

Town Of Kindersley



MASTER SPECIFICATIONS

MARCH 12, 2018

TABLE OF CONTENTS

	Pages
SECTION 1000 GENERAL REQUIREMENTS	
Section 1001 Definitions	2
Section 1002 General Instructions	4
Section 1100 Measurement and Payment	9
Section 1200 Contractor's Use of Site	11
Section 1300 Project Schedule and Inspection	16
Section 1400 Alternates	22
Section 1500 Submittals	23
Section 1600 Quality Control	25
Section 1700 Temporary Facilities and Controls	26
Section 1800 Environmental Protection	29
Section 1900 Materials and Equipment	30
 SECTION 2000 EARTH WORK	
Section 2100 Park Grading	2
Section 2200 Topsoil and Seeding	5
Section 2300 Trenching, Backfilling and Compaction for Utilities	9
Section 2400 Site Excavation, Embankment and Compaction	16
 SECTION 3000 WATER AND SEWER	
Section 3100 Water Distribution	2
Section 3200 Sanitary Sewers	11
Section 3300 Storm Sewer	20
Section 3400 Manholes	28
Section 3500 Catch Basins	31
Section 3600 Building Services	33
Section 3700 CCTV Sewer Inspection	38
Section 3800 Trenchless Installation	47

Table of Contents
Page 2

SECTION 4000 ROADWAYS

Section 4100	Subgrade Construction	2
Section 4200	Granular Subbase	9
Section 4300	Granular Base Course	13
Section 4400	Milling	17
Section 4500	Hot Mix Asphalt Pavement	19
Section 4600	Prime, Tack and Fog Coats	29
Section 4700	Adjustment of Appurtenances	33

SECTION 5000 CONCRETE

Section 5100	Concrete Formwork	2
Section 5200	Concrete Reinforcement	5
Section 5300	Cast-In-Place Concrete	8

APPENDICES

A	Standard Drawings	
---	-------------------	--

Town Of Kindersley



MASTER SPECIFICATIONS

SECTION 1000	GENERAL REQUIREMENTS	PAGE
Section 1001	Definitions	2
Section 1002	General Instructions	4
Section 1100	Measurement and Payment	9
Section 1200	Contractor's Use of Site	11
Section 1300	Project Schedule and Inspection	16
Section 1400	Alternates	22
Section 1500	Submittals	23
Section 1600	Quality Control	25
Section 1700	Temporary Facilities and Controls	26
Section 1800	Environmental Protection	29
Section 1900	Materials and Equipment	30

1.0 GENERAL

- .1 Contractor means the person or entity contracted to undertake the construction works, as designated as such in the Contract Documents.
- .2 Owner means the person or entity designated as such in the Contract Documents. This may be the land developer or the Town. Where applicable, 'Owner' may also refer to the person designated as the Site Representative of the Owner.
- .3 Town means the Town of Kindersley, in the Province of Saskatchewan.
- .4 Work means the total construction and services and the carrying out and doing of all things, whether of a temporary or permanent nature, required by or reasonable inferable from the contract documents.

2.0 EARTH WORK

- .1 **Boulder Excavation** is defined as boulders, pieces of concrete or masonry, in excess of 0.2 cubic metres and having an average diameter less than 600 mm, which can be removed with a power operated excavator.
- .2 **Common Excavation** is defined as the excavation of all material other than rock, and shall include over-burden over rock, hard pan, quicksand, frozen earth and boulders up to a size of 0.2 m³ or boulders having an average diameter less than 600 mm.
- .3 **Ditch** is defined as V-shaped earthen drainage channel of varying depth with 3:1 sideslopes.
- .4 **Swale** is defined as broad V-shaped earthen drainage channel of shallow depth with 8:1 or flatter sideslopes.
- .5 **Topsoil** is defined as organic material and is to be removed and placed on the designated topsoil disposal stockpile.
- .6 **Unstable Subgrade** is material which is unstable, or where it contains material harmful to the culvert such as ashes, cinders, refuse, vegetable or organic material.

3.0 WATER AND SEWER

- .1 Not applicable

4.0 ROADWAYS

- .1 **Adjustment of Appurtenances** is the addition or removal of at least one grade ring or course of brickwork, resetting disturbed grouting and change of rim/cover elevations.

- .2 **Fog Coat** is the application of bituminous materials to seal small cracks and surface voids on asphalt surface materials or a curing seal for Cement Stabilized Base Course.
- .3 **Prime Coat** is the application of bituminous material to granular base course, preparatory to placing bituminous surfacing materials or asphaltic concrete base course.
- .4 **Roadway Common Excavation** is defined as the excavation of all material including rock and shall include over-burden, hard pan, quicksand, frozen earth and boulders.
- .5 **Tack Coat** is the application of bituminous material to a previously constructed paved surface of any type in preparation of placing bituminous surfacing materials.
- .6 **Topsoil** is defined as organic material and is to be removed and placed on the designated topsoil disposal stockpile.

5.0 CONCRETE

- .1 Not applicable

END OF SECTION

1.0 USE OF SPECIFICATIONS

- .1 The complete work under these specifications shall be governed by the dictates of good practice in all details of materials and methods even if not minutely specified.
- .2 The work shall be properly coordinated with the requirements of other units of work specified in other sections.
- .3 All drawings are to be read in conjunction with all Sections of this specification.

2.0 CONTRACT DOCUMENTS

- .1 The Contract Documents are complementary and what is required by any one shall be as binding as if required by all.
- .2 If there is a conflict within the Contract Documents:
 - .1 The Contractor shall promptly notify the Owner of the conflict
 - .2 The order of priority of documents, from highest to lowest, shall be:
 - .1 Addenda (if any);
 - .2 Contract Documents
 - .3 Notice of Acceptance;
 - .4 Schedules;
 - .5 Specifications; and
 - .6 Drawings;
 - .3 Drawings of larger scale shall govern over those of smaller scale of the same date;
 - .4 Dimensions shall not be scaled from Drawings under any circumstances. In the event the Contractor requires dimensions not shown on Drawings, Contractor shall request the required dimensions from Owner; and
 - .5 Later dated documents shall govern over earlier dated documents of the same type.
- .3 Any work that may reasonably be inferred from the Contract Documents as being required to perform the Work shall form part of the Work and shall be performed by the Contractor, whether or not it is specifically called for, and shall include the supply of all materials, plant, labour, equipment necessary

to complete the Work. The intent is that a complete project will be provided by the Contractor.

- .4 Words and abbreviations used in the Contract Documents which have well known technical or trade meanings, or are defined in the Contract Documents, shall be interpreted in accordance with such meanings or Definitions.
- .5 Industry standards, whether or not bound or referred to in the Contract Documents, shall apply to the Work.
- .6 The Contractor is responsible to coordinate all Drawings to totally complete the Work.
- .7 The Drawings are a diagrammatic view of the Work required but do not limit the extent of the work required to totally complete the details and work intended. It is the Contractor's responsibility to apply its expertise to execute the intended work shown on the Specifications and Drawings. The Contractor shall coordinate all Drawings with the sizes and dimensions of services, fixtures and equipment in the locations shown on the plans or as site conditions permit. Any changes required to facilitate and complete the installation of such services, fixtures or equipment shall be made at no additional cost to the Owner, unless a Change Order or a Change Directive has been issued.
- .8 Notwithstanding the apparent generality of the Specifications or the Drawings as to any detail, or the apparent omission from them of a detailed description concerning any point, the Specifications and the Drawings shall be interpreted as requiring that only the best general practice is to prevail and that only material and workmanship of the first quality are to be used in the performance of the Work.
- .9 Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of the Owner as to the Work, it is intended that such requirement, direction, review or judgment shall be solely to evaluate the Work for general conformance with the design concept for the Project (unless there is a specific statement indicating otherwise). Notwithstanding any such requirement, direction, review or judgement by the Owner, the Owner does not have authority to supervise or direct performance of the Work or authority to undertake responsibility contrary to these provisions.

3.0 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy of each of the following:

- .1 Construction Issue Contract Drawings
- .2 Contract Documents
- .3 Specifications
- .4 Addenda
- .5 Reviewed Shop Drawings
- .6 Change Orders
- .7 Other Modifications to Contract
- .8 Field Test Reports
- .9 Approved work Schedule
- .10 Up to Date Record Drawing Mark-Ups
- .11 Manufacturer's Installation and Application Instructions
- .12 WHMIS and Other Safety Data
- .13 Contractor's Safety Manual

4.0 **UNITS**

- .1 The SI (metric) system of units, is used on the drawings and throughout this specification. The SI system shall be the sole basis for measurement, layout, and all associated work under this Contract.
- .2 The Owner's interpretation of SI, as set forth in CAN 3 Z 234.1 "Metric Practice Guide" and CAN 3 Z 234.2 "The International System of Units", shall govern.

5.0 **CODES AND STANDARDS**

- .1 Perform work in accordance with National Building Code of Canada (NBC), latest Edition and all other applicable regulations.
- .2 The Contractor shall comply with all laws, ordinances, rules, regulations, codes and orders relating to the Work, the preservation of the public health and to constructions safety which are or become in force during the performance of the work.
- .3 Within the text of the Specifications, reference may be made to the following standards:
 - ACI - American Concrete Institute
 - AISC - American Institute of Steel Construction
 - ANSI - American National Standards Institute
 - ASTM - American Society of Testing and Materials
 - AWWA- American Water Works Association
 - CEC - Canadian Electric Code (published by CSA)
 - CGA - Canadian Gas Association

CGSB	-	Canadian Government Specification Board
CISC	-	Canadian Institute of Steel Construction
CMB	-	Construction Materials Board
CSA	-	Canadian Standards Association
EIB	-	Electrical Inspection Branch
IEEE	-	Institute of Electrical and Electronic Engineers
IPCEA	-	Insulated Power Cable Engineers Association
NACE	-	National Association of Corrosion Engineers
NBC	-	National Building Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
NSC	-	National Standard of Canada
ULC	-	Underwriters Laboratories of Canada

- .4 Conform to the latest version of such standards available at the time of tendering, in whole or in part, as specified.
- .5 If there are questions as to whether any product or system is in conformance with applicable standards, the Owner reserves the right to have such products or systems tested to prove or disprove conformance with Contract Documents, or by the Contractor in the event of non-conformance.

6.0 PERMITS

- .1 The Owner shall obtain and pay for the building permit and all other permits, licences, inspections and certificates and pay all fees for the performance of the Work, but this shall not include the obtaining of permanent easements or rights of servitude.
- .2 The Contract price shall include the cost of these permits, licences, inspections, certificates and fees.
- .3 Except where otherwise specified, the Contractor shall pay all royalties, rent and other payments or compensation (if any) for obtaining all materials required for the Work.
- .4 The Owner shall ensure that the Contractor, all trades and sub-trades have appropriate business licences to work in the Town and in the Province of Saskatchewan.

7.0 PROJECT MEETINGS

- .1 Owner will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

8.0 SITE CONDITIONS

- .1 The Bidder must examine the site of the Work before submitting the Bid, either personally or through a representative and satisfy himself as to the nature and location of the Work, local conditions, soils structure and topography at the site of the Work, the nature and quality of the materials to be used, the equipment and facilities needed preliminary to, and during, the prosecution of the Work, the means of access to the site, on-site accommodation, all necessary information as to risks, contingencies and circumstances as may affect the Bid, and all other matters which can, in any way, affect the Work under the Contract. The Tenderer is fully responsible for obtaining all information required for the preparation of the Bid and for the execution of the Work.
- .2 The Bidder is not entitled to rely on any data or information included in the Bid Documents as to site or sub-surface conditions or test results indicating the suitability or quantity or otherwise off-site or subsurface materials for backfilling or other uses in carrying out the construction of the Work. If the Bidder requires additional time to conduct their own investigations or is of the opinion either that the site or subsurface conditions or that site or subsurface materials differ materially from that indicated by data or information included in the Bid Documents, he shall promptly request such additional time or notify the Owner in writing of this opinion before the time of Bid submission. The Owner will either extend the time for submission of Bids to enable Bidders to carry out further investigation or issue an addendum modifying the Bid Documents or both as the circumstances may permit.

END OF SECTION

1.0 GENERAL**1.1 Progress Certificates**

- .1 The Contractor is to prepare monthly Progress Certificates and submit to the Owner for approval.
- .2 The Contractor is responsible for undertaking all measurements and computations required for payment applications.
- .3 If, because of climatic or other conditions reasonably beyond the Contractor's control, there are items of work which cannot readily be completed, the payment for the work which has been completed shall not be delayed on account thereof, but the Owner may withhold a sufficient and reasonable sum in addition to the Builder's Lien Act holdback, as will adequately protect the Owner.

1.2 Measurement

- .1 The scope of each payment item will be as described on the bid form.
- .2 Completed quantities shall be calculated as follows:

Unit in Tender Form	Measurement Calculation
Lump sum	Percentage of completion to date
Each	Total number of units installed to date
Lineal / square / cubic metre	Total metres installed to date
Cash Allowance	Total amount utilized, in accordance with Section 1.3 "Cash Allowance".

1.3 Cash Allowance

- .1 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, Products, construction machinery and equipment, freight, unloading, handling, storage, installation and other authorized expenses incurred in performing the Work stipulated under the cash allowance.
- .2 The Contract Price, and not the cash allowance, includes the Contractor's overhead and profit in connection with such cash allowance.
- .3 Expenditures under cash allowances shall be authorized by the Owner. Where the actual cost of the Work under any cash allowance exceeds the amount of the allowance the Contractor shall be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess, provided that the Contractor has obtained prior written approval from the Owner for any excess costs. Where the actual cost of the Work under any cash allowance is less than the amount of the allowance, the Owner

shall be credited for the unexpended portion of the cash allowance, but not the Contractor's overhead and profit on such amount.

- .4 The Contract Price shall be adjusted by written order to provide for any excess or deficit to each cash allowance.
- .5 Progress payments on account of authorized expenditures under cash allowances shall be certified on the Owner's monthly certificates for payment.

2.0 EXTRA WORK

- .1 When extra work is to be performed, under written order by the Owner, The Contractor shall be reimbursed for actual cost incurred in doing the work, and shall receive an additional payment of 10% of such cost to cover their indirect overhead costs and profit.
- .2 The term "cost" shall cover all payroll charges for men employed and supervision required under the specific order, including allowances for Workers' Compensation, insurance and holiday allowance; the invoiced cost of all material supplies required, rental of power driven plant at the rates and under the terms specified in the current issue of the "Equipment Rental Rates" of the Department of Highways and Transportation of the Province of Saskatchewan; and any other costs incurred by the Contractor as a direct result of executing the order, if previously approved by the Owner.

END OF SECTION

1.0 CONSTRUCTION EASEMENTS

- .1 The Contractor shall be responsible for obtaining any construction easements beyond the easement limits as set out on the drawings.

2.0 MATERIALS STORAGE

- .1 Do not unreasonably encumber site with materials or equipment.
- .2 Move stored products or equipment, which interfere with operations of Owner or other contractors.
- .3 Obtain and pay for use of additional storage or work areas for operations.

3.0 PROTECTION OF SURVEY MONUMENTS

- .1 The Contractor shall take all necessary precautions to prevent the destruction of site survey monuments.
- .2 Prior to commencement of construction operations, the Contractor shall acquaint himself with the survey monuments on the site and thus be aware of their location.
- .3 Contractor shall place 38 x 89 mm markers at property pins, bench marks and control points, and paint fluorescent orange prior to construction start.
- .4 Upon completion of construction operations, an inspection shall be carried out to determine if any of the survey monuments have been removed or damaged. The Contractor shall reimburse the Owner for any cost involved in replacement by Registered Saskatchewan Land Surveyor of any monuments which have been removed or damaged.

4.0 SALVAGED MATERIAL

- .1 All salvaged material is the property of the Owner and shall be removed from the work site to a location designated by the Owner.

5.0 SITE DAMAGE AND RESTORATION

- .1 The Contractor shall protect the work, the Owner's property and the properties adjacent to the work site from damage.
- .2 At their own expense, the Contractor shall make good any damage which may arise as the result of their operations under the contract, to a condition equal to or better than the condition prior to construction.
- .3 This includes, but is not limited to, disturbed / excavated roadways, damaged culverts, underground utilities, drainage routes, sidewalks, curbs and lot accesses.

6.0 SAFETY AND PROTECTION OF THE WORK AND PROPERTY

- .1 For the purposes of this project, the Contractor is assigned the role of Prime Contractor for the Work Site and is responsible for ensuring compliance with the Occupational Health and Safety Act and Occupational Health and Safety Regulations by all employers and employees on the Work Site.

7.0 ACCESS TO PROPERTIES AND STREET MAINTENANCE

- .1 Until the date of substantial completion, the Contractor, at their cost, shall be responsible for street maintenance and access to properties.
- .2 Such maintenance and access to properties shall include providing proper drainage, temporary gravel streets, street levelling with use of motor patrol, and providing towing services when required.

8.0 ROAD CLOSURES & STREET SIGNS

- .1 The Contractor shall notify the Owner prior to the removal of any existing street and traffic signs. The Contractor will notify the Owner upon construction completion to ensure that signs are replaced.
- .2 The Contractor shall submit a Road Closure permit forty-eight (48) hours in advance of closing any Town streets.
- .3 Notification shall be given to the Town when these streets are open to traffic and all services are back in operations.

9.0 EXISTING INFRASTRUCTURE**9.1 Locating**

- .1 The location and elevation of existing underground utilities is compiled from records, but is not guaranteed.
- .2 Notwithstanding any other provision, the Contractor shall be responsible for determining at their expense the actual location and elevation of all sewer, water and gas mains or lines, electric light, power, telephone or telecommunications, conduits, or other such structures or utilities whether or not shown on the plans.
- .3 The Contractor shall be responsible for notifying the respective utility at least forty-eight (48) hours in advance of their intention to carry out operations in the vicinity of the said utility and, if required, shall pay for any service supplied for locating of these utilities.

9.2 Clashes

- .1 Where existing utilities or other street improvements are found to be within the lines of the work, the Owner shall be notified. The Contractor shall then proceed as directed by the Owner or the respective utility corporation.
- .2 If the proposed work can be altered to avoid the conflict with the existing utility and the Owner so orders, the Contractor shall supply all labour and material required to change the work to conform to the new alignment. No extra payment will be made for this work and no extra allowance shall be made to the Contractor for any loss of time involved.

9.3 Construction near Existing Utilities

- .1 When traversing beneath existing utilities they must be supported with timber shoring approved by the Owner. Prior to backfilling the trench, the suspended utility must be supported from below with well-tamped gravel bedding or unshrinkable fill supplied, placed and paid for by the Contractor.
- .2 The Contractor shall be responsible at their own expense for locating the dead ends of existing water mains or sewer mains from which new construction must start. When new construction must start at an existing manhole, the Contractor shall construct the required connection. Such connections shall be included in the overall tender price.
- .3 The Contractor shall take precautions to protect existing sidewalks and curbs from damage as a result of their operations. Where it is necessary for equipment to work on or cross existing sidewalks, the Contractor shall carefully place planks or mats on the sidewalk.
- .4 No sidewalk or curb shall be removed by the Contractor without the approval of the Owner.
- .5 When a utility is exposed during construction, the Contractor shall immediately inform the Owner of the utility, who may inspect the utility prior to backfilling.

10.0 INTERRUPTION OF SERVICES

- .1 The Contractor shall organize the work in such a manner that interruption of service will not occur.
- .2 If the Contractor anticipates such interruptions he shall notify the Owner prior to award of Contract.
- .3 During construction, if it becomes necessary to disrupt services, the persons to be affected and the Owner shall be given due and reasonable notice of such interference by the Contractor.

- .1 A Town representative will attend to open and close of all valves necessitated by this construction.
- .2 At least 48 hours' notice shall be given to the Town of the need of such waterworks man.
- .3 The Contractor will be responsible for determining the location of all connections that traverse the site of the work and the Town will provide all available information on such connections upon request.
- .4 All costs incurred for disruption of service and for repair of surface and/or underground utilities damaged by the Contractor's operation shall be the Contractor's responsibility.
- .5 Maintenance of existing utilities and structures repaired or supported are the responsibility of the Contractor for the duration of the maintenance period.

11.0 ARCHAEOLOGICAL INTERESTS

- .1 Immediate notice shall be given to the Owner if evidence of archaeological finds are encountered during construction.
- .2 Items of historical, cultural or archaeological interest such as cornerstones, headstones, commemorative plaques, inscribed tablets and similar objects found on site shall be left in place until specific instruction from the Owner is given.

12.0 SURVEY

12.1 Layout

- .1 The Owner will lay out the work covered by this Contract. Layout will consist of survey stakes to define location, alignment and elevations of the work.
- .2 Contractor shall provide the Owner with 48 hours advance notice of requiring survey stakes, and shall coordinate staking requirements with the Owners work schedule.
- .3 The Contractor shall set grades and layout work in detail from the control points and grades established by the Owner. The Contractor may set additional grades and lay out the work in sufficient detail to conform to their construction practices, but all grades shall be determined from the control points and grades as established by the Owner.
- .4 If requested by the Owner, the Contractor shall provide and pay for all stakes, markers, tools, and any help reasonably required for laying out the work, collecting record and quantity information.

- .5 If requested by the Owner, the Contractor shall supply a competent survey assistant to assist the Owner on a part time basis as required throughout the Work. The Owner will estimate the competency of the survey assistant. The Owner may request alternate personnel which shall be provided by the Contractor until a basic level of competency is consistently demonstrated by the survey assistant provided.

12.2 Commencement

- .1 Before commencing work, the Contractor shall satisfy himself as to the meaning and correctness of all stakes, markers and grade sheets.
- .2 The Contractor shall pay all restoration charges for damaged survey layout, stakes, markers, etc.

13.0 SITE ACCESS

- .1 Maintain unobstructed access to fire and police appurtenances, telephone, electric, water, sewer, gas or other public utilities and private properties.
- .2 If applicable, the Contractor shall coordinate their work with and provide access to other contractors working in the area.

END OF SECTION

1.0 WORK SCHEDULE

- .1 Provide within ten (10) working days after the contract award, in form acceptable to Owner, schedule showing anticipated progress stages and final completion of work within time period required by contract documents.
- .2 Interim reviews of work progress based on schedule submitted by Contractor will be conducted as directed by Owner and schedule updated by Contractor in conjunction and with approval of Owner.

1.1 Liquidated Damages

- .1 In case the Contract is not completed within the time stated in the Contract, or by, or prior to a date the Contractor will pay to the Owner as liquidated damages, the actual cost to the Owner of maintaining its engineering, inspection and other forces and equipment on the Work after said time for completion, together with such other damages as may be suffered by the Owner because of the Contractor's failure to complete the Work on time.

2.0 HOURS OF WORK

- .1 The Contractor's hours of work shall comply with all Local, Provincial, and Federal regulations. At all times, operational noise shall be kept to a practicable minimum for construction operations. Hours of work shall not exceed beyond 7:00 A.M., to 9:00 P.M., without prior authorization by the Owner. Hours of work shall be established by the Contractor and the Project Owner prior to construction start-up. Hours of work shall become part of the work schedule.
- .2 The Owner's representative is to be informed not less than forty-eight (48) hours in advance if work is to be carried out beyond the normal hours of work established in Schedule.
- .3 If the Project Construction is behind schedule, the Owner may order the Contractor to take actions as deemed necessary to maintain the progress required by the Work schedule, at the Contractor's expense. Actions may include, but are not limited to:
 - .1 The supply of additional labour
 - .2 The provision of additional hours of work
 - .3 Furnishing of additional equipment
- .4 Permission of the Owner does not relieve the Contractor of the responsibility for attaining necessary permission from local governing agencies.

3.0 ROUTINE INSPECTION OF WORK

- .1 The Owner and Town shall, at all times, have free and uninterrupted access to the Work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access.
- .2 The Contractor shall provide, at no cost to the Owner / Town, such labour and access as may be required to enable the Owner / Town to carry out a complete inspection of all installation and materials.
- .3 If the Contract Documents, the Owner's instructions, or the laws or ordinances of the Place of the Work require any work to be specially tested, inspected or approved, the Contractor shall give the Owner timely notice of readiness of the Work for all required tests, inspections or approvals.
 - .1 The Contractor shall arrange for tests, inspections or approvals by other authorities and shall give the Owner timely notice of the date and time.
 - .2 If the Contractor covers, or permits to be covered, Work that has been designated for special tests, inspections or approvals before such tests, inspections or approvals are made, given or completed, the Contractor shall, if so requested, uncover the Work, have the inspections or tests satisfactorily completed and correct such work at its own expense.
 - .3 The Contractor shall furnish promptly to the Owner and Town a copy (in pdf format) of certificates and inspection reports relating to the Work.
- .4 Re-examination of questioned work may be ordered by the Owner. If such work is determined by the Owner to be in accordance with the requirements of the Contract Documents, the Owner shall pay the cost of re-examination and replacement. If such work is determined by the Owner to not be in accordance with the requirements of the Contract Documents, the Contractor shall correct such work and shall pay the cost of re-examination and correction.
- .5 The Contractor shall incur the cost of making any test or inspection, including the cost of samples required for such test or inspection, if such test or inspection is designated in the Contract Documents to be performed by the Contractor, or is designated by laws or ordinances applicable to the Place of the Work.
- .6 The Contractor shall incur the cost of samples required for any test or inspection to be performed by the Owner or the Owner if such test or inspection is designated in the Contract Documents.

- .7 No obligation shall be imposed on the Owner by reason of any testing, inspection or approval, nor shall any failure to test, inspect or approve relieve the Contractor of responsibility for the Work.

4.0 DEFECTIVE WORK

- .1 The Owner / Town has the authority to stop work and order the re-excavation and removal of any or all installations if any materials or installation method employed does not conform to these specifications.
- .2 The Contractor shall promptly correct any defective Work which has been rejected by the Owner as failing to conform to the Contract Documents, whether incorporated in the Work or not. Thereafter, the Contractor shall promptly correct any defective Work in accordance with the Contract Documents and without expense to the Owner and shall bear the expense of making good all work of Other Contractors destroyed or damaged by such correction.
- .3 If the Contractor does not correct such defective Work within the time fixed by written notice from the Owner, the Owner may have such defective Work corrected at the expense of the Contractor. If the Contractor does not pay the expense of such correction within five (5) Days after receipt of an invoice therefor, the Owner may, upon ten (10) Days' written notice, deduct from the Contract Price all expenses that should have been borne by the Contractor.
- .4 If, in the opinion of the Owner, it is not expedient to correct defective Work, the Owner may deduct from the Contract Price the difference in value between the Work as done and that called for by the Contract Documents, the amount of which shall be determined by the Owner. Any reduction of payment to the shall in no way relieve the Contractor from its obligations pursuant to the Contract.

5.0 MILESTONE INSPECTION PROCEDURES

- .1 Contractor's Inspection: The Contractor and their Sub- Contractors shall conduct an inspection of the work and correct all deficiencies.
- .2 Owner's Inspection: The Contractor shall notify the Owner, in writing of satisfactory completion of the "Contractor's Inspection", and request a "Owner's Inspection". The Owner's Inspection shall consist of the Owner and Contractor.
- .3 Deficiencies: During the "Owner's Inspection" a list of all deficiencies shall be drawn up and signed by the Owner. The Contractor shall correct all deficiencies in a satisfactory manner.
- .4 Substantial Completion Inspection: When the Contractor is satisfied that all identified deficiencies have been corrected, the Contractor shall request, in writing a "Substantial Completion Inspection". The Inspection team shall consist of the Town, Owner and the Contractor.

- .5 Total Completion Inspection: When the Contractor is satisfied that all deficiencies have been corrected at or during the Performance Testing, the Contractor shall request in writing, a "Total Completion Inspection". The Inspection team shall consist of the Town, Owner and the Contractor.

6.0 CONTRACT CLOSEOUT

6.1 Progressive Cleaning

- .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other Contractors.
- .2 Make arrangements with and obtain permits from authorities having jurisdiction for off-site disposal of waste and debris.
- .3 Remove waste material and debris from the site at the end of each working day.
- .4 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

6.2 Final Cleaning

- .1 At the completion of the construction work, all areas on which work has been done shall be left in a neat and presentable condition.
- .2 All drainage paths which have been blocked as a result of the work shall be repaired or restored to their original condition or better.
- .3 Dispose of all surplus excavated material, trees, brush, rock, boulders and pieces of concrete or masonry, including those less than 0.3 m³ in volume, at a location approved by the Owner or Owner.
- .4 The Contractor, with the Owner, shall inspect all equipment, buildings, valve boxes, manhole tops, and shall operate all valves to ensure that no damage has occurred during the construction and clean-up operations.
- .5 Remove debris and surplus materials.
- .6 Remove snow and ice from access to building.

6.3 Record Documents - Actual Site Conditions

- .1 Owner will provide two sets of white prints for record drawing purposes.
- .2 Maintain project record drawings current as work progresses and record neatly and accurately deviations from Contract Documents.
- .3 Record the following information:

- .1 Depths of various elements of foundation in relation to bench mark indicated on drawings.
- .2 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
- .3 Field changes of dimension and detail.
- .4 Changes made by Change Order or Site Instruction.
- .4 Identify each set of drawings as "Project Record Drawings" and date and sign each set.
- .5 Record changes in red. Mark on one set of prints and at completion of project and prior to interim inspection, neatly transfer notations to second set and submit both sets to Owner.

7.0 WARRANTY, MAINTENANCE AND COMPLETION

7.1 Overall

- .1 The Contractor shall be responsible for faulty materials and/or workmanship for a period of one year (the warranty period) from the date of the Interim Certificate of Completion.
- .2 The Contractor shall also be responsible for maintenance or corrections which develop as a direct result of faulty materials and/or workmanship.
- .3 The warranty period will commence upon completion of the work in each construction season providing conditions are met to the satisfaction of the Town and Owner.
- .4 The term "Maintenance" as used in these specifications does not include operation of the system or rectification of problems arising out of system operation, failure of Public Utilities, general wear and tear on operational equipment, tools, structures, and appurtenances or failures resulting from work performed by others. Continuous regrading and cleaning up streets, rights of way and other working areas necessitated by the use of such areas by others, weather conditions and other factors beyond the Contractor's control shall be considered as operational hazards not maintenance.
- .5 After due notification in writing to the Contractor, the Owner may proceed with correction of a fault at the expense of the Contractor and their Surety.
- .6 In emergency situations, endangering life or public property, the Owner shall proceed with repairs and thereupon advise the Contractor of the failure, and resulting costs shall be paid by the Contractor.

7.2 Trench Subsidence

- .1 The Contractor shall be responsible to ensure that trench settlement is maintained at a maximum of 50 mm for a period of one year from time of substantial completion.
- .2 Contractor shall bear the costs for repairs of subsidence beyond 50 mm by filling with asphalt, and levelling to meet the technical requirements of the approving authority.

END OF SECTION

1.0 PRODUCT ALTERNATES

- .1 For products specified only by reference standards, select any product meeting standards.
- .2 For products specified by naming several products or manufacturers, select any product and manufacturer named.
- .3 For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or equal" after specified product, submit a request for approval of any product not specifically named.
- .4 For products specified by naming only one product and manufacturer, there is no option and substitution will not be allowed.

2.0 SUBSTITUTIONS

- .1 The Owner may consider requests for substitutions providing that requests are submitted in time to allow for adequate review and describe such substitutions in full detail, the type of material, equipment or method and reasons for substitutions. Requests may be made for substitutions as an equal or as an alternate. In the case of an alternate, submit any increase or decrease in price for the substitution.
- .2 In making request for substitution, ensure that:
 - .1 The proposed product and method has been investigated and it is equal or superior in all respects to that specified.
 - .2 At least the same guarantee is given for the substitution as for the product and method originally specified.
 - .3 The installation of the accepted substitution is coordinated into the work, and make such changes as may be required for the work to be complete in all respects.
- .3 Do not substitute materials, equipment or methods into the work unless such substitutions have been specifically approved by the Owner.
- .4 Substitutions will not be considered if:
 - .1 They are indicated or implied on shop drawings or project data without formal request submitted in accordance with these specifications.
 - .2 Acceptance will require substantial revision of the Contract Documents.
 - .3 They are not submitted in accordance with these specifications.

END OF SECTION

1.0 GENERAL

- .1 The Contractor shall be responsible for the following:
 - .1 Review of all submittals prior to submission. Errors and omissions in submittals are not relieved by the Owner's review of submittals.
 - .2 Verification of field measurements, field construction criteria, catalogue numbers and similar data.
 - .3 Coordinate each submittal with requirements of the work and the Contract Documents.
 - .4 Notify the Owner in writing at time of submission, of any deviation in submittals from requirements of the Contract Documents.
- .2 Submit well in advance of schedule dates for fabrication, manufacture, erection, and installation to provide adequate time for reviews, securing necessary approvals, possible revisions and re-submittals, placing orders, securing delivery and to avoid construction delays.
- .3 Accompany each submittal with a letter of transmittal containing all pertinent information required for identification and checking of submittals.
- .4 When submittals are resubmitted for any reason, transmit under a new letter of transmittal.
- .5 Do not carry out work which requires submittals until submittals have been approved by the Owner.

2.0 SHOP DRAWINGS, TEMPLATES AND MANUALS

- .1 Prepare shop drawings which the Owner considers necessary to show details of the work to be provided in relation to adjacent work of other contracts. Clearly identify shop drawings by title and Contract, name and reference to applicable Owner's drawings. Notify the Owner in writing of changes made from the Contract Documents.
- .2 Submit in accordance with the Contract Schedule not less than Four (4) copies of shop drawings to the Owner for their review, Two (2) of the copies will be returned by the Owner, stamped to indicate that the shop drawings have been reviewed, and with comments added where applicable. If shop drawings are illegible, obscure or incomplete, they may be returned by the Owner marked "not reviewed", and such shop drawings are to be properly redrawn and resubmitted.
- .3 Make changes in shop drawings which the Owner may require consistent with the Contract, and resubmit as before. Ensure work and units supplied conform to final shop drawings.

- .4 The Owner's review of shop drawings does not relieve the Contractor of their responsibility for detail design inherent in shop drawings, correctness of dimensions and details and conformity to the Contract Documents.
- .5 Supply drawings, models, templates and special instructions or manuals called for in the Specifications, or required for the proper installation of the parts shown and conform to the intent of the Contract Documents.

3.0 INTENT

- .1 Before delivery of materials to the site, submit samples of materials as required by sections of the specifications or if so requested by the Owner for approval.
- .2 Samples must represent physical examples to illustrate materials, equipment or workmanship and to establish standards by which completed work is judged.
- .3 After approval, samples may be used in construction of the project.
- .4 Locate field samples on the project site at locations acceptable to the Owner.
- .5 Construct each sample or mock-up complete, including work of all trades required in finished work.

4.0 MANUFACTURER'S INSTRUCTIONS AND WARRANTIES

- .1 Where applicable, submit manufacturer's instructions to supplement the specifications, for the assembly and installation of specific materials or equipment.
- .2 Provide copies of such approved instructions to each crew working on the items affected.
- .3 Manufacturer's instructions only apply to particular requirements relative to the manufacturer's products and are in addition to the specifications. Do not interpret or apply such instructions to limit the work or responsibilities, the Contract Documents take precedence in all cases.
- .4 Submit warranties as applicable

5.0 CERTIFICATION OF TRADESMEN

- .1 Provide certificates, at the request of the Owner, to establish qualifications of personnel employed on the work where such certification is required by authorities having jurisdiction, by the Owner or by the Contract Documents.

END OF SECTION

1.0 INSPECTION AND TESTING OF WORK**1.1 Laboratories/Agencies**

- .1 All materials testing shall be undertaken by an independent, qualified, materials testing laboratory, approved by the Owner.
- .2 The Contractor shall be responsible for securing the testing laboratory for all portions of work requiring materials testing, including but not limited to compaction tests, asphalt tests and concrete tests.
- .3 Costs of such services, including sampling and transportation of samples, will be borne by the Contractor to be recovered from Materials Testing Cash Allowance.

1.2 Contractor Responsibility

- .1 It is the Contractor's responsibility to perform mix designs and carry out preliminary testing on aggregates to be incorporated into the work, in addition to any testing the Contractor deems to ensure that the work is in conformance with the Contract Documents.
 - .1 Costs of mix designs shall be included in the unit price bid.
- .2 The Contractor cannot rely on the testing that will be carried out by the Independent Testing Agency for Quality Control; the intention of this Testing is for determination by the Owner of satisfactory completed work for Progress Payment.
- .3 If defects are revealed during inspection and/or testing, the Owner may request additional inspection and/or testing to ascertain full degree of defects.
- .4 The Contractor shall correct defects and irregularities and pay all costs for all additional testing.

2.0 TEST RESULTS

- .1 Furnish to the Owner test results and mix designs as specifically requested in the Specifications.

END OF SECTION

1.0 TEMPORARY FACILITIES

- .1 Build and maintain temporary roads and provide traffic accommodation during period of work.
- .2 If authorized to use existing roads for access to project site, maintain such roads for duration of contract and make good damage resulting from Contractor's use of roads.

2.0 STORAGE SHEDS

- .1 Provide adequate weathertight sheds with raised floors for storage of materials, tools and equipment which are subject to damage by weather.

3.0 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Design enclosure to withstand wind pressure.

4.0 POWER

- .1 When required, arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.
- .2 Install temporary facilities for power such as pole, underground cables, etc., to approval of local power supply authority.

5.0 WATER SUPPLY

- .1 When required, arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.
- .2 Upon approval of the Town, Town water supply system may be used for construction requirements. Reimburse Town at water rates agreed upon and make good any damage.

6.0 HEATING AND VENTILATION

- .1 Pay for costs of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment. Use of direct-fired heaters discharging waste products into work areas will not be permitted unless prior approval is given by Owner.
- .2 Furnish and install temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of work.
 - .2 Protect work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Maintain minimum temperature of 10 °C or higher where specified as soon as finishing work is commenced and maintain until acceptance of structure by Owner.
- .1 Maintain ambient temperature and humidity levels as required for comfort of office personnel.
- .4 Ventilating:
- .1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
- .5 Maintain strict supervision of operation of temporary heating and ventilating equipment.
- .1 Enforce conformance with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.

7.0 REMOVAL OF TEMPORARY FACILITIES

- .1 Remove temporary facilities from site when directed by Owner.

8.0 SITE SIGNS AND NOTICES

- .1 Only Project Identification sign boards and notices for safety or instruction are permitted on site.
- .2 Format, location and quantity of site signs and notices to be approved by the Owner.
- .3 Signs and notices for safety or instruction to be in English language, or commonly understood graphic symbols.
- .4 Maintain sign boards for duration of project. Remove and dispose of signs off site on completion of project.

END OF SECTION

1.0 FIRES

- .1 Fires and burning of rubbish on site will not be permitted.

2.0 DISPOSAL OF WASTES

- .1 Burying of rubbish and waste materials on site is not permitted.
- .2 Disposal of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers, is prohibited.

3.0 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Pumping of water containing silt in suspension into waterways, sewer and drainage systems prohibited.

4.0 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Protect roots to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones of protected trees.
- .3 Minimize stripping of topsoil and vegetation.
- .4 Restrict tree removal to those designated by Owner.

END OF SECTION

1.0 GENERAL**1.1 Intent**

- .1 Use new material and equipment unless otherwise specified. All installation equipment used to execute the work shall be in safe good working condition.
- .2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
- .3 Use products of one manufacturer for equipment or material of same type or classification unless otherwise specified.

1.2 Manufacturer's Instructions

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify Owner in writing of any conflict between these specifications and manufacturer's instructions. Owner will designate which document is to be followed.

1.3 Fasteners

- .1 Provide metal fastenings and accessories in same texture, colour and finish as base metal in which they occur. Prevent electrolytic action between dissimilar metals. Use non-corrosive fastenings, anchors and spacers for securing exterior work.
- .2 Space anchors within limits of load bearing or shear capacity and ensure that they provide positive permanent anchorage. Wood plugs not acceptable.
- .3 Keep exposed fastenings to minimum, space evenly and lay out neatly.
- .4 Fastenings which cause spalling or cracking of material to which anchorage is made is not acceptable.
- .5 Obtain Owner's approval before using explosive actuated fastening devices. If approval is obtained comply with CSA Z166.

1.4 Fastening Equipment

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.

- .4 Use plain type washers on equipment, sheet metal and soft gasket, lock-type washers where vibrations occur and resilient washers with stainless steel.
- .5 All bolting used for buried or submerged appurtenances, fittings and metal products shall be Type A-304 stainless steel as per ASTM A276.

1.5 Storage, Handling and Protection of Products

- .1 Contractor shall be responsible for arranging, stockpiling, and protecting the materials from damage and theft.
- .2 The Contractor shall be responsible for the delivery of material and the Owner will not pay for materials ordered by the Contractor and not used in the work, nor pay for shipping charges on the return of such material to the supplier.
- .3 Handle and store products in a manner to prevent damage, contamination, deterioration, and soiling, and in accordance with manufacturer's recommendations when applicable.
- .4 Store packaged or bundled products in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in Work.
- .5 Products subject to damage from weather are to be stored in weatherproof enclosures, heated if required.
- .6 Store cementitious materials clear of earth or concrete floors, and away from walls.
- .7 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .8 Store sheet material and lumber on flat, solid supports and keep clear of ground.
- .9 Store and mix paints in accordance with manufacturer's instructions. Take every precaution necessary to prevent spontaneous combustion.
- .10 Remove and replace damaged products at own expense and to the satisfaction of the Owner.

1.6 Quality of Material and Workmanship

- .1 All materials which are described in these specifications and on the drawings shall be new, unless approved by Owner.
- .2 All work and materials shall be at all times open to inspection, acceptance or rejection by the Owner, but any failure or omission on the part of the Owner

to disapprove or reject any work or materials shall not be construed to be an acceptance of any defective work or material.

- .3 The Contractor shall remove at their own expense, any work or material condemned by the Owner and shall re-build and replace the same to the satisfaction of the Owner without additional charge.
- .4 The performance of this work shall be in accordance with the best practices and the finished work shall be neat in appearance.

END OF SECTION

Town Of Kindersley



MASTER SPECIFICATIONS

SECTION 2000	EARTH WORK	Page
Section 2100	Park Grading	2
Section 2200	Topsoil and Seeding	5
Section 2300	Trenching, Backfilling and Compaction for Utilities	9
Section 2400	Site Excavation, Embankment and Compaction	16

1.0 GENERAL**1.1 Description**

- .1 This section describes the rough grading of park areas, including imported fill.

1.2 Quality Control

- .1 Notification is required when unsuitable or waste material is encountered during rough grading operations.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Rough grading, prior to placement of topsoil or soil mixes for berms, swales, and all turf areas.
- .2 Rough grading and sub grade preparation for all surface treatments excluding asphalt may be subject to compaction tests by an approved testing laboratory service.

2.0 PRODUCTS**2.1 Materials**

- .1 Existing On Site Fill Material: clean subsoil material for rough grading, containing no organic matter, waste material or other unsuitable material deemed to be detrimental to construction of rough grade.
 - .1 Topsoil is acceptable fill material within soft landscape areas.
- .2 Imported Fill Material: clean subsoil material, as approved by Owner, for rough grading, containing no organic matter, waste material or other unsuitable material deemed to be detrimental to construction of rough grade.
- .3 Waste materials found on site which are deemed to be unsuitable for fill, grading or landscaping. Waste material includes:
 - .1 Soil containing spongy or yielding material, organic material, frozen materials, wet or saturated materials, toxic materials, alkaline material, and other unsuitable materials.

3.0 EXECUTION**3.1 Preparation**

- .1 Remove weeds, stones, debris, and other foreign material in excess of 50mm diameter prior to start of Work.

3.2 Layout

- .1 Establish and maintain line and grade controls using appropriate survey personnel and equipment.
 - .1 Contractor is responsible for layout accuracy.
 - .2 Check surface grades constantly as Work proceeds.

3.3 Rough Grading

- .1 Scarify surface of existing ground to depth of 150 mm prior to start of rough grading operations.
- .2 Rough grade to sub grade elevations. Ensure some moisture content between existing ground and graded material to facilitate bonding.
 - .1 Burying of waste material or unsuitable material is prohibited.
- .3 Rough grade to designed sub grades per drawings, allowing for the depths required for hard and soft landscape surface treatments.
- .4 Backfill areas over excavated below design sub grade with selected material or granular backfill.
- .5 Compact the sub grade to Standard Proctor, ASTM D-698
 - .1 Use sheeps foot type roller or other equipment to achieve compaction.
 - .2 Do not over compact the sub grade for the use intended.
- .6 Compact sub grade to the following densities:
 - .1 Turf areas 85%
 - .2 Unit Paving, Concrete and Asphalt areas 98%
- .7 Eliminate uneven or low areas, ensuring positive drainage.
 - .1 Re-grade areas damaged during construction of other Work.

3.4 Clean-Up

- .1 Remove and dispose of excess material, waste material and surface debris.
- .2 Clean adjacent walks and road surfaces at the end of each working day.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 Tolerance will be +/- 25 mm, except where greater accuracy is specified.

4.2 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section describes the requirements for topsoiling and seeding for restoration of vegetated areas.

1.2 Quality Control

- .1 The Owner to approve all topsoil, planting soil mix and soil mix amendments.
 - .1 For all topsoil material delivered to the site a one (1) litre sample of topsoil (type A and B), planting soil mix and any soil mix amendments (imported topsoil, manure, and type A sand used for the Work.
- .2 The Owner to review topsoil requirements for the Work before final placement.
- .1 Approved seed mixes for use.
 - .1 Submit "original" seed bag labels for each type of seed mix used.
- .2 Notify Owner prior to seeding.
 - .1 Failure to obtain inspection and approval of seeding operations will affect date of Construction Completion Certificate (CCC) for the Work.

1.3 Inspection

- .1 Notify Owner for inspection of:
 - .1 Placement of topsoil, before cultivation
 - .2 Placement of sand in planting beds, before cultivation and planting
 - .3 Fertilizer application and seed bed preparation, before seeding
 - .4 Seeding

2.0 PRODUCTS**2.1 Topsoil**

- .1 Existing on site, stockpiled and approved for use.
- .2 Imported Topsoil (if required)
 - .1 Neither heavy clay nor of light sandy nature.
 - .2 35% Sand, 35% Silt, 30% Clay

- .3 Containing a minimum of 5% organic matter to maximum of 20% by weight.
- .4 pH range of 6.0 to 7.5.
- .5 Free from subsoil, toxic materials, stones and foreign objects.
- .3 Sand - Type A: Homogeneous, sharp-grained.

2.2 Grass Seed and Seed Mixes

- .1 Grass seed to be Canada No. 1 Grade Seed, from a recognized seed firm, free of disease, minimum germination of 75%, minimum purity of 97% and conforming to the following seed mixes.
- .2 Seed mixes for turf, per 25 kg bag by seed count (premixed).
 - .1 Irrigation Mix.
 - .1 10.1 kg. Creeping Red Fescue "Boreal" (acceptable alternative "Jasper II")
 - .2 9.2 kg. Perennial Rye "Fiesta 3" (acceptable alternative "Playmate" or "Citation III")
 - .3 3.8 kg. Kentucky Blue "Able I" (acceptable alternative "Quantum Leap")
 - .4 1.9 kg. Kentucky Blue "Midnight" (acceptable alternative "Awesome" or "Rugby II")

2.3 Other Materials

- .1 Fertilizer: Complete synthetic, slow release with maximum 35% water soluble nitrogen.
 - .1 11-52-0, or as recommended in soil test analysis results.
- .2 Water: Free of impurities inhibiting germination and growth.
- .3 Tackifier/Binder; As approved.

2.4 Equipment

- .1 Manual seeding; "Cyclone" type manually operated seeder and flexible "drag mat".

- .2 Mechanical seeding; "Brillion" type mechanical landscape seeder which accurately places seed at specified depth and rate and rolls in single operation.
- .3 Rollers; Suitable for type of Work and seeded area.

3.0 EXECUTION

3.1 Preparation

- .1 Re-grade areas damaged during construction of other Work and remove weeds, stones, debris, and other foreign material in excess of 50mm diameter before seeding.
- .2 Approval of sub grade before topsoil and soil mix placement is required.
 - .1 Excavate and remove excess sub grade material to depths required.
 - .2 Remove weeds, stones, debris, and other foreign material in excess of 50mm diameter.
 - .3 Scarify entire area to receive topsoil.
- .3 Ensure the moisture content of the Topsoil allows for ease of placement. Placement of grading of saturated topsoil's unacceptable.

3.2 Topsoil - Turf Areas

- .1 Place Topsoil A at all Irrigation Mix areas.

3.3 Fertilizer

- .1 Apply approved fertilizer to topsoil areas at rate of 100 kg per hectare, or as recommended in soil test analysis results.

3.4 Seed Bed Preparation

- .1 Requirements:
 - .1 Fine grade and loosen topsoil to achieve loose friable bed.
 - .2 Eliminate rough spots and low areas to ensure positive drainage.
 - .3 Consolidate topsoil in seeded areas leaving surface smooth, uniform, firm against deep foot printing, and with a fine loose texture.

3.5 Seeding Operations

- .1 Do not perform work under adverse site conditions; frozen ground, saturated ground, or ground covered with snow, ice or standing water.
 - .1 Obtain approval to proceed with seeding.
 - .2 Calculate number of seed bags used for each seed mix type.
 - .3 Seed using same method as intended for other seeding operations.
- .2 Authorization is required before applying seed mixes.
 - .1 Seed half of required seed amount in one direction and remainder at right angles.
 - .2 Seed uniformly for each type of seed mix at rate of 220kg per hectare.
 - .3 Ensure seed does not spread to non-turf areas (e.g. shrub beds)
 - .4 Blend applications into adjacent turf areas achieve uniform surfaces.
- .3 Ensure seed is embedded into soil to depth of 5 mm within 1 hour of seeding.

3.6 Protection

- .1 Protect seeded areas against damage using materials and method as approved and remove protection after turf areas have been accepted.
- .2 Vehicular traffic, trenching or other activities compromising the topsoil layer is not permitted.

3.7 Clean-Up

- .1 Clean adjacent walks and road surfaces at the end of each working day.

4.0 ACCEPTANCE TESTING**4.1 Final Acceptance**

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This Section specifies requirement for excavating trenches and backfilling for installation of pipelines and appurtenances.

1.2 Quality Control

- .1 Notification is required when unsuitable or waste material is encountered during rough grading operations.

1.3 Inspections

- .1 Notify Owner for inspection of:
- .1 Materials testing
 - .2 Backfill elevations

2.0 PRODUCTS**2.1 Materials****.1 Imported Granular Backfill:**

- .1 Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting following gradation limits:

ASTM Sieve Designation		Per Cent Passing		
50.0	mm	100		
31.5	mm	60	-	100
16.0	mm	40	-	90
4.75	mm	25	-	60
2.00	mm	20	-	50
0.425	mm	10	-	25
0.075	mm	0	-	10

.2 Common Backfill:

- .1 Approved material selected from trench excavation or other source to be used in the Final Backfill zone, unfrozen and free from cinders, ashes, sods, refuse or other deleterious materials.
- .2 The maximum size of boulders permitted in backfill will be 0.02 m³ or 300 mm average diameter.

.3 Pipe Embedment Materials:

- .1 The pipe embedment zone shall be broken down into foundation, bedding, haunching, and initial backfill as identified in Figure 1 of ASTM Standard Practice D2321.
- .2 Materials for use as foundation, embedment, and backfill for all pipe material types are as classified in Table 1 of ASTM Standard Practice D2321. They include natural, manufactured, and processed aggregates and the soil types classified according to ASTM Test Method D 2487.
- .3 Class I, Class II, and Class III pipe embedment materials are suitable for use as foundation material and in the embedment zone subject to the limitations noted herein and in Table 2 of ASTM Standard Practice D2321.
- .4 Class IV-A materials should only be used in the embedment zone in special design cases, as they would not normally be construed as a desirable embedment material for flexible pipe.
- .5 Class IV-B, Class V Soils, and Frozen Materials are not recommended for embedment, and should be excluded from the final backfill except where specifically allowed by project specifications.
- .6 For ease of compactability and to facilitate proper placement of material in the haunch area of the pipe, a suggested gradation for sand within the pipe embedment zone are the following limits:

ASTM Sieve Size		Per Cent Passing		
9.50	mm		100	
4.75	mm	50	-	100
2.00	mm	30	-	90
0.425	mm	10	-	50
0.075	mm	0	-	12

The above material is classified as an ASTM D2321 Class II embedment material.

- .7 Fillcrete: Non-shrinking fill made up of a mixture of portland cement, sand, water and admixtures conforming to the following:
 - .1 Minimum 28 day compressive strength 1.00 to 2.00 MPa
 - .2 Slump 100 mm \pm 25 mm
 - .3 Portland Cement Type 10
 - .4 Air Entrainment 5% \pm 1%

.4 Bedding Stone (for use in the Foundation Zone):

A suggested material for bedding stone to be used as foundation material includes screened gravel, crushed stone or crushed gravel to following gradation requirements:

ASTM Sieve Size		Per Cent Passing		
63.0	mm		100	
37.5	mm	85	-	100
25.0	mm	75	-	95
19.0	mm	50	-	75
16.0	mm	25	-	50
9.50	mm	0	-	10

.5 Concrete:

Concrete required for cradles, Class A bedding, encasement, supports, reaction blocking to CAN A23.1-M90 and shall be 25 MPa CSA A3001 Type HS cement.

.6 Pit Locations:

The Contractor shall be responsible for locating, organizing approvals for haul roads, screening or crushing to meet specified gradations, loading, hauling and all other associated work for the specific trenching, backfilling and compaction material requirements.

3.0 EXECUTION**3.1 Site Preparation**

- .1 Remove trees, shrubs, vegetation, fences and other obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Strip topsoil and other surface materials from within limits of excavation and stockpile or dispose as specified.
- .3 The Contractor is responsible for maintaining sewage flows by pumping when replacing sewer mains. This will be considered a subsidiary obligation of the Contract and no extra payment will be made for this item. By-passed sewage shall only be discharged to a legal disposal location.

3.2 Dewatering

- .1 Trenches must be maintained in a dry condition for pipe laying. Method and execution of dewatering are the responsibility of the Contractor and should be designed such there is no detrimental impact on adjacent utilities and/or structures.

- .2 Dispose of water in a manner not detrimental to public health, environment, public and private property, or any portion of work completed or under construction.

3.3 Excavation

- .1 Excavations shall be in accordance with the Saskatchewan Occupational Health Safety Act and Occupational Health and Safety Regulations.
- .2 Minimum trench width shall conform to the drawing details. Where trench walls are stable, trench widths shall be of sufficient width, but no greater than necessary, to ensure working room to properly and safely place and compact haunching and other pipe embedment zone materials. The space between the pipe and the trench wall must be wider than the compaction equipment used to construct the pipe embedment zone.
- .3 In addition to safety considerations, the trench width in unsupported, unstable soils may compromise the structural design parameters of the pipe. Notify the Owner when unsupported, unstable soils are encountered so that actual structural support conditions are considered.
- .4 Excavate to lines, grades, elevations and dimensions indicated on drawings.
- .5 Remove and salvage or dispose replaced piping and manholes to an approved location as directed by the Owner.
- .6 The foundation soil shall be moderately firm to hard in-situ soil, stabilized soil, or compacted fill material. Ledge rock, boulders and large stones should be removed, where present, to provide a minimum clearance of 150 mm below pipe invert.
- .7 Notify Owner when soil at proposed elevation of trench bottom appears unsuitable for foundation of installation.
- .8 Remove unsuitable material from trench bottom to extent and depth necessary to stabilize foundation and replace with approved material. The cost of any granular backfill or bedding stone required to correct any unauthorized over-excavation shall be borne by the Contractor.
- .9 Where groundwater and soil characteristics may contribute to the migration of soil fines into or out of the foundation, embedment soils, sidefill, and/or backfill materials, methods to prevent migration of fines shall be provided by the Contractor.
- .10 The finished subgrade surface shall be shaped to provide a uniform and continuous support for the pipe bedding.

- .11 Unless otherwise authorized by Owner in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 10 m of trench at end of day's operation.
- .12 Stockpile suitable excavated materials required for trench backfill in approved location. Where excavated material cannot be piled along the trench, stockpile at locations approved by the Owner.
- .13 Dispose of surplus and unsuitable excavated material in an approved disposal site location.
- .14 Do not obstruct flow of surface drainage or natural water courses.
- .15 Sufficient clear space must be left on one side of the trench to accommodate the construction survey stakes.

3.4 Pipe Embedment Zone Construction

- .1 Construction in the pipe embedment zone (i.e. bedding, haunching and initial backfill) shall conform to Specifications.

3.5 Final Backfilling

- .1 Do not proceed with final trench backfilling operations until Owner has inspected and approved installations.
- .2 The Contractor shall not push final backfill directly onto the pipe until there is at least 300 mm of carefully placed initial backfill over the pipe to avoid damage to the pipe.
- .3 After the initial backfill is completed and meets specific requirements; the common backfill material shall be pushed down a ramp or slope of existing backfill and not directly onto the new bedded pipe. A crawler tractor or front-end loader working in the trench and parallel with it shall compact the trench to the required Class II or Class III backfill as outlined herein.
- .4 Notwithstanding the above, under no circumstances shall equipment that exceeds the structural capacity of the pipe be allowed direct access over the pipe until sufficient cover has been obtained. The Contractor shall be solely responsible for ensuring the equipment used during final backfilling operations is carefully selected and staged such that the pipe is not damaged during final backfilling operations.
- .5 Class II Backfill:

Class II Backfill shall be used under all street and road right of ways or as indicated on the drawings. Approved excavated material shall be placed in 300 mm lifts over the whole width of the trench. Each lift shall be compacted

to at least 98% of standard proctor maximum dry density as determined by the ASTM D698 test procedures, using mechanical compaction equipment.

.6 Class III Final Backfill:

Class III Backfill shall be used where trenches are located in parks, green space or as indicated on the drawings. Approved excavated material shall be placed in 600 mm lifts over the whole width of the trench. Each lift shall be compacted to at least 95% of standard proctor maximum dry density as determined by the ASTM D698 test procedures, using mechanical compaction equipment.

.7 Use common or granular backfill material as indicated or as required by the Owner.

.8 Backfilling around installations:

.1 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.2 Place layers simultaneously on sides of installed work to equalize loading.

.3 Place material by hand under, around and over installations until 300 mm of pipe embedment above pipe crown is provided. Dumping material directly on installations will not be permitted.

.4 Boulders in excess of 0.02 m³ or 300 mm average diameter will not be allowed in any of the backfill.

.9 Do not place frozen material in the embedment zone. During freezing weather conditions, heat the embedment material as necessary to provide enough free moisture to facilitate compaction as specified.

.10 Shoring, sheeting and bracing:

.1 Unless otherwise shown on drawings remove sheeting and shoring from trench during backfilling operations in a manner that does not disrupt the pipe embedment zone.

.2 Do not remove bracing until backfilling has reached level of bracing.

3.6 Settlement

.1 Immediately before the commencement of maintenance period, bring all fills that have settled up to grade with suitable site material.

3.7 Surplus Material

- .1 Dispose of surplus material not required for grading to the designated stockpile.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 The finished grades shall conform to the grade lines and cross-sections within a tolerance of ± 30 mm in all areas.

4.2 Materials Testing

- .1 Undertake standard proctor compaction tests, witnessed by the Owner:

4.3 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 Items of work covered by this Specification are those pertaining to excavation, filling, hauling, compaction, stockpiling and other associated work required to construct roadway subgrades and easements to the required cross-sections and grades. Lot grading in some areas will also be required.

1.2 Quality Control

- .1 Notification is required when unsuitable or waste material is encountered during rough grading operations.

1.3 Inspections

- .1 Stockpile location to be approved by the Owner.
- .2 Notify Owner for inspection of:
 - .1 Materials testing
 - .2 Backfill elevations

2.0 PRODUCTS**2.1 Materials**

- .1 Excavated or graded material to be approved by Owner before use as fill for grading work.

3.0 EXECUTION**3.1 Construction of Embankments**

- .1 Suitable excavated material shall be used in the formation of embankment fills or for other backfill. Excavation used as fill in the road shall be placed and compacted in lifts not exceeding 150 mm.
- .2 The material shall be bladed, shaped and compacted with appropriate compaction equipment to 98% of Standard Proctor Density and to conform to the required gradelines and cross-sections. Sufficient compaction equipment shall be employed to keep pace with the rate of placement of embankment fill. If required, the material shall be wetted or dried during placing to ensure the proper moisture contents as determined by the Standard Proctor Density Test.
- .3 The Contractor shall be responsible for the supply of any water necessary for the work.

3.2 Grading

- .1 Rough grade to levels, profiles, contours and typical cross-sections shown on the drawings or as staked by the Owner.
- .2 Compaction of sub-grade and fill material shall be at or near optimum moisture content to a minimum of 98% of the maximum dry density as determined by ASTM Test Designated D698.
- .3 If the soil contains moisture in excess of the optimum it shall be aerated until the moisture content has been reduced to optimum. Water shall be added if required for proper compaction.

3.3 Settlement

- .1 Immediately before the commencement of maintenance period, bring all fills that have settled up to grade with suitable site material.

3.4 Granular Base Course Placement

- .1 After completion of road grading, underground utility installations, subgrade preparation, and geotextile filter fabric installation haul granular base course and place as shown on the drawings.

3.5 Surplus Material

- .1 Dispose of surplus material not required for grading to designated stockpile.

4.0 ACCEPTANCE TESTING**4.1 Tolerance**

- .1 The finished grades shall conform to the grade lines and cross-sections within a tolerance of ± 30 mm in all areas.

4.2 Materials Testing

- .1 Undertake standard proctor compaction tests, witnessed by the Owner:

4.3 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

Town of Kindersley



MASTER SPECIFICATIONS

SECTION 3000	WATER AND SEWER	Page
Section 3100	Water Distribution	2
Section 3200	Sanitary Sewer	11
Section 3300	Storm Sewer	20
Section 3400	Manholes	28
Section 3500	Catch Basins	31
Section 3600	Building Services	33
Section 3700	CCTV Sewer Inspection	38
Section 3800	Trenchless Installation	47

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for replacing and constructing water mains, and appurtenances, to lines, grades and dimensions as directed.

1.2 Quality Control

- .1 No person other than a Town representative or member of the Fire Department or a person authorized by any of them shall open, close, or interfere with any hydrant, gate, or valve connected with the existing waterworks system.
- .2 Submit to the Owner the design of reaction blocks.
- .3 Notification is required if unsuitable or waste material is encountered.
- .4 Do not backfill trenches until pipe grade and alignment have been inspected and approved.
- .5 Drinking advisories, chlorine residual and bacterial testing must be completed and reported as per Water Security Agency (WSA) regulations.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Pipe bedding, jointing, appurtenances and concrete reaction block installation.
 - .2 Hydrostatic leakage testing, swabbing and chlorination

2.0 PRODUCTS**2.1 Water Mains****.1 PVC Pipe**

Pipe shall be DR18 PR 235, or otherwise specified on the drawings, to cast iron OD dimensions Polyvinyl Chloride conforming to AWWA Specification C900, complete with factory installed elastomeric gaskets.

2.2 Valves

- .1 Valves shall be iron body, be resilient seated gate valves conforming to ANSI/AWWA C509, counter clockwise opening, with ends to suit the pipe.
- .2 Valve boxes shall be complete with 25mm square solid steel operating extension stems, stone disc and operating nut with shirt.

- .3 Valve casings shall be adjustable cast iron casing to accommodate a 3 metre cover over the hood, top section with lid and stone disc in accordance with the Standard Drawing. The casing must rest on the bonnet of the valve and not on the stuffing box. The extension stem shall be made of 25 mm square mild steel with a bottom socket to fit a 50 mm square valve operating nut and shall extend to within 0.3 metres of the top of the casing when assembled.

2.3 Fittings for 300 mm and Smaller Pipe

- .1 Fittings shall be PVC fittings for AWWA C900 pipe manufactured in one piece of injection molded PVC compound conforming to AWWA C-905.

2.4 Flanges, Bolts, Nuts and Washers

- .1 Flanges shall comply with ANSI bolt circle. Securing bolts, nuts and washers shall be stainless steel, conforming to ASTM: A320/A320 M-93, Type B8M, Class 2. Hexagon heads shall be used.

2.5 Hydrants

- .1 Hydrants shall be Mueller Darling Canada Valve three-way hydrant dry barrel or equivalent as approved by the Town.
- .2 Hydrants shall be compression type shut off with cast iron body bronze mounted, 150 mm barrel diameter, O-Ring stem seals, for "on line" construction, and shall open with a counter-clockwise rotation conforming to AWWA Specification C502. The barrel shall be flanged at ground line and the barrel length shall be suitable for cover as indicated on drawings from flange at ground surface to crown of inlet pipe.
- .3 Hydrants shall have one 100 mm pumper nozzle and 2-65 mm hose connections conforming to AWWA C502 and threads shall conform to Sask. Mutual Aid Standards.
- .4 All hydrants are to be certified by Underwriters' Laboratory of Canada (ULC).
- .5 The operating nut shall be Pentagonal shaped. Hydrants shall be flanged at ground line. The colour of the hydrant above the ground shall be red.
- .6 Joints between hydrant and water main shall conform to the type of pipe supplied.
- .7 All nuts and bolts below grade shall be stainless steel. Hydrant barrels and tees shall be coated with Denso paste and tape.

2.6 Chlorine

- .1 Sodium hypochlorite to AWWA B300 to disinfect water mains.

3.0 EXECUTION**3.1 Preparation**

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 Trenching and Backfill

- .1 Do PVC C900 water main trenching and backfill work in accordance with ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as modified in Section 2300, and herein.
- .2 Trench depth to provide minimum cover over pipe of 3.0 m below finished grade for water distribution mains and water supply line or to grades where deeper as indicated on drawings.
- .3 Do not allow contents of any sewer or sewer service connection to flow into trench.
- .4 The Owner inspects and approves that the trench line, grade and depth meet design requirements prior to placing bedding material and pipe.

3.3 Construction in the Pipe Embedment Zone

- .1 Construct embedment zone for PVC water main in accordance with ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.
- .2 If required and approved by the Owner, replace unsuitable material in the foundation zone with granular backfill or bedding stone according to Section 2300.
- .3 Place granular bedding, haunch and initial backfill materials to details indicated in Section 2300 and as indicated on the drawings.
- .4 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks in bedding pipe.
- .5 Shape transverse depressions as required to make joints.
- .6 Compact the bedding to at least 90% standard proctor maximum dry density with the exception of the middle 1/3 of pipe diameter. Do not compact middle 1/3 of pipe diameter.
- .7 Place haunch and initial backfill to 300 millimetres above the crown of the pipe. Compact in maximum 150 millimetre lifts and compact to 90% standard proctor maximum dry density.

- .8 Exercise caution and place and compact material for haunch and initial backfill area in such a manner that adverse vertical and horizontal deflection does not occur.

3.4 Pipe Installation for PVC Pressure Pipe

- .1 Lay and join pipes in accordance with manufacturer's recommendations.
- .2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Commence laying and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed permissible deflection at joints recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipe during construction, except as may be permitted by Owner.
- .7 Whenever work is suspended, install a removable watertight bulkhead at open ends of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.
- .9 Pipe Jointing:
 - .1 Install gaskets in accordance with manufacturer's recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes carefully before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel or other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.

- .8 Apply sufficient pressure in making joints to assure that joint is complete as outlined in manufacturer's recommendations.
- .9 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipe or as otherwise approved by Owner.
- .10 Block pipes when any stoppage of work occurs in such a manner as required by Owner to prevent creep during down time.
- .11 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .12 Upon completion of pipe laying place specified granular material to dimensions indicated or directed.
- .13 Hand place granular material in uniform layers of 150 mm thick or less. Dumping of material directly on top of pipe is not permitted.
- .14 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

3.5 Installation Under Existing or Future Walks, Curbs or Swales

- .1 Wherever possible, water mains shall be bored or tunneled under existing or future walks, curbs or swales.

3.6 Concrete Reaction Blocking

- .1 Do concrete work to CSA A23.1-M90.
- .2 Place concrete reaction blocking between changes in pipe diameter, and fittings and solid ground as shown on drawings or as directed by Owner.
- .3 The thrust block shall bear against undisturbed soil and the soil shall be cut smooth and at the proper angle to the pipe. No horizontal struts or braces required for trench bracing shall remain in the concrete thrust block.
- .4 A bond breaker consisting of 0.20 millimetre (8 mil) polyethylene sheeting shall be installed between fittings, valves or plugs and the concrete of the thrust block to allow future removal of the thrust block without disturbing the fitting, valve or plug.
- .5 Do not backfill over concrete for 24 hours after placing.

3.7 Cathodic Protection

- .1 A 5.44 kg (12 lb) zinc anode shall be installed to protect all valves, hydrants and cast iron fittings.
- .2 The Contractor shall install the anodes one metre away from the fitting/valve h and shall connect the anode wire to the cast iron using the "Cadweld" method.
- .3 Following welding, the Contractor shall remove all slag from the weld, file off all sharp edges and coat all exposed cast iron surfaces, steel surfaces and "Cadweld" locations with "Denso" tape and paste
- .4 When the installation is complete, the Contractor shall pour 10 litres of water over the anode and backfill uniformly around the anode.

3.8 Valves

- .1 The top operating nut shall be within 300 mm of design grade.

3.9 Stub Ends

- .1 The ends of stub pipes shall be marked with a 38mm x 89mm wooden marker extending from the top of the stub pipe to 600mm above finished grade.

3.10 Clearance

- .1 Water main shall pass over adjacent sewer mains.
- .2 The minimum horizontal and vertical clearance between outer faces of the pipes shall be 300 and 150 mm respectively.

4.0 ACCEPTANCE TESTING**4.1 Tolerance**

- .1 The horizontal alignment of the centreline of the pipe shall not be more than 75 mm off the given line.
- .2 The vertical grade of the pipe shall not deviate from the given grade by an amount greater than 20 mm.

4.2 Hydrostatic Leakage Testing for PVC Piping

- .1 After backfilling is completed, a pressure test shall be carried out in the presence of the Owner on all lines at the maximum rated operating pressure (typically 1620 kPa / 235 psi) for the class of pipe installed.

- .2 Hydrostatic leakage testing, cleaning and flushing of pressure mains shall not be conducted when the ambient air temperature is less than + 10° C.
- .3 The pressure shall be maintained for not less than one hour by pumping additional water into the test section from a measuring tank. The test section will not be accepted if the leakage in litres per hour measured by the above method exceeds the quantity determined by the following table, or Equation 1.
- .1 Allowable leakage calculations for pipe types other than PVC shall be done in accordance with current AWWA standards.

Allowable Leakage in Litre/Hr. Per 100 Couplings Based on AWWA C605 Test Pressure (kPa)							
Pipe Diameter	350	500	700	850	1000	1400	1550
150 mm	2.2	2.6	3.0	3.4	3.6	4.3	4.5
200 mm	2.9	3.4	4.1	4.5	4.9	5.7	6.0
250 mm	3.6	4.3	5.1	5.6	6.1	7.2	7.6
300 mm	4.3	5.1	6.1	6.7	7.3	8.6	9.1
350 mm	5.0	6.0	7.1	7.8	8.5	10.0	10.6
400 mm	5.7	6.9	8.1	8.9	9.7	11.5	12.1

Equation 1: Test for C-900 Water Main:

$$L_{PVC} = \frac{N \times D \times (P)^{0.5}}{130,400}$$

$$L_{PVC} = \text{Allowable leakage in litres per hour.}$$

$$N = \text{Number of joints in the test section (Including all associated appurtenances).}$$

$$D = \text{Nominal diameter of the pipe in millimetres.}$$

$$P = \text{Average Test Pressure in kilo pascals (kPa).}$$

- .4 If the leakage exceeds the allowable, the Contractor shall locate and repair leaks and defects and repeat the test until the leakage does not exceed the allowable.
- .5 The Contractor shall provide all necessary labour, materials and equipment for the test including a suitable pump and measuring tank, pressure hoses and connection plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and leakage losses. The Contractor shall provide evidence that the gauges used are accurate.
- .6 The test section of the pipeline shall be filled with water at a velocity not exceeding 0.3 metres per second, taking care to expel all air from the high points. If air valves, service connections, or other means of venting are not provided, the Contractor shall at his own expense drill and tap small holes for the purpose at high points. He shall also provide a suitable cock to vent

air during tests. The hole shall be sealed by means of a tight fitting plug at the conclusion of the test.

4.3 Flushing

- .1 Flushing operations to be under direct control of Owner. Notify Owner at least 4 days in advance of proposed date when flushing and disinfection operations are to commence.
- .2 Flush water mains with a sufficient flow to produce a velocity of 0.9 m per second, for three volume changes in the flush section, or until foreign materials have been removed and flushed water is clear. Ensure flushed water drains to a suitable location at an appropriate flow and appropriate measures are employed to prevent erosion and flooding.
- .3 Flushing flows to be as follows:

<u>Pipe Size (mm)=</u>	<u>Flow (L/s)</u>	
	<u>Minimum</u>	<u>Maximum</u>
200	30	40
250	45	60
300	65	75

- .4 The Contractor will provide all connections and pumps as required. Employ backflow prevention measures as required.

4.4 Swabbing

- .1 After the hydrostatic leakage testing and flushing and before disinfection has been completed, the pipe shall be swabbed with swabs as supplied by Full Kote Systems or equivalent.

4.5 Disinfection

- .1 Disinfect all water mains, tie-ins and connections according to AWWA C651 except as specified herein.
- .2 If the tablet method of chlorination is utilized, the Owner shall be informed and approve at least 15 days in advance of any leakage testing, flushing and swabbing.
- .3 When flushing, swabbing and pressure testing have been completed to satisfaction of Owner, introduce a solution of chlorine into the water main utilizing the continuous feed method. Ensure the chlorine is distributed evenly throughout the entire test section.
- .4 Protect the remaining distribution system that is in use for potable water distribution or existing potable water systems from backflow from pipes undergoing disinfection.

- .5 Chlorine application to be within 3 m of filling water main and occur at same time. When application is complete, the free chlorine concentration shall be not less than 25 mg/L throughout the test section. The Contractor shall arrange for field testing and report test results, time of sample and test locations.
- .6 Chlorinated water shall be retained in the line for at least 24 hours. All appurtenances shall be operated during this time to ensure disinfection.
- .7 At the end of 24 hour period, the water shall be tested to ensure a free chlorine concentration of not less than 10 mg/L throughout the test section. The Contractor shall arrange for field testing and report test results including test sample locations and sample time.
- .8 Repeat disinfection processes until tests are satisfactory to the Owner.
- .9 Flush pipes and appurtenances of chlorine solution after satisfactory disinfection. Flushing is complete when the total chlorine concentration is suitable for potable water use. Apply a neutralizing chemical to the chlorinated water being disposed to neutralize the chlorine to a level suitable to governing regulatory agencies.

4.6 Sampling

- .1 Take water samples at end of test section and submit to an accredited lab to test for chlorine concentration and the presence of bacteria. Submit copies of the test results to the Owner.

4.7 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials.
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specified requirements for constructing trenched gravity and force main sanitary sewer.

1.2 Quality Control

- .1 Notify the Owner if unsuitable or waste material is encountered.
- .2 Do not backfill trenches until pipe grade and alignment have been reviewed and approved by the Owner.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Pipe bedding, jointing and structure installation.
 - .2 CCTV inspection.
 - .3 Infiltration/Exfiltration testing.

2.0 PRODUCTS**2.1 Sanitary Sewer Pipe**

- .1 Type PSM PVC Sewer Pipe and Fittings
 - .1 Pipe shall be Type PSM PVC sewer pipe.
 - .2 Pipe shall conform to CSA B182.2.
 - .3 Standard Dimension Ratio SDR 35, or otherwise specified.
 - .4 Factory installed locked-in gasket and integral bell system conforming to ASTM F477.
 - .5 Materials used for pipe shall come from a single compound manufacturer and shall have a cell classification of 12454-B, 12454-C, or 12364-C as defined in ASTM Standard D1784. Materials used for moulded fittings shall come from a single compound manufacturer and shall have a cell classification of 12454-B, 12454-C, or 13343-C as defined in ASTM Standard D1784.

.2 Type PSM PVC Sewer Pipe and Fittings for Insulated Sections

- .1 The sewer mains shall be insulated with 50 mm polyurethane insulation with a density of 55 kg/m³ with a compressive strength of 275-310 kPa and in locations shown on drawings or as directed by the Owner where the ground cover is less than 2.8 metres above crown of the pipe.
- .2 The insulation shall be covered with a minimum 1 mm thick HDPE outer jacket.
- .3 The insulation shall extend to the ends of the bell. Where the bell and spigot ends meet the insulation, shall be covered with mastic to ensure a waterproof joint exists.

.3 Solid Wall Polyethylene Pipe

- .1 Polyethylene pressure pipe to CSA B137.0, CSA B137.1, and AWWA C906.
- .2 Dimension Ratio (DR) 11, PE 3608.
- .3 Minimum Cell Classification ASTM C3350-140 PE 345464C.
- .4 PE4710 with minimum cell classification 445574C in accordance with ASTM D3350 is an acceptable resin although the pipe dimension ratios (DR) shall be as indicated on the drawings.

2.2 Valves

- .1 Valves and boxes with lengths to suit for sanitary force main and shall be Resilient Seat gate valves to suit pipe ends to AWWA Specification AWWA C500 and C509. Valves shall be fitted with stainless steel nuts and bolts on the bonnet.
- .2 Valve casing shall be adjustable cast iron casing to accommodate a 3 metre cover over the hood, top section with lid and stone disc in accordance with drawings. The casing must rest on the bonnet of the valve and not on the stuffing box. The extension stem shall be made of 25 mm square mild steel with a bottom socket to fit a 50 mm square valve operating nut and shall extend to within .3 metres of the top of the casing when assembled.

2.3 Cement Mortar

- .1 Portland Cement to conform to CAN A3001 Type HS.
- .2 Mortar to be one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient amount of water after mixing to give optimum consistency for placement. Do not use additives.

3.0 EXECUTION**3.1 Preparation**

- .1 Clean pipes and fittings of accumulated debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching and Backfill

- .1 Do Type PSM PVC sewer trenching and backfill work in accordance with ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as modified in Section 2300 - Trenching, Backfilling and Compaction for Utilities.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Do not perform pipe embedment until the foundation, pipe grade and alignment meet the design requirements.

3.3 Pipe Embedment Zone Construction

- .1 Construct in pipe embedment zone to conform to ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.
- .2 Pipe Embedment Zone Construction:
 - .1 Place granular bedding, haunch and initial backfill materials to details indicated in Section 2300 and drawing details.
 - .2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
 - .3 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
 - .4 Compact the bedding to at least 90% standard proctor maximum dry density with the exception of the middle 1/3 of pipe diameter. Do not compact middle 1/3 of pipe diameter.
 - .5 Place initial backfill to 300 millimetres above the crown of the pipe. Compact in maximum 150 millimetre lifts and compact to 90% standard proctor maximum dry density.
 - .6 Dumping of material directly on top of pipe is not permitted.

- .7 For flexible pipe, exercise caution and place and compact material for haunch and initial backfill area in such a manner that adverse vertical and horizontal deflection does not occur.
- .3 Concrete Bedding:
 - .1 Pipe may be positioned on concrete blocks to facilitate placement of concrete. When necessary, sufficiently anchor or weight pipe, to prevent floatation and resultant compromised line and grade, while concrete is placed and sufficiently cured.
 - .2 Do not backfill over concrete within 24 hours after placing.

3.4 Pipe Installation

- .1 Lay and join pipes in accordance with ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications and manufacturer's recommendations except as noted herein.
- .2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed permissible deflection at joints recommended by pipe manufacturer unless directed in writing.
- .6 Do not allow water to flow through pipe during construction that adversely affect the installation.
- .7 Whenever work is suspended, install a removable watertight bulkhead at open ends of last pipe laid to prevent entry of foreign materials.
- .8 Position and join pipes with approved equipment. Do not use excavation equipment to force pipe sections together.
- .9 Pipe Jointing:
 - .1 For HDPE pipe, pipe jointing shall consist of butt fusion welds or electrofusion couplers conforming to manufacturer's recommendations and performed by qualified personnel.
 - .2 Install pipe joints in accordance with manufacturer's recommendations.

- .3 Support pipes with hand slings or crane as required to minimize handling stresses and maintain concentricity until pipes are properly joined.
- .4 Align pipes carefully before joining.
- .5 Maintain pipe joints free from mud, silt, gravel or other foreign material.
- .6 Avoid displacing pipe ends or contaminating with dirt or other foreign material. Disturbed or contaminated ends shall be repositioned, cleaned or replaced before joining is attempted.
- .7 Complete each joint before joining next length of pipe.
- .8 Minimize joint deflection after joint has been made to avoid joint damage.
- .9 At rigid structures, install a pipe joint not more than 1.2 m from side of structure.
- .10 Apply sufficient pressure in making joints to assure that joint is complete as outlined in manufacturer's recommendations.
- .11 Ensure completed joints are restrained by compacting embedment material alongside and over installed pipes.
- .12 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .13 Make watertight connections to chambers as detailed.
- .14 Block pipes when any stoppage of work occurs in such a manner as required by Owner to prevent creep during down time.

3.5 Installation Under Existing or Future Walks, Curbs or Swales

- .1 Sewer shall be augured or tunneled under existing or future walks, curbs or swales.

3.6 Concrete Reaction Blocking

- .1 Do concrete work to CSA A23.1-M90.
- .2 Place concrete reaction blocking between changes in pipe diameter, and fittings and solid ground as shown on drawings or as directed by Owner.

- .3 The thrust block shall bear against undisturbed soil and the soil shall be cut smooth and at the proper angle to the pipe. No horizontal struts or braces required for trench bracing shall remain in the concrete thrust block.
- .4 A bond breaker consisting of 0.20 millimetre (8 mil) polyethylene sheeting shall be installed between fittings, valves or plugs and the concrete of the thrust block to allow future removal of the thrust block without disturbing the fitting, valve or plug.
- .5 Do not backfill over concrete for 24 hours after placing.

3.7 Cathodic Protection

- .1 A 5.44 kg (12 lb) zinc anode shall be installed to protect all valves, hydrants and cast iron fittings.
- .2 The Contractor shall install the anodes one metre away from the fitting/valve and shall connect the anode wire to the cast iron using the "Cadweld" method.
- .3 Following welding, the Contractor shall remove all slag from the weld, file off all sharp edges and coat all exposed cast iron surfaces, steel surfaces and "Cadweld" locations with "Denso" tape and paste
- .4 When the installation is complete, the Contractor shall pour 10 litres of water over the anode and backfill uniformly around the anode.

3.8 Stub Ends

- .1 The ends of stub pipes shall be marked with a 38mm x 89mm wooden marker extending from the top of the stub pipe to 600mm above finished grade.

3.9 Clearance

- .1 Water main shall pass over adjacent sewer mains
- .2 The minimum horizontal and vertical clearance between outer faces of the pipes shall be 300 and 150 mm respectively.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 Sanitary sewer pipe maximum allowable tolerance:
 - .1 The horizontal alignment of the centreline of the pipe shall not be more than 75 mm off the given line.

- .2 The vertical grade of the sewer main shall not deviate from the given grade by an amount greater than 20 mm.

4.2 Hydrostatic Leakage Testing for Forcemain Polyethylene Piping

- .1 Pressure Testing may be conducted once all pipe is installed and backfilled. Filling and pressure testing shall not be conducted on any test section until all cast-in-place concrete in contact with the test section pipe has cured for a minimum of seven (7) days.
- .2 Pressure test shall be carried out in the presence of the Owner on all lines at the maximum rated operating pressure for the class of pipe installed.
- .3 Hydrostatic leakage testing, cleaning and flushing of pressure mains shall not be conducted when the ambient air temperature is less than + 10° C.
- .4 Filling shall be done sufficiently slow and filling flows for each test section shall not exceed 50 L/s to facilitate air removal from the test section.
- .5 The Contractor shall expel the air from the test section during filling operations. If approved by the Owner, the Contractor may install temporary air release vents on the system to accommodate filling which shall be subsequently repaired following testing.
- .6 Testing of the HDPE force main shall be completed in accordance with the pipe manufacturer and with the requirements detailed in the Plastic Pipe Institute's Handbook of PE Pipe and as specified herein.
- .7 Pressure Testing shall be accomplished in the following steps for each test section:
 - .1 Initial Expansion Phase
 - .2 Test Period
- .8 During the initial expansion phase, the test section shall be pressurized to the test pressure, and sufficient make-up water shall be added each hour for three (3) hours to return to test pressure.
- .9 The Test Period shall begin after the Initial Expansion Phase is completed and the Test Pressure is attained.
- .10 After a one, two or three hour Test Period is completed, a measured amount of makeup water shall be added to the test section until the Test Pressure is attained.
- .11 The total test time including initial pressurization, initial expansion, and time at test pressure, must not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure, etc., the test section should be

de-pressurized, and allowed to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.

- .12 The Testing Pipe Environment Temperature shall be taken as the average of the test water temperature and the ambient air temperature at the time of the test.
- .13 The acceptance criteria for the leakage test shall be based on the amount of makeup water and shall not exceed the limits in the following table:

Allowance for Expansion (Litres/100 Metres of Pipe)			
Testing Pipe Environment Temperature	Nominal HDPE Pipe Size 100 mm		
°C	1 hour test	2 hour test	3 hour test
10	0.68	1.30	2.09
15	0.89	1.71	2.73
20	1.19	2.30	3.68
23	1.61	3.10	4.97

- .14 The Contractor shall repair all leaks and defects until the system passes the pressure test.
- .15 Once the test section is successfully tested, the water shall be disposed at a suitable location.

4.3 Gravity Sewer inspection by Televising:

- .1 Gravity sanitary sewers less than 1350 mm diameter shall be inspected by camera after backfilling of the trench to finished grade.
- .2 The inspection shall be made by employing television scanning equipment which shall be provided by the Contractor. The Contractor shall employ a qualified closed circuit television Contractor acceptable to the Owner to carry out the inspection.
- .3 The closed circuit television Contractor shall provide all equipment and materials necessary to conduct the inspection as specified in Section 3500.
- .4 All television inspection shall be carried out in the presence of the Owner who shall be given at least 48 hours advance notice of any testing to be carried out. Television inspection shall be performed by the Contractor on all sewers unless otherwise directed by the Owner.

4.4 Gravity Sewer Infiltration Test:

- .1 The Contractor shall conduct an infiltration test on the gravity sewer mains including manholes.

- .2 Conduct infiltration test where static groundwater level is 300 mm or more above top of pipe measured at highest point in the test section.
- .3 Do not interpolate a head greater than 750 mm above the pipe to obtain an increase in allowable infiltration rate.
- .4 Install a watertight plug at upstream end of pipeline test section.
- .5 Discontinue pumping operations for at least 72 hours before test measurements are to commence, and during this time keep thoroughly wet at least one third of pipe invert perimeter.
- .6 Prevent damage to pipe and bedding material due to flotation and erosion.
- .7 Place a 90° V-notch weir, or other measuring device approved by Owner to measure infiltration.
- .8 Measure rate of flow over a minimum of 1 hour, with recorded flow for each 5 minute interval.

4.5 Gravity Sewer Exfiltration Testing:

- .1 If required by the Owner, the Contractor shall conduct an exfiltration test.
- .2 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are commenced.
- .3 Immediately prior to test period add water to pipeline until there is a head of 0.3 m over interior crown of pipe measured at highest point of test section or water in manhole is 1.0 m above static groundwater level, whichever is greater.
- .4 Duration of exfiltration test shall be two hours.
- .5 Water loss at end of test period shall not exceed maximum allowable exfiltration over any test section.

4.6 Allowable Infiltration/Exfiltration:

- .1 Infiltration/Exfiltration shall not exceed following 40 litres per hour per 100 metres of pipe, including manholes.

4.7 Final Acceptance

- .1 Acceptance of Work shall be based on the Owner's review of all submitted results and materials.
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for constructing gravity storm sewer with bedding material to lines, grades and dimensions indicated or directed.

1.2 Quality Control

- .1 Notify the Owner if unsuitable or waste material is encountered.
- .2 Do not backfill trenches until pipe grade and alignment have been reviewed and approved by the Owner.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Pipe bedding, jointing and structure installation.
 - .2 CCTV inspection.
 - .3 Infiltration/Exfiltration testing.

2.0 PRODUCTS**2.1 Storm Sewer Pipe**

- .1 Reinforced Concrete Pipe for Direct Bury
 - .1 Storm sewers larger than 900 mm diameter (unless otherwise specified) shall be reinforced concrete pipe.
 - .2 Conform to ASTM C76, ASTM C655 and CSA A257.2.
 - .3 Pipe sections shall conform to ASTM C76 Standard pipe classifications as indicated on drawings.
 - .4 Flexible rubber gaskets conforming to CAN A257.3 and ASTM C443.
 - .5 Portland Cement: CSA A3001 Type HS.
- .2 Profile Wall PVC Sewer Pipe and Fittings
 - .1 Pipe shall conform to CSA B182.4.
 - .2 Minimum Pipe Stiffness: 320 kPa as per ASTM D2412.
 - .3 Factory installed locked-in gasket and integral bell system conforming to ASTM F477.
 - .4 IPEX Ultra-Rib (300 to 600 mm diameter), IPEX Ultra X2 (750 to 900 mm diameter) or approved equal.

.3 Type PSM PVC Sewer Pipe and Fittings

- .1 Pipe shall conform to CSA B182.2.
- .2 Standard Dimension Ratio SDR 35.
- .3 Factory installed locked-in gasket and integral bell system conforming to ASTM F477.
- .4 IPEX Ring-Tite or approved equal.

2.2 Catch Basin Leads

- .1 Catch basin leads shall be 250 mm diameter SDR 35 PVC pipe complete with rubber gaskets.
- .2 Tandem catch basin installations shall be 250 mm diameter between catch basins and 300 mm diameter SDR 35 PVC pipe from catch basin to manhole or mains. Connection directly to storm sewer mains shall only be as directed by the Owner and the diameter of the main must be twice that of the catch basin lead. IPEX-ULTRA-RIB may be used as an alternate.

2.3 Weeping Tile

- .1 Weeping tile pipe installed adjacent to the storm sewer shall be 150 mm diameter perforated high density polyethylene pipe which shall meet AASHTO M252, Type C.
- .2 Weeping tile pipe shall be complete with an exterior continuous non-woven geotextile filter fabric suitable to prevent clogging from the subgrade material.

2.4 Cement Mortar

- .1 Portland Cement: to CSA A5-171, CSA A5, Sulphate Resistant Type 50.
- .2 Mortar to be one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient amount of water after mixing to give optimum consistency for placement. Do not use additives.

3.0 EXECUTION**3.1 Preparation**

- .1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching and Backfill

- .1 Do Type PSM PVC and Profile Wall PVC storm sewer trenching and backfill work in accordance with ASTM D2321 – Standard Practice for Underground

Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as modified in Section 2300, and herein.

- .2 Do reinforced concrete pipe storm sewer trenching and backfill work in accordance with ASCE Type 2 Standard Installation except as modified in Section 2300 - Trenching, Backfilling and Compaction for Utilities, and herein.
- .3 Do not allow contents of any sewer or sewer connection to flow into trench.
- .4 Confirm trench line, grade and depth meet design requirements prior to placing bedding material and pipe.

3.3 Construction in Pipe Embedment Zone

- .1 Construct pipe embedment zone for PVC storm sewer in accordance with ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.
- .2 Construct embedment zone for reinforced concrete pipe storm sewer pipe in accordance with ASCE Standard Practice 15 – Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations except as modified herein.
- .3 Pipe Embedment Zone Construction:
 - .1 Place granular bedding, haunch and initial backfill materials to details indicated in Section 2300 and drawing details.
 - .2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
 - .3 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
 - .4 Install PVC and reinforced concrete pipe as a Type 2 installation as per the detail drawings. As noted on the detail drawing, do not compact bedding material under the middle 1/3 of pipe diameter of the pipe.
 - .5 Place haunch and initial backfill to 300 millimetres above the crown of the pipe. Compact in maximum 150 millimetre lifts to the specified density for a Type 2 installation.
 - .6 For flexible pipe, exercise caution and place and compact material for haunch and initial backfill area in such a manner that adverse vertical and horizontal deflection does not occur.

- .4 Concrete Bedding:
 - .1 Pipe may be positioned on concrete blocks to facilitate placement of concrete. When necessary, sufficiently anchor or weight pipe, to prevent floatation and resultant compromised line and grade, while concrete is placed and sufficiently cured.
 - .2 Do not backfill over concrete within 24 hours after placing.

3.4 Pipe Installation in Open Trench Construction

- .1 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends. Do not exceed maximum joint deflection recommended by pipe manufacturer. Install PVC pipe and fittings in accordance with CSA B181.12.
- .2 Lay and join pipes in accordance with specified Standard Practices and manufacturer's requirements. Lay pipes on prepared bedding, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed providing uniform support throughout its full length. Commence laying at the lowest point of the length being laid and proceed in upstream direction with bell socket ends of pipe facing upgrade.
- .3 Do not allow water to flow through pipe during construction.
- .4 Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .5 Pipe Jointing:
 - .1 Install flexible rubber gaskets in accordance with manufacturer's recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes carefully before joining. Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .4 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted. Only the lubricant recommended by the rubbing ring manufacturer shall be applied to the rubber ring or ends of the pipe.
 - .5 Complete each joint before laying next length of pipe. Minimize joint deflection after joint has been made to avoid joint damage. Apply

sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

- .6 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
- .7 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.
- .8 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .9 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.
- .10 Upon completion of pipe laying, and after Owner has inspected pipe joints, place specified granular material to dimensions indicated or directed.
- .11 Hand place granular material in uniform layers of 150 mm thick or less. Dumping of material directly on top of pipe is not permitted.
- .12 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

3.5 Appurtenances

- .1 Install all manholes, drop inlets, junctions, risers, catch basins and other appurtenances at the locations shown on the construction drawings and/or as directed by the Owner. Installation shall be in accordance with the drawings for each appurtenance.
- .2 A minimum of 2 grade rings are required immediately beneath the manhole cover.
- .3 Confined rubber gasket joints conforming to ASTM C443 shall be used between all joints and between manhole barrel joints. All joints shall be finished smoothly with cement mortar.
- .4 The channelled floor of the manholes shall be smooth and true to line and grade and shall be constructed of concrete shaped to provide a smooth, unobstructed flow. The benching shall be trowelled to a smooth finish. Branch lines entering the manhole shall be channelled to join the main line at an acute angle.
- .5 Sewer pipe into existing manholes must be grouted in. Since concrete will not bond to PVC pipes, it will be necessary to coat the PVC pipe with an approved cementing agent to which sand has been added to form a suitable

surface to which the concrete will bond. All PVC pipe shall be connected in accordance with the ASTM Standard.

- .6 Break into existing manholes, catch basins or sewers as shown on the construction drawings. This work shall be performed in a workmanlike manner according to the dictates of good practice. Existing manhole floors shall be rechannelled and properly benched, the junction area shall be grouted to form a smooth joint, all debris including concrete and excavated material shall be removed and the vicinity of the connection shall be left in a tidy condition acceptable to the Owner.

3.6 Weeping Tile Installation

- .1 Installation shall be to manufactures specifications and company with ASTM D2321.
- .2 The weeping tile shall be installed parallel to the storm sewer and matching the top of pipe elevation.
- .3 The weeping tile shall be continuous and connected to both the upstream and downstream storm sewer manholes at elevations set by the Owner. Length between manhole connections should not exceed 91 metres.
- .4 Weeping tile connections to the storm sewer system shall be capped as required by the Owner to prevent rapid flow back into the weeping tile during system surcharging. The cap shall be fastened to the end of the pipe and have a 32 mm hole drilled at the invert to allow drainage to pass.
- .5 At no time shall the weeping tile be connected to the sanitary sewer system.
- .6 The weeping tile shall be bedded within crushed rock. 200 mm lift of crushed rock should be placed and compacted. The weeping tile shall be covered with 200 mm of crushed rock. The crushed rock drainage layer shall be wrapped in non-woven geotextile fabric where required by the Owner to prevent migration of fines into the weeping tile.

3.7 Clearance

- .1 Water main shall pass over adjacent sewer mains
- .2 The minimum horizontal and vertical clearance between outer faces of the pipes shall be 300 and 150 mm respectively.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 Storm sewer pipe maximum allowable tolerance:

- .1 The horizontal alignment of the centreline of the pipe shall not be more than 75 mm off the given line.
- .2 The vertical grade of the sewer main shall not deviate from the given grade by an amount greater than 20 mm.
- .2 Weeping tile maximum allowable tolerance:
 - .1 35 mm from vertical grade
 - .2 100 mm from horizontal alignment

4.2 Sewer inspection by televising:

- .1 Storm sewers less than 1350 mm diameter shall be inspected by camera after backfilling of the trench to finished grade.
- .2 The inspection shall be made by employing television scanning equipment which shall be provided by the Contractor. The Contractor shall employ a qualified closed circuit television Contractor acceptable to the Owner to carry out the inspection.
- .3 The closed circuit television Contractor shall provide all equipment and materials necessary to conduct the inspection.
- .4 All television inspection shall be carried out in the presence of the Owner who shall be given at least 48 hours advance notice of any testing to be carried out. Television inspection shall be performed by the Contractor on all sewers unless otherwise directed by the Owner.

4.3 Exfiltration Testing:

- .1 If required by the Owner, the Contractor shall conduct an exfiltration test.
- .2 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are commenced.
- .3 Immediately prior to test period add water to pipeline until there is a head of 1.0 m over interior crown of pipe measured at highest point of test section or water in manhole is 1.0 m above static groundwater level, whichever is greater.
- .4 Duration of exfiltration test shall be two hours.
- .5 Water loss at end of test period shall not exceed maximum allowable exfiltration over any section of pipe between manholes.

4.4 Infiltration test:

- .1 Storm sewer pipe 1350 mm diameter and larger and manholes, shall be examined visually for infiltration ensuring required provincial safety measures are employed to conduct such an examination. Where required by the Owner, the Contractor shall conduct an infiltration test, as specified herein.
- .2 Conduct infiltration test in lieu of exfiltration test where static groundwater level is 300 mm or more above top of pipe measured at highest point in the test section.
- .3 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
- .4 Install a watertight plug at upstream end of pipeline test section.
- .5 Discontinue pumping operations for at least 72 hours before test measurements are to commence, and during this time keep thoroughly wet at least one third of pipe invert perimeter.
- .6 Prevent damage to pipe and bedding material due to flotation and erosion.
- .7 Place a 90° V-notch weir, or other measuring device approved by Owner, in invert of sewer at each manhole.
- .8 Measure rate of flow over a minimum of 1 hour, with recorded flow for each 5 minute interval.

4.5 Allowable Infiltration/Exfiltration:

- .1 Infiltration and exfiltration shall not exceed following 0.2 litres per millimetre of pipe diameter per hour per 100 metres of pipe.

4.6 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials.
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for constructing new and adjusting manholes as indicated or as directed.

1.2 Quality Control

- .1 Notify Owner if unsuitable or waste material is encountered.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Manhole base elevations.

2.0 PRODUCTS**2.1 Manholes**

- .1 Concrete to CSA A23.1-M90.
- .2 Manholes shall be precast circular 1050 mm diameter for sanitary and 1200 mm diameter for storm, or as otherwise indicated on the drawings, to ASTM C478. Top section eccentric cone with opening offset and vertical ladder installation.
- .3 Joints: to be made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.
- .4 Bituminous caulking compound: to CGBS-4a.
- .5 Mortar:
 - .1 Aggregate: to CSA A82.56.
 - .2 Cement: to CSA A8.
- .6 Ladder rungs: steel safety steps galvanized after fabrication.
- .7 Adjusting rings: to ASTM C478.

2.2 Frame and Cover

- .1 Standard manhole frame and cover to be Norwood F-39 or Titan Foundry Type TF-105..

2.3 Drop Manhole Pipe

- .1 To be same as sewer.

3.0 EXECUTION**3.1 Excavation and Backfill**

- .1 Excavate and backfill to Section 2300.
- .2 Excavation requires approval prior to installing manholes.

3.2 Concrete Work

- .1 Do concrete work to CSA A23.1-M90 and Section 5000.

3.3 Installation

- .1 Construct units to details indicated, plumb and true to alignment and grade.
- .2 Complete manholes as pipe laying progresses. Maximum of three manholes behind point of pipe laying will be allowed.
- .3 Pump manhole excavations dry and remove soft and foreign material before placing base.
- .4 Set bottom section of precast unit on a bed of min 150 mm well compacted crushed rock. Crushed rock shall be placed on undisturbed soil.
- .5 Make each successive joint watertight with approved rubber ring gaskets, mastic joint filler, cement mortar, or combination thereof.
- .6 Clean surplus mortar and joint compounds from interior surface unit as work progresses.
- .7 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .8 Place stub outlets and bulkheads at elevations and in positions indicated.
- .9 Set frame and cover to required elevation using adjusting rings. Final adjustment to be at finished pavement.
- .10 Manholes to be made watertight from the outside prior to backfilling.

3.4 Benching

- .1 Clean units of debris and foreign materials; remove fins or sharp protuberances.

- .2 For sewer, bench to provide a smooth U-shaped channel. Side height of channel to be 0.75 times diameter of sewer. Adjacent floor to be sloped at 1 in 10. Channels to be curved smoothly. Slope invert to establish sewer grade. For pipes smaller than 250 mm use standard pipe, breaking out upper half of pipe upon completion of manhole.
- .3 Pre-benched manholes shall be watertight connections between pipe and manhole with pipe manufacturers rubber gaskets.

3.5 Stubs

- .1 Precast manholes shall have sewer pipe stubs cast into base during fabrication.
- .2 If sewer pipe stubs are not cast into the precast base, coring a hole will be accepted using an approved coring machine.
- .3 Using hammer's or any other method of providing a hole in the precast base will not be accepted.

3.6 Safety Platforms

- .1 Install safety platform at intermediate levels where the manhole depth is greater than 6m.
- .2 The lowest plate form shall be above incoming flow and maximum spacing of safety plate form is limited to 6 m.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 Maximum allowable tolerances for installed manholes are:
 - .1 Horizontal: 10 mm horizontal in 1.5 m vertical.
 - .2 Vertical: ± 10 mm for any elevation shown.

4.2 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials.
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for constructing new and adjusting catch basins as indicated or as directed.

1.2 Quality Control

- .1 Notify the Owner if unsuitable or waste material is encountered.

1.3 Inspections

- .1 Notify Owner for inspection of:
- .1 Catch-basin elevations.

2.0 PRODUCTS**2.1 Catch Basin Materials**

- .1 Materials used for Catch Basins shall be in accordance with current ASTM Specification C-478 and as per Standard Drawings 2011-04.
- .2 The precast barrel and base shall be constructed as a single unit, 600 mm diameter unless otherwise noted in the drawings.

2.2 Frame and Covers Materials

- .1 Frames and Cover types shall be the following, or approved equal:

Type	Product (Manufactured by Titan Foundry)
Vertical Curb	Barrier curb and gutter inlet Type TF-106
Rolled Curb	Type TF-33 COS
Flat Top	Type TF-104 Herzog

2.3 Grade Rings

- .1 Grade rings shall be constructed of 30 MPa concrete with a minimum thickness of 100 mm and a maximum thickness of 200 mm.
- .2 Final adjustment grade rings shall be INFRA-RISER composite rubber grade rings with a minimum thickness of 25mm and a maximum thickness of 50 mm.

3.0 EXECUTION**3.1 Excavation and Backfill**

- .1 Excavate and backfill to Section 2300.
- .2 Excavation requires approval prior to installing catch basins.

3.2 Concrete Work

- .1 Do concrete work to CSA A23.1-M90 and Section 5000.

3.3 Installation

- .1 Construct units to details indicated, plumb and true to alignment and grade.
- .2 Complete catch basins as pipe laying progresses.
- .3 Pump excavations dry and remove soft and foreign material before placing base.
- .4 Set bottom section of precast unit on a bed of min 150 mm well compacted crushed rock. Crushed rock shall be placed on undisturbed soil.
- .5 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .6 Set frame and cover to required elevation using adjusting rings. Final adjustment to be at finished pavement.
- .7 Catch basins to be made watertight from the outside prior to backfilling.

4.0 ACCEPTANCE TESTING**4.1 Tolerance**

- .1 Maximum allowable tolerances for installed catch basins are:
 - .1 Horizontal: 10 mm horizontal in 1.5 m vertical.
 - .2 Vertical: ± 10 mm for any elevation shown.

4.2 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials.
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for constructing building services and appurtenances, to lines, grades and dimensions as directed.

1.2 Quality Control

- .1 Notify the Owner if unsuitable or waste material is encountered.
- .2 The Town must be contacted for assessment for any new service connection prior to installation or reuse of any existing service connection.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Pipe bedding, jointing, appurtenances installation.

2.0 PRODUCTS**2.1 Sewage Pipe and Fittings**

- .1 Polyvinyl Chloride Pipe: PVC pipe shall be SDR 28, 100 mm diameter unless otherwise specified, conforming to ASTM D3034. Joints to be rubber ring type. Fittings to be of similar manufacture to the pipe.
- .2 Sewer Pipe Insulation: Insulated sewer service pipe as required by the Owner or when the cover over the service line is less than 2.8 metres, shall be insulated with expanded polystyrene insulation as follows:
 - .1 The insulation shall have a density of 24 kg/m³ and the thickness shall be an actual minimum thickness of 50 mm with a compressive strength of 110 kPa;
 - .2 The insulation on pipe and fittings shall be covered with a minimum 1 mm thick HDPE outer jacket.
 - .3 The insulation shall extend to the ends of the bell. Where the bell and spigot ends meet the insulation, it shall be covered with mastic to ensure a waterproof joint exists.

2.2 Water Pipe and Fittings

- .1 Water Pipe: Pipe for building services shall be High Density Polyethylene Pipe (HDPE), SDR9, Series 200 conforming to AWWA C901. The pipe shall be manufactured in accordance with ASTM D2737 and all current revision, using materials designated PE2306, PE3306 or 3406. Joints shall be standard compression type with stainless steel inserts with no alternates.

- .2 Corporation Stops: Shall be standard brass with Mueller tapping thread suitable for compression type connection to piping.
- .3 Curb Stops: Curb stops shall be standard brass with drain and compression type joints, Mueller Mark II Oriseal valve with drain. The valve casing shall be John East #3063 curb box.
- .4 Thaw Wire: Thaw wire shall be No. 4 AWG bare stranded copper wire.
- .5 Filler Grease: Shall be Grade O Zunicon Light, Food Grade.

3.0 **EXECUTION**

3.1 **Preparation**

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 **Trenching and Backfill**

- .1 Do trenching and backfill work to Section 2300.
- .2 Trench depth to provide minimum cover over sewer pipe to 2.8 m and 3.0 m for water from finished grade.

3.3 **Bedding**

- .1 Bedding shall be Sand Bedding as detailed on drawings and extend to 300 mm above the crown of the pipe.
- .2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .3 Shape transverse depressions as required to make joints.
- .4 Compact full width of bed to at least 95% of maximum dry density.
- .5 Place bedding stone in lieu of sand bedding material when required by the Owner.
- .6 Fill any excavation below level of specified bedding with bedding stone.

3.4 **Sewer Pipe Installation**

- .1 The Contractor shall install a sewer connection to each of the lots to be serviced.
- .2 Where ground conditions permit, sewer pipes shall be bored underneath the proposed sidewalks.

- .3 Pipe Installation shall be as per Section 3200 Sanitary Sewers.
- .4 Service pipe shall be connected to the sewer main with an approved saddle.
- .5 Where building services are laid across recently excavated trenches, particular care shall be given to supporting the pipes. If necessary, backfilled material below the pipes shall be re excavated and backfilled and compacted to ensure that the pipes will not settle.
- .6 Sanitary service pipe to have a minimum 1.5% slope.
- .7 Extend the service pipe to 300 mm inside right-of-way, or as indicated on the drawings.
- .8 Upon completion of pipe laying, install water tight plug and surround and cover pipes with approved material placed to dimensions indicated or requested.
- .9 Complete trench backfill.

3.5 Water Pipe Installation

- .1 The Contractor shall install a water connection to each of the lots staked by the Engineer.
- .2 Construct service connections at right angles to water main unless otherwise directed.
- .3 Locate curb stops 300 mm inside right-of-way, or as indicated on the drawings. Water pipe shall terminate at the same point as the sewer service pipe unless directed otherwise by the Owner.
- .4 Tap main at 2:00 o'clock or 10:00 o'clock position only.
- .5 Water main corporation stop shall be 200 mm from the sanitary sewer service installation, and at least 1 m from pipe joints and adjacent service connections, unless otherwise required by the manufacturer.
- .6 Leave corporation stop valves fully open.
- .7 In order to relieve strain on connections, install service pipe in "Goose Neck" form with sandbags to support horizontal and vertical gooseneck.
- .8 Install curb stop with corporation box on services 50 mm or less in diameter. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.
- .9 Curb stop to be installed on a concrete bearer block, placed on undisturbed ground.

- .10 Curb stop upper riser bolt to be hand tightened to facilitate easy telescopic adjustment during road construction.
- .11 Top of curb stop shall be set 100 mm below the finished back of walk elevation.
- .12 Place temporary location markers at ends of plugged or capped water lines. Each marker to consist of a 38 x 100 mm timber stake extending 600 mm above grade. Paint exposed portion of space red with "Water Service Line" label in black.
- .13 Complete trench backfill.

3.6 Old Connections

- .1 Old connections that are not re-used will have to be cut off at the mains.

3.7 Boring

- .1 Where soil conditions permit, the Contractor shall install building services by boring under the proposed sidewalk and curb locations rather than by excavating a trench. Approval from the Owner must be obtained before the Contractor may excavate a proposed sidewalk.
- .2 The boring shall commence either from a shaft or a trench in the street. The auger shall be aligned with the desired location at the building and shall be inclined at the required grade. The bore hole shall be of sufficient size so that the building sewer pipe and the water service pipe may be readily passed through.
- .3 Where the bore hole has deflected from the desired course the boring equipment shall be restarted and another bore hole augered.
- .4 Only building sewer pipe which can be readily pushed through the bore hole without disturbing the joints shall be used therein. The front pipe end shall be adequately plugged to prevent earth or other foreign matter entering the pipe.
- .5 A shaft shall be excavated at the location of the curb stop in order that the curb stop, extension rod, service box and drainage sump may be installed.
- .6 If boring is not completed without approval by the Owner then the full depth of the excavation shall be backfilled with granular base material in maximum 150 mm lifts compacted to at least 98% of maximum dry density and the entire cost shall be borne by the Contractor
- .7 Only successful boring shall be paid even in the event that the Contractor attempted to bore cut was unable to due to ground conditions.

3.8 Clearance

- .1 Water main shall pass over adjacent sewer mains
- .2 The minimum horizontal and vertical clearance between outer faces of the pipes shall be 300 and 150 mm respectively.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 Sanitary service pipe to have a minimum cover of 2.8 m and minimum grade of 1.5%.
- .2 Water service pipe to have minimum cover of 3.0 m

4.2 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies the requirements for T.V. inspection of sewer mains which shall consist of cleaning the mains, pulling a closed circuit T.V. (CCTV) camera through the mains and recording the condition of the inside periphery, providing traffic control around the work area and submission of recordings and reports. The work shall be completed within the limits of the contract documents.

1.2 Quality Control

- .1 The Work shall be comply with the standards of the National Association of Sewer Servicing Companies (NASSCO) and the Pipeline Assessment Certification Program (PACP).
- .2 Qualifications:
 - .1 Provide a minimum one operator on site at all times with each inspection unit who holds a valid certificate from the National Association of Sewer Service Companies (NASSCO) in the Pipeline Assessment and Certification Program (PACP). Ensure each operator is fully trained in all aspects of sewer inspection and capable of making accurate observations and recording all conditions that may be encountered in the sewers.
 - .2 Perform inspection work only when PACP certified operators are on site.
 - .3 Submit a valid copy of the PACP Certificate for each operator to the Owner at least 5 working days before starting the inspection work.
- .3 The Contractor shall be responsible for all works performed by the subcontractor, for traffic control and any other related work incidental to the completion of television inspection.

1.3 Inspections

- .1 Notify Owner of:
 - .1 CCTV schedule
 - .2 Any sewers that could not be televised and shall state the reasons why they could not be televised.
- .2 Submissions:
 - .1 Within 2 weeks after inspection the Contractor shall submit a formal Multi-Sensor Inspection Report, in paper and digital (PDF) formats,

that summarizes all inspection activities and includes all inspection data in their raw format, along with any software required to view or utilize the raw data.

- .2 The Report shall include the following information:
 - .1 Inspection video with standard video and audio overlays in XSVD MPEG-2 format.
 - .2 Still images captured from the inspection video in JPEG or BMP format.
- .3 The location, nature and extent of all defects in the sewer shall be recorded in the inspection report.

2.0 EQUIPMENT

2.1 General

- .1 All tools, machinery, and equipment used in handling materials and executing any part of the work shall be subject to the approval of the Owner. All such equipment shall be maintained in efficient working order and where any of the machinery or equipment is found to be unsatisfactory, it shall be improved or replaced by the Contractor to the satisfaction of the Owner.

2.2 Inspection Unit

- .1 Sewer and manhole inspection unit is to consist of a self-contained vehicle with separate areas for viewing and storage complete with the following equipment as a minimum.
 - .1 Cellular telephone and suitable communication system linking all crew members.
 - .2 Fans and blowers capable of removing fog that may be present in sewers at the time of the inspection.
 - .3 Video cameras, lighting, cables and power source.
 - .4 Video monitor, videocassette recorder and digital video recorder.
 - .5 Computer system with video capture card or dedicated unit and other related equipment.

2.3 CCTV Video Inspection Equipment

- .1 Video inspection is to consist of the following.

- .1 Video camera capable of panning 360° and tilting 270° with optimum picture quality provided by focus and iris adjustment. Focal range to be adjustable from 100 millimetres to infinity.
- .2 Adjustable light source to allow an even distribution of light around the sewer or manhole perimeter without loss of contrast, flare out of picture, or shadowing. Ensure lighting illuminates the sewer or manhole ahead of the camera to be able to determine general condition, features and upcoming defects.
- .3 Video overlay equipment capable of superimposing a minimum of 15 lines with up to 30 characters per line of alphanumeric information onto the video recording.

2.4 High Velocity Cleaning Equipment

- .1 High velocity cleaning equipment is to be capable of producing a minimum flow rate of 4.1 litres per second at 13,800 kPa of pressure complete with the following.
 - .1 Selection of nozzles capable of effectively scouring and removing sediment from the sewer pipe wall and transporting debris in all sizes of the sewers to be cleaned.
 - .2 Water tank.
 - .3 Auxiliary engines.
 - .4 Pumps.
 - .5 Hydraulically driven hose reel with a wash down gun for cleaning manholes.
 - .6 Approved backflow prevention device for filling water tank from a hydrant.
- .2 The equipment shall be of sufficient size, capacity, and condition to endure continuous operation in 150 mm through 1,200 mm diameter pipe.

2.5 Hazard Lights

- .1 The mobile van, sewer flusher and service vehicles shall be equipped with rotating amber lights of sufficient number and height for the amber lights to be visible from all directions of approach.

2.6 Heating System

- .1 A heating system or suitable alternative is required to prevent fogging of the lines during cold weather inspection.

2.7 Distance Meter

- .1 The meter shall record distance travelled by the camera to 0.1 metres with an accuracy of plus or minus 0.2 percent.
- .2 It must be connected to the video equipment in such a manner that the distance is automatically imprinted onto the video.

3.0 EXECUTION**3.1 General**

- .1 The Contractor shall inform the Owner one week prior to the commencement of the Contract.
- .2 The Owner shall expose all manholes, which the Contractor has been unable to locate.
- .3 The Owner shall provide any bypass pumping, if required, at no cost to the Contractor.
- .4 The Owner may require that work on busy streets be done at off peak hours.
- .5 The Contractor shall schedule the work so that the flows in the storm sewer trunks are at a minimum to maximize the information obtained by CCTV inspection.

3.2 Cleaning

- .1 A high pressure sewer flusher and vacuum shall be used to clean the sewer. Cleaning shall be sufficient to produce recordings which are unobstructed by material in the sewer main.
- .2 Start the cleaning operation with the upstream sewers in the system and proceed downstream with the direction of flow. Clean all contributing upstream sewers before proceeding with cleaning downstream sewers.
- .3 Clean sewers and manholes completely of debris including sludge, dirt, sand, gravel, rocks, bricks and other solid and semi-solid materials.
- .4 Advise the Owner immediately when pipe material or backfill material is observed during the cleaning of a sewer. The Owner will direct one of the following operations be performed.
 - .1 Complete or attempt to complete cleaning of the sewer.
 - .2 Suspend cleaning operations and inspect the sewer.
 - .3 Simultaneously clean and inspect the sewer.

- .5 Continuously remove debris from the downstream manhole during sewer cleaning. Do not allow debris to be passed into the downstream sewer unless approved by the Owner.
- .6 The waste material dislodged during flushing shall be intercepted, decanted, and delivered to the pre-designated waste disposal .
- .7 Take necessary precautions to ensure that no flooding of public or private property occurs during sewer and manhole cleaning. Reduce pressure of cleaning equipment as directed by the Owner.

3.3 Access to Hydrants

- .1 The Owner shall designate a hydrant from which the Contractor can obtain water as required for sewer cleaning. The Owner shall check the condition of the hydrant before commencement of the Contract and upon completion of the Contract. The hydrant shall only be operated by workers familiar with hydrant operation. Any damage to the hydrant or water mains due to the improper operation shall be repaired by the Town. The cost of such repairs shall be deducted from payment for other work completed by the Contractor.

3.4 Pulling Camera

- .1 Camera inspection is to be performed on one sewer section at a time, pulling the camera through the pipe in the direction of flow. Pulling against the flow will be permitted where an obstruction requires a reverse set up. The distance meter is to be zeroed at the beginning of each section of main televised. A sewer section is defined as the length of pipe between adjacent manholes.
- .1 A sewer flusher may be required for pulling the camera. It is mandatory that a flusher be used for pulling where there are; high flows, dips and flat grades that may accumulate material that will obscure the camera lens and where there is light debris in the line. The flusher shall be used to lower flow levels and to move minor deposits of sludge and debris and clean the camera lens to ensure total viewing of the inside periphery of the pipe.
- .2 Where the condition of the pipe permits, the method of pulling is optional and may be accomplished by directly pulling with a flusher or by pre-stringing the mains with a flusher and using a winch to pull the camera. The Owner shall be advised of all mains which are pre-strung, the string lines shall be taut and tied to manhole steps.
- .3 Communication between the person pulling the camera and the person monitoring its progress must be adequate to quickly stop the camera if necessary to prevent jamming of the camera or damage to the sewer.
- .4 Camera travelling speeds in the pipelines shall be as follows:
 - .1 0.10 m/s for diameters less than 200 mm

- .2 0.15 m/s for diameters 200 mm to 310 mm
- .3 0.20 m/s for diameters exceeding 310 mm
- .5 The view of the camera is to be transmitted to a suitably sized monitor located in the mobile van, allowing continuous monitoring and recording of the progress of the colour T.V. camera. During recording a log is to be kept identifying the location of all defects and lateral connections. Still recordings shall be made of defects in the sewer.

3.5 Recording Defects in the Sewer

- .1 The camera shall be stopped for 10 to 15 seconds to record defects. Defects shall include open and/or offset joints, cracked pipe, deflected or collapsed pipe, missing pipe segments, root infiltration, groundwater infiltration, pipe misalignment, corrosion and erosion.
- .2 A separate log shall be kept of service connections with comments of condition.
- .3 Photographs shall be taken as directed by the Owner or at the discretion of the television scanning operator. A minimum of one photo per manhole reach is required plus one of every deficiency.
- .4 Manhole identity shall be noted clearly as indicated on the drawings.

3.6 Recording Resolution

- .1 Provide a minimum of 250 lines of resolution around the periphery of the picture for digital MPEG video playback.
- .2 Confirm recording resolution if requested by the Owner by recording a RETMA type resolution chart as follows.
 - .1 Set up camera and accessories for the recording to simulate an actual inspection i.e. video signal routed through the cable reel, video overlay system, etc.
 - .2 Record camera being introduced and reaching its final position for the test.
 - .3 Resolution chart is to fill the monitor screen;
 - .4 Resolution chart is to be illuminated evenly and uniformly without reflection and illumination source is to accurately simulate the lighting used in the sewer inspections.
 - .5 Record test for a minimum of 30 seconds.
 - .6 Identify the camera on the recording;

- .7 Perform the test at the start of a tape or digital recording.

3.7 Screen Information on Video Recordings

- .1 Clearly display in legible letters for 30 seconds on the monitor and video recording at the start of each inspection a video overlay system containing the following alpha-numeric information. Enter this information before beginning the inspection utilizing Town GIS identifiers:

line 1: Contract ID	e.g. 10-0061
line 2: Street Name	e.g. MAIN ST
line 3: Start MH to Finish MH ID	e.g. sanmh-289 to sanmh-290
line 4: Pipe ID	e.g. sanmain-324
line 4: Sewer Size (diameter)	e.g. 200 mm
line 8: Contractor Name	e.g. XYZ LTD
line 9: Date and Time of Inspection	e.g. 03/17/2014-14:15
line 10: Direction of Inspection	e.g. WITH FLOW
line 11: Start MH to Finish MH	e.g. 119.5 m
Steel Tape Measured Distance	
line 12: Cable Calibration Distance	e.g. 1.5 m

- .2 Clearly display in legible letters on the periphery of the monitor and video recording the following information during the inspection. Arrange the information to minimize interference with the inspection image:

bottom centre: automatic update of the camera's distance from the centre of the start manhole e.g. 15.3 m

top centre: Street Name e.g. MAIN ST

- .3 Use the following naming convention when entering street and place names in sewer and manhole inspection records.

Term	Naming Convention	Term	Naming Convention
Street	ST	First	1ST
Avenue	AV	Second	2ND
Boulevard	BV	Third	3RD
Road	RD	Fourth	4TH
Bay	BY	Fifth	5TH
Crescent	CR	Sixth	6TH
Lane	LN	North of	N OF
Drive	DR	South of	S OF
Place	PL	East of	E OF
Way	WY	West of	W OF
Cove	CV	North Property Line	NPL
Highway	HW	South Property Line	SPL
		East Property Line	EPL
		West Property Line	WPL
		Centre Line	CL

- .4 Use uppercase lettering for all street/place naming and location descriptions. Reference street locations relative to the direction of flow where possible.

Reference sewer location using street name and start/end manhole locations as follows:

.1 Street/Place

Enter the street name, followed by a Naming Convention, if required, in brackets noting its location within the right of way, e.g. CENTRAL AV (N OF CL).

.2 Location/Description

Enter manhole number followed by "TO", followed by manhole number, e.g. 2712 TO 2711.

3.8 Digital Format Video Recordings

- .1 Capture the inspections in digital format in colour from the live video source on digital versatile discs, DVD-R format to the following minimum requirements. Adjust requirements as required to achieve 250 lines of resolution specified in clause 3.9 of this specification.

.1 XSVD MPEG2 format.

.2 Picture Size: NTSC 352 x 240 @ 29.97 frames per second.

.3 Data/Bit Rate: MPEG-2 @ 3.0 M-bits/sec.

- .2 Obtain digital video inspections from first generation recordings using video capture equipment capable of capture with no frame loss.

- .3 Digital video inspections can to be saved to a hard-drive and later transferred to recordable digital versatile disc, DVD-R media for submission.

- .4 Provide file names containing up to a maximum of 64 characters for each digital video file in accordance with the following.

.1 STREET NAME-PIPE ID-DATE.MPG

Eg. - MAIN ST – sanmain-32417-Mar-14.MPG

- .5 Submit digital files of the original video inspections to the Owner on recordable digital versatile discs, DVD-R format in 5.2 millimetre slim-line clear "jewel cases" capable of displaying a summary sheet containing the information listed in this specification.

- .6 Submit one complete single digital file for each inspection. Ensure the entire inspection of a particular sewer or manhole is contained on the same DVD-R disc. Record reverse set-up inspections of a sewer immediately after the original inspection where possible.

3.9 Reverse Set - Up Inspection

- .1 Perform a reverse set-up inspection when a blockage in the sewer prevents completion of the inspection from the upstream manhole. Move the equipment to the downstream manhole and attempt to complete the inspection of the entire sewer to the upstream manhole.

3.10 Excavation to Remove Camera

- .1 Advise the Town immediately if equipment becomes stuck in a sewer.
- .2 The Town shall excavate, if required to free lodged camera equipment at no cost to the contractor. The Contractor shall bare any costs which arise for the Contractor due to delays incurred while the equipment is retrieved. Camera equipment repairs caused by lodging of camera shall be borne by the Contractor.
- .3 Repeat cleaning of the sewer to remove sediment and debris that may have entered the sewer during removal of the equipment.

4.0 ACCEPTANCE TESTING**4.1 Final Acceptance**

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Scope**

- .1 This section specifies the requirements for the trenchless supply and installation of water main pipe.

1.2 Quality Control

- .1 Only trained operators should be permitted to operate the drilling equipment
- .2 Manufacturer's operating instructions and safety practice shall always be followed.
- .3 Prior to commencing work, submit a plan containing the following information to the Owner:
 - .1 Setup area including plan dimensions, pit locations including area, depth and shoring requirements.
 - .2 Tie-in details at manholes and pipes installed by open cut methods.
 - .3 Pipe information including dimensions, recommended safe pull force (factor of safety of 2.5) and critical buckling stress criteria for the pipe.
 - .4 Entrance and exit angles for the pipe showing no curvature less than the minimum allowable radii of curvature criteria as established by the pipe manufacturer.
 - .5 The proposed and drill path, including its horizontal and vertical alignments and the location of buried utilities and substructures along the path.
 - .6 Material Safety Data Sheets (MSDS) and Material Specification Sheets for proposed drilling mud with the Bid for this Contract.
 - .7 Proposed methods to control, collect, transport and dispose of drilling fluids and spoils.
- .4 After work is completed, submit a drill log to the Owner, showing the installed alignment and depths for the entire trenchless pipe route.
- .5 Notify Owner if unsuitable or waste material is encountered, or any impassable below ground barriers are experienced.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Pipe jointing at the frequency as agreed with the Owner.

- .2 Acceptance testing: Hydrostatic leakage testing, swabbing and chlorination

2.0 PRODUCTS

2.1 Water Mains for Trenchless Installation

- .1 Polyvinyl Chloride Pipe (PVC) Fully Restrained Joint for Trenchless Installation
 - .1 AWWA C900 and CSA B137.3.
 - .2 Minimum Standard Dimension Ratio DR18
 - .3 TerraBrute CR by IPEX or approved equal
- .2 Flexible transition couplers (trenched pipe to trenchless pipe)
 - .1 Elastomeric gasket and stainless steel clamp, tightening mechanism and insert in accordance with ASTM C1173 Type B with shear ring.
 - .2 Coupler shall be able to accommodate differing pipe diameter transitions.

3.0 EXECUTION

3.1 Equipment

- .1 The Contractor shall be responsible for the directional drilling method and equipment. The Contractor shall confirm that the drilling rig and mud mixing system have the capacity required to successfully complete the installation knowing the length of the crossing and product type and diameter, and considering ground and groundwater conditions that can be reasonably foreseen.
- .2 Operating range and degree of accuracy of proposed tracking system shall be adequate to meet project conditions. Tracking/steering equipment shall allow for continuous monitoring of the drilling head along the entire proposed alignment. If a poor contact with sound is expected to occur at any section, this should be communicated to the Engineer prior to commencement of construction.
- .3 The drilling unit must be equipped with an electrical strike safety package. The package should include warning sound alarm, grounding mats and protective gear.

3.2 Pre-Commencement

- .1 All utility crossings shall be exposed using hand excavation or another approved method to confirm depth.

- .2 Excavation for entrance and exit pits is to be of sufficient size to avoid a sudden radius change of the pipe and resultant excessive deformation.

3.3 Installation Procedures

- .1 General:
 - .1 Drilling and mud pressure in the borehole shall not exceed that which can be supported by the overburden to prevent heaving or hydraulic fracturing of the soil ("Frac-out").
 - .2 Entrance and exit angles of the drill string should range between 8° and 20° and 5° and 10° respectively. Any deviation from these values shall be reviewed by the Engineer.
 - .3 If a drilled hole beneath an artificial surface must be abandoned the hole shall be filled with grout or bentonite to prevent future subsidence.
 - .4 Pipe installation should be performed in a manner that minimizes the stress and strain of the pipe within the pipe tolerances and limits as established by the pipe manufacturer.
- .2 Drilling and Back-Reaming:
 - .1 Drilling mud may be used during drilling and back-reaming operations, pending the approval of a fluids management plan.
 - .2 A sufficient number of pre-reams shall be utilized as to avoid heaving while enlarging the hole to the desired diameter.
 - .3 During back-reaming, the conduit must be sealed at either end with a cap or lug to prevent water, drilling fluids and other foreign materials from entering the pipe.
 - .4 Pipe rollers, skates or other protective devices should be used in the installation of products 150 mm outside diameter or larger.
 - .5 Where possible and unless otherwise approved by the Engineer, the product pipeline will be fused, welded or connected into one string prior to commencement of the pull-back operation.
 - .6 The pilot hole shall be back-reamed to accommodate and permit free sliding of the product inside the borehole.

3.4 Installation of Pipe

- .1 Provide the locations and sizes of shafts to the Engineer upon request for review before excavating.

- .2 Excavate shafts and provide shoring if required in accordance with Section 02300.
- .3 For installation in a cored hole, a neat hole shall be cored out for the installation of the casing pipe to a maximum of 25 mm larger than the largest pipe outside dimension. "Plugging", "reaming" or other construction methods that displace soil shall not be permitted.
- .4 Construct pipe embedment in shafts ensuring uniform support under the pipe throughout its full length. Pipe embedment in the shaft shall be constructed above the pipe to a depth of 300 millimetres above the top of the pipe for the full trench width in accordance with open trench installation specifications.
- .5 Install the pipe of the specified diameter according to the pipe manufacturer's recommendations at the location, limits, line and grade shown on the Drawings using trenchless methods. Ensure the pipe is not in tension. Trenchless installation methods shall produce no upheaval, settlement, cracking, movement, or distortion of the existing ground or other infrastructure, nor shall it permit the formation of voids outside of the pipe barrel.
- .6 Protect the pipe to prevent it from being crushed or damaged during installation. Should the pipe be damaged, the damaged portion, if not in the hole, shall be replaced. If the damaged portion is within the hole, it shall be repaired or replaced as directed by the Engineer.
- .7 Join individual pipe lengths in accordance with the manufacturer's instructions and performed by qualified personnel.

3.5 Connections to Trenched Pipe

- .1 Connect or join ends of pipes installed by the directional drilling method to trench installed pipe with flexible couplers approved for each pipe material.
- .2 Sufficient pipe length for joining adjacent sections of pipe shall be pulled into the entrance pit. This additional pipe shall not be damaged or interfere with the subsequent drilling of the next section of pipe.

3.6 Drilling Fluids - Collection and Disposal Practices

- .1 Utilize a drilling mud with low toxicity and impact during the drilling process. Only drilling mud which meets the environmental approvals and permits shall be used.
- .2 Drilling fluids shall be recycled through a holding tank located on the shore to minimize loss of fluid.
- .3 When working in an area of contaminated ground, the slurry shall be tested for contamination and disposed of in a manner that meets government requirements.

- .4 Precautions shall be taken to keep drilling fluids out of the streets, manholes, sanitary sewers, and other drainage systems including streams and lakes. Use straw bale berms and other methods to provide containment for spilled fluids.
- .5 The Contractor shall make a diligent effort to minimize the amount of drilling fluids and cuttings spilled during the drilling operation and shall clean up all drilling mud overflows or spills. At the completion of the pipe installation, the drilling fluids shall be removed from the site for disposal.

4.0 ACCEPTANCE TESTING

4.1 Tolerances

- .1 Maintain a horizontal alignment accuracy within 300 mm of the alignments shown on the Drawings and more accurate when connecting to existing infrastructure.
- .2 Maintain a vertical alignment accuracy of within 20 mm of design elevations and no reversal of slope.

4.2 Pressure & Chlorination

- .1 Undertake the following tests related to the intended service, and material type, as described in other Sections this Specification.
 - .1 Hydrostatic Leakage Testing
 - .2 Swabbing
 - .3 Disinfection
 - .4 Sampling
 - .5 Gravity Sewer Inspection by Televising
 - .6 Gravity Sewer Infiltration / Exfiltration

4.3 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

Town of Kindersley



MASTER SPECIFICATIONS

SECTION 4000	ROADWAYS	Page
Section 4100	Subgrade Construction	2
Section 4200	Granular Subbase	9
Section 4300	Granular Base Course	13
Section 4400	Milling	17
Section 4500	Hot Mix Asphalt Pavement	19
Section 4600	Prime, Tack and Fog Coats	29
Section 4700	Adjustment of Appurtenances	33

1.0 GENERAL**1.1 Description**

- .1 Items of work covered by this Specification are those pertaining to excavation, filling, hauling, compaction and other associated work required to construct the subgrade to the cross sections and grades specified in the construction drawings.

1.2 Quality Control

- .1 Notification is required if unsuitable subgrade or waste material is encountered.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Proof Roll test
 - .2 Compaction Testing

2.0 PRODUCTS**2.1 Imported Granular Fill (Pit-Run)**

- .1 Material for the imported granular material must be approved by the Owner and shall consist of sound, hard, durable, uniformly graded crushed gravel and shall not contain organic or soft materials, materials that break up when alternately frozen and thawed or wetted and dried, or other deleterious materials.
- .2 Imported granular fill shall be placed in 150 mm lifts. Each lift shall be compacted to 98% of Standard Proctor Density, using mechanical compaction equipment.

2.2 Geotextile Filter Fabric

- .1 Non-Woven Geotextile
 - .1 Materials shall be Geotex 601 as manufactured by Propex or approved equal. Non-Woven Geotextile shall be composed of either polyester or polypropylene filaments or other synthetic material.
 - .2 Continuous filaments or staple filaments are acceptable.
- .2 Woven Geotextile
 - .1 Materials shall be Woven Geotextile No. 2033 as manufactured by AMOCO or Geotex 3 x 3 as manufactured by PROPEX or approved equal.

.2 General:

- .1 Polymeric filaments to be strong, rot proof and oriented into a stable network which retains its relative structure during handling, placement and in service.
- .2 Resistant to deterioration by ultraviolet light, heat exposure, acid and alkali action.
- .3 Indestructible by micro-organisms and insects.
- .4 Formed into a mat by spun bonding, needle punching or other similar process.

.3 Mass:

- .1 Manufacturer to select mass per square metre of fabric to meet specified physical strength requirements.

.4 Minimum Physical Strength Requirements:

	Unit	Test Method	Strength
Grab Tensile Strength (unaged fabric) in any principal direction	N	ASTM-D-4632	2,000 x 1,550
Mullen Bursting Strength	kPa	ASTM-D-3786	6,890
Trapezoidal Tear Strength	N	ASTM-D-4533	800

.5 Uniformity:

- .1 Uniformity of fabric to be determined using CGSB test method 5.A.

.6 Seams

- .1 Seams of fabric to be sewn with thread of a fibre having similar physical properties as fabric material.
- .2 Seam strength to be not less than 90% of tensile strength of unaged fabric in any principal direction. Alternately overlap 600mm at joints or as per manufacturers recommendations.

.3 Geogrid

- .1 Biaxial geogrid shall be TBX2500 as manufactured by Terrafix or GRIDPRO BXP15 as manufactured by Propex, or approved equal.

.2 General:

- .1 Polymeric filaments to be strong, rot proof and oriented into a stable network which retains its relative structure during handling, placement and in service.
 - .2 Resistant to deterioration by ultraviolet light, heat exposure, acid and alkali action.
 - .3 Indestructible by micro-organisms and insects.
 - .4 Formed into a single layer mat by needle punching or other similar process.
- .3 Minimum Physical Strength Requirements:

	Unit	Test Method	Strength
Ultimate Tensile Strength	kN/m	ASTM-D-6637	25
Tensile Strength @ 5% Strain	kN/m	ASTM-D-6637	17.5

2.3 Weeping Tile

- .1 Weeping tile pipe installed within or below the compacted subgrade during street and/or curb construction shall be 100 mm diameter perforated high density polyethylene pipe which shall meet AASHTO M252, Type C.
- .2 Weeping tile pipe shall be complete with an exterior continuous non-woven geotextile filter fabric suitable to the subgrade material properties.

3.0 EXECUTION

3.1 Unstable Subgrade

- .1 Where the subgrade is unstable, or where it contains materials such as ashes, cinders, refuse, vegetable or organic material, the Contractor shall excavate such material to the width, depth and length designated by the Owner and dispose of the material as required. The subgrade shall then be made by backfilling with approved native material or imported granular material as required by the Owner. Material shall be placed in successive layers not exceeding 150 mm in depth and compacted to a minimum of 98% Standard Proctor Density.

3.2 Subgrade Preparation

- .1 The subgrade shall be scarified and compacted to a minimum of 98% Standard Proctor Density at optimum moisture content, over the full width of the cross-section. The material shall be worked to ensure as much uniformity as possible in material.

- .2 All topsoil encountered during this operation shall be removed and replaced with suitable clay material excavated elsewhere on the project. The subgrade moisture content shall be maintained to the required specifications until completion of the project.
- .3 Light blading of the subgrade will be required during the compaction process to assure that any distortion of the roadway is corrected.
- .4 Soft spots or areas of subgrade failure due to unsuitable material which appear during the rolling shall be excavated as required by the Owner and backfilled with suitable native material or imported granular fill when directed by the Owner. Backfill material shall be compacted into place. It shall be the Contractor's responsibility to co-ordinate the overall excavation and subgrade preparation, so that suitable native material can be placed in the sub-cut areas directly from cuts elsewhere on the project. Payment for removal of unsuitable material will be made as common excavation. Payment for replacement and compaction of native material used to replace unstable subgrade will be paid for at the Unit Price tendered for common excavation.
- .5 Water shall be added or the material shall be aerated to bring the moisture content to optimum value. The supply of water shall be the responsibility of the Contractor.
- .6 Upon completion of subgrade preparation, the Contractor shall protect it against all damage.

3.3 Geotextile Installation

- .1 Install geotextiles to the lines and grades shown on the drawings or as directed by the Owner.
- .2 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position.
- .3 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .4 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .5 Overlap each successive strip of geotextile over previously laid strip by 600 mm or to the manufacturer's specifications, whichever is greater.
- .6 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .7 After installation, cover with overlying layer within 4 hours of placement.
- .8 Replace damaged or deteriorated geotextile to approval of Owner.

- .9 Place and compact soil layers in accordance with Specification.
- .10 Non-woven geotextiles shall be installed as directed by the Owner for material separation and/or to prevent the migration of fines into the granular base.
- .11 Geogrids:
 - .1 Geogrids shall be installed per the manufacturer's recommendations in locations determined by the Owner. Geogrids shall be used to reinforce subgrade or granular base material strength.
 - .2 May be used in combination with other geotextile fabrics.
 - .3 Geogrid installation to reinforce unstable subgrade surrounding valves, manholes, and other underground utilities may require cutting and overlapping.

3.4 Weeping Tile Installation

- .1 Installation shall be to manufacturer's specifications and company with ASTM D2321 with the exception that minimum cover shall be 0.3 metres.
- .2 The weeping tile shall be continuous and connected to both the upstream and downstream storm sewer manholes or catch basins at locations and elevations set by the Owner.
- .3 Weeping tile connections within catch basins and manholes shall be capped as required by the Owner to prevent rapid flow back into the weeping tile during system surcharging. The cap shall be fastened to the end of the pipe and have a 32 mm hole drilled at the invert to allow drainage to pass.
- .4 At no time shall the weeping tile be connected to the Town sanitary sewer system.
- .5 For new street construction which the Owner deems it necessary or without storm sewer shall have weeping tile installed within the compacted subgrade.
 - .1 The weeping tile pipe shall be installed below and centered beneath the curb and gutter. There shall be a minimum of 200 mm between the top of the weeping tile pipe and the bottom of the curb and gutter compacted sand cushion.
 - .2 The weeping tile shall be bedded with sub-drainage sand.
 - .3 Weeping tile shall be installed prior to placement of granular base material.

- .6 For existing street construction which the Owner deems it necessary there shall be weeping tile installed within the compacted subgrade.
 - .1 Pipe shall be installed adjacent to the curb line at a distance that will not undermine and cause concrete curb and gutter instability. Any sections of curb and gutter which are damaged or settle from original grade during weeping tile installation shall be replaced at the Contractor's expense.
 - .2 Invert of weeping tile pipe shall be 350 mm below bottom of concrete gutter elevation. Where concrete gutter does not exist the weeping tile pipe invert shall be a minimum of 600 mm below the finished asphalt grade.
 - .3 The weeping tile shall be bedded with sub-drainage sand.
 - .4 Weeping tile shall be installed prior to placement of granular base material.

3.5 Compaction

- .1 The top 150 mm of the subgrade shall be scarified and compacted to a minimum of 98% Standard Proctor Density at optimum moisture content, over the full width of the roadway cross-section. The material shall be worked to ensure as much uniformity as possible in material.
- .2 Final compaction of the subgrade surface shall be done with pneumatic tire rollers. Rolling shall be continued until all loose soil is properly compacted true to design elevations but not uniformly high or low.
- .3 Trench backfill encountered in the preparation of the subgrade which has not been compacted sufficiently, shall be excavated and recompacted. The cost of this item shall be included in the unit price tendered for subgrade preparation.
- .4 Inaccessible areas by large compaction equipment shall be compacted by mechanical hand tampers.

4.0 ACCEPTANCE TESTING

4.1 Tolerances

- .1 The finished surface of the subgrade shall conform to grades approved by the Owner, and shall show no depression more than 15 mm under a straightedge 3.0 m long when placed parallel to the centreline. Subgrade higher than the approved grades shall be cut to the required grades.
- .2 The subgrade tolerance for roadways, sidewalks, curbs, ditches, boulevards, etc., shall be ± 30 mm.

4.2 Proof Roll

- .1 Before acceptance by the Owner and prior to application of the subsequent layer of roadway materials, the subgrade surface shall be true to cross-section and grade, and shall conform to the density and bearing ratio requirements specified.
- .2 The Contractor shall supply a truck loaded to 8,200 kilograms axle load (4.5 kilograms per millimeter of tread width) for subgrade axle test. This test will be undertaken when compaction of the subgrade has been completed, and shall be carried out under the direction and in the presence of the Owner. It will be used as a supplement to density tests for determining performance of the Contract. No separate payment shall be made for this work.
- .3 Any rutting or deflection points noted during the axle test shall be repaired by the Contractor and at the Contractor's expense. Following repairs, the axle test shall be repeated.

4.3 Materials Testing

- .1 Undertake the following tests:
 - .1 Wash Sieve Analysis
 - .2 Plastic Index
 - .3 CBR Value
- .2 Undertake standard proctor compaction tests, witnessed by the Owner:
 - .1 Compaction results shall be based on a minimum of one density test per 500 square metres of road. Additional tests may be called for by the Owner as deemed necessary.

4.4 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 Items of work covered by this Specification are those pertaining to excavation, filling, hauling, compaction and other associated work required to construct the subbase to the cross sections and grades specified in the construction drawings.

1.2 Quality Control

- .1 Pre-Construction Submissions:
 - .1 At least 2 weeks prior to commencing work, inform Owner of proposed source of granular materials.
 - .2 The Contractor shall provide a sieve analysis of the material for the Owner review.
 - .3 Preliminary review of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for.
 - .4 The Owner has the right to request additional testing if there are any concerns with the proposed aggregate.
- .2 Construction Submissions
 - .1 The Contractor shall provide weigh scale receipts for each load to the Owner at the time of load delivery. The Contractor shall quote using his own certified scale only with the approval of the Owner or where indicated within the tendering documents.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Proof Roll test
 - .2 Compaction Testing

2.0 PRODUCTS**2.1 Granular Subbase**

- .1 Material for the granular subbase shall consist of sound, hard, durable, uniformly graded crushed gravel and shall not contain organic or soft materials, materials that break up when alternately, frozen and thawed or wetted and dried, or other deleterious materials.
- .2 When compacted near the optimum moisture content to not less than 98% of the maximum dry density corrected for the stone content as determined by ASTM D698, the material shall have a minimum CBR value of 35 compacted at 98%.
- .3 Granular subbase shall meet the following gradation when tested to ASTM C136.

SUBBASE COURSE

Sieve Designation (mm)	Percent Passing
	Sub-Base Course
50.0	100
12.5	70 – 100
5.0	50 – 85
2.0	35 – 75
0.400	15 – 35
0.160	8 – 22
0.071	0 - 13
Plasticity Index (%)	0 - 6

3.0 EXECUTION**3.1 Placing**

- .1 The granular subbase shall not be placed until the underlying subgrade has been inspected by the Engineer.
- .2 The granular material shall be placed in uniform layers not exceeding 150 mm in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and leveled with suitable equipment. Material shall be handled in a manner such that segregation of the coarser and finer fractions will not occur.

3.2 Compaction

- .1 All granular subbase layers shall be compacted in layers not exceeding 150mm in thickness near the optimum moisture content to not less than 98% of the maximum dry density corrected for stone content as determined by ASTM D698 Method A for the material used.

- .2 During compaction, the moisture content shall be maintained at the optimum moisture content as determined by ASTM D698. If the moisture content exceeds the optimum moisture content, the material shall be aerated by mechanical means until the material has dried sufficiently to reach the optimum moisture content. Water shall be added if the moisture content is below optimum. Watering and compacting shall be controlled to prevent pumping of fines to the surface or washing fines away.

3.3 Elevations

- .1 Before acceptance by the Owner and prior to application of the subsequent layer of roadway materials, the subbase course surface shall be true to cross-section and grade, and shall conform to the density and bearing ratio requirements specified.

4.0 ACCEPTANCE TESTING

4.1 Tolerances

- .1 The finished surface of the subbase shall conform to grades approved by the Owner, and shall show no depression more than 10 mm under a straight edge 3.0 m long placed parallel to the centreline.
- .2 Granular subbase higher than the approved grades shall be cut to the required grades.

4.2 Proof Roll

- .1 The Contractor shall supply a truck loaded to 8,200 kilograms axle load (4.5 kilograms per millimeter of tread width) for axle test. This test will be undertaken when compaction of the layer has been completed, and shall be carried out under the direction and in the presence of the Owner. It will be used as a supplement to density tests for determining performance of the Contract. No separate payment shall be made for this work.
- .2 Any rutting or deflection points noted during the axle test shall be repaired by the Contractor and at the Contractor's expense. Following repairs, the axle test shall be repeated.

4.3 Materials Testing

- .1 Undertake the following tests:
 - .1 Wash Sieve Analysis
 - .2 Plastic Index
 - .3 CBR Value
- .2 Undertake standard proctor compaction tests, witnessed by the Owner:

- .1 Granular subbase compaction results shall be based on a minimum of one density test per 500 square metres of road. Additional tests may be called for by the Owner as deemed necessary.

4.4 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 Items of work covered by this Specification are those pertaining to excavation, filling, hauling, compaction and other associated work required to construct the base course to the cross sections and grades specified in the construction drawings.

1.2 Quality Control

- .1 Pre-Construction Submissions:
 - .1 At least 2 weeks prior to commencing work, inform Owner of proposed source of granular materials.
 - .2 The Contractor shall provide a sieve analysis of the material for the Owner review.
 - .3 Preliminary review of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for.
 - .4 The Owner has the right to request additional testing if there are any concerns with the proposed aggregate.
- .2 Construction Submissions
 - .1 The Contractor shall provide weigh scale receipts for each load to the Owner at the time of load delivery. The Contractor shall quote using his own certified scale only with the approval of the Owner or where indicated within the tendering documents.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Proof Roll test
 - .2 Compaction Testing

2.0 PRODUCTS**2.1 Granular Base Course**

- .1 Material for the granular base course shall consist of sound, hard, durable crushed rock or crushed gravel and shall not contain organic or soft, thin elongated, or laminated materials, materials that break up when alternately frozen and thawed or wetted and dried, or other deleterious materials.
- .2 When compacted near the optimum moisture content to not less than 100% of the maximum dry density corrected for the stone content as determined by ASTM D698, the material shall have a minimum CBR value of 65 and a maximum particle size of 18 mm.
- .3 Granular base course shall meet the following gradation when tested to ASTM C136 and ASTM C117, and give a smoother curve without sharp breaks when plotted on a semi-log grading chart:

BASE COURSE		
Sieve Designations (mm)	Percent by Weight Passing	
	Lower Limit	Upper Limit
19.0	100	100
12.5	75	100
5.0	50	75
2.0	32	52
0.900	20	35
0.400	15	25
0.160	8	15
0.071	6	11
Plasticity Index	0	6
% Fractured Face	60 Minimum	
% Light Weight Pieces	5 Maximum	

3.0 EXECUTION**3.1 Placing**

- .1 The base material shall not be placed until the underlying subgrade has been accepted by the Owner. The granular material shall be placed in uniform layers not exceeding 150 mm in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and leveled with suitable equipment. Material shall be handled in a manner such that segregation of the coarser and finer fractions will not occur.

3.2 Compaction

- .1 All granular base course layers shall be compacted near the optimum moisture content to not less than 100% of the maximum dry density corrected for the stone content as determined by ASTM D698 Method A for the material used.
 - .1 The thickness of any compacted base course lift shall not be less than seventy-five millimeters (75 mm) and not greater than one hundred and fifty millimeters (150 mm).
- .2 Oversize material shall not be incorporated into the base course.
- .3 During compaction, the moisture content shall be maintained at the optimum moisture content as determined by ASTM D698. If the moisture content exceeds the optimum moisture content the material shall be aerated by mechanical means until the material has dried sufficiently to reach the optimum moisture content. Water shall be added if the moisture content is below optimum. Watering and compacting shall be controlled to prevent pumping of fines to the surface or washing fines away.

3.3 Shaping and Finishing

- .1 Prior to hot mix applications a prime coat shall be placed on the finished final lift of base course in accordance with the requirements of Bituminous Prime and Fog Coat.
- .2 Streets, roads, and lanes used for hauling material, that are damaged, shall be repaired by the Contractor at the Contractor's expense.
- .3 Before acceptance by the Owner and prior to application of the subsequent layer of roadway materials, the surface shall be true to cross-section and grade, and shall conform to the density and bearing ratio requirements specified.

4.0 ACCEPTANCE TESTING**4.1 Tolerance**

- .1 The finished surface of the granular base course shall conform to grades approved by the Owner, and shall show no depression more than 5 mm under a straight edge 3.0 m long placed parallel to the road centerline.
- .2 Granular base course higher than the approved grades shall be cut to the required grades.

4.2 Proof Roll

- .1 The Contractor shall supply a truck loaded to 8,200 kilograms axle load (4.5 kilograms per millimeter of tread width) for subgrade axle test. This test will

be undertaken when compaction of the subgrade has been completed, and shall be carried out under the direction and in the presence of the Owner. It will be used as a supplement to density tests for determining performance of the Contract. No separate payment shall be made for this work.

- .2 Any rutting or deflection points noted during the axle test shall be repaired by the Contractor and at the Contractor's expense. Following repairs, the axle test shall be repeated.

4.3 Materials Testing

- .1 Undertake the following tests:
 - .1 Wash Sieve Analysis
 - .2 Plastic Index
 - .3 CBR Value
- .2 Undertake standard proctor compaction tests, witnessed by the Owner:
 - .1 Granular base course compaction results shall be based on a minimum of one density test per 1,000 square metres of road. Additional tests may be called for by the Owner as deemed necessary.

4.4 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 Items of work covered by this Specification are those pertaining to the removal of existing asphalt pavement to remove distressed pavement, restore cross-section, improve profile, restore clearances, or improve drainage.

1.2 Quality Control

- .1 Notify the Town of any traffic signals or cathodic protection test stations near the construction area. The Town will mark the location of the traffic loop wires or cathodic protection cables.
- .2 Approval from the Owner must be obtained prior to conducting milling operations within 300 mm of the marked wires.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Markings of traffic loop wires or cathodic protection cables
 - .2 Completion of milling

2.0 PRODUCTS

- .1 Not applicable

3.0 EXECUTION**3.1 Equipment**

- .1 The milling equipment shall be commercially manufactured to perform the work satisfactorily.
- .2 The machine will be self-propelled with sufficient power, traction, and stability to maintain accurate depth of cut.
- .3 The machine will be equipped with adjustable controls to establish and maintain profile, cross slope and grade at each end of the cutting drum, +/- 25mm. The drum width will be sufficient to efficiently mill the required area.
- .4 Broken, missing, or worn teeth shall be replaced if the machine is unable to maintain a consistent surface texture.
- .5 The machine shall have a dust suppression system.

3.2 Preparation

- .1 Damage to wires and existing infrastructure will be repaired at the expense of the contractor. Traffic loops need to be replaced once a wire is damaged.

3.3 Cold Milling of Asphalt

- .1 Mill the existing surface to the depth, width, grade and profile as specified on the construction drawings. The surface of the milled surface shall be uniform. Variances in milling shall be no greater than 15mm below a 3m straight edge.
- .2 Milling thickness of pavement removal shall be described as nominal thickness with the following ranges;
 - .1 19mm = 0mm to 38mm
 - .2 25mm = 0mm to 50mm
 - .3 38mm = 0mm to 76mm
 - .4 50mm = 0mm to 100mm
- .3 Pavement shall be removed to the edge of the concrete gutter or curb. Vertical faces shall be milled at the outer edges of the milled area to a minimum depth of the nominal depth specified.
- .4 When milling results in a vertical face greater than 25mm between the adjacent lane, the mill shall be performed on the adjacent lane in the same day.
- .5 Milled material shall be collected by mechanical sweeping, loaded, and hauled to the site designated by the Owner. Dust suppression is required when sweeping.

4.0 ACCEPTANCE TESTING**4.1 Final Acceptance**

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 The work to be done under this item of the specification includes the supply and placing of hot mix asphalt concrete.

1.2 Quality Control

- .1 Pre-Construction Submissions:
 - .1 The Contractor shall submit asphalt concrete mix design based on the Marshall Method and trial mix test results to the Owner for review at least two (2) weeks prior to commencing work and before any asphalt is used in the work.
 - .2 The Contractor shall provide a sieve analysis of the aggregate material for the Owner's review. The Contractor shall pay for all costs of performing these tests.
 - .3 The Contractor shall supply a five point, 50 blow, Marshall method mix design on the approved aggregate for the asphaltic mix to meet the required criteria.
 - .1 The Marshall Stability value and Flow Index shall be tested by ASTM Designation D-1559 for Resistance to Plastic Flow of Bituminous Mixtures.
 - .2 The Percentage Voids and Percentage Aggregate Voids filled with Asphalt shall be determined according to the Marshall Method of Mix Design for Hot Mix Asphalt Paving.
- .2 Construction Submissions
 - .1 The Contractor shall provide weigh scale receipts for each load to the Owner at the time of load delivery. The Contractor shall quote using his own certified scale only with the approval of the Owner or where indicated within the tendering documents.
- .3 Construction Considerations
 - .1 No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Results of Asphalt Marshall Report

.2 Results of Asphalt Core tests

2.0 PRODUCTS**2.1 Aggregate**

- .1 Aggregate shall consist of hard, durable, uniformly graded crushed gravel and shall not contain organic or soft materials that break up when alternately frozen and thawed or wetted and dried, nor other deleterious materials.
- .2 Aggregate shall meet the following gradation when tested to ASTM C136 and ASTM C117, and give a smooth curve without sharp breaks when plotted on semi-log grading chart.

ASPHALT AGGREGATE		
Sieve Designations (mm)	Per Cent by Dry Mass Residential Class II	
	Lower Limit	Upper Limit
16.0	100	100
12.5	78	97
9.0	66	90
5.0	50	72
2.0	32	51
0.900	21	37
0.400	16	27
0.160	7	15
0.071	4	10
Sand Equivalent	50 minimum	
% Fractured Face	60.0 minimum	
% Light Weight Pieces	1.5 maximum	

- .3 The Liquid Limit shall not exceed 25 and the Plasticity Index shall not exceed 6 for the portion of material passing the 400 sieve.
- .4 Crushed Fragments: At least 60% of fragments within following size ranges to have at least 2 freshly fractured faces:
- | | |
|---------------------------|---------------------------------|
| Passing
20.0 mm | Retained On
to 5.0 mm |
|---------------------------|---------------------------------|
- .5 Maximum of 3.0% total deleterious matter by total mass of combined aggregate.
- .6 Should the grading of the mineral aggregates supplied to the plant not meet the gradation above, mineral filler shall be added in the weight hopper of the asphalt plant in such quantities as will be required to meet the specifications.

2.2 Asphalt Mix

- .1 Mix design to meet the following criteria:

Parameter	Criteria
Marshall Stability at 60°	Not less than 8,000 N
Marshall Flow Index	2.0 mm to 4.0 mm
Percentage Voids of Total Mix	3.5% to 5.5%
Percentage Aggregate Voids Filled with Asphalt	75% to 90%
Voids in Mineral Aggregate (VMA)	14.0% minimum
Permissible Variation of Asphalt Cement from Job Mix	0.25%
Asphalt Film Thickness (µm)	7.5 minimum
Asphalt Cement Content	5.7% minimum
Anti-Stripping Agent or Lime	Stripping Potential <5%

2.3 Mineral Filler

- .1 Mineral filler shall consist of Portland Cement, Pozzolan, commercially ground stone dust or other mineral dust approved by the Owner. Mineral filler shall have a Plasticity Index of Zero and, when tested by means of laboratory sieves, it shall meet the following gradation.

Sieve Size (mm)	Percent Passing (by weight)
0.400	100
0.160	not less than 90
0.063	not less than 70
0.045	not less than 62

- .2 Mineral filler to be dry and free flowing when added to aggregate.

2.4 Asphaltic Binder

- .1 The asphaltic binder shall be uniform in character, shall not foam when heated to 175° C, and shall meet the following requirements:

Parameter	Criteria
Designation	A/C 150/200
Penetration (ASTM D5) under 100 g for 5 sec. at 25° C	170 to 240
Flash Point (ASTM D92) filled or unfilled	greater than 232° C
Ductility (ASTM D113) strain rate of cm/sec.	25° C greater than 100(+) cm
Solubility in CC1 ₄ (unfilled)	99.0(+)%
Kinematic Viscosity in Centistokes at 135° C	150(+)
Thin Film Oven Test Penetration under 100 g for 5 sec. at 25° C	45(+)%

2.5 Storage of Materials

- .1 The aggregate shall be stockpiled at the mixing plant. Stockpiles shall be constructed by placing the aggregate in uniform layers over a pre-determined stockpile area in such a manner that no segregation of the

various particle sizes results. The asphalt binder shall be stored in suitable tanks at a temperature not exceeding 150°C.

2.6 Mixing Plant

- .1 The mixing plant and auxiliary equipment shall be such as to combine, dry, and heat the mineral aggregate, heat the asphalt and accurately proportion the asphalt and aggregate to produce a uniform mixture. The mixing plant shall meet the requirements of A.S.T.M. Designation D995 for Bituminous Mixing Plant Requirements.

3.0 EXECUTION

3.1 Preparation of Site

- .1 Patch and correct depressions and other irregularities to approval of the Owner before beginning paving operations. Prior to laying mix, clean surfaces of loose and foreign material and apply prime coat or tack coat in accordance with Section 4500.

3.2 Preparation of Mixture

- .1 The mineral aggregate, and mineral filler when required, shall be combined by means of hoppers and conveyors at the cold feed plant. The aggregate shall be dried and delivered at a temperature of 1200C to 1600C to the mixer. The temperature between these limits shall be regulated according to the penetration grade of the asphalt, temperature of the atmosphere and workability of the mixture. The aggregate shall be dry mixed in the mixer for not less than 15 seconds.
- .2 The asphalt cement shall be brought to temperature of 1200 to 1600C before mixing with aggregate. The temperature between these limits shall be regulated to the penetration grade of the asphalt used.
- .3 The aggregate and asphalt cement shall then be mixed in the proportions as determined by the design mix. The temperature of both the aggregate and asphalt cement shall be maintained between 1200C and 1500C until mixing is completed. The time of mixing shall be not less than 30 seconds, and shall be such that a homogenous mixture is produced in which all particles of the aggregate are uniformly coated with asphalt.
- .4 The bituminous mix temperature at mixer discharge shall be controlled between low temperature of 130oC and a maximum high temperature of 150oC.
- .5 Mix Tolerances
 - .1 All mixture furnished shall conform to the job mix formula within the range of tolerance specified.

	<u>Aggregate Material Passing</u>	<u>Percent by Weight</u>
	5.0 mm Sieve	± 5
	0.90 mm Sieve	± 3
	0.071 mm Sieve	± 1.5
.2	The amount of bituminous material designated for the job mix shall be maintained within the tolerance of 0.25 percentage points.	
.3	The temperature for mixing asphaltic mixtures shall not vary from those specified in the job mix formula by more than 5° C.	

3.3 Transportation of Mix

- .1 The mixture shall be transported from the mixing plant to the work in vehicles with tight metal boxes previously cleaned of all foreign materials. The vehicles shall be suitably insulated and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions. The inside surface of all vehicles may be lightly lubricated with a thin oil or soap solution prior to loading, but excess lubricating will not be permitted.
- .2 Any accumulation of asphaltic material which was collected in the box shall be thoroughly cleaned before loading with hot mix.
- .3 Trucks shall be maintained perfectly clean of mud or any substance which could contaminate the working area.

3.4 Paver

- .1 The mixture shall be laid with a mechanical self-powered spreader capable of spreading the mixture true to line, grade and crown as required. The paver shall be equipped with hopper and distributing screw of the reversing type to place the mixture evenly in front of adjustable screeds.
- .2 Mechanical self-powered pavers shall be equipped with electronic screed control system capable of automatically maintaining screed elevations on each side of the paver through any combination of stringline, 9.1 m long ski-type device or joint matching shoe.

3.5 Placing

- .1 The Contractor shall remove all loose and foreign material and water prior to placing the asphaltic concrete mixture. The mixture shall be delivered at a minimum temperature of 130° C or maximum temperature of 150° C and laid in dry conditions and only when the ambient air temperature is 2° C and rising.
- .2 The mixture shall be laid and rolled to the widths and thickness shown on the drawings. The finished surface shall have the minimum number of longitudinal and horizontal joints as practicable.

- .3 The maximum thickness of any lift shall not exceed 50 mm compacted thickness. Subsequent lifts shall not be placed over the underlying layer within 24 hours. Before rolling is started, the surface shall be checked, inequalities in depth adjusted and fat spots or sandy accumulations replaced and irregularities in alignment or grade along the outside edge shall be corrected.
- .4 The Contractor will only be allowed to place bituminous mix during daylight hours. Daylight hours are from sunrise to one-half hour before sunset.
- .5 When temperature of surface on which material is to be placed falls below 10° C, provide extra rollers as necessary to obtain required compaction before cooling.
- .6 Do not place hot mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .7 In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Owner. The material shall be distributed uniformly to avoid segregation of coarse and fine aggregates. Broadcasting of material shall not be permitted. During the spreading operation, all material shall be thoroughly loosened and uniformly distributed by lutes or rakes. Material that has formed into lumps and does not break down readily shall be rejected.

3.6 Joints

- .1 A continuous well-sealed bond is required between old and new surfaces. The contact surface of all longitudinal joints shall be painted with a thin and uniform coat of hot asphalt primer before placing the new mix, and the same treatment shall be given to contact joints with curbs, gutters, manholes and other appurtenances.
- .2 When the work is resumed after a lapse of several hours, one end shall be cut back approximately 150 mm to a new and clean surface before paving is started and heat shall be used as necessary to ensure a proper bond.
- .3 Where the asphaltic concrete material is placed in two layers; longitudinal joints in the two layers shall be staggered by a minimum of 150 mm.
- .4 Where the proposed pavement meets the existing pavement, the Contractor shall cut to a neat square edge to ensure a good seam. The cost of this cutting shall be included in the unit price bid for hot mix asphaltic concrete.

3.7 Rollers

- .1 The rollers used for compaction shall be self-propelled steel-wheeled and rubber tired rollers, weighing at least 3.6 kilograms per millimeter width of tread.

- .2 The rollers shall be in good condition without backlash when reversed and shall be operated by competent operator.
- .3 The wheels shall be kept properly moistened, but excess water or lubricant will not be permitted.
- .4 The rollers must be kept in continuous operation as nearly as practicable and all parts of the pavement shall receive substantially the same compaction.

3.8 Rolling and Compaction

- .1 Before rolling is started, the surface shall be checked, inequalities in depth adjusted and fat spots or sandy accumulations replaced, and irregularities in alignment or grades along the outside edge shall be corrected.
- .2 At least one steel wheeled and one rubber tire roller shall be used for every 40 tonnes of asphaltic concrete laid per hour.
- .3 Rolling shall start as soon as the pavement will bear the roller without checking or undue displacement, working from the lower part or edge to the high part or edge continuously until no roller marks are left in the finished surface and no further compaction is possible.
- .4 The rollers must be kept in continuous operation as nearly as practicable and all parts of the pavement shall receive substantially the same compaction. Rolling shall be done at a maximum speed of 5 km per hour.
- .5 At all curbs, manholes and other appurtenances, and at all locations not accessible to the roller, hand tampers shall be used to produce the same density as provided by the roller.
- .6 The completed pavement shall not have a density of less than 98% of the laboratory compacted density as determined by methods described in ASTM D1559, using a compaction of 50 blows for each face.

3.9 Finish

- .1 The finished pavement shall be true to the required profile and cross-section. The allowable tolerance for finished pavement shall be ± 5 mm, and the surface shall show no depressions or bumps exceeding 3 mm under a straight-edge 3 m long placed parallel to the road centreline.
- .2 Finished surface shall have a tightly knit texture free of visible signs of poor workmanship such as, but no limited to:
 - .1 Segregation
 - .2 Areas exhibiting excess or insufficient asphalt
 - .3 Improper matching of longitudinal and transverse joints

- .4 Roller marks, cracking, or tearing
- .3 If surface and grade tolerances are exceeded, or if surface texture is not met, repair defective areas as required by the Owner.

3.10 Defective Work

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form a true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking or hairline cracking.

3.11 Clean Up

- .1 Locations shall be cleared of all excess material resulting from the paving operation and any damage caused by the Contractor shall be repaired to the Owner's satisfaction within 3 days of the date of completion of the street or lane. Failure to cleanup or repair damage may result in other crews undertaking this work without notice to the Contractor and deducting the costs from money due to the Contractor.

4.0 ACCEPTANCE TESTING

4.1 Bituminous Mixture Samples

- .1 The Contractor shall arrange for samples of the bituminous mixture to be taken from the spreader or haul truck and forwarded to an approved laboratory for testing. One such sample shall be obtained per 2,000 square metres of area surfaced except during the initial period of construction when a greater number of samples will be necessary.
- .2 The following tests shall be performed on all samples of the bituminous mixture submitted to the laboratory.
 - .1 Bitumen Content
 - .2 Aggregate Gradation
- .3 On the first four samples submitted and on every third sample thereafter, the following additional tests shall be performed.
 - .1 VMA
 - .2 Per Cent Air Voids
 - .3 Marshall Stability
 - .4 Flow

- .5 Density
- .4 One core sample shall be obtained for each one hundred lineal metres of street paved. Core sample locations should correspond to the same locations as samples gathered for Lab testing. All core samples shall be tested for bitumen content and density and measured for thickness. Every third specimen shall also be tested for aggregate gradation.
- .5 The Contractor shall repair all test holes with fresh, hot mix asphaltic concrete mixture, and thoroughly compact it to the required density with no additional compensation.

4.2 Failure to Meet Compaction Density and Thickness Requirement

- .1 The Owner reserves the right to reject any Hot Mix Bituminous Surface Course whatsoever which does not meet all the specified requirements for the Hot Mix Bituminous Surface Course.
- .2 The Owner may, at their sole discretion, accept Hot Mix Bituminous Surface Course which does not meet the specified density and thickness requirements and, in such case, payment shall be made on the basis of a percentage scale for the Hot Mix Bituminous Surface Course product by each test as follows:

- .1 Density Specified to 98% of Marshall

Compacted Density % of Marshall	Payment
98 to 100	100%
97.6 to 97.9	98%
97.0 to 97.5	96%
96.6 to 96.9	93%
96.0 to 96.5	90%
94.0 to 95.9	75%
92.0 to 93.9	50%
Less than 92%	Replace pavement – no payment for removal or replacement

- .2 Thickness ($X = \frac{\text{actual thickness}}{\text{design thickness}}$)

Variation in Thickness From Design Thickness	Pavement
more than specified thickness – 5 mm thin	100%
6 mm thin – 15 mm thin	X^2 (100%)
more than 15 mm thin	No Payment

- .3 If any Hot Mix Bituminous Surface Course tested in accordance with this Specification fails to meet the specified density, the Contractor may request coring of the Hot Mix Bituminous Surface Course in question. When such coring is approved by the Owner, arrangements shall be made by the Contractor, through the Owner, to employ an independent, qualified testing service, all at the expense of the Contractor. The cores shall be taken and

tested within three days of the testing of the cores representing the Hot Mix Bituminous Surface Course in question. One core shall be taken for each strength test previously taken and there shall be no doubt that the cores taken represents the area in question. Cores shall be tested in accordance with the requirements of A.S.T.M. Designation D1559 and reported by the independent testing service shall constitute a test. When more than one core strength is taken, in one area the average of all the core strength tests shall represent the strength of the Hot Mix Bituminous Surface Course in question.

4.3 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 Items of work covered by this Specification are those pertaining to the installation of roadway coatings.

1.2 Quality Control

- .1 Traffic shall not be permitted to travel on tack or fog coat until cured.
- .2 Traffic shall not be permitted to travel on prime coat until 6 hours after application or until completely cured. After this period of time, excess asphalt material remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface.
- .3 The Contractor shall use flagmen, if required; provide and maintain signs, barricades, and keep all animals and pedestrians off newly primed surfaces until cured.
- .4 Allow prime coat to properly cure before paving.

1.3 Inspections

- .1 Notify Owner for inspection of:
 - .1 Approval of existing surface before applying asphalt prime, tack or fog coats.

2.0 PRODUCTS**2.1 Prime Coat**

- .1 The bituminous material for priming the base course shall be liquid asphalt. Asphalt types may vary from medium curing (MC) type MC-30 to MC-250; from emulsified asphalt Types SS-1 to SS-1H or a special emulsified asphalt primer S.E.P. 1 or S.E.P. 2 depending on conditions to suit the base and time of season. The type of asphalt suitable for this application shall be a 50:50 mixture of water and SS-1 applied at a rate of 1.5 L/m² providing the hot mix asphalt pavement is placed immediately after curing is complete.

2.2 Tack Coat

- .1 The bituminous material for tacking the existing asphalt surface shall be liquid asphalt. The asphalt types may vary from rapid curing (RC) type RC-30 to RC-250; from emulsified asphalt types SS-1 to SS-1H, depending on conditions to suit the base and time of season.

2.3 Fog Coat

- .1 The bituminous material for sealing the surface course if specified shall be liquid asphalt. The asphalt types may be emulsified asphalt type SS-1 or medium curing (MC) type MC-30, depending on the surface material to be sealed and time of season. The type of asphalt suitable for this application shall be a 50:50 mixture of water and SS-1 applied at a maximum rate of 0.5 L/m².

2.4 Sand Blotter

- .1 The materials for sand cover shall consist of clean granular mineral material, all of which shall pass a 5.0 mm sieve.

3.0 EXECUTION**3.1 Equipment**

- .1 Cleaning equipment shall consist of power brooms, flushers, and whatever hand scrapers may be necessary to remove all foreign material.
- .2 The pressure distributor used for applying asphaltic material shall be equipped with pneumatic tires and shall be so designed and operated as to distribute the asphaltic material in a uniform spray without atomization, in the amount and between the limits of temperature specified. It shall be equipped with a fifth wheel speed tachometer registering metres per second and so located as to be visible to the truck driver to maintain the constant speed required for uniform application at the specified rate.
- .3 The pump shall be operated by a separate power unit, or by the truck power unit. It shall be equipped with a metre registering litres per minute passing through the nozzles and located to be readily visible to the operator.
- .4 Suitable means for accurately measuring the temperature of the asphaltic material shall be provided.
- .5 The thermometer well shall be so placed as not to be in contact with a heating tube. The distributor shall be so designed that the normal width of application shall be not less than 2 m, with provision for the application of lesser width when necessary.
- .6 If provided with heating attachments the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

3.2 Preparation

- .1 Immediately prior to applying the asphaltic primer, tack or fog coat, the surface shall be brought to uniform cross-section by patching all depressions

and defective areas using an approved patching material and by removing all bumps and irregularities.

- .2 All loose and foreign material shall be removed by light sweeping.

3.3 Application

- .1 Clean surface as required.

- .2 Upon the prepared surface the asphalt shall be applied uniformly at a rate of from 1.0 to 1.50 litres/square metre (L/m²) for asphalt primer, and at a rate of from 0.25 to 0.90 L/m² for tack coat and a rate not exceeding 0.5 L/m² for fog coat. The asphalt primer, tack or fog coat shall be applied only when the surface is dry or slightly damp, unless otherwise allowed by the Owner in writing, or only when the air temperature in the shade is above 10°C. Hand apply asphaltic primer in areas not accessible with the distributor.

- .3 The application temperature of the asphalt primer, tack or fog coat shall be as follows:

- .1 Rapid Curing Asphalt:

RC-30	51 – 68°C
RC-70	74 – 88°C
RC-250	100 – 110°C

- .2 Medium Curing Asphalt:

MC-30	51 – 68°C
MC-70	74 – 88°C
MC-250	100 – 110°C

- .3 Emulsified Asphalt:

SS-1	24 – 54°C
SS-1H	24 – 54°C

- .4 Emulsified Asphalt Primer: 15 – 50°C

- .4 Coat contact surfaces of curbs, gutters, headers, manholes and like structures with a thin uniform coat of asphalt material. Do not prime or tack surfaces that will be visible when paving is complete. Work adjacent to the roadway shall be completely protected from the application operation by a suitable covering. Any unnecessary splashing of the asphalt shall be cleaned.

- .5 Do not apply asphalt coat when air temperature is less than 5°C or when rain is forecast within 8 hours. Do not apply prime or tack coat if surface temperature is less than 2°C. Do not apply fog coat if surface temperature is less than 10°C.

- .6 The Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.
- .7 The asphalt primer should preferably be entirely absorbed by the base course and therefore require no sand cover. If, however, the asphalt has not been completely absorbed 24 hours after application, just sufficient sand shall be spread over the surface to blot up excess asphalt and prevent it from being picked up by any traffic.

4.0 ACCEPTANCE TESTING

4.1 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 The items of work governed by this Section of the Specifications are those required to supply and adjustment of the surface elevations of existing valve boxes, curb boxes, catch basin covers, and manhole covers to the required finished elevations.

1.2 Quality Control

- .1 Not applicable

1.3 Inspections

- .1 Not applicable

2.0 PRODUCTS**2.1 Valve Box Extensions**

- .1 Valve box extensions shall be 150 mm cast iron and are to be completely coated with an asphaltic type varnish to prevent corrosion.

2.2 Manhole Grade Rings and Blocks

- .1 Precast grade rings and blocks for manhole grade adjustment shall conform to ASTM C478 and C139 respectively.
- .2 Final adjustment riser/ring shall be composite rubber INFRA-RISER as Manufactured by East Jordan Iron Works or approved equal.

2.3 Mortar

- .1 Mortar shall be Sulphate Resistant ASTM Type 50.

3.0 EXECUTION**3.1 Inspection of Existing Appurtenances**

- .1 Prior to the start of construction on any street or block, the Contractor shall locate and inspect all manholes, catch basins, and valves in order to satisfy himself that they are all in proper working condition. Any damaged materials shall be brought to the immediate attention of the Owner, who will make arrangements with the Owner for replacement parts. Damaged materials, which are not brought to the immediate attention of the Owner, will be the sole responsibility of the Contractor and shall be repaired by the Contractor at his own expense.

3.2 Valve and Curb Boxes

- .1 Adjustment of valve box tops and curb box tops shall include the repair of any broken boxes. The Owner will supply necessary replacement parts. Any materials damaged by the Contractor shall be replaced at the sole cost of the Contractor. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be so made that the valves operate as effectively as before the adjustment.

3.3 Manhole and Catch Basins

- .1 Manhole and catch basin covers shall be adjusted so that the cover conforms to the required finished elevation. All adjustments are to be made with mortar and brick or grade rings firmly set in position and grouted.
- .2 Final adjustment shall include a minimum of 25 mm composite rubber grade ring below frame and cover. Maximum height of stacked composite rubber adjustment risers should not exceed 75 mm.
- .3 Steel extensions for frame and cover shall not be used unless accepted in writing by the Owner.
- .4 The Contractor shall notify the Owner if existing manholes or catch basins have less than 150 mm of grade rings, more than 300 mm of grade rings, existing grade rings are damaged, or existing cone appears to be damaged prior to or during construction.

3.4 Manhole Reconstruction

- .1 Manholes may be reconstructed or lowered using precast rings or blocks where an adjustment is not possible. The blocks shall meet the requirements of A.S.T.M. Specification C139.

3.5 Backfill

- .1 Should any backfill be required around the valve box, manhole or catch basin cover below the elevation of the road subbase surface, Granular backfill shall be used and properly compacted in place.
- .2 Granular Backfill
 - .1 Clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting following gradation limits:

<u>ASTM Sieve Designation</u>		<u>Per Cent Passing</u>		
50.0	mm	100		
31.5	mm	60	-	100
16.0	mm	40	-	75
4.75	mm	25	-	60
2.0	mm	20	-	45
0.425	mm	10	-	25
0.075	mm	0	-	10

4.0 ACCEPTANCE TESTING**4.1 Final Acceptance**

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

Town Of Kindersley



MASTER SPECIFICATIONS

SECTION 5000	CONCRETE	Page
Section 5100	Concrete Formwork	2
Section 5200	Concrete Reinforcement	5
Section 5300	Cast-In-Place Concrete	8

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for supply installation and removal of concrete formwork for structures.

1.2 Quality Control

- .1 Obtain Owner's permission before framing openings in Structural joists, beams or columns.

1.3 Inspections

- .1 Notify Owner for inspection of formwork alignment and elevation prior to concrete pouring.

2.0 PRODUCTS**2.1 Materials**

- .1 Formwork Materials shall be steel or wood of sufficient strength to resist the pressure of wet concrete: to CSA A23.1.
- .2 Form Ties: snap-off metal ties, free of devices that will leave hole larger than 25 mm diameter, in concrete surface.
- .3 Form Release Agent: colourless mineral oil, free of kerosene or other incompatible material or fluids, compatible with applied finish.
- .4 The use of bent, twisted, battered or worn-out forms will not be permitted.

3.0 EXECUTION**3.1 Responsibility**

- .1 The design of formwork and its supporting framing shall be the responsibility of the Contractor.

3.2 Workmanship

- .1 Do concrete formwork to CSA A23.1, except as otherwise specified herein.
- .2 Verify lines, levels and column centres before proceeding with formwork. Ensure that dimensions agree with drawings.
- .3 Hand trim sides and bottoms of earth forms and remove loose dirt prior to placing of concrete.

- .4 Align form joints and make watertight without affecting appearance of concrete. Keep form joints to minimum.
- .5 Use 20 mm chamfer strips on external corners of beams, joists, columns, curbs, machine bases.
- .6 Form chases, slots, openings, drops and recesses as detailed or required.
- .7 Set screed with top edge level to proper elevation.

3.3 Inserts

- .1 Set sleeves, ties, anchor bolts, pipe hangers and other inserts, in concrete work as required by other trades.
- .2 No sleeves, ducts, pipes or other openings shall pass through joists, beams, or columns, except where detailed on the drawings.
- .3 Confirm location of all sleeves and openings, shown on structural drawings and check against architectural, mechanical and electrical drawings.
- .4 Install continuous preformed flashing reglets to form where flashings occur at concrete surfaces.
- .5 Install formed construction joints to floor pattern pouring sequence, set vertical, top screed to required elevations, sufficiently secure to resist movement of wet concrete. Drive stake cleanly through vapour barrier.

3.4 Form Removal

- .1 Leave formwork in place for the following minimum periods of time after pouring concrete:
 - .1 12 hours for sidewalks, curb and gutter
 - .2 Two days for walls and sides of beams.
 - .3 Seven days for columns.
 - .4 Fourteen days for beams soffits, slabs and other structural members, or after in-situ concrete has achieved the specified 28 day strength. Responsibility for ascertaining in-situ concrete strength lies with the Contractor.

4.0 ACCEPTANCE TESTING

4.1 Tolerance

- .1 Construct formwork to maintain the following tolerances:

- .1 Deviation from vertical line - 5 mm in 3,000 mm, 10 mm in 6,000 mm and 20 mm in 12,000 mm or more.
- .2 Deviation from flat surface, for walls and floors 5 mm in 3,000 mm.
- .3 Deviation from horizontal line - 5 mm in 3,000 mm, 20 mm in 12,000 m or more.
- .4 Deviation of linear building lines from design drawings and position of columns, walls and partitions 6 mm.
- .5 Deviation in cross-sectional dimensions of columns beams, or in thickness of slabs and walls - plus or minus 6 mm.
- .2 Camber slabs and beams 6 mm per 3000 mm of span unless shown otherwise. Maintain beam depth and slab thickness from cambered surface.

4.2 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for supplying and placing reinforcing steel for concrete.

1.2 Quality Control

- .1 Submit copies of shop drawings to Owner within 2 weeks of award of contract and 1 week prior to concrete pour.
- .2 Regardless of approval of shop drawings by Owner, be responsible for fit, conformity or performance in accordance with drawings and specifications.

1.3 Inspections

- .1 Notify Owner for inspection of reinforcement.
- .2 Do not place concrete until Owner has inspected reinforcement work in place.

2.0 PRODUCTS**2.1 Reinforcing Steel**

- .1 To CSA G30.12 Billet Steel Grade 400 deformed bars. Furnish bars in full lengths shown.
- .2 Welded steel wire fabric shall conform to CSA standard G30.5
- .3 Billet steel bars shall conform to CSA standard G30.12-M
- .4 Epoxy-coated reinforcing steel shall be prepared and coated according to the requirements of ASTM A775

2.2 Wire Ties

- .1 Plain, cold drawn annealed steel wire.

2.3 Supports

- .1 Supply approved supports and chairs of strong, durable, non-corrodible materials which fasten or tie securely to reinforcing steel. Galvanized metal or plastic chairs, concrete blocks or other devices may be used provided they satisfy requirements of this section and are approved by Owner.

3.0 EXECUTION**3.1 Field Bending**

- .1 Do not field bend reinforcement except where indicated or authorized by Owner.
- .2 When authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.2 Placing

- .1 Accurately place reinforcing steel in positions indicated and hold firmly during placing, compacting and setting of concrete.
- .2 Minimum overlap of reinforcement is 40 x rebar diameter or 50 cm, whichever is greater, unless otherwise specified on the drawings.
- .3 Tie reinforcement where spacing in each direction is:
 - .1 Less than 300 mm: tie at alternate intersections.
 - .2 300 mm or more: tie at each intersection.

3.3 Connections to Existing

- .1 Reinforcement shall be drilled and dowelled into existing concrete at all joints.

3.4 Splicing

- .1 Make no splices of reinforcement other than those indicated or authorized by Owner.
- .2 Splice reinforcing bars and mesh to CAN3-S6.

3.5 Welding

- .1 Welding reinforcing steel not acceptable.
- .2 When authorized, weld to CSA W186. Use only welders qualified under provisions of CSA W47.1.
- .3 Do not weld stirrups to main tension reinforcement.

3.6 Cleaning

- .1 To CSA A23.1-94.

- .2 Shall be free from mill scale, grease and rust immediately prior to placing concrete.

4.0 ACCEPTANCE TESTING

4.1 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials
- .2 Work not meeting the specification requirements will not be approved.

END OF SECTION

1.0 GENERAL**1.1 Description**

- .1 This section specifies requirements for supplying and placing new sidewalk, monolithic sidewalk curb and gutter.

1.2 Quality Control

- .1 Pre-Construction Submissions:
 - .1 Before any aggregates are used in the work, the Contractor shall obtain and ship to a testing laboratory designated by the Owner for preliminary approval, representative samples containing not less than 25 kg of aggregate.
 - .1 Sampling shall be done in accordance with CSA Test Method A23.2 – 1A. The Contractor shall pay for all costs of obtaining and shipping samples and for all Laboratory Tests.
 - .2 Preliminary review of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply. Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. Rejected material will not be paid for.
 - .2 The Contractor shall submit to the Owner a pdf copy of a proposed concrete design mix showing the proportions of the material to be used.
 - .1 No concrete shall be used in the work before a mix design from a recognized testing laboratory has been submitted to the Owner and approved.
 - .2 The costs of the design mix and concrete samples and test shall be borne by the Contractor.
- .2 Construction Submissions
 - .1 Submit results of concrete cylinder tests to Owner.
- .3 Keep all animals and pedestrians off the newly constructed sidewalks or curb until completely set.

- .4 The Contractor shall be responsible for keeping all vehicles off the work for a period of 5 days after the concrete has been finished.

1.3 Inspections

- .1 Notify Owner for inspection of:
- .1 Concrete pour.
 - .2 Concrete cylinder test collections.

2.0 PRODUCTS

2.1 Granular Base Course

- .1 To Section 4300.

2.2 Cement

- .1 All cement used shall be Normal Portland Cement and shall conform to CSA standard CAN3-A5 Type 10 or Type 50.

2.3 Course Aggregates

- .1 Coarse aggregate shall consist of crushed stone or gravel or combination thereof, having hard, strong, durable particles, free from elongated particles, dust, shale, earth, vegetable matter or other injurious substances.
- .2 Coarse aggregate shall conform to the requirements of CSA CAN3-A23.1-M77 with the following gradation limits:

Sieve Opening	Percent Passing
28 mm	100%
19 mm	90 - 100
9.5 mm	25 - 60
5 mm	0 - 10
2.5 mm	0 - 5
80 um	0 - 1

2.4 Fine Aggregates

- .1 Fine aggregate shall consist of sand, stone screenings or there inert materials with similar characteristics or a combination thereof having clean, hard, strong, durable uncoated grains and free from an injurious amount of dust, lumps, shale, alkali, organic matter, loam or other deleterious substances.
- .2 Fine Aggregates shall conform to the following gradation limits:

Sieve Opening	Percent Passing
10 mm	100%
5 mm	95 - 100
2.5 mm	80 - 100
1.25 mm	50 - 90
630 µm	25 - 65
315 µm	10 - 35
160 µm	2 - 10
80 µm	0 - 3

- .3 The aggregates shall be stockpiled in such a manner as to minimize segregation. Stockpiles should be built up in layers of uniform thickness.

2.5 Concrete Strength

- .1 All concrete shall be proportioned and mixed to produce a concrete having a minimum compressive strength of 32 MPa at 28 days or as specified on the drawings.

2.6 Water

- .1 The water used in mixing or curing concrete shall be clean and free from salt, oil, acids, alkalis, and organic or other deleterious substances.

2.7 Air Entraining Admixture

- .1 An air entrainment admixture conforming to the requirements of CSA Standard A266.1 shall be used to produce an air entrained concrete containing not less than 5% and not more than 8% entrained air, as determined by the standard test described in CSA Standard CAN3-A23.2-4C.

2.8 Reinforcing Steel

- .1 To Section 5200.

2.9 Expansion Joint Filler

- .1 Expansion joint filler shall be a 19 mm thick non-extruding bituminous type and shall conform to ASTM D1751 for preformed expansion joint filler.

2.10 Expansion Joint Sealer

- .1 Joint sealer shall conform to CGSB standard specification for polyurethane sealing compound 19-GP-15 or ASTM standard specification for hot poured joint sealer D-1190.

2.11 Membrane Curing Compound

- .1 Curing compound shall be impervious resin base, conforming to ASTM standard specification C309 Type, 1D-Type B. The membrane curing compound shall be applied in accordance with the manufacturer's instructions.

2.12 Concrete

- .1 The concrete mix shall be designed as follows, or as specified on the drawings:
- .1 Minimum 28 day compressive strength 32 Mpa
 - .2 Slump not exceeding 75 mm
 - .3 Maximum aggregate size 20 mm
 - .4 Air entrainment 5.0 % to 8.0 %

2.13 Levelling Course

- .1 Levelling course for fills of less than 50 mm shall be medium to coarse graded sand meeting the following gradation when tested to ASTM C136 and ASTM C117, and give a smooth curve without sharp breaks when plotted on semi-log grading chart:

Sieve Size (mm)	Percent Passing (by weight)
25.0	100
5.0	95 – 100
1.25	53 – 85
0.200	10 – 30
0.063	0 - 10

- .2 The liquid limit shall not exceed 25 and the plasticity index shall not exceed 6 for the portion of material passing 0.400 mm sieve.
- .3 The leveling course for fills of more than 50 mm shall consist of base aggregate meeting the requirements of this Specification.
- .4 The leveling course shall be compacted to not less than 98% of the Standard Proctor Density for the material.

2.14 Geotextile Filter Fabric

- .1 To Section 4100.

3.0 EXECUTION**3.1 Appurtenances**

- .1 Appurtenances shall be located, examined for deficiencies and staked by the Contractor prior to work beginning on a particular section and any deficiencies noted must be reported to the Owner immediately.
- .2 Upon completion of a block of work, the Contractor shall relocate these structures and inspect them with the Owner. Any damage, which may have occurred during the concreting operations and deficiencies not previously reported to the Owner, shall be repaired at the Contractor's expense.

3.2 Concrete Mixing

- .1 Ready-mixed concrete shall be mixed and transported in accordance with CSA Standard CAN3-A23.1-M77.
- .2 Concrete shall be mixed on site, only with prior approval of the Owner.

3.3 Grade Preparation

- .1 The bed for the sidewalks, curbs and sidewalks shall be excavated and prepared as per Section 2400 Site Excavation, Embankment and Compaction and Section 4100 Subgrade Construction.
 - .1 Subgrade preparation for curb gutter and sidewalk construction will involve compacting existing subgrade materials to a depth of 150 mm below the bottom of the curb or sidewalk and minimum 125 mm wider than finished edge of curb/sidewalk utilizing mechanical tampers and equipment.
 - .2 Unsuitable subgrade materials encountered at this depth shall be removed and replaced with granular backfill upon the instruction of the Owner.
 - .3 The subgrade shall be compacted to 98% of Standard Proctor Density.
 - .4 The curb subgrade shall be maintained until the final concrete work is in place and backfilling completed.
- .2 A layer of compacted clean leveling base course shall be used where required as a foundation material under concrete sidewalks, curbs and driveway crossings. The base on which the concrete will rest shall be thoroughly wetted immediately prior to placing the concrete and must not be frozen, muddy or have areas of water pondage.

- .3 The subgrade elevation shall be finished to tolerances requiring 50 mm of leveling course materials on the subgrade when not extruded. The material shall be compacted to 98% Standard Proctor Density.

3.4 Forms

- .1 To Section 5100.
- .2 Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed.

3.5 Reinforcement

- .1 To Section 5200.
- .2 Reinforcement shall be free from mill scale, grease and rust immediately prior to placing concrete.

3.6 Placement

- .1 The concrete shall be placed directly after mixing, but not later than one half hour (30 minutes) after mixing has begun.
- .2 Re-tempered concrete shall not be used.
- .3 The concrete shall be transported by methods, which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.
- .4 Concrete shall be placed continuously until a complete section between expansion joints has been poured.
- .5 The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

3.7 Mechanical Extruding Machines

- .1 If an extruding machine is used in constructing curbs, curb and gutter, sidewalk or combined curb and sidewalk, the material excavated to accommodate the machine shall be either stockpiled at a specified location or windrowed to the centre of the street with a minimal disruption to the traffic.

3.8 Scheduling

- .1 The Contractor shall schedule his work in such a manner as to not have more than seven days or 1500 m, whichever is greater, of work in progress

at one time. This includes the entire process of preparing the subgrade for the concrete, to the final backfilling and cleaning up.

3.9 Expansion and Contraction Joints

- .1 The sidewalk shall be divided into 1.5 m sections by the use of tooled joints.
- .2 All curbing shall have a 25 mm deep tooled joint at 1.5 m intervals to coincide with joints placed in monolithic or combined sidewalks.
- .3 At the beginning and end of curb radii, an expansion joint shall be constructed.

3.10 Curing

- .1 All concrete shall receive two applications of membrane curing compound, applied in accordance with the manufacturer's instructions.
 - .1 The first application is to be applied after the disappearance of the water sheen and the final finishing of the concrete. During hot, dry, windy days, the first application shall be applied immediately after final finishing and before all free water on the surface has evaporated.
 - .2 The second applications shall be made immediately at right angles to the first so that complete coverage on the surface is attained.
- .2 Immediately after removal of the forms all exposed surfaces shall be thoroughly wetted with water and then sprayed with membrane curing compound.

3.11 Sidewalk Ramps

- .1 Sidewalk ramps shall be constructed as shown on the Drawings at locations shown on the drawings or designated by the Owner.
- .2 The Contractor shall shape the subgrade to maintain specified concrete thickness and shall pour the ramps at the time of the sidewalk and curb construction.

3.12 Construction Record Imprints

- .1 Each block of sidewalk constructed shall be marked at each end with a suitable tool showing legibly the name of the Contractor and year of construction.
- .2 Curb box locations are to be marked at right angles along the back of sidewalk. Imprint is to be 150 mm from the back of sidewalk and have initials C.C. Imprints shall be legible and supplied by the Contractor at his cost.

3.13 Temperature Requirements

- .1 When the temperature of the surrounding atmosphere is at, or below 4°C, the aggregate and the mixing water shall be heated to not less than 4°C and be entirely free of frozen materials.
- .2 The aggregate shall not be heated to more than 60°C, and the concrete when deposited in the forms shall have a temperature of not less than 10°C and not more than 38°C.
- .3 The concrete shall be maintained at a minimum temperature of 10°C for not less than four days after placing.

3.14 Finishing

- .1 Surfaces shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings and staked by the Owner. The surface shall be consolidated and smoothed using a wood float. Light steel trowelling shall be used followed by a uniform brush finish.
- .2 After brushing and before the concrete has taken its initial set, surfaces shall be edged at all joints to prevent chipping of the concrete and where required edges rounded to the required radius. No patching will be allowed.
- .3 Access crossing to lanes and private property shall be struck off and screeded to the required slope and cross-section.

3.15 Backfill

- .1 After the installation of the concrete works any excavated material shall be replaced to the original street grade or the elevations designated by the Owner and compacted to not less than 98% Standard Proctor Density.
- .2 Backfill along the backs of walks or curbs, to 50 mm below top of the concrete, within seven days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150 mm to a minimum density of 95% Standard Proctor Density, to a distance 300 mm from the back of the walk or curb. Granular material which may have existed shall be replaced.
- .3 Boulevard areas (between sidewalks and curbs and gutters) and buffer strips shall be filled to final grade with 100mm of topsoil. The topsoil shall be free of weeds and debris and approved by the Owner. The slopes across the boulevard shall be 3%, or as per the drawings.

3.16 Final Cleanup

- .1 As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition.

- .2 All gutters and street drainage ditches which have been blocked as result of the Contractor's trenching operation shall be restored or repaired at the Contractor's expense.
- .3 The Contractor shall, at his own expense, dispose of all surplus excavated material, organic soil, rock boulders and pieces of concrete and masonry, including those less than 0.1 m³ in volume at an approved off-site disposal area.

4.0 ACCEPTANCE TESTING

4.1 Tolerances

- .1 The finished surfaces of all concrete work shall be true to the required cross-section with a tolerance of plus or minus 3 mm from the required elevation and dimensions.
- .2 Surface of curbs, gutters or sidewalks shall not show any depressions or bumps exceeding 3 mm under a straight edge 3 m long placed parallel to the curb or sidewalk.
- .3 Concrete not meeting the requirements specified shall be removed to the nearest joint and replaced at the Contractor's expense.

4.2 Subgrade Materials Testing

- .1 To Section 4100

4.3 Materials Testing

- .1 A set of three cylinders shall be taken at the following intervals:
 - .1 For every 100 m³ of concrete poured, and
 - .2 For each side of each block, and
 - .3 At the start of each day, and
 - .4 At other intervals as directed by the Owner.
- .2 Three concrete cylinders shall constitute one test and shall be made from the same batch or load. They shall be stored undisturbed on site for 24 hours, covered with a plastic sheet to prevent loss of moisture. They shall then be delivered to an approved testing laboratory for curing with one cylinder tested at seven days and the other two at twenty-eight days.
- .3 When construction begins, the Owner may take additional cylinders in order to establish a concrete strength pattern in the early stages of the project.

- .4 Concrete testing shall be done in conformance with the following standard specifications:

Test	Current Issue of ASTM
Sampling of Fresh Concrete	C172
Test for Slump of Concrete	C143
Compression and Flexure Test	C31
Compressive Strength of Molded Concrete Cylinders	C39
Measurement of Air Content	C173 or C231

4.4 Failure to Meet Strength Requirements

- .1 The Owner reserves the right to reject any concrete whatsoever which does not meet all the specified requirements for the concrete.
- .2 At the sole discretion of the Owner, concrete which does not meet the specified strength requirements may be accepted and, in such case, payment shall be made on the basis of a percentage scale for the concrete product represented by each test as follows:

32.0 MPa Concrete:

32.0 MPa and over	100% of the unit bid price
29.2 MPa to 32.0 MPa	90% of the unit bid price
26.5 MPa to 29.1 MPa	70% of the unit bid price
All concrete below 26.5 MPa will be rejected.	

- .3 Furthermore, the Owner reserves the right to reject any particular portion of a pour if there exists manifest evidence that this particular portion of the pour has a strength that is below the minimum acceptable strength required under this Section.
- .4 If any concrete tested in accordance with this Specification fails to meet the specified strength, the Contractor may request coring of the concrete in question.
- .1 When such coring is approved by the Owner, arrangements shall be made by the Contractor, through the Owner, to employ an independent, qualified testing service, all at the expense of the Contractor.
- .2 The cores shall be taken and tested within seven days of the testing of the twenty-eight day cylinders representing the concrete in question.
- .3 Three cores shall be taken for each strength test previously taken and there shall be no doubt that the cores taken and the cylinders under consideration represent the same batch of concrete.

- .4 Cores shall be tested in accordance with the requirements of CSA A23.2-14C and the average strength of the cores as reported by the independent testing service shall constitute a test.
- .5 When more than one core strength test is taken, the average of all the core strength tests shall represent the strength of the concrete in question.
- .5 The foregoing procedure may be altered if the concrete in question was placed during weather conditions not suitable, in the opinion of the Contractor, to permit satisfactory curing.
 - .1 When 7 day test results indicate that the concrete is likely to be sub-standard or rejected, the Contractor will be notified and can either request to arrange coring at that time or can continue to provide curing for the remainder of the 28 day period.
 - .2 In the event that the Contractor chooses to take cores after 7 days, they shall be taken as described in the foregoing paragraph, transported to an approved laboratory, and cured for a period of time such that the total curing time in place in the structure, plus the curing time in the laboratory is equal to 28 days.
 - .3 The cores shall then be tested and reported as described in the foregoing paragraph.
- .6 In cases where the concrete strength, as indicated by the cores, is higher than the strength based on the concrete cylinder results, the core results shall be used as the basis of acceptance and payment of the concrete. If the core strengths are lower than the strength from the concrete cylinder tests, the cylinder tests shall govern.

4.5 Failure to Meet Thickness Requirements

- .1 No payment will be made for concrete placed at thickness less than specified.

4.6 Final Acceptance

- .1 Acceptance of this portion of Work shall be based on the Owner's review of all submitted results and materials.
- .2 Work not meeting the specification requirements will not be approved.

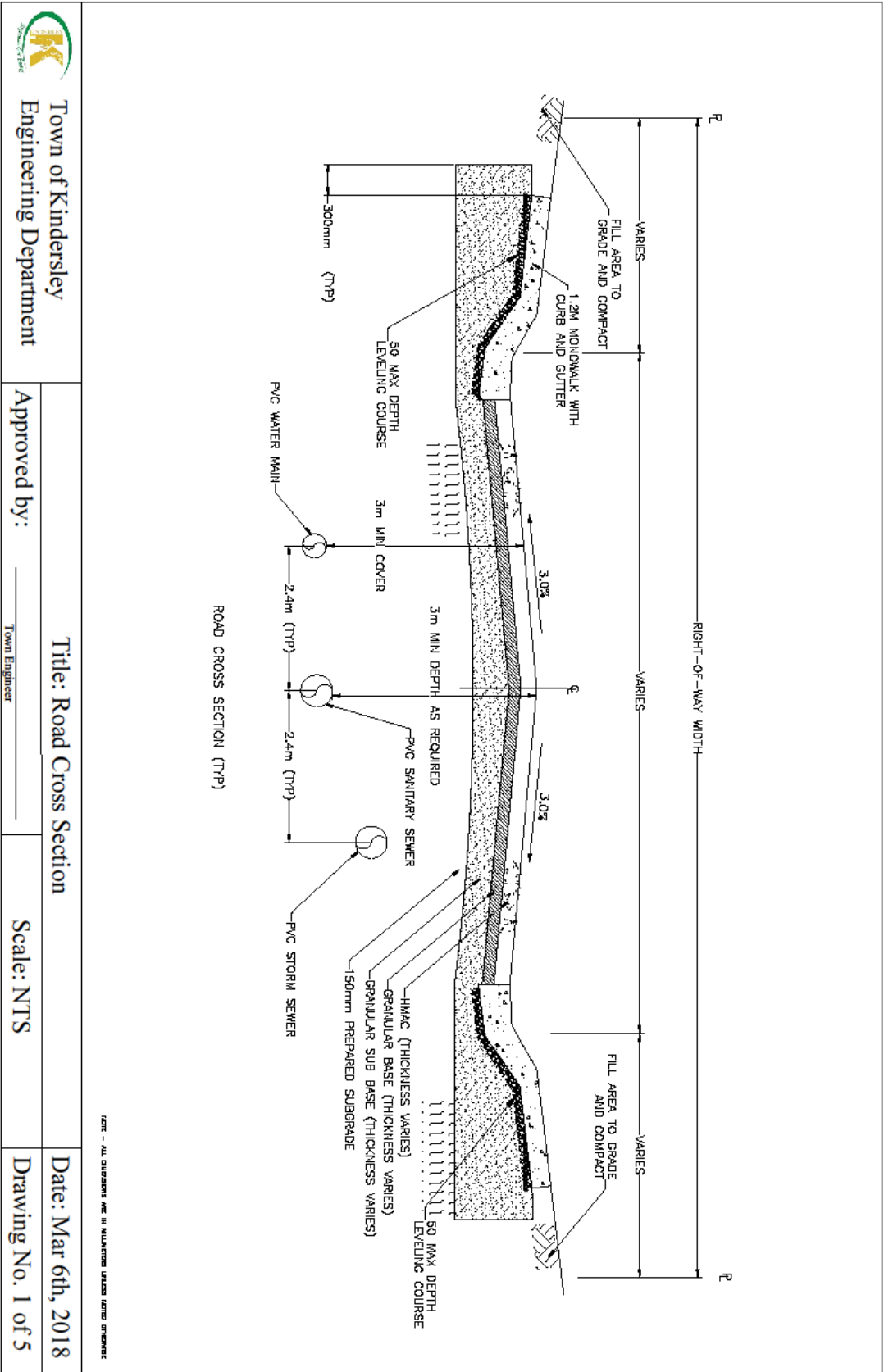
4.7 Concrete Deterioration

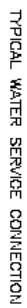
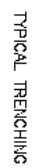
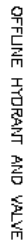
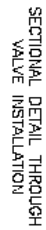
- .1 Concrete that shows surface scaling, deterioration, cracks wider than 1 mm, or loss of cement or aggregate during the maintenance period will be

rejected and require removal and replacement by the Contractor at no cost to the Owner.

END OF SECTION

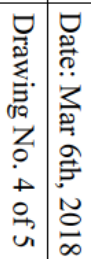
STANDARD DRAWINGS



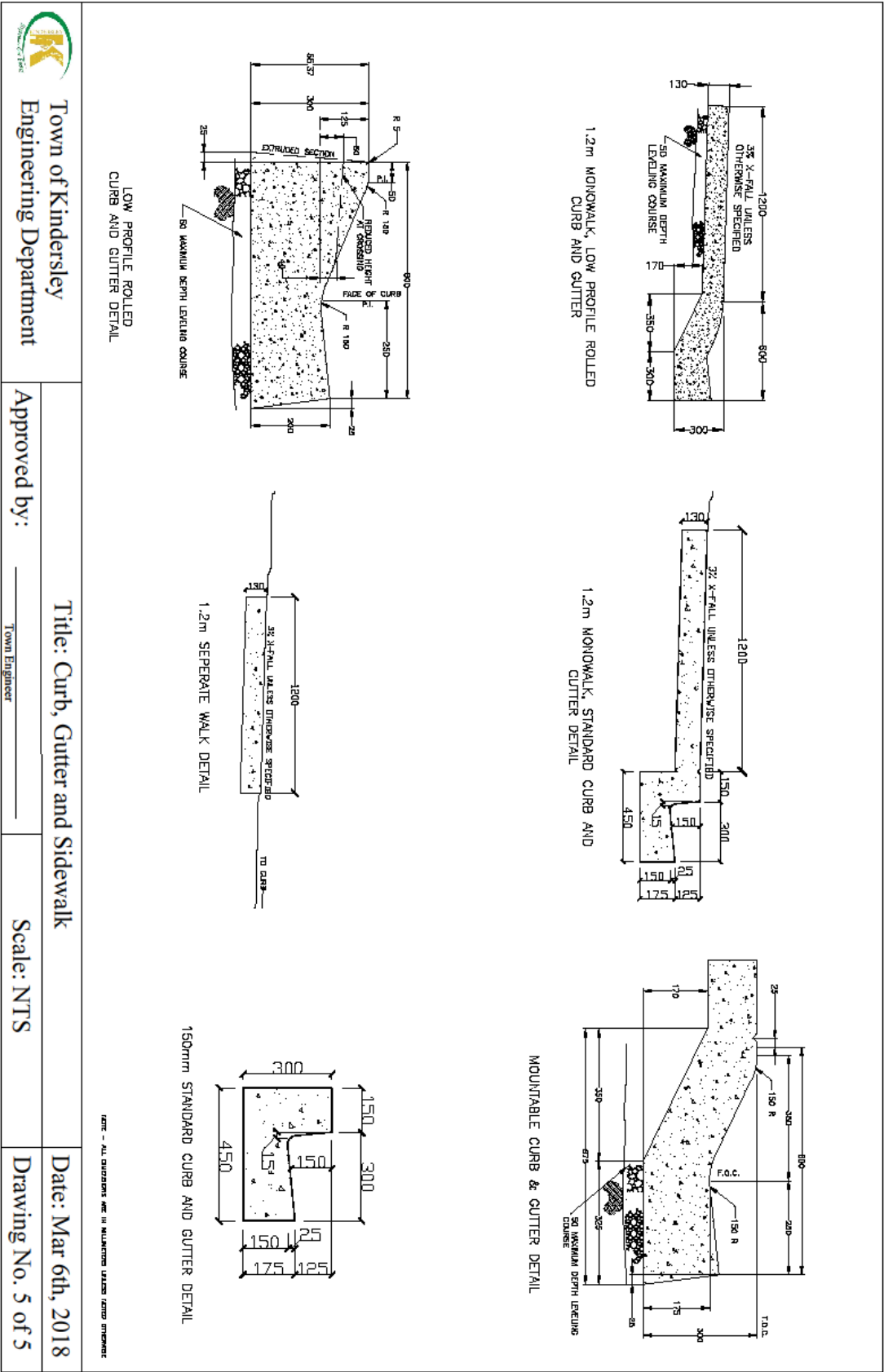



Date: Mar 6th, 2018
Drawing No. 2 of 5

[illegible]



STANDARD DRAWINGS



 Town of Kindersley Engineering Department	Title: Curb, Gutter and Sidewalk		Date: Mar 6th, 2018
	Approved by: _____ Town Engineer	Scale: NTS	Drawing No. 5 of 5