: 1 – Water Utility Excavation, Backfill and Clean Up
- 2.02** All services shall be designed and installed as detailed in the specifications and according to the procedures set out in this specification.
- 2.03** Where strict compliance with these specifications is impractical or unreasonable, the Trustee of the Kemp Lake Waterworks District may permit a minor variance to the specifications provided prior approval is obtained. Once approved a record of these changes shall be sent to the District.

3.0 Definitions - The following Definitions shall apply to all Agreement Documents.

3.01 The Agreement

The Agreement means the Water Main Connection/Extension Agreement. Unless otherwise specified, the law of British Columbia shall govern the Agreement.

3.02 Water Connection/Extension Agreement

The Agreement Documents form the Water Main Connection/Extension Agreement. This Agreement is the undertaking by the parties to perform their respective duties, responsibilities and obligations as prescribed in the Agreement Documents and represents the entire agreement between the parties. The Agreement supersedes all prior negotiations, representations or agreements, either written or oral. The Agreement may be amended only as agreed upon between the parties.

3.03 Agreement Documents

The Agreement Documents consist of the executed Water Main Connection/Extension Agreement between the Kemp Lake Waterworks District and the Owner, the Kemp Lake Waterworks District's Definitions, Procedures and Policies, Engineering Specifications, Standard Drawings, Warranty Agreement and such other documents including amendments as agreed upon between the parties.

3.04 District

The term District means the Kemp Lake Waterworks District or its authorized agent or representative as designated to the Owner in writing.

3.05 Owner

The Owner is the person, firm or corporation identified as such in the Water Main Connection/Extension Agreement and is referred to throughout the Agreement Documents as if singular in number and masculine in gender. The term Owner means the Owner or his authorized agent or representative as designated to the Kemp Lake Waterworks District in writing but does not include the Consulting Engineer or Contractor.

3.06 Applicant

The Applicant is the person, firm or corporation identified as such in the Agreement Documents and is referred to as if singular in number and masculine in gender. The term Applicant means the Owner or his authorized agent or representative as designated to the Kemp Lake Waterworks District in writing but does not include the Consulting Engineer or Contractor.

3.07 Consulting Engineer

The Consulting Engineer is the person, firm or corporation identified as such in the Agreement Documents and is an Engineer or holder of a limited license, licensed to practice in the Province of British Columbia, and is referred to throughout the Agreement Documents as if singular in number and masculine in gender.

3.08 Contractor

The Contractor is the person, firm or corporation identified as such in the Agreement Documents and is referred to as if singular in number and masculine in gender. The term Contractor means the Contractor or his authorized representative as designated to either the Owner or the Kemp Lake Waterworks District in writing, which shall undertake the installation of the waterworks on behalf of either the Owner or the Kemp Lake Waterworks District.

3.09 Engineer Client Agreement

The Engineer Client Agreement is the agreement entered into by the Owner and a Consulting Engineer wherein the Owner engages the professional services of the Consulting Engineer to provide the level of engineering service required by the Agreement Documents for the design and construction supervision of the waterworks.

3.10 Waterworks

The Waterworks means the total construction and related services required by the Agreement Documents.

3.11 Work

The Work means the total construction and related services required by the Agreement Documents.

3.12 Trustee of the Kemp Lake Waterworks District

The Trustee of the Kemp Lake Waterworks District is the official in charge of the Kemp Lake Waterworks District and is referred to throughout the Agreement Documents as if masculine in gender. The term Trustee of the Kemp Lake Waterworks District means the Trustee of the Kemp Lake Waterworks District or any employee, agent or representative authorized to act on his behalf.

3.13 Waterworks Inspector

The Waterworks Inspector is a person either employed or engaged by the Kemp Lake Waterworks District and is referred to throughout the Agreement Documents as if masculine in gender. The term Waterworks Inspector means the District representative or Consulting Engineer approved by the Trustee of the Kemp Lake Waterworks District who shall make such inspections and tests as he considers necessary, of any work being carried out under the Agreement Documents and shall coordinate works being carried out within the areas served by the District.

3.14 Authority Having Jurisdiction

The Authority Having Jurisdiction means that public body with powers to enforce statutes, regulations, codes and by-laws, and to issue consents, approvals, licenses and permits, in a given area, all as applicable and necessary to the design and construction of the works.

3.15 Prepayment Of The Estimated Costs

Prepayment Of The Estimated Costs means the deposit to be made by the Owner to the District in the form of cash, certified cheque and/or Irrevocable Letter of Credit equal to 100 percent of the estimated amount of the cost of installing and paying for the waterworks required by the Agreement Documents.

3.16 Design Drawings

The term Design Drawings means those drawings prepared in accordance with the Agreement Documents which are a detailed, illustrative description of the work to be constructed.

3.17 Preliminary Design Drawings

The term Preliminary Design Drawings means those Design Drawings that show the location and layout of the works and contain sufficient detail to enable the project to be reviewed by the Kemp Lake Waterworks District and other authorities having jurisdiction.

3.18 Design Approval

The term Design Approval means those Design Drawings that have been given final approval by the Kemp Lake Waterworks District.

3.19 “As Constructed” Drawings

The term “As Constructed” Drawings means those Design Drawings which have been revised to reflect any changes in design that were incorporated into the actual construction of the works.

**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION A – 2**

WATER MAIN CONNECTION/EXTENSION PROCEDURES AND POLICY

1.0 Introduction

1.01 This section contains Water Main Connection/Extension Procedures and Policy that apply to the Kemp Lake Waterworks District.

2.0 General Information and Policies

2.01 The extension and upgrading of water distribution systems in the Kemp Lake Waterworks District to serve new customers or new development is the responsibility of the District, but the entire cost of works and services is at the Applicant's expense.

2.02 Consulting Engineers engaged by the Applicant and in accordance with these specifications shall carry out topographical surveys, design and preparation of drawings for waterworks.

2.03 General Provisions

- a) The estimated costs of waterworks extensions shall be based upon compliance with these specifications and the requirements of other regulatory authorities having jurisdiction.
- b) The District may charge builders or subdividers in or of unserved areas the full cost, in advance, for extensions and the servicing of the unserved area, plus a reasonable portion of replacing or enlarging any existing works (including pipelines, pumping plants, reservoirs and control systems) which will serve the area, and if there are no pipelines to the subdivision, the subdivider shall pay for one large enough to supply the subdivision.
- c) The District will only assume ownership and responsibility to operate and maintain water distribution works that comply with these specifications and are located along publicly gazetted roads, through right-of-ways or easements held in the District's name, or on property owned outright by the District.

2.04 Responsibility for Material

- a) Responsibility for Material Furnished by Contractor

The contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labour required for the replacement of installed materials.

The District shall approve all materials furnished by the Contractor before being incorporated into the works. A list of approved construction materials is contained in Appendix A.

b) Responsibility for Material Furnished by District

The Contractor's responsibility for material furnished by the District shall begin at the point of delivery thereof to said Contractor. Materials already on the site shall become the Contractor's responsibility on the day work commences.

c) Responsibility for Safe Storage

The Contractor shall be responsible for the safe storage of material furnished by or to him, and accepted by him, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

2.05 Liability

The Contractor shall protect himself and indemnify and save the District harmless from any and all claims which arise from the Contractor's operations where bodily injury, death, or property damage is caused and for this purpose shall, without restricting the generality of the foregoing, maintain insurance acceptable to the District to the limits set forth as follows:

- a) Contractor's Public Liability and Property Damage
 - i) Bodily Injury – Inclusive limits not less than \$2,000,000
 - ii) Property Damage – Each Accident \$2,000,000

- b) Vehicle Public Liability and Property Damage
 - i) Bodily Injury – Inclusive limits not less than \$2,000,000
 - ii) Property Damage – Inclusive limits not less than \$2,000,000

The District shall be named as an additional insured on the Contractor's public liability and property damage policy, and shall be provided with thirty (30) days notice in writing should a policy be cancelled or changed.

The Contractor shall maintain general liability insurance covering premises and operations liability, contractor's contingency liability with respect to the operations of subcontractors, completed operations liability, contractual liability and automobile liability insurance (owner, non-owned, or hired units).

The Contractor shall furnish acceptable evidence of compliance with all requirements of the applicable Workers' Compensation Act or Ordinance of the Province including payment due thereunder.

All liability insurance policies shall be written in such terms as will fully protect the Contractor notwithstanding his assumption of liability and his indemnification covenants.

Prior to commencement of any work hereunder, the Contractor may be required to file with the District a copy of each insurance policy and certificate required. All such insurance shall be maintained until final completion of the work including the making good of faulty work or materials except that coverage of completed operations liability shall in any event be maintained for twelve (12) months from date of acceptance as approved by the Engineer.

2.06 Qualification

The required works and services must be installed by a Contractor qualified to carry out the particular type of work required. The Engineer may request the Contractor's previous experience on similar projects and reserves the right to disqualify a Contractor should the Contractor be unqualified.

- 2.07** For any works within an existing public right-of-way undertaken by anyone other than the District, a performance bond in the amount of 150% of the estimated construction cost of all works within any public right-of-way must be posted with the District. Bonding shall either be in the form of a cash deposit, certified cheque, or letter of credit. The performance bond will be released upon the District's notice of substantial completion of the bonded works.

3.0 Right-of-Way or Easement Documents

- 3.01** The Applicant shall have all right-of-way documents prepared for waterworks where the District will assume responsibility for maintenance. Where a single right-of-way is required, the minimum acceptable width is 6.0 m.
- 3.02** Rights-of-way shall be located within a single property adjacent and parallel to property boundaries and shall be clear of proposed building sites.
- 3.03** The Applicant shall provide rights-of-way for the eventual extension of the water main as required by the Trustee of the Kemp Lake Waterworks District.

4.0 Engineering Supervision

- 4.01** The Consulting Engineer shall be responsible for the layout, construction, inspection and approval of all services that are the responsibility of the Applicant.
- 4.02** Engineering review on work carried out by the Contractor shall include sufficient inspection to ensure that the works and services are constructed in general accordance with the approved design drawings and specifications. If requested by the District, the Consulting Engineer shall submit copies of his inspection reports to the District.
- 4.03** In addition to the Consulting Engineer carrying out construction review, the District shall bring to the attention of the Contractor and the Consulting Engineer the use of unacceptable materials or practices. If remedial action is not taken to the satisfaction of the District, the waterworks will not be accepted.
- 4.04** If the Consulting Engineer wishes to make any changes in approved design either before or during the execution of the work, he shall first submit a marked print showing proposed revisions to the District's office. If approval is granted for revision, the original drawing shall be immediately revised, signed by the Trustee of the Kemp Lake Waterworks District and new prints issued.
- 4.05** The attention of the Consulting Engineer is directed to the safety regulations of the Workers' Compensation Board (WCB) of British Columbia.

As all District employees or their agents have been instructed to enter only those excavations which meet the requirements of WCB regulations, no approval will be given to installations which cannot be inspected because of unsafe working conditions.

5.0 Circulation and Approval of Design Drawings

- 5.01** The Consulting Engineer shall prepare Preliminary Design Drawings and upon completion, submit four copies of same to the District for review and comment.
- 5.02** After review by the District, a marked set of drawings showing comments will be returned to the Consulting Engineer for revisions to the design drawings.
- 5.03** When all items have been corrected the Consulting Engineer shall submit four copies of the revised Design Drawings to the District for final approval.
- 5.04** A letter of confirmation that an Engineer Client agreement is in force must be received prior to design approval. The Engineer Client Agreement must provide for the level of engineering service required in this specification. A copy of such a letter shall be supplied to the Trustee of the Kemp Lake Waterworks District.
- 5.05** Any right-of-way outside of the proposed subdivision plan must be obtained and registered by the Applicant prior to Design Approval. See section 3.0 of this specification for right-of-way preparation procedure.
- 5.06** Where authorization, approval and/or permits are required from municipalities, senior governments and other authorities having jurisdiction, it is the Applicant's responsibility to obtain these. Developments adjacent to, affected by or affecting the following will require plans to be submitted to the appropriate municipal/non-municipal authority:

Capital Regional District.
Municipality having jurisdiction.
Ministry of Transportation and Highways.
Fire District having jurisdiction.
Ministry of Health - Public Health Engineer.
B.C. Hydro, B.C. Telephone, Centra Gas, Railway, right-of-ways.
Main water courses.
Drain Outfalls.

The above approvals are required prior to design approval.

6.0 Service Installation

- 6.01** The following steps shall be carried out prior to start of construction of the waterworks:
- a) Design drawings must have approval of the District.
 - b) The Consulting Engineer shall make arrangements to inspect the site of the work in the company of a District representative 24 hours prior to the start of construction.

If work proceeds without approved inspections, the District will require the works to be exposed for an inspection prior to acceptance.
 - c) All necessary permits and approvals must be obtained from the authority having jurisdiction before work proceeds.

6.02 A copy of the approved Design Drawing and the Kemp Lake Waterworks District Specifications and Standard Drawings shall be maintained by the Contractor at the construction site during the installation of all waterworks. A clean set of drawings shall be kept for marking all “As Constructed” details and shall be submitted to the District upon completion of the work.

6.03 Waterworks and services shall not be permitted to operate as part of the District’s distribution system until the waterworks and services have been inspected, tested, disinfected and approved in writing by the District.

6.04 The cost of providing any temporary connection to an existing water system for the purpose of supplying water for testing of a newly installed system is the responsibility of the applicant. All connections to an existing water pipe are to be undertaken by the District.

7.0 Submission of As-Constructed Drawings

7.01 Prior to final approval being awarded by the District, the Contractor is to submit to the District a marked-up set of drawings showing the location of all installed works. Drawings are to be clean and dimensions and notations are to be legible. Refer to specification B-2 for preparation of As-Constructed drawings.

8.0 District Acceptance of Works and Services

8.01 Upon the authorization of the District and after the receipt of satisfactory as-constructed drawings, warranty security and the acceptance of the required works, any relevant deposits guaranteeing the satisfactory installation of the works shall be returned to the Applicant.

8.02 Warranty security shall be held by the District in the form of an Irrevocable Letter of Credit or cash deposit for the one (1) year period of warranty for all services commencing from the date of transfer of works to the KLWD. The security shall be in the amount:

- 20% of the contract price or Engineer’s estimate (whichever is greater) for price or estimate of \$10,000 or greater
- \$2,000 for any contract price or Engineer’s estimate (whichever is greater) for price or estimate of less than \$10,000 but greater than \$2,000
- the contract price or Engineer’s estimate (whichever is greater) for price or estimate of \$2,000 or less

8.03 The District may release a portion of any deposit for work requiring an extended period of construction provided that:

- a) The Consulting Engineer certifies in writing the extent and value of work completed, as well as itemizing the outstanding work and cost of same (including outstanding engineering fees for the submission of “As Constructed” drawings if applicable), and that the completed works meet the specifications of the District.
- b) Verification is obtained from the District that the work to date is acceptable.

Monthly payments may be released according to the following schedule:

- c) If the total estimated value of construction is \$10,000.00 or less, no releases will be permitted until completion of the work.
- d) If the total estimated value of construction is greater than \$10,000.00, up to 75 % of the value of the work performed may be released.

8.04 The District will not accept the works until “As Constructed” drawings have been provided and approved. The period of the Warranty will begin on the date the “As Constructed” drawings are approved by the District. The District will retain any remaining deposits until the Warranty begins.

9.0 Warranty of Works and Services

9.01 The Owner/Applicant shall be responsible for and at his own expense execute all work, repair, alteration, reconstruction or replacement required to remedy any defect, fault or deficiency in or developing in the completed work not only up to the receipt and approval of the Consulting Engineer’s “As Constructed” drawing but also during the period of warranty of twelve (12) months after the date of approval of each “As Constructed” drawing.

9.02 In the event repairs are required which necessitate the interruption of service to any customer and/or the draining of any main, the District reserves the right to perform the work and charge the costs to the Owner/Applicant.

9.03 All such works of rectification, repair and warranty shall be executed upon the written request of the District. Should the Applicant neglect or fail to commence the execution of such works within the time period given by the District, the District shall complete the remedial works according to the terms of the Warranty Agreement.

9.04 Final Acceptance by the District

- a) The District shall inspect the works prior to the expiration of the warranty period. Any deficiencies shall be corrected as noted above prior to release of the Warranty deposit.
- b) If rectification or repair does not take place within the time allowed by the District, the District shall complete the remedial works according to the terms of the Warranty Agreement.
- c) If no deficiencies have developed during the warranty period, the Warranty deposit shall be released.

10.0 Testing

10.01 The Contractor under supervision and direction from the Consulting Engineer, shall disinfect newly installed water main and fittings after the Contractor has carried out a satisfactory leakage test.

10.02 The Consulting Engineer shall, at his discretion, arrange for periodic compaction testing within the trench where trenches are over one meter deep. Test results shall be submitted to the District.

10.03 The Contractor under supervision and direction from the Consulting Engineer, shall flush and then obtain samples from the newly installed water main, and have these samples subject to a coliform test by a qualified testing laboratory. Coliform test results are to meet or exceed Guidelines for Canadian Drinking Water Quality, and are to be approved and passed by the Consulting Engineer.

11.0 Payment

11.01 Payment of costs shall be as follows:

- a) Work that is to be carried out by District forces is subject to Prepayment of the estimated costs. Six weeks must be allowed after payment for preparation of plans, work orders and scheduling of the work.
- b) Where work is to be carried out by the owner, with materials being supplied by the District, prepayment for the estimated costs of materials must be made to the District.

**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION B – 1**

PREPARATION OF DESIGN DRAWINGS

1.0 Scope

1.01 This specification shall govern the preparation of all engineering drawings for design of services within the District.

2.0 General

2.01 Any information received from the District on existing services shall be used as a guide only. Verification of locations and elevations must be checked by actual survey. The District takes no responsibility for the exactness of service information obtained from plates and drawings. Confirmation of the location of underground utilities shall be the sole responsibility of the Applicant.

2.02 All existing statutory rights-of-way or easements and their permitted uses must be checked through the Land Titles Office and be shown lightly shaded on the design drawing. Registration numbers shall be shown.

2.03 All proposed rights-of-way for new services are to be shown as a dashed line. These shall be tied to the iron pin in each lot, together with their width, permitted use, and the note “acquire” or “proposed”. Right-of-way documents shall be prepared as detailed in these specifications.

2.04 A north arrow, existing and proposed street names shall be shown on the design drawing. The north shall be generally oriented towards the top of the sheet.

2.05 All services shall generally be shown on one plan using the symbol shown in brackets for the following:

(MC)	Mountable Curb	(G)	Gas
(NMC)	Non-mountable Curb	(W)	Water
(S/W)	Sidewalk	(U/G)	Underground wiring
(S)	Sewer	(H)	Hydro Pole
(D)	Drain	(T)	Telephone Pole

Other services shall be clearly designated on the drawing.

2.06 Existing water mains, sanitary sewer mains, storms drains (including all appurtenances), ditches, pavement, curbs, sidewalks, underground wiring, gas, poles, trees, service connections and other underground utilities shall be indicated in plan and profile where applicable.

2.07 All proposed utilities shall be fully dimensioned as specified herein.

3.0 Drawing Information

- 3.01** Standard sheet size is A1 metric size 594 mm x 841 mm.
- 3.02** Use transparent plan/profile paper complete with standard District title block in the lower part of the sheet. Personalized Company plan/profile paper may be used provided it can meet the following requirements:
- 1) Plan view shall be in the lower half of the page with District title block added in the lowest 50 nun of the page.
 - 2) Profile view shall be 1 x 5 lines to the centimeters and occupy the upper half of the page.
- The use of the plan on one sheet and profile on a second sheet shall not be allowed.
- 3.03** Layout dimensions shall be given from an existing or proposed iron pin or lot line.
- 3.04** Proposed construction shall be shown as dashed lines and the existing shown as solid lines.
- 3.05** Lines and printing shall be in Leroy and be of uniform size using the following weights for Lot lines #.25; Road lines #.5; Sewer, drain, water lines #.35. Construction notes shall be confined to a separate “note” column, wherever possible, with numbered references in plan or profile.
- 3.06** Road and/or water main chainage shall be tied to an iron pin from the start of construction.

4.0 Scales

Normally:	Horizontal 1:500	Vertical 1:100 or 1:50
Details: *	Horizontal 1:200	Vertical 1:20 or 1:50
Cross Sections:	Horizontal 1:100	Vertical 1:100
Structural Details:	1:20	

*e.g.: a detail of piping.



5.0 Requirements for Subdivision Key Plan

- 5.01** A key plan, when required, shall be on the right side of the design drawing and shall include the following information:
- a) Plan of adjacent streets and existing lots with streets named and legals of adjacent lots given.
 - b) Civic address with the property being subdivided shown shaded.
 - c) North arrow.
 - d) The location of existing and proposed hydrants.
 - e) Contours at 1, 2 or 5 m intervals.

- f) Title “Proposed Subdivision of (give the full legal)”.
- g) If the subdivision is to be developed in stages, each proposed stage shall be clearly outlined and order of development indicated.

5.02 If a key plan is not required, the house number of existing houses shall be shown on the detailed design plan.

6.0 Requirements for Waterworks

6.01 Drawings shall indicate whether the water main passes over or under other underground utilities which it is crossing, shown  or .

6.02 The following information shall be shown on the profile:

- a) The size, type and class of pipe, and class of bedding.
- b) For mains 200 mm and larger, profile grades to 2 decimal places.

6.03 The following information shall be shown on the plan:

- a) The offset of the main centerline from the property line.
- b) Where the short pipe lengths are required on curves, refer to District Specification W-1, section 3.09.
- c) Extent of work required of the District in making the connection to the existing water main.

7.0 Requirements for Other Utilities

7.01 Complete details of other utilities shall be obtained from the appropriate utility company.

7.02 The following information shall be shown on the plan:

- a) Existing utilities.
- b) Utility offset from property line and/or iron pin.
- c) Lot connections and other appurtenances.
- d) Existing and proposed poles shall be dimensioned from the pole road face to property line and/or pin.

7.03 Underground utilities shall be shown schematically.

**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION B – 2**

PREPARATION OF “AS CONSTRUCTED” DRAWINGS

1.0 Scope

1.01 This specification governs “As Constructed” drawings of the installed waterworks.

2.0 General

2.01 “As Constructed” drawings shall consist of one paper print of the approved design drawing with changes or corrections made as required in Section 2.02. This shall be followed after approval by a mylar of the original design drawing, revised as required to show services as constructed.

2.02 The “As Constructed” drawings shall clearly show the location of all services as installed using offsets from survey pins. The extent shall be shown by inking the constructed service in dark blue. The locations will be shown either by check-marking any original dimension on the drawing (if they are correct) or by showing the revised dimension beside the original dimension. In addition, the location to the end of underground pipe shall be shown.

2.03 Within two weeks of completion of the waterworks to be installed by the Applicant, the Consulting Engineer shall deliver “As Constructed” drawings to the District. These drawings shall include the following statement signed, sealed and dated by the Consulting Engineer:

“I certify that the following services

were reviewed during construction and were installed in general accordance with District Specifications and Standard Drawings and as shown on this drawing.”

3.0 Tolerances

Layout Dimensions

- 3.01**
- a) Record all horizontal dimensions to the nearest 150 mm;
 - b) Record all vertical elevations to the nearest 3 mm except that ground elevations and service connection inverts at property line shall be to the nearest 30 mm;
 - c) Record road horizontal locations to the nearest 30 mm.
 - d) Record road vertical locations to the nearest 15 mm.
- 3.02** All other dimensions, i.e. structures, etc. shall be recorded to the tolerances shown on the drawings and appropriate specifications.

4.0 Additional Required Details

4.01 Water

- a) Show domestic water services and reference to corner iron pin.
- b) Location of corporation stops.
- c) Location of rock cuts and maximum depth of rock excavation.
- d) Profile of main indicating numerically the invert at 15 m stations.
- e) Reference locations of fire hydrants to main valve and IP.
- f) Location of all valves and reference to iron pin.

4.02 Road, Curb and Sidewalk

- a) Location of end of curb, sidewalk and pavement.

4.03 Bridges, etc.

- a) Location of structure
- b) Elevation of deck

**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION W – 1**

DESIGN OF WATER MAINS AND WATER SERVICES

1.0 Scope

1.01 This specification shall govern the design of all water pipe and waterworks appurtenances within the Kemp Lake Waterworks District.

2.0 General

2.01 Water mains shall not be extended unless the residual pressure will be greater than 140 kPa (20 psi) at the meter box during average daily demand. If this is not adequate to serve the property, it shall be the responsibility of the property owner to provide a suitable booster pump.

2.02 Fire flows for single family residential areas shall not be less than 2000 L/m (400 Igpm) for one hour duration in addition to domestic consumption at maximum daily rate. Residual pressure shall not be less than 140 kPa (20 psi).

3.0 Location

3.01 The water main shall be located within a road allowance as approved by the authority having jurisdiction.

3.02 The water service shall be located in the road allowance fronting the lot to be serviced. If required, traffic islands with planting areas shall be provided with a 25 mm water service.

3.03 The water main shall be installed along the full frontage of the property to be developed and extended to the most convenient existing water main that will provide an adequate supply of water. The water main shall extend at least 1.25 m beyond the pavement at the extreme end of a cul-de-sac.

3.04 The water main shall not be located within 1 m of any utility pole.

3.05 Where it is necessary for the water main to cross other underground services the crossing shall be made at an angle greater than 20 degrees and the vertical clearance between services at the crossing point shall be not less than 75 mm, except as detailed in Section 3.06 below.

3.06 At any location there shall be a minimum linear horizontal clearance of 1 m between the water main and other existing or proposed underground services or open ditches, except sanitary sewers, unless an approved construction technique is employed. A minimum linear horizontal clearance of 3 m shall be maintained between the water main and a sanitary sewer with the exception that in rock or hardpan the water main may be located on a bench with continuous support and having a horizontal separation of 450 mm minimum and the invert of the water main a minimum of 450 mm above the crown of the sanitary sewer.

- a) Where a water main crosses over or under a sanitary sewer or sanitary sewer service connection with less than one (1) meter clear vertical distance between the water main and the sewer line, sufficient protection shall be provided to enable repairs of either pipe line without damage or rupture of both mains. This protection shall be provided by:
- i) using ductile iron water main at the crossing for a distance of three (3) meters both sides of the crossing or,
 - ii) by sleeving the sewer main in ductile iron pipe at the crossing for a distance of three meters both sides of the crossing or,
 - iii) providing a suitable pipe bridge between the mains or,
 - iv) by other means satisfactory to and approved in advance of construction by the District Engineer.

3.07 At all intersections the pipe shall connect to existing mains. If mains are in different pressure zones, refer to Standard Drawing No. 2800-14.

3.08 Where the final road pattern prevents the looping of the water main network, a supplementary connection of a minimum of 150 mm diameter to an existing main may be required which may necessitate the provision of a 6.0 m right-of-way in favour of the District.

3.09 For PVC pipe in 6.1 m lengths the minimum radius of curvature shall be as follows:

150 mm pipe – 70 m
200 mm pipe – 91 m

3.10 At all dead ends, provision shall be made for flushing the completed main prior to filling and testing. Provision shall also be made for expelling air during filling by the installation of double acting air valves or main cocks where necessary.

3.11 All water mains shall be installed to a designed grade to provide a minimum depth of cover of 0.9 m (3 ft.) to the top of the pipe.

4.0 Pipe Size

4.01 Water mains shall be a minimum of 150 mm diameter.

5.0 Materials

5.01 All pipe and fittings shall conform to the current CSA, AWWA, or ASTM specifications for a working pressure of 1030 kPa (150 psi). Where working pressure exceeds 1030 kPa (150 psi) pressure class of pipe and fittings shall be increased accordingly.

5.02 Ductile Iron pipe shall have a gasketed push-on joint and a cement mortar lining conforming to AWWA Standard C151. Pipe shall have cement mortar lining inside and asphalt lining outside.

- 5.03** PVC pipe shall conform to AWWA Standard 900-75 “Polyvinyl Chloride” (PVC) Pressure Pipe 150 mm through 300 mm for water. The pipe is to be minimum class 150 [Dimensional ratio (DR) of 18 maximum] with Ductile Iron outside diameter and Integral Bell Gasketed Joint. The pipe shall be supplied in 6.0 m nominal lengths.
- 5.04** 19 mm, 25 mm, 39 mm and 50 mm water service tubing shall be polyethylene tubing (Series 160 conforming to CSA B137.1) or approved alternative. Stainless steel inserts shall be used in all polyethylene tubing.
- 5.05** Main stops and service stops shall have compression type end fittings suitable for polyethylene pipe. Main stops shall have corporation threads for the saddle clamps.
- 5.06** Single broad strap stainless steel service clamps or double strap steel service clamps with corporation thread to match the main stop in 5.05 of appropriate sizes shall be provided for each proposed water service connection.
- 5.07** Gate valves up to 300 mm shall be standard, 860 kPa (125 psi) iron body, bronze mounted solid wedge or double disc, resilient seat with N.R.S. turning counter clockwise to open with 50 mm square operating nut. Resilient seat valves shall be used for valves up to 300 mm in diameter.
- 5.08** A valve box shall be provided with each gate valve and as required for other appurtenances.
- 5.09** Thread sealant shall be NSF approved.
- 5.10** Fire hydrants shall be 150 mm, Mueller A442 RH, tested for a working pressure of 1030 kPa (150 psi) and having one 122 mm pumper port and two 65 mm hose ports. The 65 mm hose ports are to be threaded to the BC Standard and provided with caps. The pumper port must be fitted with a 100 mm Storz coupling and cap. The operating nut is to be pentagonal with 25 mm sides turning clockwise to open and the port caps shall have the matching nuts. A drain valve shall be incorporated in the base of the hydrant. PVC pipe as defined in 5.03 above only shall be used between hydrant and the water main.

6.0 Fire Hydrants

- 6.01** Hydrants shall be located in the boulevard and should preferably be located at or near a street intersection; otherwise they may be located on the projection of the property line dividing two lots. The Kemp Lake Waterworks District shall determine the location where hydrants must be installed.
- 6.02** Generally a hydrant shall not be located within 3 m of a utility pole or light standard, within 1 m of underground service pipes or open ditches, or within 2.2 m of the curb line.
- 6.03** There shall be a gate valve on each fire hydrant.
- 6.04** All hydrants shall be set to finished grade in accordance with Standard Drawing No. 2800-2. All hydrants shall have a minimum depth of bury of 1.2 m (4 ft.).
- 6.05** Hydrants shall conform to AWWA C502, Dry Barrel Fire Hydrants and standards as required by the Fire Commissioner of British Columbia.
- 6.06** Hydrants shall be rated for a minimum working pressure of 1034 kPa (150 psi).

- 6.07** Only compression type hydrants shall be acceptable.
- 6.08** Inlet connections shall be for 150 mm (6") or 200 mm (8") I.D. pipe.
- 6.09** Inlet joints shall conform to AWWA C 111.
- 6.10** All joints shall fit Thickness Class 50 ductile iron pipe or Class 150 PVC, whichever material is being used.
- 6.11** For push-on joints, two lugs for 19 mm (3/4") tie rods shall be provided on the horizontal centerline of the inlet connection. Where mechanical joint restraint is not used, concrete thrust blocks shall be installed.
- 6.12** Hose port connections shall be two in number, set at 90° or 180°, and for 63.5 mm (2 1/2") hose, 8 threads for 25.4 mm (1"), maximum O.D. 76.2 mm (3"), British Columbia Standard for Hose Threads. Port connections shall not have independent valves.
- 6.13** One 123 mm (4 15/16") I.D. port connection shall be provided, have 8 threads for 25.4 mm (1"), maximum O.D. 147.6 mm (5 13/16").
- 6.14** Hydrants shall open clockwise.
- 6.15** Hydrant operating nuts and port cap nuts shall be pentagonal in shape, with 25 mm sides.
- 6.16** All hydrants shall be equipped with "Storz" Quick Connect nozzles on the pumper port.

7.0 Valves

- 7.01** Line valves shall be not more than 365 m apart. For convenience of operations, line valves should be located adjacent to a hydrant if there are no connecting mains within 120 m.
- 7.02** Line valves or hydrant valves shall not be located within 600 mm of a curb line, in a ditch, or above another service.
- 7.03** A line valve of the same diameter as the pipe, where deemed necessary by the District, shall be placed on each downstream branch of all "tee" and "cross" fittings.
- 7.04** Double acting air valves, if deemed necessary by the District, shall be installed at all high points on water mains.
- 7.05** On service connections greater than 25 mm, a valve and box shall be placed on the connection adjacent to the main.
- 7.06** Valve boxes shall be Robar Type D-9A square, or equal. The value box shall be placed so that the arrow points downstream.

8.0 Fittings

- 8.01** All fittings and appurtenances shall generally have standard hub ends (Tyton or approved equal) except where valves are attached to the fitting, in which case flanges shall be used.
- 8.02** Flush valves shall be installed at all dead ends.
- 8.03** Approved restrainers shall be used where deemed appropriate and necessary, and shall be installed in accordance with Standard Drawings No. 2800-12 and 2800-13.

9.0 Thrust Blocks

- 9.01** Thrust blocks shall be constructed in accordance with Standard Drawing No. 2800-6.
- 9.02** Can use 'Uniflange' restrainers.

10.0 Sewer Crossings

- 10.01** The purpose of this section is to clarify the KLWD requirements for sewer and water main crossings.
- 10.02** This section shall be considered to govern over conflicting clauses contained within this document.
- 10.03** A sewer main shall not be allowed to cross over a water main. This does not apply to sewer house connections or water services. or water services.
- 10.04** Where a sewer house connection crosses over a water main, the requirements of Table 10.1 shall govern.
- 10.05** Where a sewer main crosses under a water main the requirements of Table 10.2 shall govern.

Table 10.1 – Sewer HC over water main

Separation between sewer and water main	Less than 150 mm	Less than 1.0m but greater than 150 mm	Greater than 1.0 m
Crossing Requirement Based on Water Main Material	NOT PERMITTED		
DI		6	1
PVC		3 or 4 or 5	1
AC		3 or 4 or 5	1
CI		3 or 4 or 5	1
Cu		3 or 4 or 5	1
GI		3 or 4 or 5	1

Table 10.2 – Sewer under water main

Separation between sewer and water main	Less than 150 mm	Less than 1.0m but greater than 150 mm	Greater than 1.0 m
Crossing Requirement Based on Water Main Material	NOT PERMITTED		
DI		1	1
PVC		3 or 4 or 5	1
AC		2	2
CI		3 or 4 or 5	1
Cu		3 or 4 or 5	1
GI		3 or 4 or 5	1

These notes pertain only to the use of tables 10.1 and 10.2

Crossing	1.	No action required
Requirements	2.	KLWD to replace the water main with Ductile Iron water main for a distance of 3.0 meters on both sides of the sewer main. Any joint within this section shall be wrapped with Denso tape.
	3.	Protect water main in accordance with KLWD specification W-1, 3.06. The KLWD specification refers to three methods of protection, replacement of water main with DI, sleeving the sewer main in DI or providing a pipe bridge. A pipe bridge is discussed below. A pipe sleeve is the preferred option.
	4.	To construct a pipe bridge, pour a concrete slab between the pipes, a minimum of 100 mm thick, min 20 MPa comp strength, full sewer trench width, 3.0 each side of crossing. No surface of the slab shall be within 150 mm of the water main.
	5.	Install steel plates between the sewer and water main. Plates shall be a minimum of 6 mm thick and sized according to construction specifications.
	6.	Denso wrap any joint within 3.0 meters of crossing.

**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION W – 2**

INSTALLATION OF WATER MAIN AND WATER SERVICES

1.0 Scope

- 1.01** This specification shall govern the installation of all water pipe and waterworks appurtenances within the Kemp Lake Waterworks District.
- 1.02** Water services originate at the main and terminate at the meter box and shall include the saddle, the corporation stop, the polyethylene service line, the meter harness and the meter box, but excludes the meter. The District will install the meter and harness when service is required.

2.0 General

- 2.01** The installation, including jointing, shall be in accordance with the current AWWA Standards.
- 2.02** Ductile iron pipe shall be installed without joint conductance unless specifically required for corrosion protection.
- 2.03** When the water main is under construction in a trench, water and debris shall be prevented from entering openings in the water main by keeping the excavation sufficiently dewatered and also by capping or plugging such openings with watertight fittings. Pipe and fittings shall be protected from contamination during construction. At the end of each working day pipes shall be securely capped.
- 2.04** The 25 mm water service tubing shall be of one continuous piece between the main stop and curb service.
- 2.05** Existing valves shall not be opened or closed by unauthorized persons.
- 2.06** For existing 100 mm diameter pipe; 25 mm services shall be tapped a minimum 600 mm apart, (and 600 mm from a collar) and rotated a minimum of 100 mm on the circumference of the pipe. Larger services into pipes greater than 100 mm diameter shall be a minimum of 1.25 m apart. Service saddles shall be installed in all cases.
- 2.07** Where installation of other services cross under Asbestos Cement (AC) water mains, a section of the AC main shall be replaced with Ductile Iron pipe such that the full trench width is bridged by Ductile Iron. This work shall be done by District Crews at the Applicant's expense.
- 2.08** Blocking shall be installed as required. Concrete used for precast or cast in place blocks shall have a minimum 20 MPa compressive strength at 28 days.
- 2.09** The pipe shall not be backfilled until it has been inspected, approved, and the horizontal and vertical alignment recorded by the Consulting Engineer.
- 2.10** Connection of a new pipeline to an existing water main shall be done by the District. The Contractor is to notify the District when they are ready to have the water line connected to an existing water main.

2.11 Where valve boxes or fire hydrants are to be located in the gravel shoulder of a paved highway, the top of the valve box shall be installed to the grade of the gravel shoulder. A square area of minimum 2 meters x 2 meters within which the valve or hydrant is captured, shall be excavated to a depth of 50 mm and a hot or cold mix asphalt shall be placed and compacted to a final depth of 50 mm. The new asphalt area shall extend to the edge of the existing road paved surface.

3.0 Location of Mains

3.01 The main and appurtenances shall be located to within 60 mm horizontally of the position shown on the approved plan.

3.02 All pipe shall be laid to designed alignment and grade with the following tolerances:

- a) Horizontal tolerance shall not be greater than 60 mm from designed location. The rate of deviation from the required alignment shall not exceed 30 mm in 7.5 m.
- b) Vertical tolerances shall not be greater than 10 mm from designed grades on 200 mm and larger water mains.

3.03 When the water main is within the road allowance, it shall have a minimum of 1.0 m cover.

4.0 Location of Services

4.01 The curb stop in a meter box is to be located within the property frontage, 1 meter into the road SRW from the property frontage. Final meter location along property frontage to be approved by the District.

4.02 The location of the meter box at the property line shall be marked with a 50 mm x 100 mm wooden post painted blue and staked into the ground with minimum 0.5 m projecting above grade.

4.03 Water services shall be installed from the water main to the property line, using the shortest practical route.

4.04 The ditch excavation shall be deep enough to allow a minimum of 0.9 m of cover material to be placed over the water service except the curb stop which shall have 250 mm cover.

5.0 Bedding

5.01 Bedding for all water pipe shall be as detailed on Standard Drawing No. 2800-4.

6.0 Testing the System

6.01 All water service connections shall be installed prior to pressure testing of the water mains.

6.02 Pressure Test - After the pipe has been laid and backfilled or partially backfilled, all newly laid pipe and hydrants shall be subjected to a hydrostatic pressure equal to the design pressure of the pipe being used, for a 2 hour duration. Pressure tests shall be conducted in conformity with AWWA Standard C600 - 87, Section 4 or latest revision thereof.

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install main stops at such points as to allow air to expel as the line is filled. After the air is expelled, the main stops shall be closed and the test pressure applied using a pump connected to the pipe. The test pressure shall be corrected based on the elevation of the lowest point of the section under test and the elevation of the test gauge. The Contractor shall furnish the pump, pipe connection including any necessary taps, and all necessary apparatus.

- 6.03** A leakage test shall be conducted after the pressure test has been satisfactorily completed. Tests shall be done by the Contractor at his own expense and shall be performed under the direct supervision of the Consulting Engineer. The Contractor shall furnish all the necessary apparatus and furnish the necessary assistance to conduct the test. A pressure equal to the design pressure of the pipe being used shall be maintained during the test at the lowest elevation of the system being tested.

Pressure piping will not be accepted until the leakage is less than the maximum allowable leakage determined from the following formula:

$$L = \frac{ND \bar{O} P}{130,000}$$

where L = the allowable leakage in liters per hour
N = the number of joints in the test section
D = the nominal diameter of the pipe in millimeters
P = the average test pressure during the leakage test in kilopascals

A coupling collar shall count as 2 joints.

The Contractor shall, at his own expense, locate and repair defective joints until the leakage is within the specified limits.

- 6.04** Upon completion of the back filling and satisfactory test results the water system shall be flushed clean of any debris in accordance with AWWA standards.
- 6.05** Certification that pressure and leakage tests have satisfactorily passed, shall be provided to the District by the consulting Engineer.

7.0 Disinfection

- 7.01** Disinfection shall be performed by the Contractor under direct supervision by the Consulting Engineer, and shall be repeated until Regional Health specifications are achieved. Disinfection shall be done in accordance with current AWWA standards.
- 7.02** The District shall be contacted by the Contractor twenty-four (24) hours in advance of disinfection to set up a suitable time for a health sample to be taken for testing in the District's laboratory for compliance with Regional Health specifications.

**KEMP LAKE WATERWORKS DISTRICT
SPECIFICATION T – 1**

WATER UTILITY EXCAVATION, BACKFILL AND CLEAN UP

1.0 Scope

1.01 This specification shall govern the excavation, back filling and clean up for water utility trenches within the District. This relates to backfill above the pipe zone and below the finished surface.

2.0 Excavation

2.01 The trench shall be excavated to the required alignment, width, depth and grade as shown on Kemp Lake Waterworks District Standard Drawings.

2.02 Excavated material shall not be stockpiled on the roadway.

2.03 Where the maximum trench width shown on the Kemp Lake Waterworks District Standard Drawings is exceeded, reference must be made to the Consulting Engineer who shall obtain the approval of the District before further construction may continue.

2.04 If the bottom of the trench is organic or other unsuitable material, the trench shall be over excavated to firm ground and backfilled with suitable compacted material for pipe support, unless otherwise specified by the Consulting Engineer.

2.05 Trench water must be removed.

2.06 All solid rock boulders and large stones shall be removed to provide a minimum clearance of 150 mm around the pipe.

2.07 Where an existing structure or underground installation may be affected by the works, it is the responsibility of the Consulting Engineer to inform the owner of such utility sufficiently in advance to enable the owner to specify what protective measures must be taken.

3.0 Backfill

3.01 Where a pipe or conduit is installed beneath an existing or foreseeable future pavement, sidewalk, driveway or gravel shoulder, the backfill shall be pit run gravel or equal, compacted to a minimum 95% Standard Procter Density (SPD), except for the top 300 mm which shall be 100% SPD.

3.02 Suitable native materials may be used as backfill where the pipe or conduit is installed in non-traveled areas. Backfill in these cases shall be free of stones over 150 mm size, frozen material, organic, or other perishable or objectionable material that would prevent proper consolidation or which might cause subsequent settlement.

3.03 Controlled density backfill, where required, shall be used in lieu of compacted gravel backfill. Controlled density or non-shrinking fill shall be manufactured and placed in accordance with Canadian Portland Cement Association publication CPOO4.01P.

3.04 Where it is required to replace topsoil it shall occupy the upper 300 mm of the trench and shall be mounded on top to allow for settlement. If the installation is under a developed lawn, the soil shall be fine raked during the appropriate season and sown with a top quality grass seed at the rate of 50 grams of seed per square meter and shall be rolled and thoroughly watered.

4.0 Cleanup

4.01 Gravel filled trenches shall be maintained to within 25 mm of the original surface prior to final paving.

4.02 Patching cuts in existing pavement:

- a) Cuts shall be hot mix paved within 3 days of backfilling and to the same thickness as the adjacent pavement or 50 mm, whichever is thicker.
- b) If weather conditions do not permit hot-mix asphalt, cuts shall be paved within 3 days of back filling using cold-mix asphalt and replaced as weather permits.
- c) Where the excavation is on the shoulder or under the traveled portion of the street, the surface material shall be cut in neat straight lines at the edges of the trench by means of an asphalt cutting wheel, milling machine or pneumatic pavement breaker. Where the edges of any area requiring re-paving extend outside the straight line cuts, further cuts shall be made so that the final patch will have a neat appearance.
- d) Any area of pavement adjacent to the excavation that has become undermined or deformed due to excavation practices or blasting, shall be removed and re-paved as above.
- e) The pavement of cuts that have settled shall be removed; the trench shall be re-compacted and re-paved.

5.0 Testing

5.01 The Consulting Engineer shall arrange for periodic compaction testing within the trench where trenches are over 1.0 m deep. Test results shall be submitted to the District.

6.0 Final Approval

6.01 Upon completion of the work the Consulting Engineer shall notify the District and will schedule a final inspection with the District. The Contractor at his own expense shall remedy any deficiencies found in the work during the final inspection until such time that the District finds that the work has been satisfactorily completed.

APPENDIX A
KEMP LAKE WATERWORKS DISTRICT APPROVED CONSTRUCTION MATERIALS

The following list is not intended to be exhaustive, however materials not appearing in this list must have the written approval of the District prior to installation.

GATE VALVES – 75mm - 300mm Class 150 ANSI/AWWA C509-87

Must be resilient wedge design, Tyton X Tyton, Tyton X Flange, Flange X Flange, M. J. X Flange or M. J. X M. J.

Must be left hand opening, with 50.8mm (2") operating nut.

Approved Gate Valves:

- Mueller Super Seal Part # A-2370-41
- Clow
- AVK Series # 25
- Bibby Ste. Croix, Resilient Wedge Gate Valve, 100mm, 150mm, 200mm only, SS Stem and nut, Ductile Body

PIPE – 100mm - 300mm

Approved materials

- C900 PVC ANSI/AWWA C900-89
- Pressure Class 350 Ductile Iron ANSI/AWWA C151/A21.51-91

FIRE HYDRANTS

Must be right hand opening; minimum of 1219mm (4') bury depth, and have 2- 62mm (2 1/2") hose nozzles, 1 - 123mm (4 15/16" I.D., 5 13/16" O.D.) pumper port and 150mm Tyton or M. J. inlet

Approved manufacturers and models

- Mueller Modern Centurion Catalogue # A442

FLEXIBLE COUPLINGS

Approved manufacturers and models

- Robar Catalogue # 1408
 - Romac model # 501
 - Rockwell (Smith - Blair) #411
-

RESTRAINERS

Approved manufacturers and models

- Uniflange 1300-C, 1350-C
-

COMBINATION AIR VALVES

All air valves must have internal fusion bonded epoxy coating.

Approved manufacturers and model

- APCO model # 143-C
-

SERVICE SADDLES

Must be stainless steel full circle, fully passivated 304SS with Corporation thread.

Approved manufacturers and models:

- Robar series 2506
-

CORPORATION STOPS

Approved manufacturers and model

- Mueller part # H-15008 Mueller(Corporation) Thread with 110 compression outlet
-

BRASS “Y” CONNECTORS, 25mm X 19mm X 19mm

Approved manufacturer and model

- Mueller part # H-15343
-
-

ANGLE METER STOPS

Approved manufacturer and model

– Mueller part # H-14253 - Plain flat head stop with 110 compression inlet

BOLTS

Minimum grade 2, hot dipped galvanized NC thread.

GASKET MATERIAL

Neoprene 3mm (1/8") or 1.6mm (1/16") with cloth insert.

THREAD SEALANT

Must be non-toxic, NSF approved.

Approved material

Whitlam/select unyte – soft set grit free

METER BOXES AND LIDS

Meter boxes must be concrete, 300mm (12") deep. Lids must be cast iron, marked as meter and painted bright yellow. Lids must conform to Standard Drawing No. 2800-23.

Approved manufacturers and models

A.E. Concrete #37

Lid – Alf s Castings catalogue # D-37

VALVE BOXES

Must be square, flat top, with direction of flow clearly shown and have a locking cap.

Approved manufacturer and model

Nelson Type Valve Box with locking lid

BRONZE GATE VALVES 12MM - 75MM Class 125

Must be left hand opening, F.I.P.T. X F.I.P.T.

Approved manufacturer and model

– Red & White Figure 206-A

CHECK VALVES

Must meet AWWA/ANSI C508
Fl. x Fl. ends, Bronze disc facing.

Approved manufacturer and models

Mueller Co. #14244 Angle meter, dual check
Mueller Co. #14242 In line meter, dual check

COATINGS

Floors of Concrete Chambers

NSP - 100 Epoxy Concrete Sealer
NSP - 122 Epoxy-Phenolic Floor Coating.

BRONZE FITTINGS

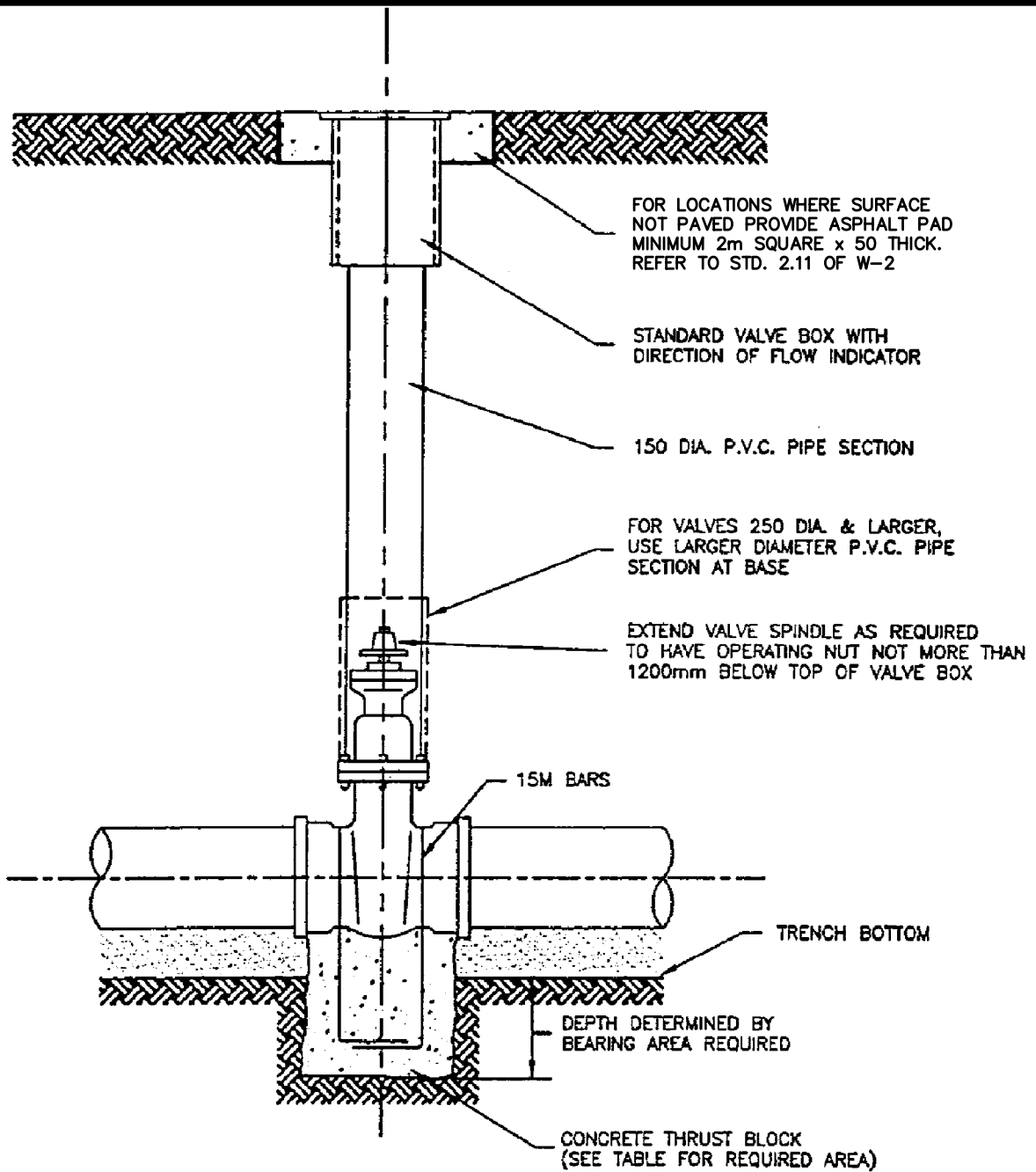
Must be in accordance with A.W.W.A. C-800

Approved manufacturer and models

- James Jones Company, J-20OSG, Coupling: Super Grip Tube Size, 19mm, 25mm, 19mm x 25mm, 50mm
- James Jones Company, J-261 1 SG, 90 deg. Elbow: Super Grip Tub Size, 19mm, 25mm, 25mm x 13mm, 50mm
- James Jones Company, J-2617SG, Tee: Super Grip Tube Size Connections. (All), 19mm, 25mm, 19mm x 19mm x 25mm
- James Jones Company, J-2619SG, Ell: Super Grip Tube Size, Male Iron Pipe, 19mm, 25mm
- James Jones Company, J2621SG,. Ell: Super Grip Tube Size, Female Iron Pipe, 19mm, 25mm
- James Jones Company, J-2623SG, Coupling: Super Grip Tube Size, To Female Copper Thread, 19mm, 25mm, 25mm x 19mm
- James Jones Company, J-2635SG, 45deg: Super Grip Tube Size, To Male Iron Pipe, 19mm, 25mm
- James Jones Company, J-2640, Coupling: PVC To Male Iron Pipe, 38mm, 50mm
- James Jones Company, J-2641 Coupling: PVC x FIP, 50mm
- James Jones Company, J-2642 Coupling: PVC x PVC
- James Jones Company, J-2625SG “Y” Branch 60 deg. Inlet: 25mm Super Grip Tube Size, Outlets 19mm Super Grip Tube Size
- James Jones Company, J-2631SG Angle “U” Branch With 90 deg. Inlet Angle To Outlets: Super Grip, Tube Size, Outlets Male Iron Pipe
- James Jones Company, J-130 Straight, Male Iron Pipe, Swivel Meter Coupling: Nut With Washer, Octagon Barrell
- James Jones Company, J-132 90 deg. Male Iron Pipe, Swivel Meter Coupling: Nut With Washer, 19mm, 25mm
- James Jones Company, J-134 Male Iron Pipe, Ribbed Barrell, Swivel Meter Coupling: Nut With Washer, 19mm, 25mm
- James Jones Company, J-136 Washers: For Meter Couplings, Leather
- James Jones Company, J-137 Washers: For Meter Couplings, Fiber, Thick Or Thin Available, 19mm, 25mm, 32mm, 38mm, 50mm
- James Jones Company, J-128-H Water Bushing: Hexagon, With Gasket-Soldering Not Required, 38mm x 25mm, 25mm x 32mm
- James Jones Company, J-129 Bronze Water Meter Flange: Female Iron Pipe, Less Bolts and Gasket, 38mm, 50mm

LIST OF STANDARD DRAWINGS

NUMBER	APPROVED FOR GENERAL USE	TITLE
2800-1	YES	STANDARD LINE VALVE INSTALLATION
2800-2	YES	STANDARD FIRE HYDRANT ASSEMBLY
2800-4	YES	STANDARD TRENCH, PIPE BEDDING & BACKFILLING
2800-5A	YES	STANDARD AIR VALVE INSTALLATION 100mm – 300mm
2800-5B	YES	STANDARD AIR VALVE INSTALLATION 100mm – 300mm
2800-6	YES	STANDARD THRUST BLOCK DETAILS
2800-7	YES	STANDARD TRENCH DAM FOR SLOPES TO 30%
2800-8	YES	STANDARD TRENCH DAM FOR SLOPES OVER 30%
2800-9	YES	STANDARD FLUSH VALVE INSTALLATION
2800-10	YES	STANDARD, WATER SERVICE CONNECTION
2800-11	YES	STANDARD METER BOX LOCATION & SERVICE LINE LOCATION
2800-12	YES	STANDARD MECHANICAL THRUST RESTRAINT APPLICATIONS
2800-13	YES	RECOMMENDED RESTRAINED LENGTHS OF PIPE
2800-14	YES	VALVE BOX WARNING DISK
2800-19	YES	BACKFLOW PREVENTION DEVICE INSTALLATION
2800-24	NO	STANDARD AIR VALVE INSTALLATION LARGE DIAMETER PIPE
2800-29	NO	TYPICAL RESERVOIR SAMPLING STATION
2800-31	NO	PRECAST 100mm SENSUS FIRELINE METER VAULT



VALVE SIZE	BEARING AREA REQUIRED at TEST PRESSURE		
	700 KPa (100 psi)	1000 KPa (150 psi)	1400 KPa (200 psi)
100	0.2m ²	0.3m ²	0.4m ²
150	0.3m ²	0.45m ²	0.6m ²
200	0.6m ²	0.9m ²	1.2m ²
250	0.9m ²	1.35m ²	1.8m ²
300	1.2m ²	1.8m ²	2.4m ²

NOTE:
BEARING AREAS CALCULATED USING
SOIL BEARING CAPACITY OF 50KPa
(1000 PSF)(UNDISTURBED SAND)
FOR SOFTER SOILS CONSULT ENGINEER

KEMP LAKE WATERWORKS DISTRICT

STANDARD LINE VALVE INSTALLATION

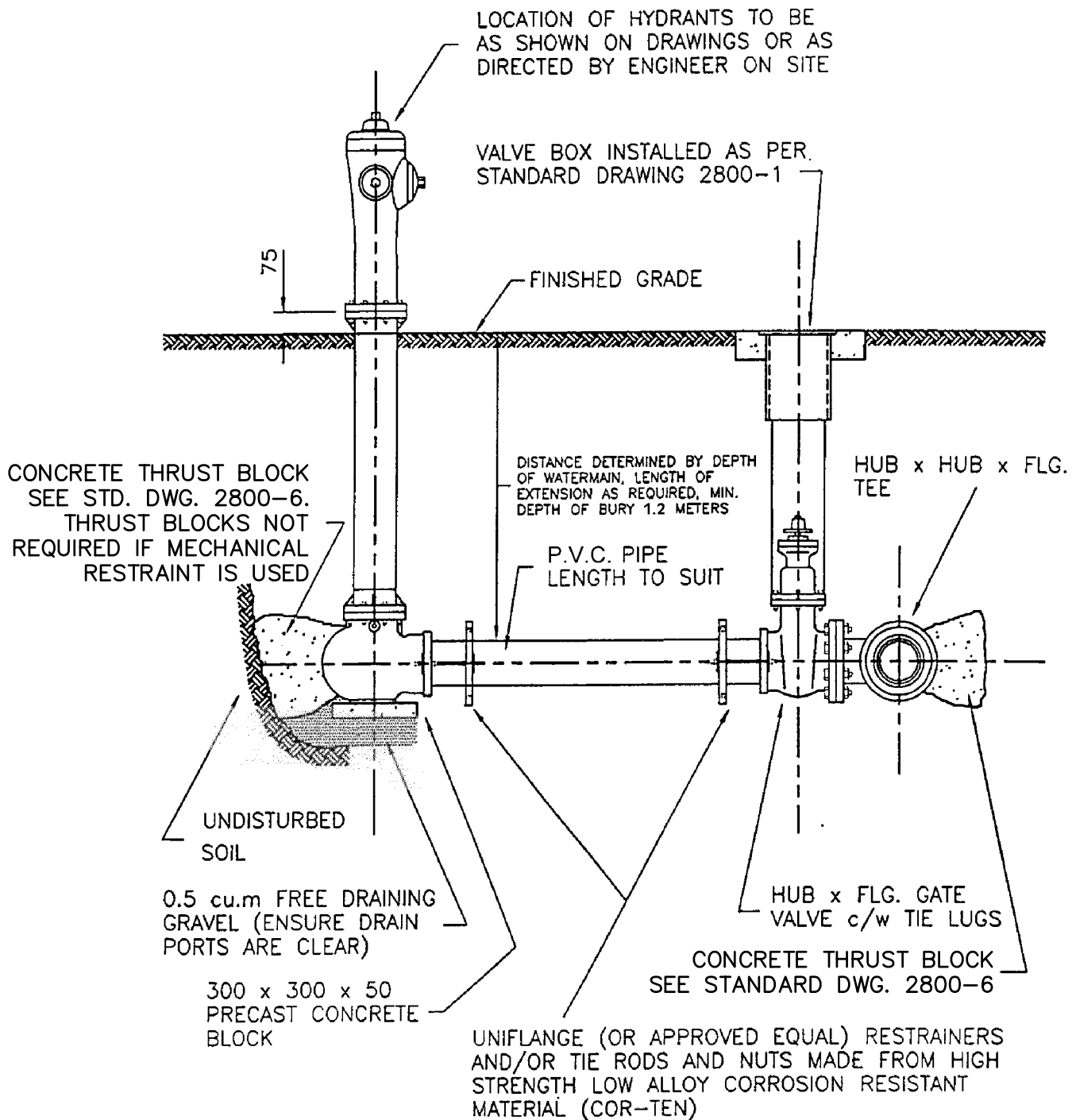
DATE: NOV. 2004

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-1



KEMP LAKE WATERWORKS DISTRICT

STANDARD FIRE HYDRANT ASSEMBLY

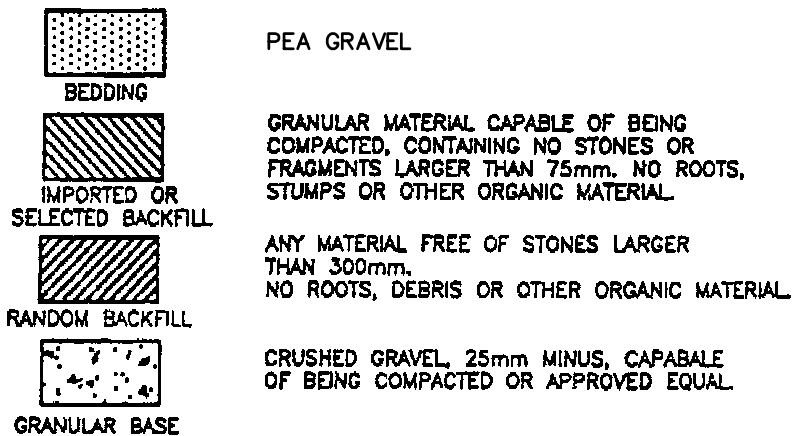
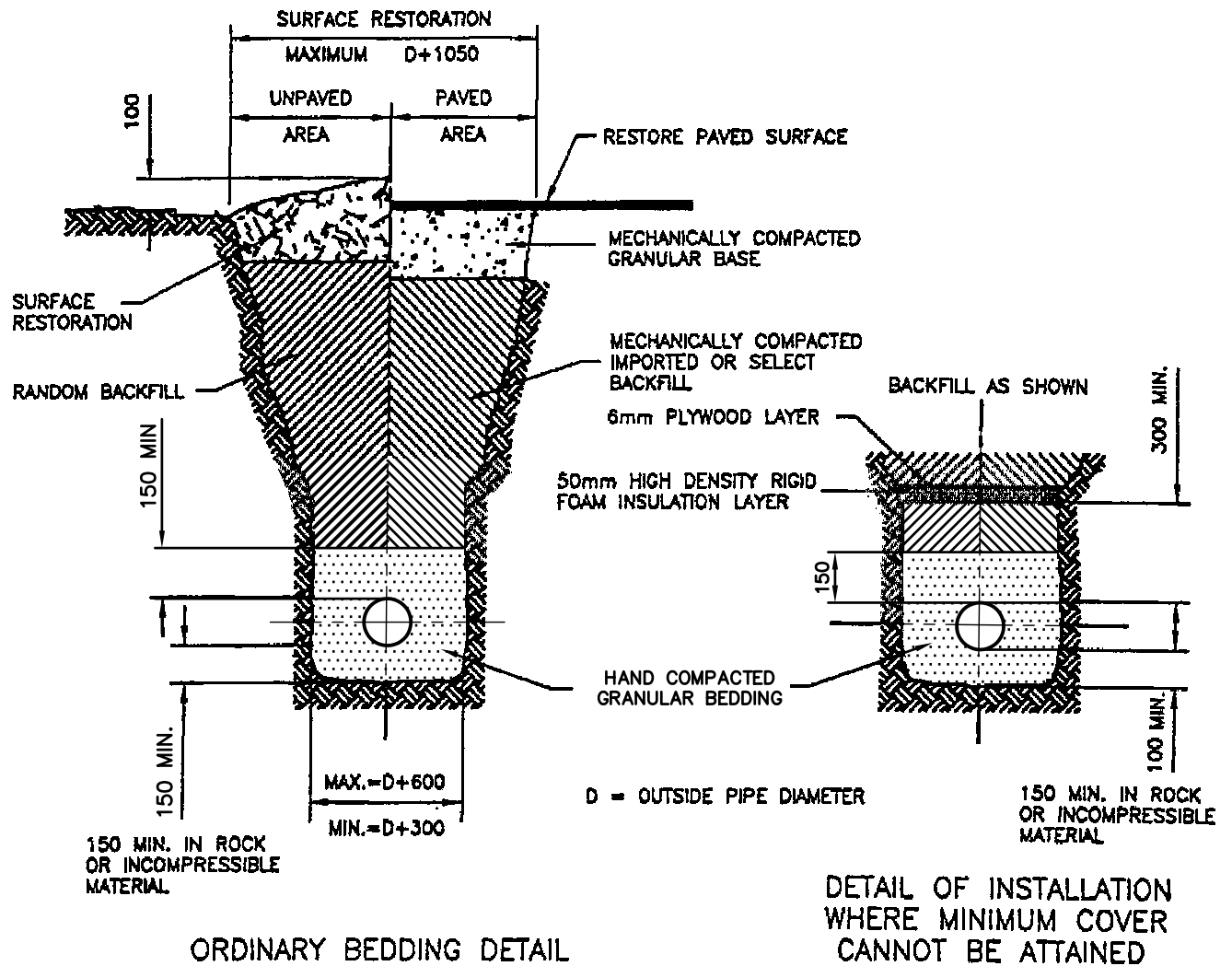
DATE: NOV. 2004

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-2



NOTES:

1. UNDER THE TRAVELLED PORTION OF ROADS AND DRIVEWAYS OR WITHIN 1.5M FROM THE EDGE OF TRAVELLED ROADWAY, THE TRENCH SHALL BE BACKFILLED WITH COMPACTED IMPORTED OR SELECT BACKFILL UP TO 300mm BELOW ROAD SURFACE, THE REMAINING TRENCH TO BE BACKFILLED WITH 25mm MINUS CRUSHED ROAD GRAVEL.
2. RANDOM BACKFILL SHALL BE COMPACTED TO A MINIMUM 90% STANDARD PROCTOR DENSITY.
3. IMPORTED OR SELECT BACKFILL SHALL BE COMPACTED TO A MINIMUM OF 95% STANDARD PROCTOR DENSITY.
4. GRANULAR BEDDING SHALL BE COMPACTED TO A MINIMUM 95% STANDARD PROCTOR DENSITY.
5. CONTROLLED DENSITY BACKFILL MAY BE USED IN LIEU OF IMPORTED OR SELECT BACKFILL AND GRANULAR BASE.
6. THIS DRAWING REPRESENTS THE MINIMUM REQUIREMENTS. THE PIPE MANUFACTURER'S RECOMMENDED BEDDING AND BACKFILLING SPECIFICATION SHALL GOVERN.
7. REFER TO K.L.W.D. ENGINEERING SPECIFICATIONS FOR FURTHER DETAILS. DISCREPANCY BETWEEN THE PIPE MANUFACTURING RECOMMENDATION AND THIS DRAWING SHALL BE REFERRED TO THE K.L.W.D. ENGINEER.

KEMP LAKE WATERWORKS DISTRICT

STANDARD TRENCH PIPE BEDDING & BACKFILLING

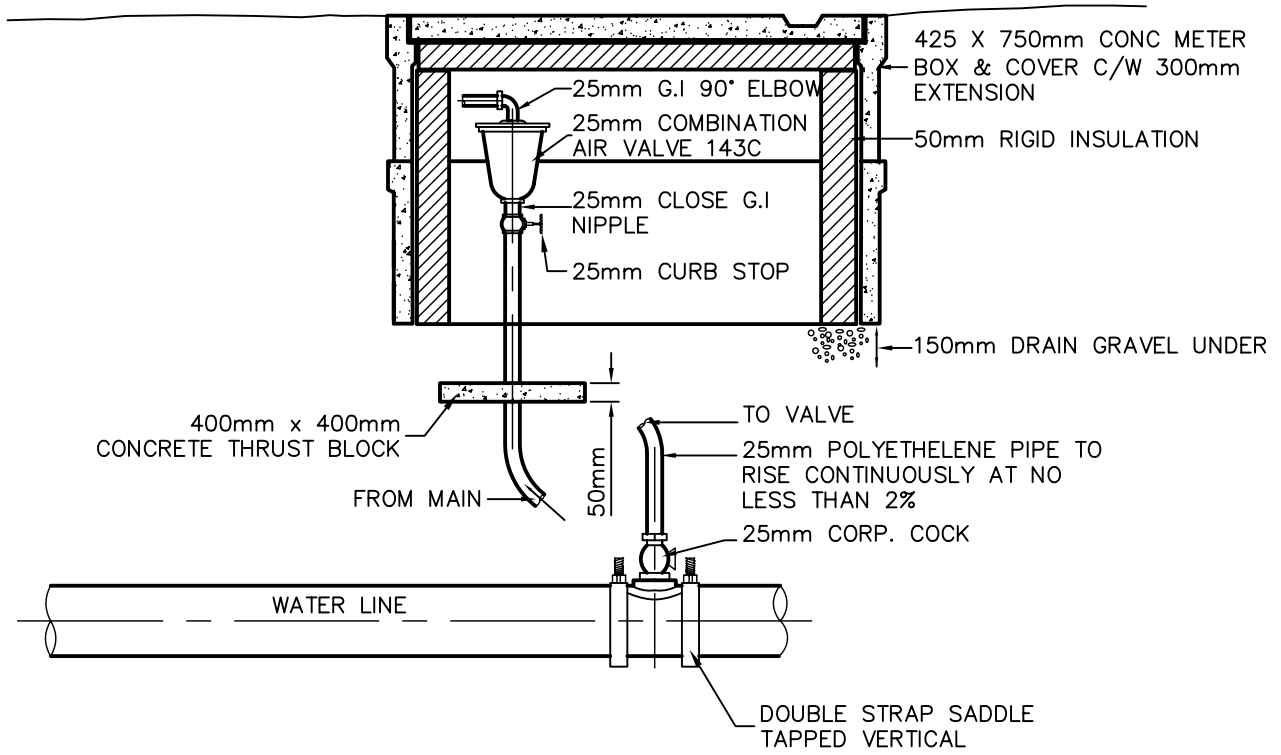
DATE: NOV. 2004

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.: 2800-4



KEMP LAKE WATERWORKS DISTRICT

STANDARD AIR VALVE INSTALLATION 100-300mm

DATE: NOV. 2004

DRAWN BY:

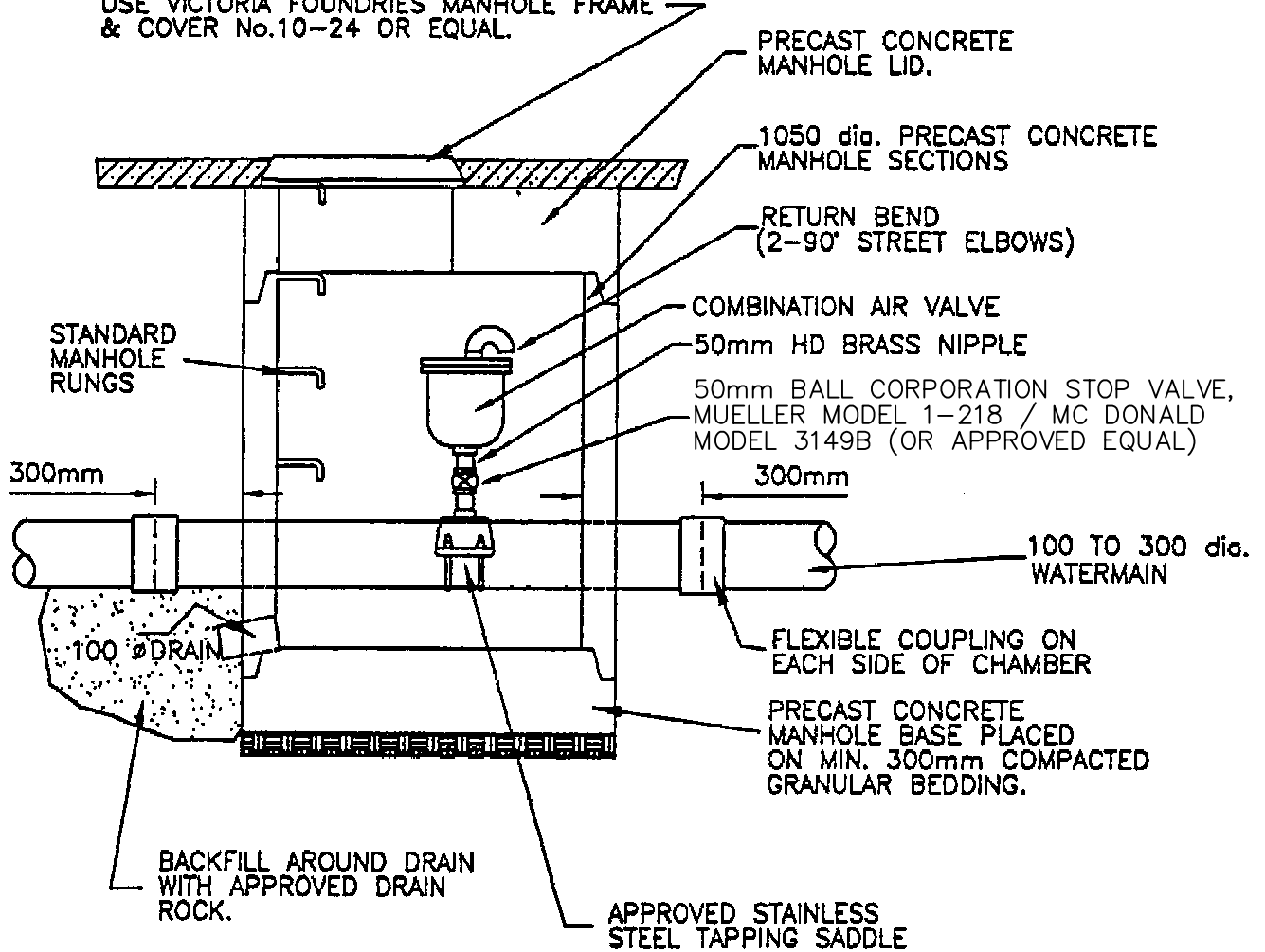
SCALE: NTS

CHECKED BY:

DWG NO.:2800-5A

WHERE INSTALLED IN AREAS SUBJECT TO VEHICULAR TRAFFIC USE VICTORIA FOUNDRIES MANHOLE FRAME & COVER No.10-264 OR EQUAL. RESTORE SURFACE TO ORIGINAL CONDITION.

WHERE INSTALLED IN NON TRAFFIC AREAS USE VICTORIA FOUNDRIES MANHOLE FRAME & COVER No.10-24 OR EQUAL.



KEMP LAKE WATERWORKS DISTRICT

STANDARD AIR VALVE INSTALLATION 100-300mm

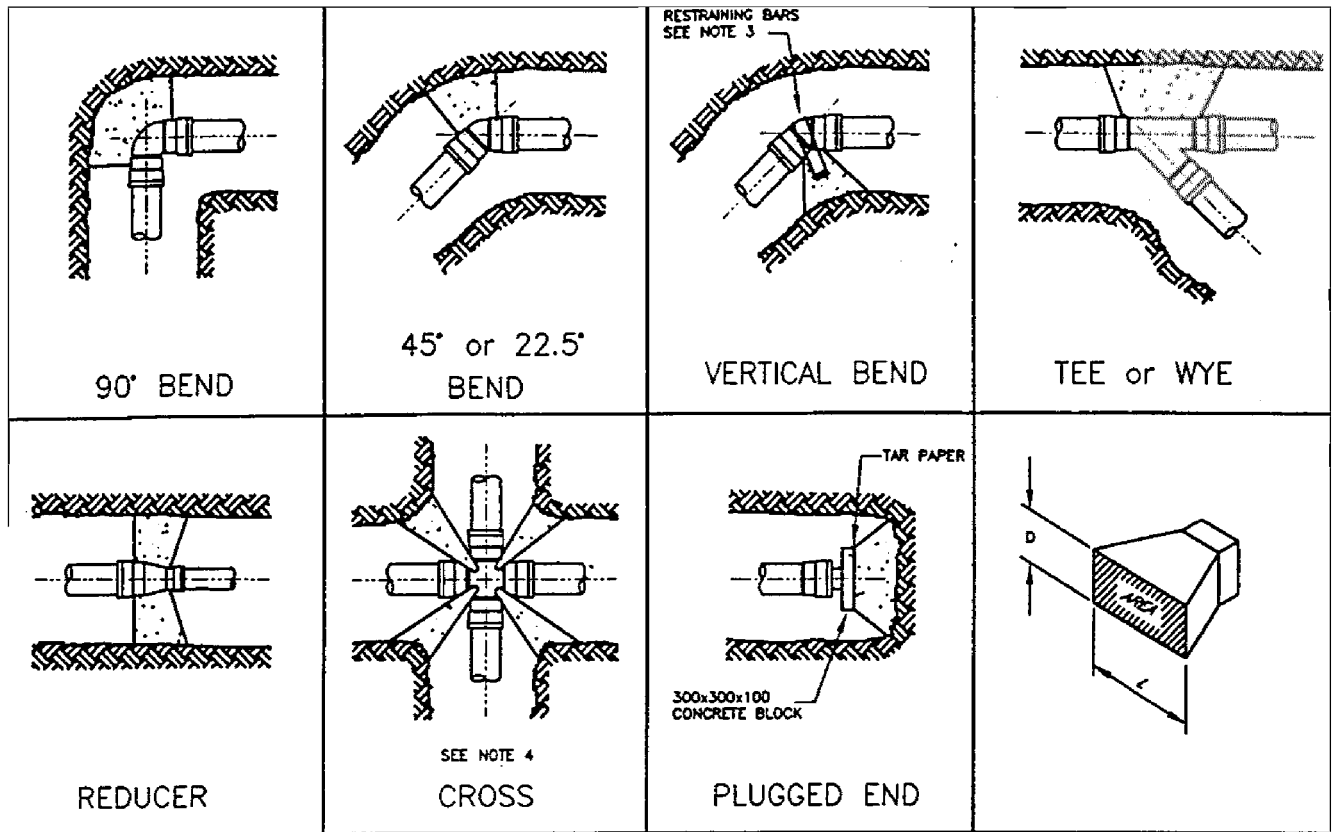
DATE: NOV. 2004

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-5B



MINIMUM THRUST AREA BASED ON WATER PRESSURE OF - 1000KPa (150psi)
 & SOIL BEARING CAPACITY OF - 100KPa (2000psf)

FITTING	PIPE SIZE	AREA SQ. METERS	L x D AT FACE	FITTING	PIPE SIZE	AREA SQ. METERS	L x D AT FACE
90° BEND	100	0.2	0.7 x 0.3m	22.5° BEND	100	0.1	0.5 x 0.2m
	150	0.4	1.0 x 0.4m		150	0.2	0.7 x 0.3m
	200	0.7	1.2 x 0.6m		200	0.2	0.7 x 0.3m
	250	1.1	2.0 x 0.6m		250	0.3	0.8 x 0.4m
	300	1.6	2.0 x 0.8m		300	0.5	1.0 x 0.5m
45° BEND or WYE	100	0.2	0.7 x 0.3m	CAPPED END OR TEE	100	0.2	0.7 x 0.3m
	150	0.3	1.0 x 0.3m		150	0.3	0.8 x 0.4m
	200	0.4	1.0 x 0.4m		200	0.5	1.0 x 0.5m
	250	0.6	1.0 x 0.6m		250	0.8	1.2 x 0.7m
	300	0.9	1.5 x 0.6m		300	1.1	1.4 x 0.8m

- NOTES:
1. SOIL BEARING CAPACITY USED IS THAT FOR SOFT CLAY, FOR SOFTER SOILS THRUST BLOCKS SHALL BE DESIGNED BY THE ENGINEER.
 2. THRUST BLOCKING FOR FITTINGS LARGER THAN 300 DIA. SHALL BE DESIGNED BY THE ENGINEER.
 3. VOLUME OF CONCRETE IN VERTICAL BEND ANCHORS TO BE DETERMINED BY THE ENGINEER. USE 2-20M RETAINING BARS PER CUBIC METRE.

4. FOR CROSSES USE VALUE FOR 45° BEND IN EACH QUADRANT.
5. WHERE PIPE SIZE DIFFERS IN ANY ONE FITTING USE VALUE FOR LARGEST SIZE.
6. CONCRETE NOT TO ENCRUCH ON PIPE BARREL, BUT TO BEAR ON FITTING ONLY.
7. CONCRETE TO BE 15MPa (2000psi) COMPRESSIVE STRENGTH.

KEMP LAKE WATERWORKS DISTRICT

STANDARD THRUST BLOCKS DETAIL

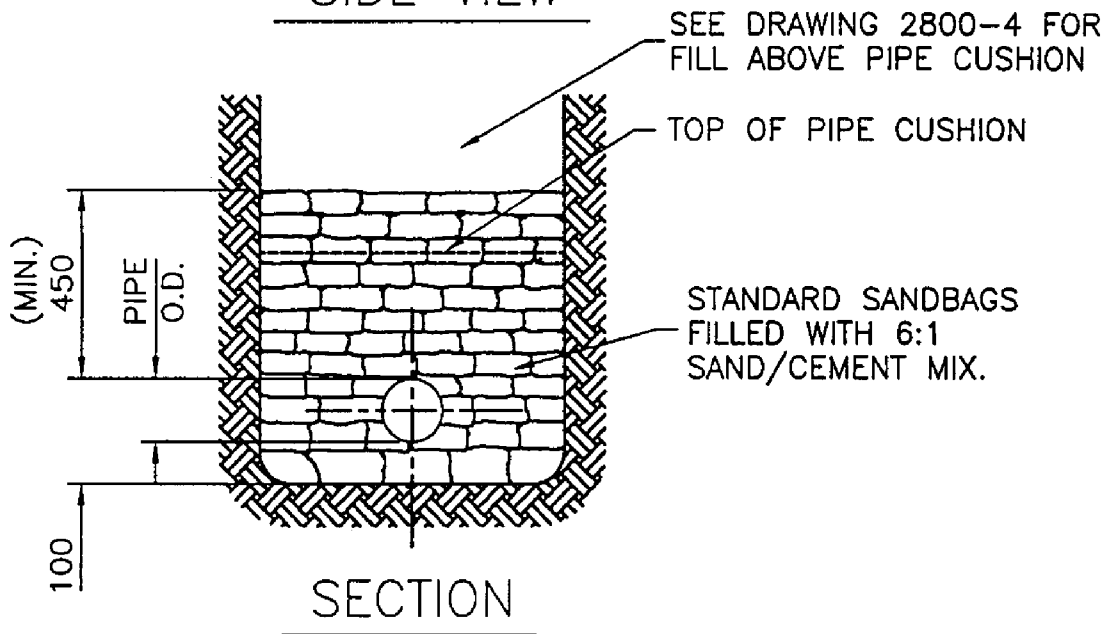
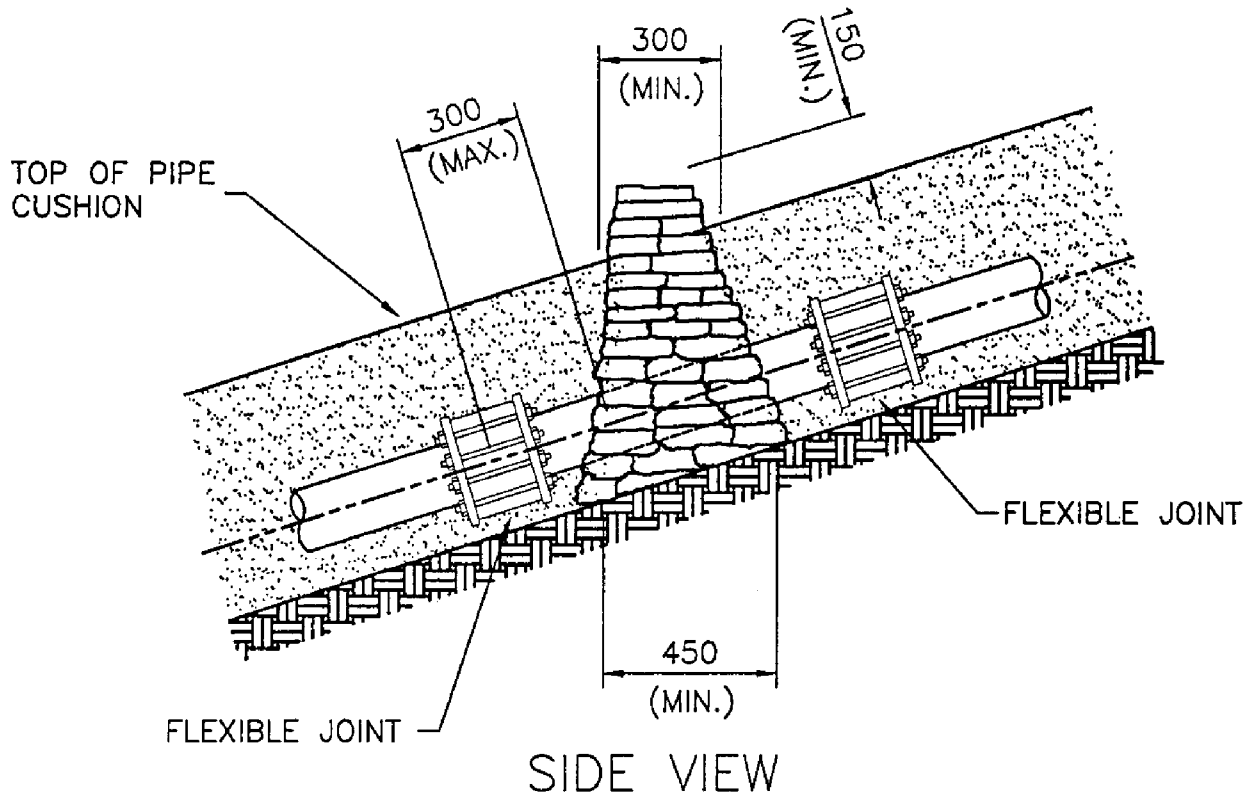
DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-6



TRENCH DAMS TO BE CONSTRUCTED:

- (A) ON PIPE INSTALLATIONS WITH 10% to 15% SLOPE, NOT MORE THAN 30M APART
- (B) ON PIPE INSTALLATIONS WITH 15% to 30% SLOPE, NOT MORE THAN 15M APART
- (C) AS DIRECTED BY THE ENGINEER ON SITE

WHERE PIPE INSTALLATION EXCEEDS 30% REFER, TO DRAWING 2800-B

KEMP LAKE WATERWORKS DISTRICT

STANDARD TRENCH DAM FOR SLOPES TO 30%

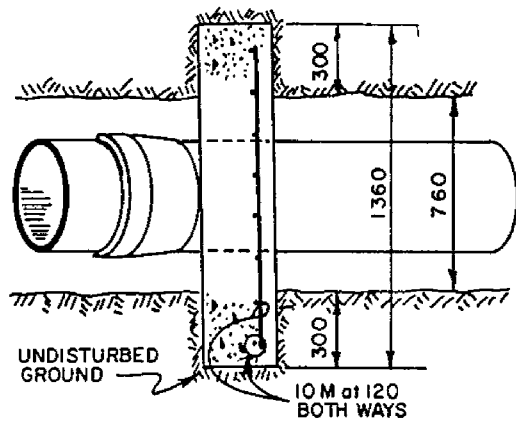
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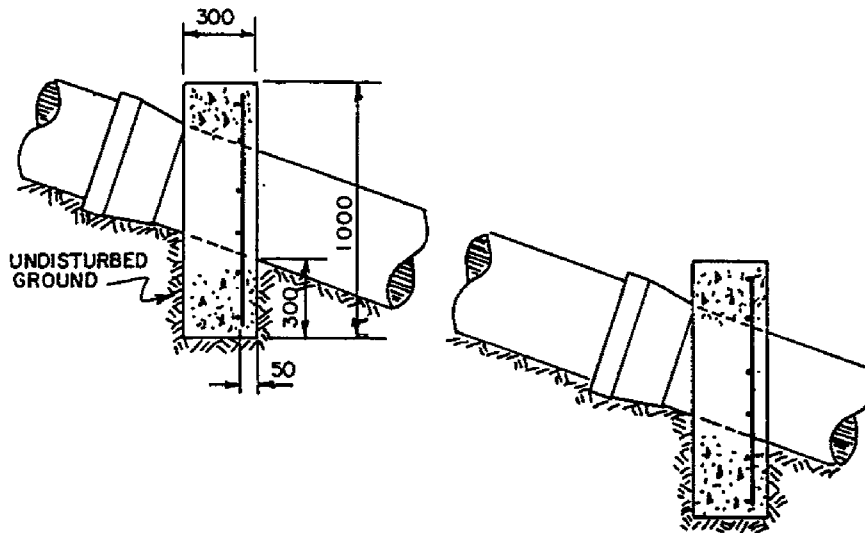
SCALE: NTS

CHECKED BY:

DWG NO.:2800-7



P L A N



S I D E V I E W

PLACE ANCHORS AT EVERY SECOND PIPE JOINT EXCEPT IN UNSTABLE GROUND WHERE ANCHORS SHALL PLACED AT EACH PIPE JOINT.

PLACE TWO PLIES 6mil POLYETHYLENE BETWEEN PIPE AND CONCRETE

CONCRETE TO HAVE A 28 DAY STRENGTH OF 20 MPa OR MORE AND A MAXIMUM SLUMP OF 75 mm

THIS TRENCH DAM FOR USE ON SLOPES GREATER THAN 30% AND PIPE SIZE NOT TO EXCEED 400mm DIA.

FOR SLOPES LESS THAN 30% SEE DRAWING 2800-7

FOR PIPES LARGER THAN 400 mm DIA. CONSULT THE ENGINEER

KEMP LAKE WATERWORKS DISTRICT

STANDARD TRENCH DAM FOR SLOPES OVER 30%

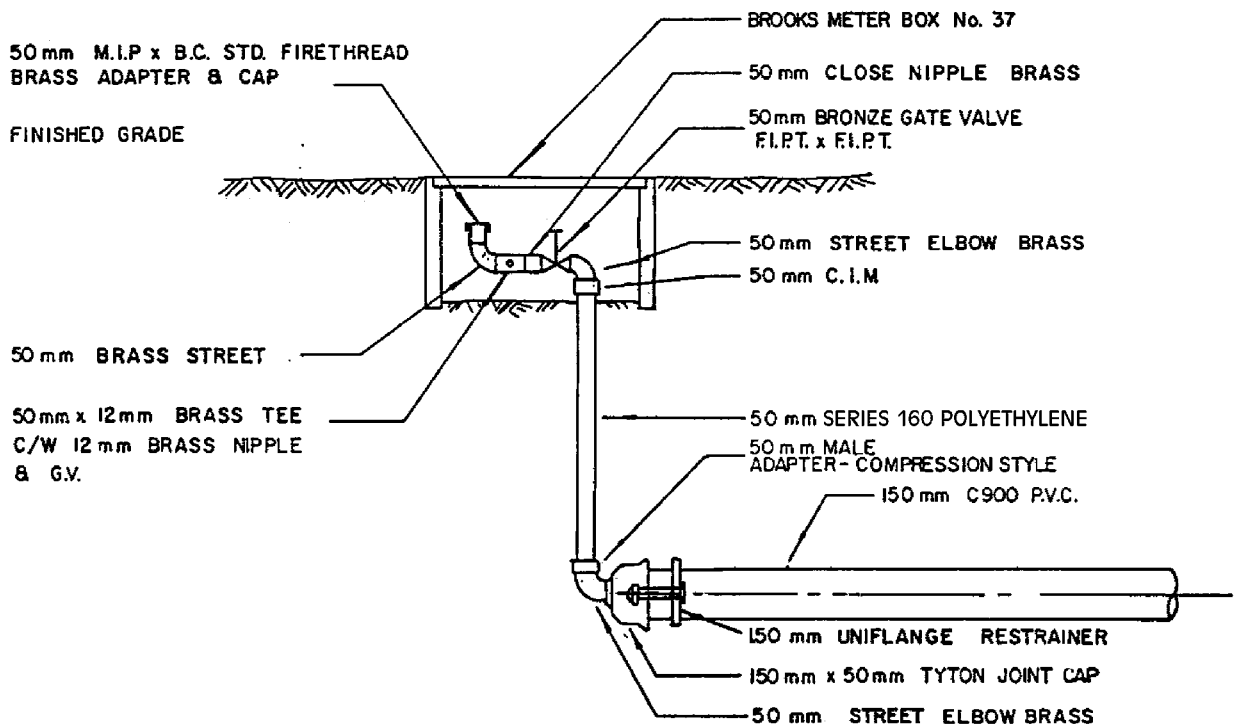
DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-8



KEMP LAKE WATERWORKS DISTRICT

STANDARD FLUSH VALVE INSTALLATION

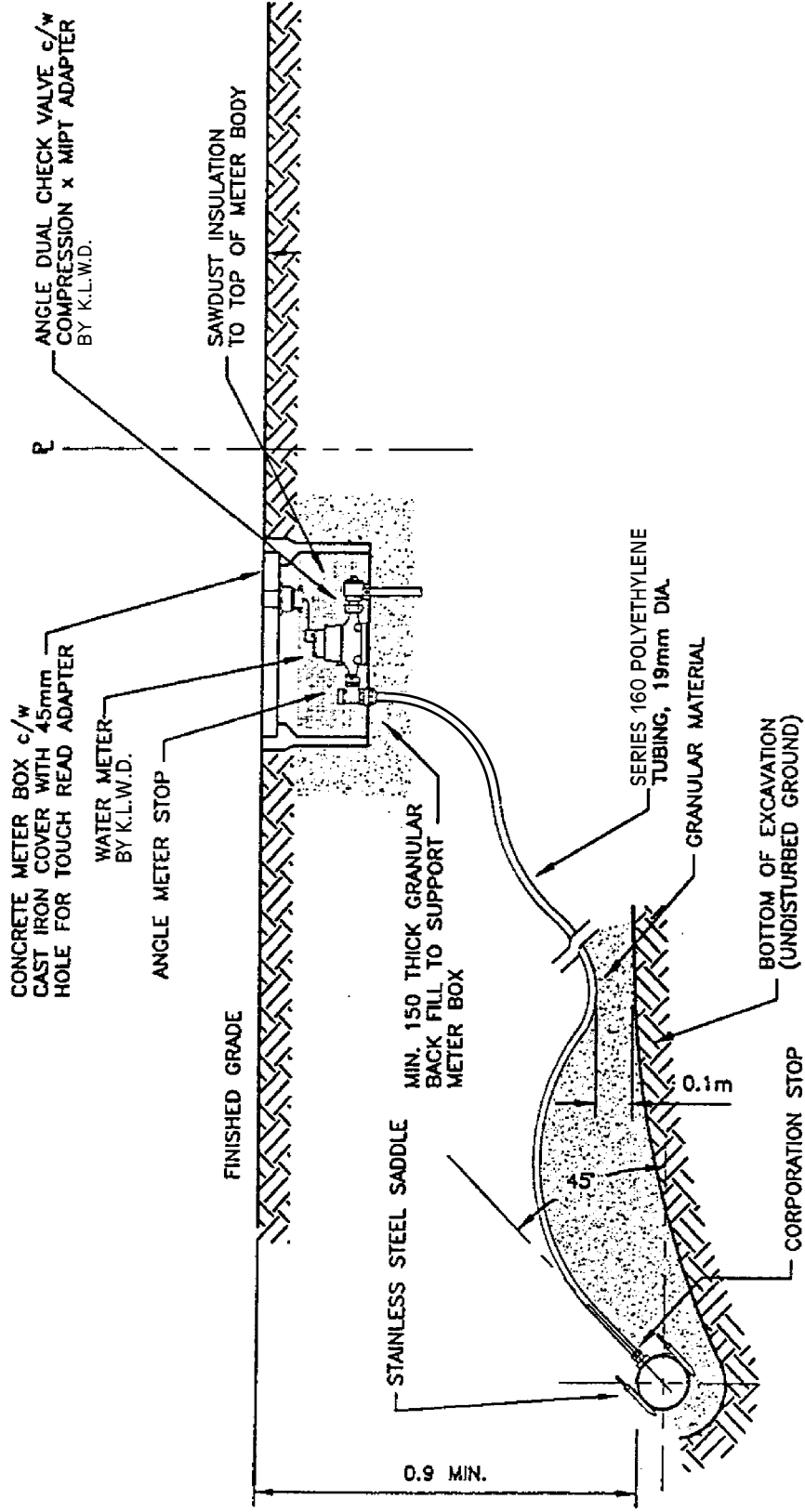
DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-9

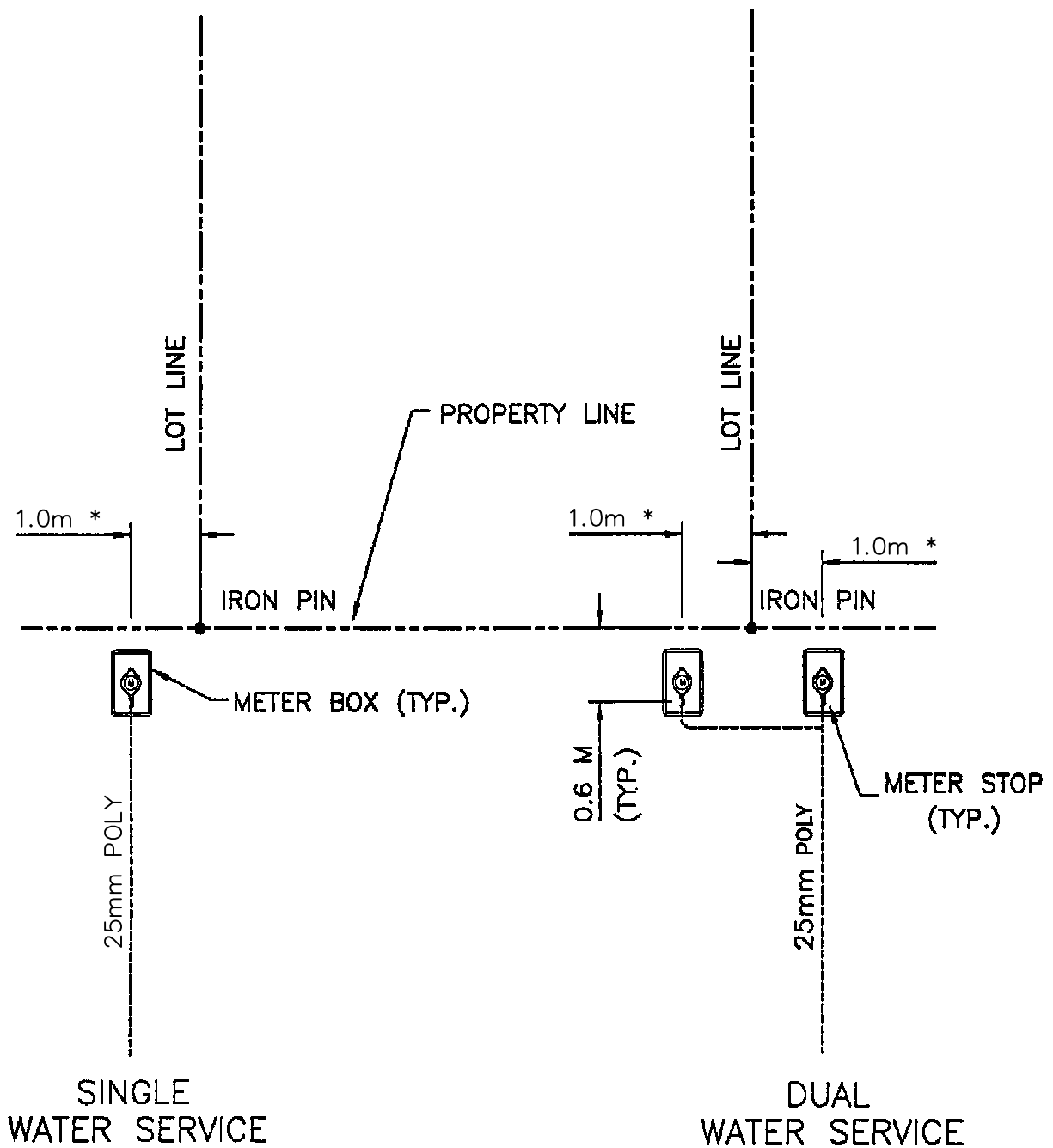


NOTE:
 ALL MATERIALS MUST CONFORM TO
 APPROVED K.L.W.D. ENGINEERING
 SPECIFICATIONS

KEMP LAKE WATERWORKS DISTRICT

STANDARD WATER SERVICE CONNECTION

DATE: NOV. 2004	DRAWN BY:	
SCALE: NTS	CHECKED BY:	DWG NO.:2800-10



* SEE STD 4.02 OF W-2

KEMP LAKE WATERWORKS DISTRICT

STANDARD METER BOX & SERVICE LINE INSTALLATION

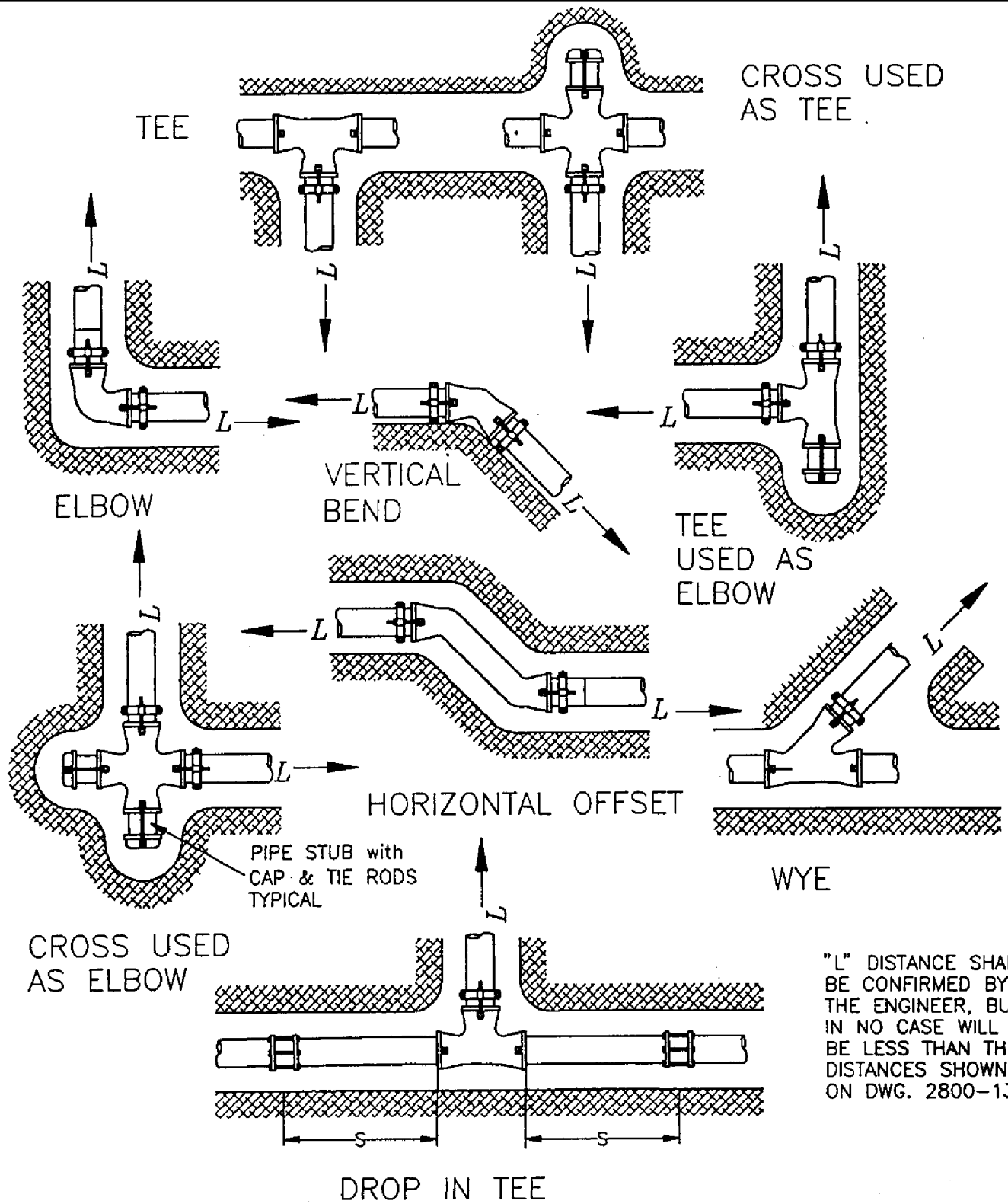
DATE: NOV. 2004

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-11



KEMP LAKE WATERWORKS DISTRICT

MECHANICAL THRUST RESTRAINT APPLICATIONS

DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.: 2800-12

RECOMMENDED RESTRAINED LENGTHS OF PIPE

PIPE: PVC, AWWA C900, DR 18
 DEPTH OF BURY ONE METRE
 MAXIMUM PRESSURE 1035kPa (150 psi, includes surge allowance)
 SAFETY FACTOR 2:1

This standard to be used in conjunction with standard drawing 2800-12.
 When depth of soil cover is less than 0.6m values for "L" must be increased by 30%.

When depth of soil cover is less than half pipe O.D. values for "L" must be increased by 100%.

When pipe is partially or fully exposed, all joints must be restrained.

When in doubt as to soil type depth or configuration, use next longest value of L.

L = LENGTH OF RESTRAINED PIPE (in metres)

NOMINAL PIPE SIZE (mm)	SILT/SAND					WET CLAY					HARD PAN				
	ELBOWS				VALVE TEE END	ELBOWS				VALVE TEE END	ELBOWS				VALVE TEE END
	11	22	45	90		11	22	45	90		11	22	45	90	
100	.3	.3	1.8	4.3	12.8	.3	.9	1.8	4.6	12.5	.3	.6	1.5	3.4	10.4
150	.6	1.2	2.4	5.8	17.7	.6	1.2	2.7	6.4	18.9	.6	.9	1.8	4.6	14.6
200	.6	1.5	3.0	7.6	23.5	.9	1.8	3.7	8.5	24.7	.6	1.2	2.4	6.1	19.2
250	.9	1.8	3.7	9.1	28.0	.9	2.1	4.3	10.4	29.6	.9	1.5	3.1	7.0	22.9
300	.9	2.1	4.3	10.7	32.9	1.2	2.4	4.9	12.2	34.7	.9	1.5	3.7	8.2	26.8

L = RESTRAINED LENGTH FOR BRANCH OUTLET OF DROP IN TEES. (in metres)

SOIL (SILT/SAND)	S = LENGTH OF PIPE ON EACH SIDE OF TEE (in metres)			
NOMINAL TEE SIZE	S = 6.1	S = 3.0	S=1.5	S=0.3
100x100	FIRST JOINT	FIRST JOINT	.3	6.4
150x150	FIRST JOINT	FIRST JOINT	3.4	9.8
200x200	FIRST JOINT	FIRST JOINT	7.0	13.4
250x250	FIRST JOINT	1.5	9.8	16.2
300x300	FIRST JOINT	4.6	12.8	19.5

KEMP LAKE WATERWORKS DISTRICT

THRUST RESTRAINT LENGTH / SOIL TYPE

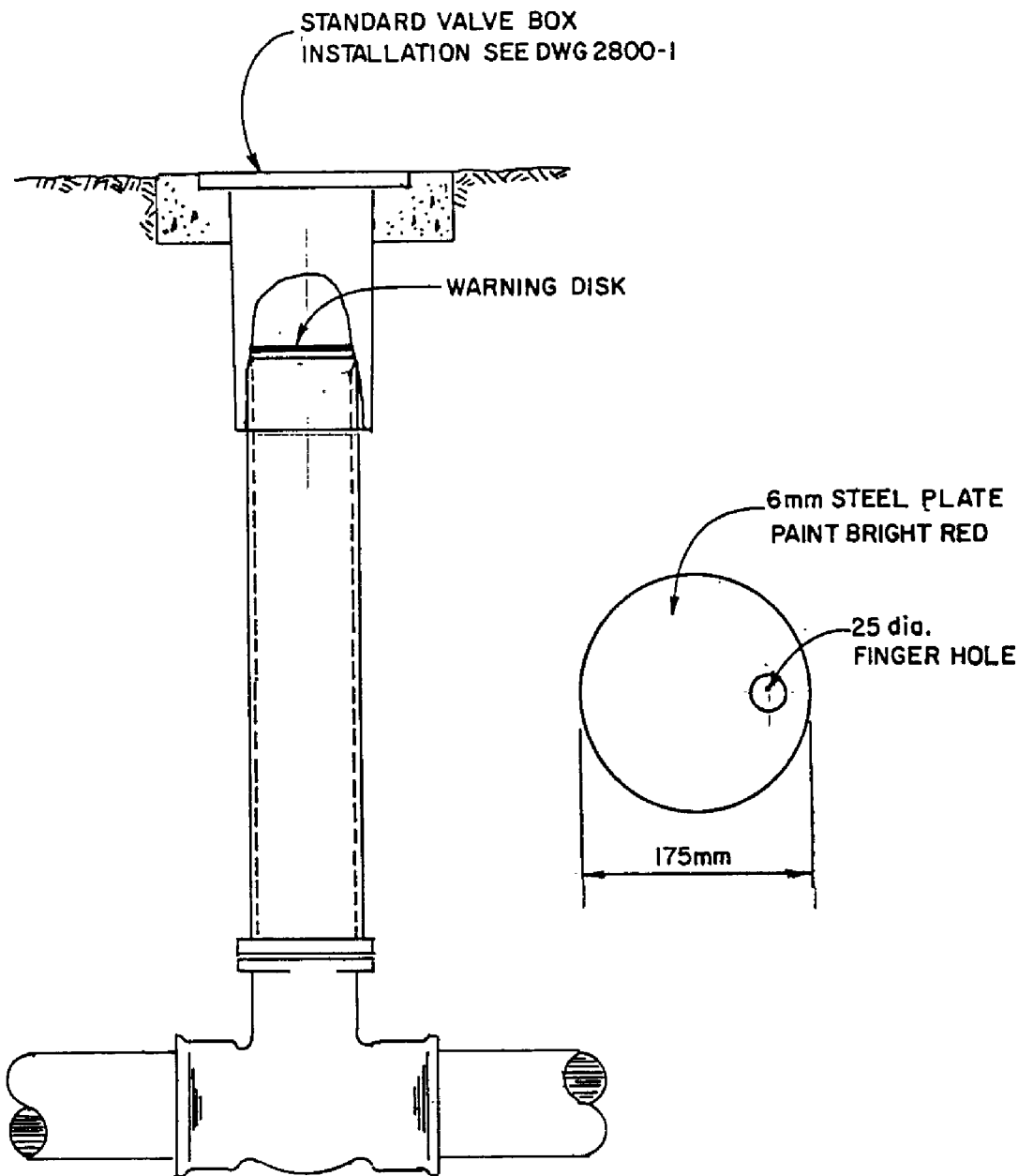
DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.: 2800-13



WARNING DISK TO BE PLACED IN VALVE BOXES OF CLOSED VALVES
AT PRESSURE ZONE BOUNDARIES

KEMP LAKE WATERWORKS DISTRICT

VALVE BOX WARNING DISK

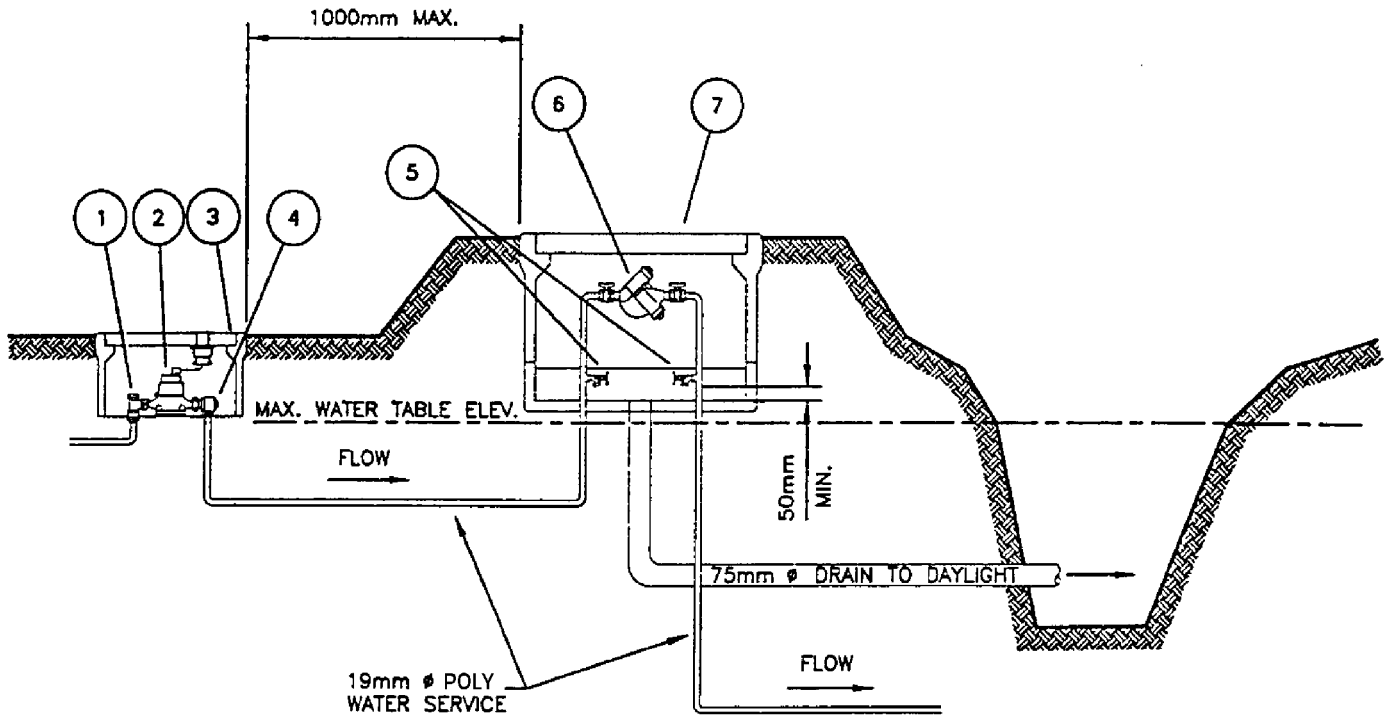
DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-14



NOTES:

1. INSTALLATION IS FOR A 19mm FEBCO MODEL 825Y REDUCED PRESSURE BACKFLOW PREVENTER. DIMENSIONS & CLEARANCES MAY VARY WITH DIFFERENT MANUFACTURES. INSTALLATION CLEARANCES MUST BE IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. BOX MUST BE INSTALLED SUCH THAT ALL DRAIN VALVES ARE LOCATED A MINIMUM OF 50mm ABOVE MAXIMUM WATER TABLE.
3. INSTALLATION MUST BE APPROVED BY LOCAL PLUMBING INSPECTOR.
4. ALL MATERIALS TO BE IN ACCORDANCE WITH CURRENT B.C. PLUMBING CODES.
5. UTILITY BOX FOR BACKFLOW PREVENTER IS A BROOKS PRODUCTS BCT 66E.

LIST OF MATERIALS:

- | | |
|---|--|
| <p>① ANGLE METER STOP</p> <p>② METER</p> <p>③ METER BOX</p> <p>④ DUAL CHECK VALVE c/w C.I. FITTINGS</p> | <p>⑤ 12mm HOSE BIBS (REMOVE THREADS FROM UPSTREAM VALVE).</p> <p>⑥ REDUCED PRESSURE BACKFLOW PREVENTER (SEE NOTE 1) PROVIDE SUPPORT FOR VALVES AS NECESSARY, ELEVATE VALVES (SEE NOTE 2).</p> <p>⑦ UTILITY BOX No.66 TOP SECTION & BASE c/w DIAMOND PLATE ALUMINUM COVER WITH 50mm RIGID INSULATION.</p> |
|---|--|

KEMP LAKE WATERWORKS DISTRICT

**REDUCED PRESSURE BACKFLOW PREVENTER
INSTALLATION (BELOW GROUND)**

DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

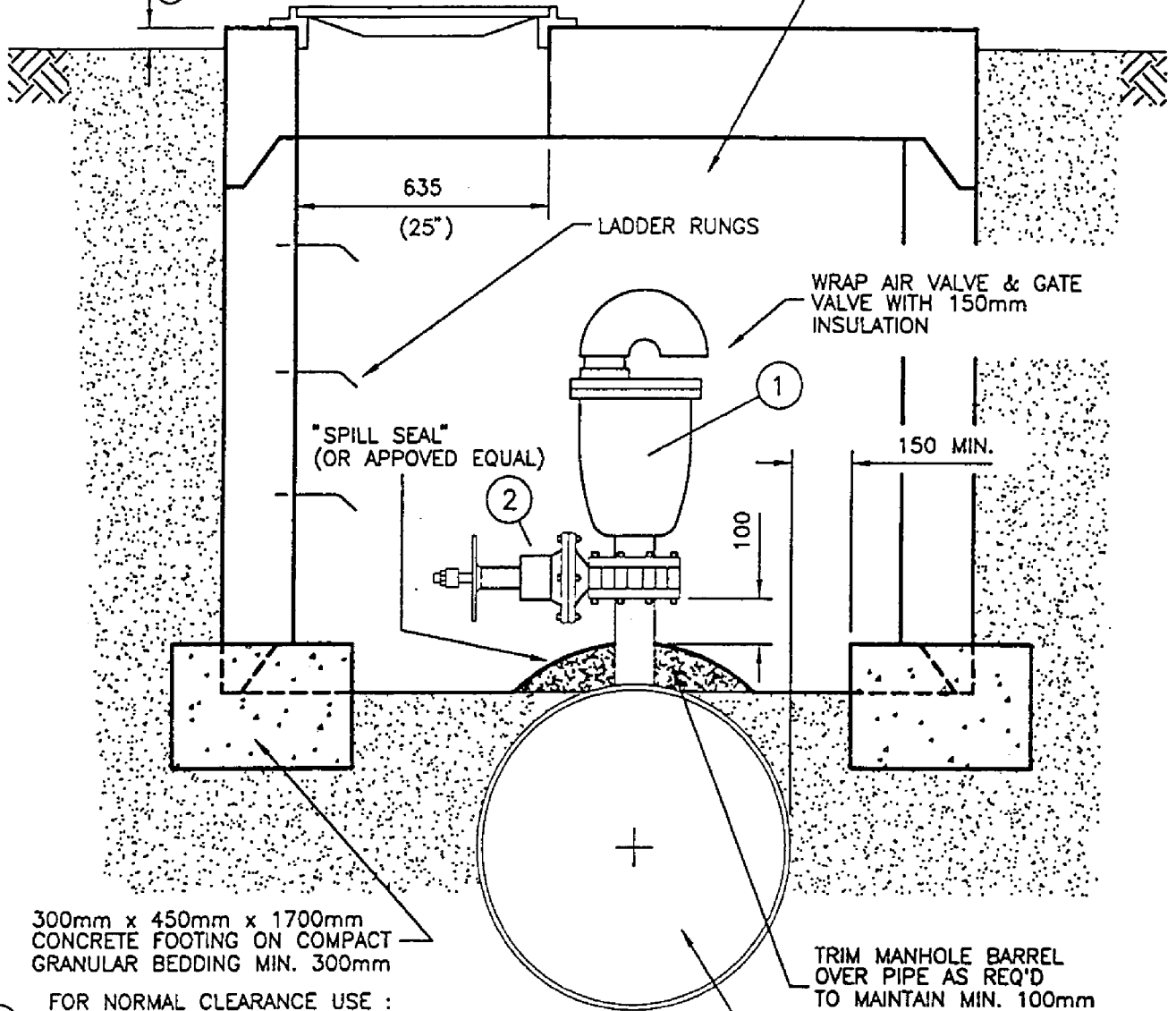
DWG NO.:2800-19

FLUSH MOUNTING MANHOLE
FRAME & COVER

1.8m x 100mm ϕ SCH 40 PAINTED
STEEL PIPE MARKER POST EMBEDDED
0.6m IN CONCRETE, IN ISOLATED
LOCATIONS.

1524mm ϕ (60") CONCRETE
MANHOLE BARREL c/w LID
(HEIGHT MAY VARY)

50
(TYP.)



SPILL SEAL
(OR APPROVED EQUAL)

LADDER RUNGS

WRAP AIR VALVE & GATE
VALVE WITH 150mm
INSULATION

150 MIN.

100

300mm x 450mm x 1700mm
CONCRETE FOOTING ON COMPACT
GRANULAR BEDDING MIN. 300mm

TRIM MANHOLE BARREL
OVER PIPE AS REQ'D
TO MAINTAIN MIN. 100mm
CLEARANCE OVER PIPE

1

FOR NORMAL CLEARANCE USE :
100mm OR 150mm ϕ FLG. APCO COMBINATION
AIR RELEASE VALVE c/w 180° RETURN (OR APPROVED EQUAL)
FOR LOW CLEARANCE USE :
GOLDEN ANDERSON (UPON K.L.W.D. APPROVAL)

LARGE ϕ ST. WATERMAIN

2

FOR NORMAL CLEARANCE USE :
100mm OR 150mm ϕ RESILIENT WEDGE GATE VALVE
(OR APPROVED EQUAL)
FOR LOW CLEARANCE USE :
100mm OR 150mm ϕ CAST S.S. FLG. KNIFE GATE
VALVE GRINNELL MODEL GR-316 (OR APPROVED EQUAL)

KEMP LAKE WATERWORKS DISTRICT

STANDARD AIR VALVE INSTALLATION LARGE ϕ PIPE

DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-24

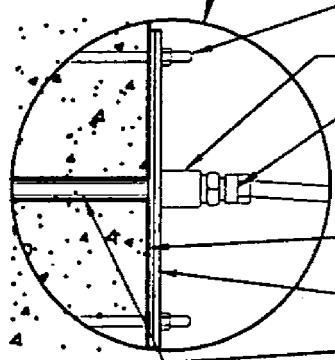
SAMPLE POINT ENCLOSURE
SEE DRAWING No.2950

CONCRETE RESERVOIR WALL

12# "TYPE L" COPPER PIPE SECTION
1250 LONG ANGLED SLIGHTLY DOWNWARD

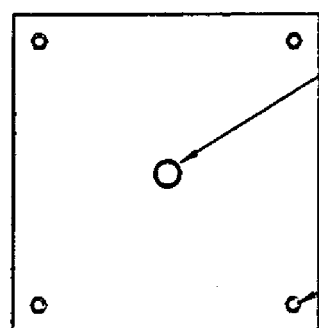
9.5# x 9.5# 150/600
BRASS BALL VALVE x 9.5 O.D.
COMPRESSION (USE REDUCER
IF NECESSARY) x 7.9 O.D.
COPPER WITH DOWN TURN.

DETAIL



9.5# "HILT" TYPE ANCHOR BOLT
20# STAINLESS STEEL PIPE COUPLING
12# COMPRESSION x 20# MALE PIPE
THREAD FITTING,(MUELLER 110 or equal).
FITTING TO BE REAMED OUT TO ALLOW
12# COPPER PIPE TO PASS THROUGH
GASKET MATERIAL 6mm THICK
STAINLESS STEEL PLATE 6mm THICK
DRAIN RESERVOIR AND CORE 20# HOLE
THROUGH WALL

PLATE



300 x 300 STAINLESS STEEL PLATE 6mm THICK
BORE 20# HOLE IN CENTER AND WELD 20#
STAINLESS STEEL PIPE COUPLING CENTERED OVER
HOLE.

BORE 12# HOLES AS SHOWN AT CORNERS
FOR ANCHOR BOLTS

KEMP LAKE WATERWORKS DISTRICT

TYPICAL RESERVOIR SAMPLING STATION

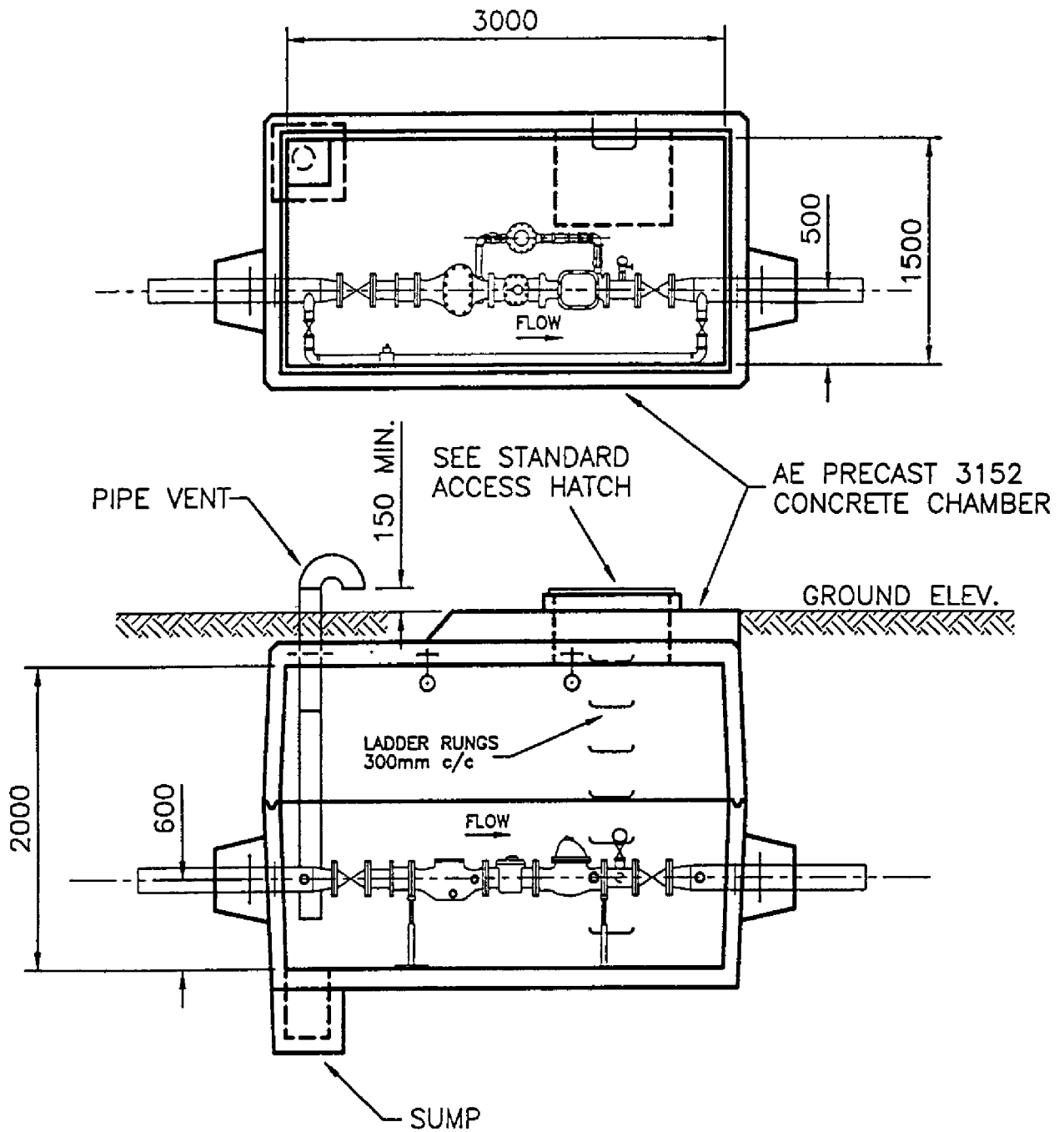
DATE: MARCH 1998

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SCALE: NTS

CHECKED BY:

DWG NO.:2800-29



KEMP LAKE WATERWORKS DISTRICT

PRECAST 100mm SENSUS FIRELINE METER VAULT

DATE: MARCH 1998

DRAWN BY:

SCALE: NTS

CHECKED BY:

DWG NO.:2800-31