TOWN OF RIVERVIEW

STANDARD MUNICIPAL SPECIFICATIONS

FEBRUARY 2022

VERSION 7.0

DISCLAIMER

The material contained in this manual regarding the Town of Riverview Standard Municipal Specifications is intended to serve as a guideline only. All information contained herein is subject to addition, deletion or modification since the date of printing. Although great effort was made to ensure the accuracy of the contents of this manual, no warranty whatsoever is made with respect to same, saving municipal capital projects solely administered by the Department of Engineering & Public Works, Town of Riverview.

Users of this publication are advised to contact the appropriate officials of the Town of Riverview to determine the current status of all information discussed herein.

The Town of Riverview and its employees will not be held liable for any loss or damage incurred by any individual or company as a result of reliance in any of the material contained in this manual.

All detailed drawings which form a part of the Town of Riverview Standard Municipal Specifications are warrantied for use on Town of Riverview projects only. The Town of Riverview will not, in any way, warrant the Detail Drawings as being appropriate for any project to be undertaken on behalf of any party other than the Town of Riverview.

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GENERAL CONDITIONS

1 DEFINITIONS

In this specification, the following words and expressions shall have the meanings hereinafter assigned to them, except where the context otherwise requires.

.1 The "Town of Riverview" or "The Owner" shall mean the Town Council of the Town of Riverview, New Brunswick and includes the Town's personal representatives or successors.

.2 "The Consultant" shall mean the consulting engineering firm or individual currently licensed to practice in the Province of New Brunswick, assigned or approved by the Town to carry out the various engineering services required to complete the project.

.3 "The Contract" and the "Contract Documents" shall mean those documents set out in Article III of the Articles of Agreement.

.4 "The Contractor" shall mean the party or parties, person or persons, firm or company, whose tender for the execution of the work has been accepted by the Town and includes the contractor's personal representatives, successors and permitted assigns.

.5 "The Developer" shall mean a company duly and regularly incorporated and/or owner of a property in the Town of Riverview, County of Albert and Province of New Brunswick who submits application for either a subdivision or works under local improvement.

.6 "The Engineer" shall mean the Director of Engineering & Works, the Project Engineer of the Town of Riverview or any other authorized person as may be appointed to supervise the carrying out of the Contract.

.7 "The Plans" shall mean and include the plans, sections and other delineations which accompany or are referred to in the specifications and any modification of such plans approved in writing for the purpose of the contract and any additional plans prepared by the Engineer to facilitate the work.

.8 "The Site" shall mean the lands and other places, on, under, in or through which the works are to be executed or carried out.

.9 "The Specifications" shall mean all sections included in this document including the form of tender, instructions to tenderers, general conditions of contract, plans and the Town's Standard Municipal Specifications contained herein and all supplementary specifications issued for a particular tender.

.10 "Working Day" shall mean Monday to Friday inclusive, from sunrise to sunset, of any week excluding statutory holidays.

.11 "The Work" shall mean all the work set out and described in "The Plans" and "The Specifications" to be executed in accordance with the contract.

.12 "Incidental items" shall be any item of work, material, labour or equipment necessary to complete a specified item of work in accordance with these specifications, supplementary general or technical specifications, contract drawings or as otherwise required by either a manufacturer or in accordance with recognized standard practice and procedures, for which there is no particularly identified or specified item under any other part of the Town's specifications and for which no payment will be made.

.13 "Plant" includes all tools implements, machinery, vehicles, buildings, structures, equipment, articles and things required for the execution of the work;

2 ADHERENCE TO PLANS AND SPECIFICATIONS

.1 The Contractor shall execute the works strictly in accordance with the plans and Specifications, or with any Supplementary directions, details or Change Orders ordered by the Engineer, as required for the proper completion of the contract.

3 DOCUMENTS

.1 The Contractor will be provided without charge with three (3) copies of the Contract Documents or parts thereof as are reasonably necessary for the performance of the Work.

.2 It is the responsibility of the Contractor to ensure that they are in possession of drawings "APPROVED FOR CONSTRUCTION" and a copy of the latest edition of the TOWN OF RIVERVIEW STANDARD MUNICIPAL SPECIFICATIONS before commencement of any work.

.3 The Contractor shall keep one copy of current Contract Documents and shop drawings at the Place of the Work, in good order and available to the Engineer and his representatives. This requirement shall not be considered to include the executed set of Contract Documents.

.4 Drawings, Specifications, Models, and copies thereof furnished by the Engineer are and shall remain his property with the exception of the signed Contract sets belonging to each party to this Contract. Such documents and models are to be used only with respect to the Work and are not to be used on other Work. Such documents and models are not to be copied or revised in any manner without the written authorization of the Engineer.

4 MEASUREMENTS, PRECEDENCE AND DISCREPANCIES

.1 In the event of conflicts or inconsistencies between or among Contract Documents, the following order of precedence shall apply to the extent only of such conflict or inconsistency:

(a) documents of later date shall govern and prevail, unless otherwise expressly specified therein or herein;
(b) figured dimensions shown on a drawing shall govern and prevail where they differ from scaled dimensions from the same drawing;
(c) drawings of larger scale shall govern and prevail over those of a smaller scale of the same date;
(d) detailed drawings shall govern and prevail over general drawings;
(e) technical specifications shall govern and prevail over drawings with respect to qualitative aspects of the work;
(f) drawings shall govern and prevail over technical specifications regarding location and quantitative aspects of the Work;
(g) detailed designs and specifications shall govern and prevail over general designs and specifications;
(h) the terms of this Agreement shall govern and prevail over other Contract Documents unless otherwise expressly specified therein;
(i) the Articles of this Agreement shall govern and prevail over the schedules to this Agreement, unless otherwise expressly specified in any such schedule; and
(j) the Technical Specifications shall govern and prevail over the Plans.

5 CONTRACT BINDING

.1 The Contract shall inure to the benefit of and be binding upon the parties hereto and their heirs, executors, administrators, successors, and assigns.

6 ASSIGNMENT

.1 The Contract may not be assigned without the written consent of the Owner and until the latest requirements of the Financial Administration Act, Chapter 10, Acts of New Brunswick, 1966 have been complied with where applicable.

7 INDEMNITY BY CONTRACTOR

.1 Except as provided in Section 8, the Contractor shall indemnify and save harmless the Owner from and against all claims, demands, losses, costs, damage, actions, suits, or proceedings by whomsoever made, brought or prosecuted in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor in executing the work under the contract or to an infringement or an alleged infringement by the Contractor of a patent of invention.

.2 For the purposes of subsection .1, "activities" includes an act improperly carried out, an omission to carry out an act and a delay in carrying out an act.

8 INDEMNITY BY OWNER

.1 The Owner shall indemnify and save harmless the Contractor from and against all claims,

.2 demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract which are directly attributable to:

(a) lack of title, a defect in title or an alleged lack of title or defect in title to the site of the work; or
(b) an infringement or an alleged infringement of any patent of invention in executing anything for the purposes of the contract, the model, plan or design of which was supplied by the Owner to the Contractor.

9 ELECTED MEMBERS

.1 No member of the Owner's Council or member of the Legislative Assembly of the Province of New Brunswick shall be admitted to any share or part of the contract or to any benefit arising therefrom unless such member of the Council falls within the latest requirements of Section 49 of the Elections Act, Chapter 9, Acts of New Brunswick, 1967.

.2 No member of the Owner's Council shall be admitted to any share or part of the contract or to any benefit arising therefrom if the Owner's funds are involved, whether directly or indirectly, in the payment for or financing of such contract.

10 SERVING NOTICES

.1 Notices shall be in writing and shall:

(a) be delivered to the Contractor in person, or, if the Contractor is a corporation or partnership, be delivered to the superintendent or to a senior administrative officer of the corporation or partnership, or
(b) be sent by mail to the Contractor or his superintendent addressed to the address mentioned in the contract, and if any question arises as to when any such notice was given to or received by the Contractor it shall be deemed to have been sufficiently given to and received by him:
    (i) if it were delivered pursuant to paragraph (a), on the day it was delivered, or
    (ii) if it were sent by mail pursuant to paragraph (b), on the day it was received by the Contractor or on the sixth day after it was mailed, whichever is the earlier.

11 AUTHORITY OF THE ENGINEER

.1 The Engineer will provide administration of this Contract as described in the Contract Documents.

.2 The Engineer, appointed by the Owner, will be the Owner's representative during construction and until completion of any correction of defects under the provisions of warranty, or until the issuance of the Certificate of Final Acceptance of the Work, whichever is later. The Owner's instructions to the Contractor shall be forwarded through the Engineer. The Engineer will have authority to act on behalf of the

Owner only to the extent provided in the Contract Documents, unless otherwise modified by written agreement.

.3 The Engineer will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences or procedures required for the Work in accordance with the applicable New Brunswick construction practices. The Engineer will not be responsible for or have control or charge over the acts or omissions of the Contractor, his Subcontractors, or their agents, employees or other persons performing any of the Work.

.4 The Engineer will have authority to reject work which in his opinion does not conform to the requirements of the Contract Documents. Whenever he considers it necessary or advisable he will have authority to require special inspection or testing of work whether or not such work has been fabricated, installed or completed. However, neither the Engineer's authority to act nor any decision made by him either to exercise or not to exercise such authority, shall give rise to any duty or responsibility of the Engineer to the Contractor, his subcontractors, or their agents, employees or other persons performing any of the Work.

12 NO IMPLIED OBLIGATION

.1 No implied obligation of any kind by or on behalf of the Owner shall arise from anything in the Contract, and the express covenants and agreements herein contained and made by the Owner are and shall be the only covenants and agreements upon which any rights against the Owner are to be founded; and, without limiting the generality of the foregoing, the Contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the Contract.

.2 Nothing contained in the Contract Documents shall create any contractual relationship between the Engineer and the Contractor, his Subcontractors, his suppliers, or their agents, employees or other persons performing any of the Work.

13 DISPUTE & ARBITRATION

.1 Introduction

All disputes arising out of or in connection with the interpretation or application of this Agreement are subject to the following dispute resolution mechanism which is intended to provide for a quick and less expensive method of resolving disputes.

.2 Mandatory Resolution Meeting

Upon written notice of a dispute, it shall in the first instance be referred to the Town’s Chief Engineer and the Chief Executive Officer of the Contractor who personally shall meet and attempt to resolve the dispute within a period of thirty (30) Business Days from the date a party notifies the other of the dispute.

.3 Arbitration

If the dispute remains unresolved at the expiry of the thirty (30) Business Day period provided for in Section .2 above, such dispute shall be determined exclusively by arbitration in accordance with the provisions of the Arbitration Act, RSNB 2014, c 100 (the "Arbitration Act") unless modified by this Article.

The Arbitration shall be heard and determined by a single arbitrator. The party making the reference to arbitration shall nominate a candidate to act as arbitrator and the other party shall have ten (10) Business Days to agree. If the parties cannot agree upon the person to act as arbitrator the arbitrator shall be appointed by a judge of the court of Queens Bench of New Brunswick.

Each party shall within (30) thirty Business Days of the submission to arbitration disclose and provide copies to the opposing party of all documents upon which it intends to rely at the arbitration. The arbitrator shall have the right to order the production of any other document if he finds that it would be unfair for the requesting party to proceed to the arbitration without that document. Nothing in this clause or Agreement, however, shall be construed as an obligation on either party to disclose all documents as provided by the Rules of Court of any jurisdiction.

There shall be no oral examinations for discovery in connection with any arbitration pursuant to this Agreement unless upon motion to the arbitrator the requesting party is able to prove that: 1) it has taken reasonable steps to obtain the information sought; 2) it has been unable to obtain the information; 3) the information is vital to the arbitrator's understanding of a significant issue in the arbitration; and 4) it would be unjust to proceed to arbitration without the information.

The decision of the arbitrator is final and shall not be the subject of an appeal with the sole exception of the right to seek leave to appeal on a question of law alone as set out in sections 3 and 45(1) of the Arbitration Act.

.4 Performance of Obligations during Litigation

Subject to the provisions of this Agreement other than the specific subject matter of the dispute, the parties shall continue the performance of their respective obligations during the resolution of any dispute, including during any period of arbitration or court proceedings, unless and until this Agreement is terminated or expires in accordance with its terms.

14 DEFAULT OR REMOVAL OF WORK FROM CONTRACTOR

.1 In any of the following cases, namely:

(a) where the Contractor has made default or delayed in commencing or in diligently executing the work or any portion thereof to the satisfaction of the Engineer and the Engineer has given notice thereof to the Contractor and has by such notice required the Contractor to put an end to such default or delay, and such default or delay continues for six (6) days after such notice was given;

(b) where the Contractor has made default in the completion of the work, or any portion thereof, within the time limited for such completion by the contract;
(c) where the Contractor has become insolvent;
(d) where the Contractor has committed an act of bankruptcy;
(e) where the Contractor has abandoned the work;
(f) where the Contractor has made an assignment of the Contract without the required consent; or
(g) where the Contractor has otherwise failed to observe or perform any of the provisions of the Contract the Owner may, without any other authorization, take all or any portion of the work out of the Contractor's hands and may employ such means as he may see fit to complete the work.

.2 Where the work or any portion thereof has been taken out of the Contractor's hands under subsection .1 the Contractor shall not, except as provided in subsection .3, be entitled to any further payment in respect of the work so affected including payments then due and payable but not paid, and the obligation of the Owner to make payments in respect thereof as provided for in the Terms of Payment shall be at an end with respect to that portion of the work taken out of his hands, and the Contractor shall be liable to and upon demand therefore shall pay to the Owner an amount equal to all loss and damage suffered by the Owner by reason of the non-completion of the work by the Contractor.

.3 Where the work or any portion thereof has been taken out of the Contractor's hands under subsection .1 and is subsequently completed by the Owner, the Engineer shall thereafter determine the amount, if any, of holdback and progress claims of the Contractor in respect thereof unpaid at the time of taking the work out of his hands that in his opinion are not required by the Owner for the purposes of the Contract and the Engineer shall, if he is of the opinion that no financial prejudice to the Owner will result, authorize payment of that amount to the Contractor.

15 CONTRACTOR'S CONTINUING OBLIGATION

.1 The taking of the work, or any portion thereof, out of the Contractor's hands pursuant to Section 14 does not relieve or discharge the Contractor from any obligation under the contract or imposed upon him by law except the obligation under the contract to complete the physical execution of that portion of the work so taken out of his hands.

.2 If the work or any portion thereof is taken out of the Contractor's hands pursuant to Section 14, all materials and the interest of the Contractor in all real property, licenses, powers and privileges acquired, used or provided by the Contractor for the purpose of the work shall be the property of the Owner without compensation to the Contractor.

16 SUSPENSION OF WORK

.1 The Engineer may require the Contractor to suspend execution of the work either for a specified or unspecified period by giving notice to that effect to the Contractor.

.2 The Contractor upon receiving notice of the Owner's requirement pursuant to subsection .1 shall suspend all operations except those which, in the Engineer's opinion, are necessary for the care and preservation of the work, the materials and plant.

.3 During the period of suspension the Contractor shall not remove from the Site any part of the work, any materials or any plant without the consent of the Engineer.

.4 If the period of suspension is 30 days or less, the Contractor, upon the expiration of the period of suspension, shall resume the execution of the work and except where the suspension order was due to the Contractor not diligently prosecuting the work or failing to prosecute the work in a good and workmanlike manner he is entitled to be paid the cost of any plant, labour and material necessarily involved in complying with the suspension.

.5 If the period of suspension is more than 30 days and if, upon the expiration of the period of suspension, the Engineer and the Contractor agree that the execution of the work be completed by the Contractor, the Contractor shall resume operations and complete the execution of the work in accordance with any terms and conditions agreed upon by the Engineer and the Contractor.

.6 If upon the expiration of a period of suspension of more than 30 days, the Engineer and the Contractor do not agree that the work will be completed by the Contractor or they are unable to agree upon the terms and conditions under which the Contractor will complete the work, the notice of suspension shall be deemed to be a notice of termination.

17 TERMINATION OF CONTRACT

.1 The Owner may at any time by giving notice to that effect terminate the contract.

.2 The Contractor shall upon receipts of a notice pursuant to subsection .1 cease all operations forthwith.

.3 If the contract is terminated pursuant to subsection .1 the Owner shall pay to the Contractor an amount equal to the lesser of:

(a) the value as agreed upon by the Contractor and the Engineer of all work performed by the Contractor as at the date of termination or, if the Contractor and the Engineer cannot agree, as calculated in accordance with the formula set out in the Contract Documents less all amounts already paid to the Contractor by the Owner and less all amounts which the Contractor is liable to pay to the Owner; and
(b) five (5) percent of the value of the remaining unperformed work.

.4 If the contract is terminated pursuant to subsection .1 the Owner shall pay to the Contractor an amount equal to the value as agreed upon by the Contractor and the Engineer of all work performed by the Contractor as of the date of termination or, if the Contractor and the Engineer cannot agree, as calculated in accordance

with the formula set out in the Contract Documents, less all amounts already paid to the Contractor by the Owner and less all amounts which the Contractor is liable to pay to the Owner.

.5 Subsection .3 is applicable only to a fixed price arrangement and subsection .4 is applicable only to a unit price arrangement.

18 SUB-CONTRACTING

.1 Except for the subcontracting proposed by the Contractor in his accepted tender, neither the whole nor any part of the work may be subcontracted by the Contractor without the consent of the Engineer.

.2 Every Subcontract by the Contractor, whether as proposed in the approved tender or as approved by the Engineer under subsection .1, shall provide that the subcontractor shall comply with all terms and conditions of this contract which can reasonably be applied to his undertaking.

.3 The Contractor shall include as part of his Contract, all Subcontracts for such portions of the work not done by the Contractor's organization.

.4 The Contractor shall not make any changes to the named Subcontractors listed in the tender form unless written approval of the change is received from the Engineer.

19 INSURANCE

The Contractor shall provide, maintain and pay for the insurance coverage listed in this General Condition unless otherwise stipulated:

.1 General Liability Insurance:

General Liability Insurance shall be in the joint names of the Contractor, Sub-Contractor, the Owner and the Engineer with limits of not less than five million dollars ($5,000,000) inclusive per occurrence for bodily injury, death and damage to property including loss of use thereof, with property damage deductible of one thousand dollars ($1,000). The form of this insurance shall be the latest edition and shall be maintained continuously from commencement of the Work until twelve (12) months following the date of Substantial Performance of the Work as set out in the Certificate of Substantial Performance, or until the Certificate of Final Acceptance is issued, whichever is the later.

Completed Operations Liability shall remain in force for the duration of the warranty and maintenance period which is twelve (12) months following the date of Substantial Performance of the Work as set out in the Certificate of Substantial Performance, or until the Certificate of Final Acceptance is issued, whichever is the later.

Should the Contractor decide not to employ Subcontractors for operations requiring the use of explosives for blasting, or pile driving for caisson work, or removal or weakening of support of property, building or land; a separate policy endorsement shall be provided if any blasting is to be carried out under the contract.

All insurances required to be provided and maintained by the Contractor shall be negotiated for, procured from, and the premium paid to a resident agent of an Insurance Company licensed to do business in the Province of New Brunswick.

.2 Automobile Liability Insurance:

Automobile liability insurance in respect of licensed vehicles shall have limits of not less than five million dollars ($5,000,000) inclusive per occurrence for bodily injury, death, and damage to property, in the following forms endorsed to provide the Owner with not less than fifteen (15) days written notice in advance of any cancellation, change or amendment restricting coverage:

.1 Standard non owner automobile policy including standard contractual liability endorsement.

.2 Standard owner's form Automobile Policy providing third party liability and accident benefits insurance, and covering licensed vehicles owned or operated by or on behalf of the Contractor.

.3 Property Insurance

.1 Builders All Risks property insurance shall be in the joint names of the Contractor, the Owner and the Engineer, insuring not less than the sum of the amount of the Estimated Contract Price and the full value, as stated in any amendments to the General Conditions, or products that are specified to be provided by the Owner for incorporation into the Work, with a deductible not exceeding one per cent of the amount insured at the site of the Work. The form of this insurance shall be the latest edition and shall be maintained continuously until ten (10) days after the date of the Final Acceptance of the Work as set out in Certificate of Final Acceptance.

.2 The policies shall provide that, in the event of a loss or damage, payment shall be made to the Owner and the Contractor as their respective interests may appear. The Contractor shall act on behalf of the Owner and himself for the purpose of adjusting the amount of such loss or damage payment with the Insurers. When the extent of the loss or damage is determined, the Contractor shall proceed to restore the Work. Loss or damage shall not affect the rights and obligations of either party under the Contract except that the Contractor shall be entitled to such reasonable extension of Contract Time relative to the extent of the loss or damage as the Engineer may decide in consultation with the Contractor.

.4 Payment for loss or damage:

.1 The Contractor shall be entitled to receive from the Owner, in addition to the amount due under the Contract, the amount at which the Owner's interest in restoration of the Work has been appraised, such amount to be paid as the restoration of the Work proceeds and in accordance with the requirements of applications for payments, and certificates and payments. In addition, the Contractor shall be entitled to receive from the payments made by the Insurer the amount of the Contractor's interest in the restoration of the Work.

.2 The Contractor shall be responsible for deductible amounts under the policies except where such amounts may be excluded from the Contractor's responsibility.

.5 Contractors' Equipment Insurance:

.1 Builders All risks contractors' equipment insurance covering construction machinery and equipment used by the Contractor for the performance of the Work, shall be in a form acceptable to the Owner and shall not allow subrogation claims by the Insurer against the Owner. The policies shall be endorsed to provide the Owner with not less than fifteen (15) days written notice in advance of a cancellation, change or amendment restricting coverage. Subject to satisfactory proof of financial capability by the Contractor for self insurance of his equipment, the Owner agrees to waive the equipment insurance requirement.

.2 Unless specified otherwise, the duration of each insurance policy shall be from the date of commencement of the Work until the date of Final Acceptance of the Work as set out in the Certificate of Final Acceptance.

.3 The Contractor shall provide the Owner with proof of insurance prior to commencement of the Work and shall promptly provide the Owner with a certified true copy of each insurance policy exclusive of information pertaining to premium or premium basis used by the Insurer to determine the cost of the insurance.

.4 If the Contractor fails to provide or maintain insurance as required in this General Condition or elsewhere in the Contract Documents, then the Owner shall have the right to provide and maintain such insurance and give evidence thereof to the Contractor and the Engineer. The cost thereof shall be payable by the Contractor to the Owner on demand or the Owner may deduct the costs thereof from monies which are due or may become due to the Contractor.

20 BONDS

.1 The Contractor shall provide to the Owner a performance bond and a labour and material payment bond according to the requirements set out in the Instructions to Tenderers. The performance bond and labour and material bond shall comply with

any applicable requirements under the *Construction Remedies Act*, SNB 2020, c 29 (the "Act") and any regulations thereunder.

.2 The performance bond shall cover the faithful performance of the contract, including the period of maintenance, satisfactory to the Town as to form and issuer. The performance bond shall have a coverage limit of at least fifty percent (50%) of the awarded contract price. If a performance bond is accepted, the Town will return such cheques or bid bond comprising the initial deposit on receipt of the performance bond and approval of same.

Where permitted by the Act, the Town may allow alternate forms of security. Alternate forms of security, if any, shall be specified through the Particular Specifications.

.3 The labour and materials payment bond shall have a coverage limit of at least fifty percent (50%) of the awarded contract price.

.4 The performance bond and labour and material payment bond shall be issued by a duly licensed surety company authorized to do business in the province of New Brunswick.

.5 The bonds described in Section 20 shall remain in effect until issuance of the Certificate of Final Acceptance.

21 PERMITS, LICENCES, LAWS AND RULES

.1 The Contractor shall obtain the permits, licenses and certificates and pay the fees required for the performance of the Work which are in force at the date of tender closing, but this shall not include the obtaining of permanent easements or right of way.

.2 The Contractor shall pay for and be in possession of a valid Building Permit and all other necessary permits, licenses, certificates of inspection that may be required by authorities having jurisdiction for the execution and/or approval of the work with exception of approval of plans by Provincial Fire Marshall.

.3 The Work shall comply with local by-laws and ordinances, rules and regulations of the Province affecting local building requirements. Notify Engineer, in writing, of deviation from such regulations found in the Contract Documents.

22.1 CERTIFICATE OF SUBSTANTIAL PERFORMANCE

.4 Substantial Performance is achieved once the improvement under the contract is ready for use or is being used for the purposes intended, and when costs to complete the contract and correct known defect are not more than:

(i) 3% of the first $250,000 of the contract price,
(ii) 2% of the next $250,000 of the contract price, and
(iii) 1% of the balance of the contract price.

To ensure installed works are performing as intended the following must be complete prior to obtaining Substantial Performance:

(b) the Work has passed any final tests required under the Contract,
(c) the full commissioning of all components of the Work has been performed and accepted,
(d) all operations and maintenance (O&M) manuals have been received and accepted,
(e) all CCTV inspections have been done, received, and accepted.

A deficiency inspection is required prior to reaching Substantial Performance in order to calculate costs to correct known defects. The contractor shall advise the Engineer in writing to request the deficiency inspection, and within ten (10) working days following the receipt of this letter, the Engineer shall arrange for an inspection of the work with the Engineering Department and the contractor.

As per Section 7(2) of the Act, the value of the services or materials remaining to be supplied and required to complete the improvement shall be deducted from the contract price in determining substantial performance if it is agreed not to complete the improvement expeditiously, or if the improvement cannot be completed expeditiously due to reasons beyond the control of the Contractor.

The Engineer shall issue a Certificate of Substantial Performance pursuant to Sections 41 and 42 of the Act and in the form prescribed under Regulation 2021-81 of the Act. The Contractor shall post and deliver the Certificate of Substantial Performance within the time specified and as required by Section 41 the Act.

.5 DEFICIENCY RETENTION

The amount deducted from the contract price for the purpose of ensuring the completion of a deficiency in the work shall be referred to as the Deficiency Retention.

If a deficiency is identified in the work, the Town may retain as a Deficiency Retention sufficient funds to allow the proper completion of the work by others, including the use of the Town's own forces or another contractor. The amount retained shall be no less than an amount equal to twice the Engineer's estimate of the cost of remedying the deficiency. The amount shall be retained until the deficiency is remedied to the satisfaction of the Engineer.

Deficiency Retention, Liquidated Damages and Bonus or Penalty, if applicable, will be calculated and deducted from Payment Certificates.

.6 RELEASE OF HOLDBACK

The Town shall release the 10% holdback required under the Act upon the expiration of sixty (60) days from the date of issuance of the Certificate of Substantial Performance and the Town's receipt of the following documents:

(i) A Statutory Declaration (in the form provided by the Town) stating that all persons who have been employed on the contract or who have furnished equipment and materials for the works have been paid, except for statutory holdbacks properly retained, and that the firm has no further claims against the Town of Riverview with respect to this contract (except for any retained holdbacks); and

(ii) A Clearance Certificate from WorkSafeNB.

The Town may retain such further amounts from the Contractor as required or permitted under the Act.

22.2 CERTIFICATE OF COMPLETION OF CONTRACT

As per the Act, the contract is completed when the cost of completing it, correcting a known defect, or supplying the services or materials remaining to be supplied for the improvement is not more than 1% of the contract price.

The Engineer shall issue a Certificate of Completion of Contract upon the completion of the contract.. The final holdback amount, less any monies owing to the Town by the Contractor, shall be paid upon the expiration of sixty (60) days after the completion of the contract.

23 CERTIFICATE OF FINAL ACCEPTANCE

.1 Eleven (11) months after the date declared in the Certificate of Substantial Performance, the Contractor shall advise in writing that the works are fully completed and are ready for final inspection. Within ten (10) working days following receipt of this letter the Engineer shall make arrangement for this final inspection of the work with the Engineering Department and the Contractor.

.2 The Contractor shall promptly correct all defects, deficiencies, etc. which are identified during the final inspection.

.3 When this work has been completed, the Engineer shall prepare the "Certificate of Final Acceptance". The Contractor shall sign the certificate, affixing the corporate seal thereto declaring that the Contractor has no further claims against the Town of Riverview whatsoever with respect to the contract.

24 MAINTENANCE PERIOD

.1 The warranty and maintenance period shall commence on the date declared the Certificate of Substantial Performance is signed and remain in effect for a minimum

of twelve (12) months and until issuance of the "Certificate of Final Acceptance". The Contractor, at his own cost, shall be responsible to inspect, audit and maintain the works and remedy any omissions or defects and deficiencies discovered or appearing in the works from the first day of construction and the Contractor further agrees to correct or pay for any damages to other work resulting from the said defects or the correction thereof.

.2 Deficiencies of a non-emergency nature must be repaired within one (1) week of observation or after receipt of instructions in writing to do so. Deficiencies of an urgent or emergency nature must be repaired immediately upon observation or upon receipt of notification from the Engineer. Every effort possible must be made by the Contractor to repair such deficiencies immediately. The failure to make the necessary repairs or corrections due to lack of equipment, material, labour or any reason whatsoever will result in the Town causing the works to be done at the expense of the Contractor.

.3 All costs and expenses incurred in correcting any defects that appear prior to and during the warranty and maintenance period, whether performed by the Contractor, his representative, or the Owner or its representatives, shall be borne by the Contractor. The Contractor shall, in addition, be liable to the Town for all expenses, losses, or damage incurred by the Town as a result of any faulty materials and defective workmanship, or as a result of the Contractor's failure to correct any defects as observed or as notified, including but not restricted to all engineering costs, inspection and testing the work.

.4 The Contractor's failure to resolve the defects or deficiencies shall permit the Town access to the Contractor's performance bond to resolve such defects or deficiencies.

.5 Neither the Certificate of Substantial Performance, the Certificate of Final Acceptance, nor any payment made thereunder by the Town, shall relieve the Contractor of his responsibilities for faulty materials or defective workmanship. Notwithstanding the previsions of this article, if any statute in force in the jurisdiction where the product was manufactured or if the manufacturer's warranty extends the liability for faulty products or workmanship beyond the scope of this Contract, then the provisions for such statute or manufacturer's warranty shall apply.

25 BONUS FOR EARLY COMPLETION AND LIQUIDATED DAMAGES FOR DELAY

.1 For the purposes of bonus for early completion, the work shall be deemed to be completed when all know defect or supply of service, or materials are done. For greater clarity the contract is required to be completed in its entirety along with any known deficiency and the date of issuance of the Certificate of Completion shall not be used to qualify for bonus for early completion.

.2 The Engineer may, on the application of the Contractor if made in accordance with the time limits in subsection .2 and made before the day fixed by Article I of the Articles of Agreement for Completion of the work or any specified portion thereof

or before any new date for completion previously fixed under this subsection, if in his opinion it is in the public interest, extend the time for completion of the work or any specified portion or portions thereof by fixing a new day for such completion.

.3 Where the Contractor does not complete the work or any specified portion thereof by the day fixed by Article I of the Articles of Agreement for such completion or by such subsequent day, if any, to which the time for completion has been extended under subsection .1, but does complete the work or portion thereafter, the Contractor shall pay to the Owner for each working day of the period of delay during which the work in its entirety is not complete, the sum of **$1,000.00** and associated engineering costs. The sum of $1,000.00 is a genuine pre-estimate of the damages the Owner will suffer as a result of any delay by the Contractor.

.4 For the purposes of the Penalty and liquid damages for delay, the work shall be deemed to be completed on the day the Engineer issued his Certificate of Completion, and "period of delay" means the period commencing on the day fixed by Article I of the Articles of Agreement for completion of the work or any portion thereof or such subsequent day, if any, to which the time for completion has been extended under subsection .1 and ending on the day immediately preceding the day on which the work or portion thereof is completed.

.5 If in the opinion of the Engineer the work could have been completed within the authorized time and the Contractor has failed to meet the completion date, the Owner reserves the right to charge all on-site inspection costs to the Contractor. Such costs will be deducted from progress claims.

.6 Where the Contractor completes the work by the day fixed by Article I of the Articles of Agreement for such completion the Owner shall pay to the Contractor for each working day the work is completed before the day fixed for completion, the sum of **$1,000.00** to a maximum of $10,000.00 or as specified in the tender document. The sum of $1,000.00 is a genuine pre-estimate of the money the Owner will save as a result of each day of early completion.

26 CHANGES IN THE WORK

.1 The Engineer, may at any time before he issues the Certificate of Final Acceptance, in writing:

(a) order work or material in addition to that provided for in the Plans and Specifications; and
(b) delete work or change the dimensions, nature, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications.

.2 All contemplated changes in the work shall be issued by the Engineer on a standard "Request for Estimate and Change Order" form.

.3 Contractor shall, upon receipt of the Request for Estimate and Change Order, submit to the Engineer for his approval within ten (10) days, an estimate of the

change in the Contract Price for the changes in work. Estimates for changes shall be priced in detail giving: actual net material trade prices (not list price); actual labour costs (including payroll burden); and actual equipment rental.

.4 Engineer shall within five (5) days notify the Contractor whether estimates are accepted or further information required. Acceptance shall be indicated in writing and a signed copy of form returned to Contractor.

.5 When a Request For Estimate and Change Order is issued by the Engineer, work in the areas affected or related thereto shall be immediately suspended and shall not be resumed until Change Order has been approved or cancelled by the Engineer which shall be the authority for Contractor to commence work on change. No claim for delays shall be allowed for the temporary work stoppage unless all work on the project is affected by the contemplated change.

.6 Upon receipt of a Change Order the Contractor shall execute the work in accordance with such orders, deletions, and changes as if the same had appeared in and been part of the Plans and Specifications.

.7 Minor changes in the work shall be as ordered by a letter from the Engineer and the Contractor shall proceed with work immediately, price such changes and record in the monthly minutes of meetings under a separate article along with the price.

.8 Minor changes appearing in minutes of meeting shall be reviewed monthly and items agreed upon shall be grouped and issued under a single change order.

27 VALUATION OF CHANGES IN THE WORK

.1 If the type of work involved in a Change in the Work is included in the items contained in the Schedule of Quantities and Unit Prices, it shall be performed on the same payment basis as the original Work unless changed pursuant to Clause 27.2 and the Contract Time may be changed to such time as the Engineer may decide in consultation with the Contractor.

.2 Should the actual quantity of an item in the Schedule of Quantities and Unit Prices Form of Tender vary by more than 25% of the Estimated Quantity, either the Owner or the Contractor may request a revision to the Contract Unit Price contained in the schedule. Such a request for a revision in a Contract Unit Price shall be made as soon as reasonably possible after the party concerned becomes aware of the circumstances. If the Owner and Contractor cannot agree on a revision of the Contract Unit Price, the price shall be revised by use of one of the methods set out in General Conditions 31 to 34.

.3 If the type of work involved in a Change in the Work is not included in the items contained in the Schedule of Quantities and Unit Prices, or is such as to alter the nature or intent of the work included in this Schedule, the value of such change shall be determined in one or more of the following methods:

(a) by estimate and acceptance in a lump sum;
(b) by unit prices agreed upon;
(c) force account;
(d) by variation of the Contract Unit Prices.

.4 In the case of Changes in the Work, the form of presentation of costs and methods of measurement shall be agreed to by the Engineer and Contractor before proceeding with the change. The Contractor shall keep accurate records, as agreed upon, of quantities or costs and present an account of the cost of the Change in the Work, together with vouchers where applicable. No claim for compensation will be considered unless such detailed account has been received. No payment or compensation for the costs of repairs to equipment or for construction equipment standing idle on the site will be considered.

28 MAINTAIN RECORDS BY CONTRACTOR

.1 The Contractor and each Subcontractor shall maintain

(a) the detail of the compilation of his estimate showing labour, materials, overhead and all other elements entering into his unit or lump sum prices as prepared for the purpose of tender, and
(b) full records of the actual cost to him of the work together with all proper tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto, and shall make them available to audit and inspection by the Owner, the Comptroller of the Province of New Brunswick, or by persons acting on their behalf. Contractor shall allow them to make copies thereof and to take extracts therefrom, and shall furnish them with any information which they may require from time to time in connection with such records.

.2 The records maintained by the Contractor and each subcontractor pursuant to this section shall be kept intact until the expiration of two years from the date of issuance of the Final Certificate of Completion or until the expiration of such other period as the Owner may direct.

.3 The Contractor shall require all subcontractors and all firms, corporations, and persons directly or indirectly controlled by or affiliated with the Contractor and all firms, corporations and persons directly or indirectly having control of the Contractor to comply with the subsections .1 and .2 as if they were the Contractor.

29 EXAMINATION OF SITE

.1 It is the responsibility of the Contractor to become familiar with and understand the nature and extent of the work to be executed, the nature of the soil, surface water drainage, the general form of the surface of the ground, and generally of all matters which can in any way influence the tender, in so far as possible. Information on any matter derived from the plans and specifications or obtained from the Engineer or from test pits, etc. shall not in any way relieve the Contractor from risk or from fulfilling the terms of the Contract.

.2 All details and incidental items not particularly mentioned in the specifications but which, whether in temporary or permanent works, must evidently be required by the nature of the work shall be considered included in the contract. On submission of the bid, it shall be understood that this has been done and provision for all risks, incidental items and contingencies are included in the contract price.

30 ADJUSTMENTS DUE TO SOIL CONDITIONS, NEGLECT OR DELAY

.1 No payment, in addition to the payment expressly promised by the contract, will be made by the Owner to the Contractor due to any extra expense, loss or damage incurred or sustained by the Contractor including a misunderstanding on the part of the Contractor as to any fact, whether or not such misunderstanding is attributable directly or indirectly to the Owner or any of the Owner's agents or servants, and whether or not any negligence or fraud on the part of the Owner's agents or servants is involved unless, in the opinion of the Engineer the extra expense, loss or damage is directly attributable to:

(a) a substantial difference between information relating to soil conditions at the site of the work, or a reasonable assumption of fact based thereon, in the Plans and Specifications or other documents or material communicated by the Owner to the Contractor for his use in preparing his tender and the real soil conditions encountered at the site of the work by the Contractor when executing the work, or

(b) neglect or delay occurring after the date of the contract on the part of the Owner in providing any information or in doing any act which the contract either expressly requires the Owner to do or which would be done by an Owner, in accordance with the usage of the trade to enable his Contractor to carry out an undertaking similar to the work being executed under the contract for the Owner, in which case, if as a condition precedent the Contractor has given to the Engineer written notice of his claim before the expiration of thirty days from the encountering of the soil conditions giving rise to the claim or from the day on which the neglect occurs or the delay commences, as the case may be, the Owner shall pay to the Contractor in respect of the additional expense, loss or damage incurred or sustained by reason of that difference, neglect or delay, an amount equal to the cost of the additional plant, labour and materials necessarily involved.

.2 If, in the opinion of the Engineer, the Contractor has effected a saving of expenditure by reason of the execution of the work by the Contractor being rendered less difficult, and less costly because the soil conditions actually encountered by the Contractor at the site of the work when executing the work are substantially different from soil conditions indicated in information, or a reasonable assumption of fact based thereon in the Plans and Specifications or other documents or material communicated by the Owner to the Contractor for his use in preparing his tender, the amount set out in Article II of the Articles of Agreement shall be reduced by an amount equal to the saving effected by the Contractor.

.3 Paragraph (a) of subsection .1 and subsection .2 are applicable only to a fixed price arrangement.

.4 If information relating to soil conditions at the site of the work appeared in the Plans and Specifications or in other documents or material communicated by the Owner to the Contractor for his use in preparing his tender and if the real soil conditions encountered at the site of the work by the Contractor when executing the work are substantially different from such information, or a reasonable assumption of fact based thereon, so that the cost to the Contractor of executing the work is directly and substantially increased or decreased by reason of such difference then the Engineer and the Contractor may by agreement in writing amend the price per unit for any class of plant, labour or material involved therein, so that the benefit of a substantial decrease in cost shall accrue to the Owner and the burden of a substantial increase in cost will not be borne by the Contractor.

.5 Subsection .4 is applicable only to a Unit Price Arrangement.

.6 No claim by the Contractor shall be valid in situations where subsection .4 is applicable unless he shall be given written notice thereof to the Owner within thirty days from the encountering of the soil conditions giving rise to such claim.

31 DETERMINATION OF COST - UNIT PRICE

.1 Whenever it is necessary to determine the cost of labour, plant or material the Unit Price Table shall be used. That is, the cost shall be equal to the product of the agreed quantity of such labour, plant or material expressed in the appropriate unit of measurement multiplied by the price in respect of such unit.

32 DETERMINATION OF COST - AGREEMENT

.1 If the Unit Price method of determination cannot be used because the labour, plant or material involved is not included in the Unit Price Table, the cost of the labour, plant or material shall be the amount agreed upon by the Contractor and the Engineer.

33 DETERMINATION OF COST - COST PLUS

.1 Where other methods of determination cannot be used and the Engineer and Contractor do not agree as provided by the Unit Price Method or Agreement Method, the Owner and the Contractor may, by an agreement in writing, agree to determine the cost of labour, plant or material to be equal to the aggregate of

(a) all reasonable and proper amounts actually expended by or legally payable by the Contractor in respect of the labour, plant or material which fall within any of the classes of expenditure described in subsection .2 (being costs which are directly attributable to the execution of the work and are not costs in respect of which the allowance in paragraph (b) is made); and

(b) 15% of the total of the expenditures of the Contractor that meet the test in paragraph (a) (being an allowance for all other expenditures by the Contractor and for profit and without limiting the generality of the foregoing, being also an allowance for payments and charges relating to overhead,

head office expenses and general administration costs of the Contractor, including finance and interest charges).

.2 Classes of expenditure that are allowable are:

(a) payments to subcontractors, agreed to by the Owner;
(b) wages, salaries, and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work other than wages, salaries, bonuses, living and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless such personnel is engaged at the site of the work with the approval of the Engineer;
(c) payments for materials necessary for and incorporated in the work, or necessary for and consumed in the execution of the work;
(d) payments for consumable tools, other than tools customarily provided by tradesmen, necessary for and used in the execution of the work;
(e) payments for preparation, inspection, delivery, installation and removal of materials necessary for the execution of the work;
(f) payments for renting, erecting, maintaining, and removing temporary offices, sheds and similar structures necessary for and used by the Contractor in executing the work;
(g) assessments in respect to the work payable under any statutory requirement or other agreements relating to payroll burdens;
(h) payments for renting plant and allowances for plant owned by the Contractor necessary for the execution of the work providing that such payments or allowances are reasonable and do not exceed the equipment rental rate set out in Schedule A, to the Regulations made under the Crown Construction Contracts Act;
(i) payments for inspection, delivery, installation and removal for the execution of the work; and
(j) other payments made with the approval of the Engineer that are necessary for the execution of the work.

34 DEFINITION OR DETERMINATION OF COST

.1 For the purposes of sections 32 and 33 and except as in those sections specifically provided plant does not include tools.

.2 For the purposes of sections 31, 32, and 33 "Unit Price Table" means the table referred to in Article VI of the Articles of Agreement.

35 COST BREAKDOWN LUMP SUM WORK

.1 The Contractor shall, on contracts which are wholly lump sum and partly unit price, submit a schedule to the Owner showing the cost breakdown of the lump sum work to assist the Engineer in assessing progress claims.

36 ESCALATION - LABOUR - MATERIALS

.1 Except where the Labour Conditions contain an escalation clause the amount payable to the Contractor under the contract shall not be increased or decreased by reason of any increase or decrease in the cost of the work brought about by an increase or decrease pursuant to the Labour Conditions.

.2 Notwithstanding subsection .1, the amount set out in Article II of the Articles of Agreement shall be adjusted, in the manner provided in subsection .3, in the event of any change in any tax imposed under the Social Services and Education Tax Act of New Brunswick or the Federal Excise Tax Act

(a) after the date of the submission by the Contractor of the tender for the contract, and
(b) that applies to the materials incorporated or to be incorporated in the work and that affects the cost to the Contractor of such materials.

.3 In the event of any change after the date of submission of the tender for the contract by the Contractor in any tax described in subsection .2 that applies to the materials incorporated or to be incorporated in the work and that affects the cost to the Contractor of such materials, the amount set out in Article II of the Articles of Agreement shall

(a) be increased where the cost to the Contractor of any of the materials has been increased by virtue of the change, or
(b) be decreased where the cost to the Contractor of any of the materials has been decreased by virtue of the change, by an amount equal to such amount as it is established upon examination of the relevant records of the Contractor referred to in Section 28, represents the increase or decrease, as the case may be, in the cost to the Contractor of the materials involved that is directly attributable to the change in the tax levied on or in respect of such materials.

.4 For the purpose of determining the adjustment in the amount set out in Article II of the Articles of Agreement by virtue of any change in any tax described in subsection .2, where such tax is changed after the date of submission of the tender by the Contractor but public notice of such change has been given by the Minister of Finance of the Province or the Federal Government, as the case may be, before the date of submission of the tender, the change of such tax shall, for the purposes of this section, be deemed to have occurred before the date of submission of the tender.

.5 The Contractor is not entitled to any part of a rebate of taxes obtained by the Owner.

37 USE OF LOCAL LABOUR AND MATERIALS

.1 The Contractor shall use Canadian labour and material in carrying out the work, to the full extent to which they are procurable, consistent with proper economy and the expeditious carrying out of the work.

.2 Subject to subsection .1 the Contractor shall employ labour and obtain material from the locality where the work is being executed to the extent to which it is available and shall use the offices of the Human Resources Development Commission in the recruitment of workers wherever practicable.

.3 When the Contractor must hire additional trucks, and if the trucks are immediately available and are in the Contractor's opinion suitably equipped for the works, independent local truckers must be used.

38 QUALITY OF MATERIALS AND WORKMANSHIP

.1 The Engineer’s decision as to whether the materials supplied and the work done under this Contract comply with the requirements of these specifications will be conclusive and final. In all matters of detail not specifically covered by the specifications, the work shall be well and skilfully done in accordance with the best trade customs and standards for work of like character and purpose and in full compliance with manufacturer’s specifications and instructions, where applicable.

.2 When the work completed or being done or the kind or quality of the equipment or materials supplied or being supplied does not meet specifications or is not satisfactory, notice will be given verbally or in writing and the Contractor shall immediately, upon receipt of such notice, reconstruct the work and replace the equipment all in accordance with the specifications. All such reconstruction, replacement and repair shall be done at the expense of the Contractor.

.3 Should the Contractor refuse or neglect to comply with the Engineer’s requirements within six working days from the receipt of such notice, the Town will consider the Contractor to have forfeited the contract. The provisions of General Condition No. 14, “Default or Removal of Work from Contractor” will then be exercised.

.4 The Engineer’s failure to disapprove of, or reject, any part or parts of the work or any of the materials or equipment supplied in connection therewith at the time of making any interim Payment hereunder, or at any other time during the continuance of this contract, shall not be construed to be an acceptance of any such part or parts of the work or any such material. The removal of work and re-execution thereof shall be at the expense of the Contractor; this includes all costs involved in replacing the work (including all materials destroyed or damaged by the removal of the rejected work), or materials and the subsequent replacement with acceptable work. The Contractor shall also reimburse the Town for any additional engineering, inspection, testing, or other cost incurred in respect of rejected work or materials, whether such materials are replaced or not, or are acceptable at a lower price.

.5 If, in the opinion of the Engineer, it is not expedient to re-execute defective work, the Town may deduct from the contract price the value of the work as completed, the amount which shall be determined by the Engineer.

.6 Should the Contractor have any doubt about anything to be constructed, done or supplied, or as to any other issue, the matter shall be clarified with the Engineer before such item is commenced or delivered.

39 WORK SCHEDULE

.1 The Contractor will provide immediately following the date of the contract award a schedule showing the program and timing for construction of the various portions of the project and estimated dates for completion of each portion.

.2 No progress claims shall be paid by the Owner during the time while the Contractor is in default under subsection .1.

.3 He will submit a monthly progress report to the Engineer which will show a comparison of work completed and work as scheduled, and will revise this schedule as necessary during the course of the work.

.4 The Contractor shall notify the Engineer a minimum of seven (7) days in advance of his requirements, for drawings or approval of shop drawings not scheduled, or where no schedule is prepared.

40 ACCESS TO WORK BY OWNER

.1 The Contractor shall permit the Engineer to have access to the work and to all areas where portions of the work are being fabricated or manufactured at all times during the execution of the work. Shall provide the Engineer with full information concerning what is being done to execute the work and shall give the Engineer every possible assistance in respect of the performance of his duty to see that the work is executed in accordance with the contract and also in respect of the performance and exercise of the duties and powers specially imposed or conferred on him by the contract.

41 INSPECTION

.1 The Engineer will have the right to inspect all or any of the materials to be supplied for the works at their place of origin, manufacture, or storage. The Contractor will arrange for the Engineer to have the right of access to such parts of any supplier's premises as may be necessary for the purpose of inspection.

.2 Any work done in the absence of the Engineer shall be opened up for thorough examination and must be rebuilt or replaced as directed, at the Contractor’s expense. No approval by an Engineer shall be taken as, or construed into, an acceptance of defective or improper work or material, which must, in every case be removed and properly replaced whenever discovered at any stage of the work.

42 CONTRACTOR’S SUPERINTENDENT

.1 The Contractor shall, during working hours, until the work has been completed, keep on the site of the work a competent Superintendent who has authority to

receive on behalf of the Contractor any order, direction or other communication that may be given under the contract.

.2 The Contractor shall, upon the request of the Engineer, remove any Superintendent who, in the opinion of the Engineer, is incompetent or has been conducting himself improperly and shall replace a Superintendent so removed with another Superintendent.

43 DELIVERY OF MATERIALS

.1 The Contractor will arrange for early deliveries of materials necessary to the execution of the work and will have them on hand well in advance of the time they are actually required.

44 LAYOUT

.1 The Engineer will lay out the work once on the ground by setting stakes to establish lines, levels, and grades to indicate the location, alignment and reference elevations for the work. The Contractor will execute the work in accordance with any indication given by the Engineer.

.2 The Contractor will provide all forms, stakes and lines, batter boards, string lines, etc. required to transfer grade from the ground stakes to the work and render such assistance to the Engineer as may be necessary to establish these lines, levels and grades and measurements of work. The Contractor will be responsible for providing and maintaining approved laser alignment equipment used to control line and grade during all pipe laying. Any required transferring of manhole, catch basin and sluice box grades shall be the responsibility of the Contractor.

.3 The Contractor is responsible to retain a Land Surveyor, acceptable to the Town, currently licensed to practice in the Province of New Brunswick, to replace any property markers or monument that are disturbed by the Contractor. Failure to do so within two (2) weeks of receiving notice from the Town shall result in the Town having the work done with costs deducted from any holdback monies owed to the Contractor, provided that any liens that may be claimed against the holdback under the Act have been extinguished, discharged or otherwise provided for under the Act.

45 SAFETY

.1 Before starting the work, the Contractor will inform WorksafeNB of his intentions to begin the job. All work will be done in compliance with the Occupational Health and Safety Act, Province of New Brunswick, or subsequent provincial safety legislation.

.2 All work will be performed in a safe and efficient manner to the complete satisfaction of both the Engineer and the Safety Inspector.

.3 Town contracts valued at $50,000 (not including HST) or more need to provide a Letter of Good Standing (LoGS) under the Certificate of Recognition Program (COR) issued by the New Brunswick Construction Safety Association (NBSCA) or an acceptable equivalent. A current status of "Certificate of Recognition" is mandatory as a condition of award. **The current LoGS is required to be submitted with the tender package.** As a mandatory condition of award, low bidders will be required to submit a signed copy of the "Contractor Safety Document", Appendix "E" of the Town of Riverview Standard Municipal Specifications (current version).

.4 The Engineer will require copies of the Contractor's regular program documentation applicable to the Town's job site once the contract is signed and in progress. (eg. Safety Policy with respect to subcontractors, Safety Policy with respect to Toolbox meetings, Traffic control plan(s), Project Site Hazard Assessment (relative to each job site), name of First Aid provider on each site, Policy Statement and process of formal inspections, etc...)

.5 If, in the opinion of the Engineer, the Contractor is not conducting construction of the work with proper safety precautions for workmen as prescribed by the Occupational Health and Safety Act then the Engineer may, by giving notice in writing to the Contractor, stop the work.

.6 Where the Engineer has stopped the work the Contractor shall immediately cease his operations until the Safety Code provisions have been complied with to the satisfaction of the Engineer.

.7 No extension of time or monetary allowances will be made to the Contractor for loss or delay arising from any stoppages in work under this section.

46 FIRE LOSS

.1 If the work or any portion thereof is lost or destroyed and monies are paid to the Owner in respect of the loss or damage under a policy of insurance maintained by the Contractor pursuant to Section 19 – Insurance the monies will be held by the Owner for the purposes of the contract.

.2 The Owner may elect to retain absolutely the monies held under subsection .1 and, in such event, the monies belong absolutely to the Owner and:

(a) the Contractor is liable to the Owner in an amount equal to the amount by which the insurance monies payable is less than the loss and damages suffered and sustained by the Owner, including costs associated with clearing and cleaning the site of the work, and

(b) there shall be a financial accounting between the Owner and the Contractor in respect of the portion of the work which was lost or damaged and in respect of which monies have been retained absolutely by the Owner and there shall be included in the financial accounting all amounts paid or payable by the Owner under the contract to the Contractor, together with

all amounts paid or payable by the Contractor under the contract to the Owner and the Owner shall pay to the Contractor any balance.

.3 Upon payment as required by subsection .2 by the Owner or the Contractor as the case may be, the Owner and the Contractor are discharged from all rights and obligations under the Contract in respect of the portion of the work which was lost or damaged and in respect of which monies have been retained absolutely by the Owner as though such portion of the work had been fully completed and executed by the Contractor in accordance with the contract.

.4 If an election is not made under subsection .2 the Contractor shall restore and replace the portion of the work lost or damaged and the insurance monies shall be disbursed by the Owner to the Contractor in the manner and subject to the terms and conditions governing monies payable under the contract to the Contractor by the Owner, except that for the purpose of this subsection "100%" shall be substituted in subsection .6 of Section 4 of the Terms of Payment for "95%" and "85%".

47 CONTRACTOR'S RESPONSIBILITIES

.1 The Contractor shall guard or otherwise protect the work and shall protect the specifications, plans, drawings, information, material and real property provided by the Owner to the Contractor against loss or damage from any cause.

.2 The Contractor shall at his own expense do whatever is necessary to ensure that:

(a) no person, property, right, easement or privilege is injured, damaged or infringed by reason of the Contractor's activities under this contract;
(b) pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the execution or existence of the work;
(c) fire hazards are eliminated and in the case of a fire in or about the work that it is promptly extinguished;
(d) the health of all persons employed on the work is not endangered;
(e) adequate medical supervision of all persons employed on the work is maintained;
(f) adequate sanitation measures in respect of the work are taken; and
(g) all stakes, buoys, lines, levels and marks placed on or about the works by or under the authority of the Engineer are protected and are not removed, defaced or altered.

.3 The Engineer may direct the Contractor to do such things and to construct such works which the Engineer considers reasonable and necessary to ensure compliance with or to remedy a breach of subsection .2. The Contractor shall at his own expense comply with the directions of the Engineer.

48 INTERPRETATIONS OF CONTRACT DOCUMENTS - CLAIMS ARISING

.1 If at any time before the work has been completed and the Engineer has issued his Certificate of Final Acceptance, any question arises as to whether anything has been done as required by the contract or as to what the Contractor is required by the contract to do, and in particular, and without limiting the generality of the foregoing, as to:

(a) the meaning of anything in the Plans and Specifications;
(b) the meaning to be given to the Plans and Specifications in case of any error therein, an omission therefrom, or an obscurity or discrepancy in the wording or intention;
(c) whether the quality or quantity of any material or workmanship meets the requirements of the contract;
(d) whether the plant, materials or workmen provided by the Contractor for executing the work and carrying out the contract are adequate to ensure that the work will be executed in accordance with the contract and that the contract will be carried out in accordance with its terms;
(e) what quantity of any kind of work has been completed by the Contractor; or
(f) the timing and scheduling of the various phases of the execution of the work.

The question shall be decided by the Engineer.

.2 In matters arising other than under Section 30 - Adjustments Due To Soil Conditions, Neglect Or Delay, the Contractor shall, where he intends to submit a claim for additional time or money arising out of the construction of the work give written notice of his intention to claim

(a) in the case of changes or alterations of the work ordered by the Engineer, within 14 days of receipt of the notice of change; and
(b) in the case of a dispute arising out of interpretation of the contract, within 30 days of the first occurrence of the circumstances giving rise to the dispute.

.3 In matters arising other than under Section 30 - Adjustments Due To Soil Conditions, Neglect Or Delay, the Contractor may submit a claim for additional time or money only on those matters covered by the notice of intention to claim given under subsection .2 and such claim if not submitted within 30 days of the occurrence of that portion of the work out of which the claim arises shall be barred.

.4 The Engineer shall within 30 days of receipt of notice of claim under this section render his decision in writing to the Contractor.

.5 The Contractor shall construct the work in accordance with the decisions and directions of the Engineer given under this section and in accordance with any consequential decisions and directions given by the Engineer.

49 DEFECTS AND OMISSIONS

.1 Without restricting any warranty or guarantee implied or stipulated by law the Contractor shall at his own expense rectify and make good any defect or fault or omission that appears in the work within twelve months or within such additional period of time stipulated in the Specifications concerning particular portions of the work from the date of the Engineer's Final Certificate of Final Acceptance, or where Certificate of Substantial Performance has been issued, from the date of such Certificate.

.2 If any defect, fault or omission appears in the work and the Engineer is of the opinion that it is one which the Contractor, either under subsection .1 or under a warranty or guarantee implied or stipulated by law, is obliged to remedy and make good the Engineer may direct the Contractor to remedy and make good the defect, fault or omission by giving notice to the Contractor of the existence of the defect, fault or omission and the notice shall specify the time within which the defect, fault, or omission is to be rectified and made good.

.3 The Contractor shall rectify and make good the defect, fault or omission described in a notice given pursuant to subsection .2 within the time specified in the notice.

50 OWNER'S RIGHT TO COMPLETE WORK

.1 Where the Contractor has failed to comply with any decision or direction given by the Engineer, the Engineer may employ such methods as he may deem expedient to do that which the Contractor failed to do.

.2 The Contractor shall on demand pay to the Owner all costs, expenses and damage incurred or sustained by the Owner by reason of the Contractor's non-compliance with any decision or direction given by the Engineer and by the action taken by the Engineer pursuant to sub-section .1.

51 CONTRACTOR RIGHTS ON DISPUTED DECISION

.1 If the Contractor has, within ten days of communication to him by the Engineer of any decision or direction of the Engineer, given notice to the Engineer in writing disputing such decision or direction and stating the ground or grounds which form the basis of such dispute, the Owner shall pay to the Contractor the cost of the additional labour, materials and plant necessarily involved in carrying out the decision or direction beyond what the Contract, correctly understood and interpreted, would have required the Contractor to do.

52 CLEAN UP

.1 Waste material and rubbish shall not be allowed to accumulate and shall be removed from site daily or at regular intervals as agreed upon by the Engineer. Waste material and rubbish shall not be buried in the trench or street excavation. It shall be properly disposed of by the Contractor.

.2 Upon completion of the job all surplus construction materials, all tools, equipment, temporary structures, etc. will be removed from the site by the Contractor to the

satisfaction of and in accordance with any directions of the Engineer. All dirt, rubbish, trash, etc. becomes the property of the Contractor and must be removed from the site.

.3 The site as much as practicable must be kept in a clean and orderly appearance and free from excess material at all times. The Contractor must clean up the site periodically and keep it graded smooth as work progresses to the complete satisfaction of the Engineer.

53 PUBLIC CONVENIENCE

.1 No material or other obstruction shall be placed within 10 metres of a fire hydrant, which must be at all times readily accessible to the Fire Department. During the progress of the work the convenience of the public and the residents along the street must be provided for as far as practical.

.2 Convenient access to driveways, houses and buildings along the street must be maintained wherever possible. Temporary approaches to all crossings of intersecting streets and sidewalks must be provided and kept in good condition, wherever practical. No street or section of a street will be closed to traffic prior to the approval of the engineer, fire chief and police department, who must be notified daily of any such closures.

.3 Access to businesses must be maintained at all times during the project. The Contractor is responsible for scheduling the work to permit access to all businesses during normal business hours.

54 UTILITY INSTALLATIONS

.1 It is to be noted that certain underground and overhead facilities are located along the construction route and it will be the responsibility of the Contractor to maintain liaison with the Utility authorities to ensure that no damage is affected to these facilities.

.2 This includes, but is not limited to all water pipes, sewer pipes, gas mains, culverts, conduits, and telecommunication cables and electric power lines, etc. The approximate location of known facilities may be shown on the plans in so far as possible and based on the best available information at the time. However, the Town accepts no responsibility for the accuracy or completeness of this information.

.3 No claim will be entertained for any damage or any slowdown of work due to the aforementioned utilities.

55 RELATIONS WITH OTHER CONTRACTORS

.1 Wherever work being done by the Owner's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various

interests involved shall be established by the Engineer to secure the completion of the various portions of the work in general harmony.

.2 If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results and his failure to inspect and report shall constitute an acceptance of the other Contractor's work as fit and proper for the reception of his work except as to defects which may develop in the other contractor's work after the execution of this work.

.3 To insure the proper execution of his subsequent work, the Contractor shall measure work already in place and shall at once report to the Engineer any discrepancy between the executed work and the drawings.

56 CO-OPERATION

.1 It is to be noted that other work may be in progress under various contracts within the working area of this contract. The Contractor will, to the satisfaction of the Engineer, allow the other contractors reasonable access to the work and will co-operate with them in the carrying out of their duties and obligations.

.2 No claim will be entertained for any inconvenience or any slowdown in work due to these other Contracts.

57 CONTRACTOR'S JOB OFFICE

.1 The Contractor shall provide a temporary weather tight job office for his own use complete with facilities for filing drawings, specifications, correspondence, purchase orders and such other appurtenances as are necessary for the proper conduct of the work and shall remove same upon completion of the work. Job office shall be located in an area approved by the Engineer.

.2 The Contractor shall provide a telephone in the job office described in subsection .1 where practicable.

.3 The Contractor shall at all times during construction of the work maintain in the job office required by subsection .1 a complete and current set of plans, specifications and change orders for this contract.

58 SHOP DRAWINGS

.1 Contractors and suppliers required to submit shop drawings under various sections of the specifications or which the Engineer may deem necessary shall submit them through the Contractor to be field checked by him before being forwarded to the Engineer.

.2 Only shop drawings which have been stamped reviewed by the Engineer will be permitted at the construction site. Shop drawings not stamped must be destroyed or removed from the site.

.3 Quantity of shop drawings submitted shall be at the discretion of the Contractor. Two (2) copies will be retained by the Engineer.

.4 Shop drawings must have received final review by the Engineer before any fabrication begins.

.5 The Contractor shall notify the Engineer a minimum of seven (7) days in advance of his requirements, for drawings or approval of shop drawings not scheduled, or where no schedule is prepared.

59 MATERIALS, APPLIANCES, EMPLOYEES

.1 All materials specified by copyrighted trade name with no approved equal shall be exactly as specified. Wherever materials are specified with clause "or approved equal", or where a material or process specified without clause "or approved equal", the Contractor may apply to the Engineer in writing, after award of Contract for permission to use equal materials or processes. Requests for substitution shall state reasons for substitution, all technical data, details, amount of additions or deductions and the Engineer shall reserve the right to approve of disapprove any material or process submitted. Substitutions of any material or process shall be approved by the Engineer before fabricated or delivered to the site. Proper performance of the substituted material or process shall remain the responsibility of the Contractor.

60 NOTICE OF LIEN

.1 If the Contractor files a lien pursuant to the Act, the Contractor is required to properly serve the Clerk of the Town. In addition, the Contractor is required to simultaneously provide notice to the Engineer and the office of the General Counsel by electronic means with a request to acknowledge receipt. In the event the office of the General Counsel or the Engineer does not acknowledge receipt, notice shall be provided by personal service at the office of the General Counsel and the office of the Engineer.

.2 The Contractor will pay promptly all indebtedness for labour, services, materials, tools and equipment used in the supply and performance of Work and Contractor will observe and comply with, and cause all Subcontractors to observe and comply with, all statutory holdback, trust and deemed trust obligations pursuant to applicable laws. Before the Contractor is entitled to receive any payment, it will (if required, or if requested by the Town) furnish evidence satisfactory to the Town including, without limitation, Statutory Declarations of full payment of such indebtedness.

.3 Contractor will not allow any lien, charge or encumbrance to attach to the Work, Town property, or the holdback. If any lien, charge or encumbrance do attach, the

Contractor will immediately discharge, bond or otherwise secure against, and cause all Subcontractors and suppliers to immediately discharge, bond or otherwise secure against, any liens, charges or encumbrances which may arise in connection with the Work. All payments by the Town to Contractor hereunder will be in accordance with, and subject to, all applicable laws, including any applicable holdback requirements under the Act, sales tax or other laws.

.4 If any lien, charge or encumbrance do so attach, the Town may, without notice, discharge such lien, charge or encumbrance by securing the discharge, bond or otherwise by application to Court. The Town may withhold payment from the Contractor to the extent of such lien, charge or encumbrance exist and the Town shall be entitled to deduct the costs of such application including legal fees on a solicitor and client basis.

61 CONTRACTORS LIABILITY FOR DAMAGE TO OWNERS PLANT

.1 The Contractor is liable to the Owner for loss of or damage to material, plant or real property, whether attributable to causes beyond his control or not, supplied or made available by the Owner to the Contractor for use in connection with the work other than loss or damage resulting from and directly attributable to reasonable wear and tear.

.2 The Contractor shall not use material, plant or real property to which this section applies except for the purpose of carrying out this contract.

.3 When the Contractor has failed to make good any loss or damage for which he is liable under this section within a reasonable time after being required by the Engineer-Architect to do so, the Engineer-Architect may cause the loss of damage to be made good, and the Contractor shall thereupon be liable to the Owner for the cost thereof and shall on demand pay to the Owner an amount equal to such cost.

.4 The Contractor shall keep such records of material, plant and real property to which this section applies as the Engineer-Architect from time to time requires and shall, from time to time as the Engineer-Architect requires, satisfy the Engineer-Architect that such material, plant and real property are at the place and in the condition that they ought to be.

62 PAYMENT BY OWNERS OF CONTRACTING OBLIGATIONS

.1 The Owner may, in order to discharge lawful obligations of and satisfy lawful claims against the Contractor or a subcontractor arising out of the execution of the work, pay an amount which is due and payable to the Contractor, under any provision of the contract, directly to the obliges of and the claimants against the Contractor or the subcontractor.

.2 A payment made pursuant to subsection (1) is to the extent of the payment a discharge of the Owner's liability under the contract to the Contractor.

.3 The Contractor shall discharge all lawful obligations of his and shall satisfy all lawful claims against him arising out of the execution of the work as the same become due.

.4 The Contractor shall, whenever so requested by the Engineer-Architect, make a statutory declaration deposing to the existence and condition of the obligations and claims referred to in subsection (3).

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITION
140 Clearing & Grubbing
150 Environmental Protection

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavating, Trenching, Bedding & Backfilling of Pipelines
220 Sanitary Sewers
230 Storm Sewers
240 Manholes, Catch Basins & Sluice Boxes
250 Water Mains

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
320 Crushed Rock Base & Sub Base Materials
330 Curbs, Gutters & Sidewalks

1.2 MATERIAL CERTIFICATION

.1 Provide Certification, test results and product data for: Topsoil, Sod, Seed, Mulch, Tackifier, and Fertilizer at least 14 days prior to the incorporation in the work.

.2 Submit in writing to Engineer 14 days prior to commencing work:
- .1 Size of truck slurry tank in litres.
- .2 Amount of material to be used per tank based on size of slurry tank.
- .3 Number of tankloads required per hectare to achieve specified slurry mixture per hectare.

1.3 MEASUREMENT FOR PAYMENT

.1 Topsoil and finish grading will be measured in square metres of work satisfactorily completed. Payment for topsoil will be the contract unit price for square metres of topsoil in place including all incidentals as listed in Clause 1.3.2. No payment will be made for topsoil and finish grading when topsoil is used in conjunction with sod or hydroseed. In this case topsoil will be considered incidental to the placing of the hydroseed or sod.

.2 Incidentals will include but not be limited to:
- .1 Preparation of sub-grade for placing of topsoil will not be measured for payment.
- .2 Supplying and placing of topsoil and landscape maintenance will not be measured but will be considered incidental to the hydraulic seeding or sod. Topsoil must be placed to the grade and depth indicated including all sub-grade preparation and all soil amendments.
- .3 Supply and application of agricultural limestone will not be measured but will be considered as incidental to the work.
- .4 Disposal of any materials off site will be considered incidental to the work.
- .5 Inspection and testing of topsoil will not be measured for payment and will be considered incidental to the work.

.3 Hydraulic seeding and/or sod will be measured in square meters of hydraulic seeding or sod placed and accepted by the Engineer. Payment for work under this item including all incidentals will be at the contract unit price for hydraulic seeding and/or sod.

.4 Incidentals to the hydraulic seeding or sod operations will include but not be limited to:
- .1 Raking, watering, fertilizing and all maintenance items that may be required due to poorly established growth at provisional acceptance will be considered as incidental to the work.
- .2 Mowing and fertilizing and maintenance of all areas up until the date of provisional acceptance shall be considered incidental to the work.

.5 On projects where landscape (topsoil & seed/sod) is required due to restoration of a pipeline installation the cost of topsoil & seed/sod will be incidental to the work.

.6 Where proper restoration requires cutting back embankments or slopes on private property to obtain proper grade, the excavated material shall be classified as extra excavation and paid by cubic measurement in accordance with Section 310.

2 Products

2.1 TOPSOIL

.1 Topsoil: friable, neither heavy clay nor of very light sandy nature consisting of 45% sand, 35% silt, 20% clay and pH value of 6.0 to 7.0. Topsoil shall be screened and free of admixture of subsoil, refuse, roots, vegetation, debris, toxic materials, and stones larger than 20 mm diameter.

2.2 HYDRAULIC SEEDING MATERIALS & EQUIPMENT

.1 Grass seed: Canada Certified No. 1 Grade in accordance with Government of Canada Seeds Act and regulations.
- .1 Seed Mix for areas adjacent to privately maintained properties shall be:
  60% Kentucky Bluegrass (min – 3 varieties) equal % by weight
  20% Fescues (80% Creeping Red + 20% Tall)
  20% Nurse Grasses (100% Perennial Rye) or (80% Perennial Rye + 20% Red Top)
  Seed rate at 2.50 kg/100m^2
- .2 Seed Mix for low maintenance areas (i.e. landfills) shall be:
  40% Creeping Red Fescue
  20% Hard Fescue
  15% Canada Blue Grass
  10% Alsike or White Clover
  10% Annual Ryegrass
  5% Red Top
  Seed rate at 1.67 kg/100m^2

.2 Mulch: free of growth-inhibiting ingredients. Capable of dispersing in water to form homogeneous slurry. Capable of forming an absorptive mat ground cover allowing water percolation.

.3 Water: clean, fresh and free of impurities that would inhibit germination and growth. Town of Riverview bulk water station located at the rear of the Fire Station on Pinewood Road is available for the supply of water.

.4 Fertilizer (during hydraulic seeding operations): complete commercial, synthetic, slow release, with maximum 35% water soluble nitrogen. Ratio: 2:1:1. Rate: 0.5 kg/100m^2.

.5 Binder (Tackifier): emulsified asphalt to CAN/CGSB-16.2, Type 2 or polyvinyl acetate polymer

.6 Truck with slurry tank of a minimum 4500 L capacity and pumps capable of maintaining continuous non-fluctuating flow of solution.

2.3 NURSERY SOD

.1 Number One Turf-grass Nursery Sod that has been especially sown and cultivated in nursery fields as turf grass crop.

.1 Turf grass Nursery Sod types:

.1 Number one Kentucky Bluegrass Sod or Fescue Sod:
Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 90% Kentucky Bluegrass cultivars and 10% Chewing Fescue or Creeping Red Fescue cultivar(s) with no less than 3 varieties of bluegrass.

.2 Number one named cultivars: Nursery Sod grown from certified seed of licensed cultivar.

.2 Turf grass Nursery Sod quality:

.1 Not more than 2 broad leaf weeds or 10 other weeds per 40 square metres.

.2 Density of sod sufficient so that no soil is visible when mown to height of 40 mm.

.3 Mowing height limit: 35 to 65mm.

.4 Soil portion of sod: 9 to 15mm in thickness.

2.4 FERTILIZER

.1 Complete commercial synthetic fertilizer with minimum 65% insoluble nitrogen and blended for promoting root development of newly seeded or sod areas.

.2 Formulation ratio: 80% CSU for spring & early fall planting (6-12-3) and 100% CSU for fall planting (6-24-6). Utilize fertilizing program as stated in 3.11.

2.5 LIMESTONE

.1 Ground agricultural grade limestone containing minimum 85% of total carbonates.

.2 Gradation requirements: percentage, passing by weight, 90% passing 1.0mm sieve, 50% passing 0.125mm sieve.

.3 Apply at a rate specified by soil test results.

.4 Lime is to be placed at a sufficient rate to achieve a topsoil pH of 6 to 7. Spread lime prior to scarification.

2.6 WATER

.1 Supplied by Contractor, potable and free of impurities.

2.7 WEED & FEED

.1 Complete commercial synthetic fertilizer with minimum 65% insoluble nitrogen.
.2 Weed control agent.
.3 Apply at manufacturer's recommendations for newly established grass.

3 Execution

3.1 CONSTRUCTION METHODS

.1 Schedule placing of topsoil and finish grading to permit hydraulic seeding operations or placement of sod under optimum conditions.

3.2 TOPSOIL SOURCE QUALITY CONTROL

.1 Inspection and testing of topsoil will be carried out by the Contractor.

.2 Inform Engineer of proposed source of topsoil to be supplied and provide access for sampling. Acceptance of topsoil is subject to inspection and/or soil analysis test results. Do not commence work until topsoil has been accepted by Owner.

.3 Testing of topsoil will be carried out by laboratory designated by Engineer.

3.3 PREPARATION OF EXISTING GRADE

.1 Grade sub-grade soil and all excavated areas and areas disturbed by construction, to eliminate uneven areas and low spots, ensuring positive drainage. Compact all of these areas to at least 95% of the maximum dry density in accordance with ASTM D698. Remove soil contaminated with toxic materials. Dispose of removed materials. Contaminated material shall be disposed of off site.

.2 Cultivate entire area of sub-grade soil which is to receive topsoil to depth of 100mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted soil.

.3 Remove surface debris, roots, vegetation, branches, gravel and stones in excess of 25 mm diameter.

3.4 SPREADING OF TOPSOIL

.1 Spread topsoil after Engineer has inspected and approved subgrade.

.2 Spread topsoil with adequate moisture in uniform layers over dry subgrade where hydraulic seeding or sod is indicated. Topsoil shall not be placed on frozen subgrade.

.3 Topsoil is to be kept 15mm below finished grade for sod areas. For seeded areas, topsoil shall be applied to a lightly rolled minimum depth of 100mm.

.4 Remove all stones and dispose of off site.

.5 A “power rake” must be used to remove stones and compact topsoil, as directed by the Engineer.

.6 Restore any stockpiles to a condition acceptable to the Engineer.

3.5 SOIL AMENDMENTS

.1 Apply soil amendments at rate as specified and as specified and as determined from soil sample test.

.2 Mix soil amendments into full depth of topsoil prior to application of fertilizer.

3.6 APPLICATION OF FERTILIZER

.1 Apply fertilizer at least one week after limestone application.

.2 Spread fertilizer uniformly over entire area of topsoil at rate specified.

.3 Mix fertilizer thoroughly to full depth of topsoil.

.4 Apply weed & feed to entire topsoil and seeded area 2 weeks prior to final acceptance. DO NOT APPLY WEED AND FEED TO NEWLY PLANTED SEED.

3.7 FINISH GRADING

.1 Fine grade and loosen topsoil. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Consolidate topsoil for areas to be seeded leaving surface smooth, uniform, firm against deep foot printing, and with a fine loose texture.

.3 Repair all settled areas with screened topsoil.

.4 Dispose of any excess materials off site.

3.8 APPROVAL OF TOPSOIL AREA

.1 Prior to the placement of hydraulic seeding or sod, obtain the Engineer's acceptance of the topsoil area.

3.9 APPLICATION OF HYDRAULIC SEEDING

.1 Take reasonable care to prevent spraying items such as structures, signs, guide rails, fences, plant materials, curbs, driveways and utilities. Any overspray must be cleaned up upon request.

.2 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

.3 Seed applicator shall be charged with water and, while agitating, mulch, seed, fertilizer and lime shall be slowly added until all components are thoroughly mixed.

.4 Obtain Engineer's approval of topsoil grade depth before starting to seed.

.5 Prepare slurry mixture to be applied per $100m^2$.
- .1 Seed: 2.5 kg or as recommended by seed manufacturer
- .2 Mulch: 10 kg
- .3 Binder (Tackifier): 3 kg or as per manufacturer's recommendations
- .4 Fertilizer: 0.5 kg
- .5 Lime: As determined by soil analysis
- .6 Water: 100 L (minimum)

.6 Apply seed slurry uniformly.

.7 Blend applications into previous applications to form uniform surfaces.

.8 Re-spray areas where application is not uniform.

.9 Remove slurry from items and areas not designated to be sprayed.

3.10 SOD PLACEMENT

.1 Lay sod within 36 hours of being harvested.

.2 Lay sod sections in rows, longitudinally, along contours of slopes, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.3 Roll sod as directed by Engineer. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade not permitted.

3.11 FERTILIZING PROGRAM

.1 Fertilize during establishment and warranty periods to following program:

Month	Day	Day	Rate	Ratio
July	01	15	687 kg/ha	3:1:3
Aug	02	10	500 kg/ha	1:2:3
May	15	30	500 kg/ha	3:0:0

3.12 MAINTENANCE PRIOR TO PROVISIONAL ACCEPTANCE

.1 Perform the following operations from time of installation until acceptance.

.2 Water seeded & new sod areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.

.3 Cut grass to 40 mm when it reaches height of 60 mm. Remove clippings which will smother grassed areas as directed by Engineer.

.4 Maintain areas weed free.

.5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles. Water area completely.

3.13 PROVISIONAL ACCEPTANCE

.1 Areas will be accepted by Engineer provided that:
- .1 Seed/Sod areas are properly established.
- .2 Turf is free of eroded, bare or dead spots and 98% free of weeds.
- .3 No surface soil is visible when grass has been cut to height of 40mm.
- .4 Seeded & new sod areas have been cut at least twice. The last cut being carried out within 24 h of acceptance.

3.14 FINAL ACCEPTANCE

.1 Upon completion of the maintenance period a final inspection of the work will be conducted and all aspects of the project will be inspected.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
130 Water Mains

Section 300: STREETS & ROADWAYS
330 Curbs, Gutters & Sidewalks
370 Quality Control

1.2 REFERENCE STANDARDS

.1 Do cast-in-place concrete work in accordance with CSA A23.1 and testing in accordance with CSA A23.2, except where specified otherwise.

1.3 SAMPLES

.1 At least 2 weeks prior to commencing work, inform Engineer of proposed source of aggregates and provide access for sampling.

1.4 CERTIFICATES

.1 Minimum 2 weeks prior to starting concrete work, submit to Engineer manufacturer's test data and certification by qualified independent inspection and testing laboratory that the following materials will meet specified requirements:
- .1 Portland cement.
- .2 Grout.
- .3 Admixtures.
- .4 Aggregates.
- .5 Water.
- .6 Joint filler.

.2 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.3 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA A23.1 and that mix design is adjusted to prevent alkali aggregate reactivity problems.

.4 The Contractor shall submit certification that the concrete supplier is certified in accordance with Atlantic Provinces Ready Mix Concrete Association, Plant Certification Program or equivalent.
- .1 The concrete supplier shall submit proof of certification in the appropriate categories in accordance with CSA A23.1.

.5 The proposed mix proportions (design), certified by the Contractor or his agent, shall be submitted for review at least 5 Days before concrete production is due to start.

1.5 CONSTRUCTION QUALITY CONTROL

.1 Submit proposed quality control procedures for Engineer's review.

1.6 MEASUREMENT FOR PAYMENT

.1 No measurement will be made under this Section.

2 Products

2.1 MATERIALS

.1 Portland cement: to CAN/CSA A5.

.2 Supplementary cementing materials: to CAN/CSA A23.5.

.3 Water: to CSA A23.1.

.4 Aggregates: to CSA A23.1. Coarse aggregates to be normal density.

.5 Air-entraining admixture: to CSA A23.1 and ASTM C260.

.6 Water reducing agents: to ASTM C494 Type A (water-reducing admixtures) or Type D (water-reducing and retarding admixtures).

.7 Superplasticizers: to ASTM C494 Type F (water-reducing high range admixtures) or Type G (water-reducing, high range, and retarding admixtures).

.8 Chemical admixtures: to ASTM C494 and CAN3-A266.2. Owner to approve accelerating or set retarding admixtures during cold and hot weather placing.

.9 Curing compound: white liquid membrane forming curing compound to CSA A23.1 and ASTM C309, Ritecure/Sterncure or approved equal.

.10 Expansion Joint Material:
- .1 Premoulded, asphalt saturated, cane fibre board: to ASTM D1751.
- .2 "Flexicell" as manufactured by Sternson Limited or approved equal.

.11 Moisture Proof Paper:
- .1 Orange Label Fibereen as manufactured by Domtar or approved equal.

.12 Insulation; Shall provide a minimum R value of 10.

.13 Polyethylene; Shall be 6 mil.

2.2 CONCRETE MIXES

.1 Proportion normal density concrete in accordance with CSA A23.1, to give following properties: for all concrete as indicated.
- .1 Cement: use Normal Type 10 Portland cement
- .2 Minimum compressive strength at 28 days: 32 MPa.
- .3 Minimum cement content: 400 kg/m^3.
- .4 Class of exposure: C-2.
- .5 Nominal maximum size of coarse aggregate: 20 mm.
- .6 Slump at time and point of discharge: 80 mm ± 30 mm.
- .7 Air content: 5% - 8%.
- .8 Chemical admixtures: in accordance with ASTM C494.

.2 Proportion concrete in accordance with CSA A23.1.

.3 Do not change concrete mix without prior approval of Engineer.

3 Execution

3.1 WORKMANSHIP

.1 Provide 24 hr notice prior to placing of concrete.

.2 Pumping of concrete is permitted only after approval of equipment and mix.

.3 Ensure reinforcement (if required) is not disturbed during concrete placement.

.4 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.5 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.6 Do not place load upon new concrete until authorized by Engineer.

3.2 FINISHING

.1 Finish concrete in accordance with CSA A23.1.

.2 Rub exposed sharp edges of concrete with carborundum to produce 6 mm radius edges unless otherwise indicated.

3.3 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Engineer. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form expansion joints as indicated. Install joint filler.

.3 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.4 FIELD QUALITY CONTROL

.1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by Engineer in accordance with CSA A23.1.

.3 Engineer will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.

.4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2.

.5 Inspection or testing by Engineer will not augment or replace Contractor quality control, nor relieve him of his contractual responsibility.

.6 Should the testing indicate, after a reasonable sampling program that the product is faulty, the Contractor will be notified and the costs of further tests until satisfactory results are obtained will be at the expense of the Contractor.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITION
120 Topsoil, Hydraulic Seeding & Sod
150 Environmental Protection

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines

Section 300: STREETS & ROADWAYS
310: Roadway Excavation, Embankment & Compaction

1.2 DEFINITIONS

.1 Clearing consists of cutting trees and brush vegetative growth to not more than height specified in Clause 2.1 and disposing of felled trees and surface debris.

.2 Close-cut clearing consists of cutting off or removing at or near flush with original ground surface standing trees, brush, scrub, roots, stumps and embedded logs and disposing of fallen timber and surface debris.

.3 Clearing isolated trees consists of cutting designated trees to not more than height specified and disposing of felled trees and debris.

.4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 125 mm diameter and disposing of all fallen timber and surface debris.

.5 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments to not less than depth specified below original ground surface.

1.3 PROTECTION

.1 Prevent damage to any existing features which are to remain. Repair any damage and restore to original or better condition at no expense to Owner.

.2 Apply approved tree paint to cuts or scars suffered by vegetation designated to remain.

.3 Notify utility authorities before starting clearing and grubbing. Locate and protect utility lines. Obtain all necessary permits and coordinate work with utilities.

.4 Ensure that employees doing tree removal are competent and are provided with the proper personal protective equipment (PPE). Employees doing tree removal must have successfully completed a course from a recognized training agency. Contractor to follow WorkSafe Tree Removal requirements.

.5 No separate payment will be made for conjoined trees.

1.4 MEASUREMENT FOR PAYMENT

.1 Clearing is measured by the number of hectares cleared, including disposal of all debris, measured in a horizontal plane.

.2 Grubbing is measured by the number of hectares grubbed, including disposal of all debris, measured in a horizontal plane.

.3 Clearing and grubbing single trees or rows of trees is measured by the number of trees, including disposal of all debris.

2 Execution

2.1 CLEARING

.1 All merchantable timber shall be salvaged, such that no big tops (containing a merchantable bolt) are left.

.2 Clear trees, shrubs, uprooted stumps and surface debris not designated to remain.

.3 Cut off trees, brush, and scrub as indicated or as directed at a height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations may be 500 mm.

.4 Cut off unsound branches and cut down dangerous trees overhanging area cleared.

.5 All timber shall be property of Owner unless otherwise specified.

.6 Ornamental trees and shrubs shall not be disturbed without written permission from the Engineer.

2.2 CLOSE CUT CLEARING

.1 Cut off trees, shrubs, stumps and other vegetation at ground level to within 100 mm of original ground surface.

.2 Perform close cut clearing by hand to prevent damage to existing insulation of fibrous material.

.3 Cut off unsound branches and cut down dangerous trees overhanging area cleared.

2.3 ISOLATED TREES

.1 Cut off isolated trees indicated or directed by Engineer at a height of not more than 300 mm above ground.

.2 Grub out isolated tree stumps.

2.4 GRUBBING

.1 Grub out stumps and roots to not less than 300 mm below original ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension.

.3 Where topsoil stripping is required, it will be measured after clearing and grubbing operations.

2.5 REMOVAL AND DISPOSAL

.1 Remove cleared and grubbed materials to disposal area meeting all regulatory requirements.

.2 Usable timber and rocks become property of the Owner.

2.6 FINISHED SURFACE

.1 Leave ground surface in a condition suitable for immediate grading operations or stripping of topsoil.

END OF SECTION

1 General

1.1 GENERAL

.1 Particular care and attention must be taken regarding environmental control measures for this project.

1.2 MEASUREMENT FOR PAYMENT

.1 No measurement for payment will be made for the supply, installation and removal of silt fencing as it is considered incidental to the work.

.2 No measurement for payment will be made for the supply, installation, maintenance and removal of erosion control structures, as it is considered incidental to the Work.

.3 All work of this Section and adherence to environmental protection requirements shall be considered incidental to the Work.

1.3 COMPLIANCE AND DELAYS

.1 Failure by the Contractor to carry out Work in accordance with the requirements of this Section will result in the Contractor being liable for any fines, levies or penalties made under environment-related Acts or Regulations of the Province of New Brunswick and the Government of Canada, and may result in suspension of Work, until the Contractor commences the Work as specified and/or takes remedial measures to repair or compensate for any environmental damage resulting from his inaction or improper action in carrying out the Work.

.2 Any delays to the Contractor's Work operation resulting from suspension of Work for failure to follow the requirements of this Section will not be considered as a basis of claim for extra costs, nor for any extension of the Contract Completion Date.

1.4 EROSION CONTROL

.1 Erosion control measures to be reviewed with Engineer and Regulatory Authorities.

.2 Erosion control measures to be put in place prior to construction.

2 Products

2.1 MATERIALS

.1 All materials to be supplied by the Contractor.

.2 Sediment Control Fence Geotextile shall be supplied in accordance with the requirements of Section 350, Type W1.

.3 Erosion Control Structure Geotextile shall be supplied in accordance with the requirements of Section 350, Type N1.

3 Execution

3.1 DISPOSAL OF WASTES

.1 Do not bury rubbish and waste materials on site.

.2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

3.2 WORK ADJACENT TO WATERCOURSES

.1 The Contractor shall not commence work within 30m of a watercourse without the Department of Environment approval.

.2 The Contractor shall follow the conditions of approval stated in the Certificate of Approval to Construct as required by the New Brunswick Water Quality Regulation.

3.3 DRAINAGE

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.

.2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.

.3 During dewatering, the Contractor shall ensure that any turbid water pumped out or released from the project limits, has a suspended solids level, by the time it reaches a watercourse, of no more than 25 mg/L or other level approved by the Department of the Environment or the province of New Brunswick.

.4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements or as required by the Engineer.

.5 All necessary precautions shall be taken by the Contractor to prevent discharge or loss of harmful material into a watercourse or sewer including but not limited to creosote, hydrocarbons, biocides, fertilizers, cement, lime, paint or fresh concrete.

3.4 SITE CLEARING

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Minimize stripping of topsoil and vegetation.

.3 No clearing, grubbing, excavation, embankment construction or installation of drainage structures shall take place within the buffer zones on both sides of a natural watercourse, until the appropriate sediment control fence and erosion control are installed.

3.5 POLLUTION CONTROL

.1 Supply, install and maintain temporary erosion and pollution control devices such as filter fabric barrier and sediment control fence as required on the site. No payment will be made for this item, as it is considered incidental to the Work.

.2 Control emissions from equipment and plant to local authorities' emission requirements.

.3 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

.4 Keep paved surfaces clean. Control dust by application of calcium chloride or water.

3.6 SEDIMENT CONTROL FENCE

.1 The material may be supplied as pre-fabricated or may be constructed on site from the individual components required.

.2 The Contractor shall carry out the work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

.3 The sediment control fence shall be installed as indicated on the Contract Drawings. Prefabricated sediment control fence shall be installed as per the manufacturer's instructions.

.4 The Contractor shall maintain the sediment control fence in a functional condition continuously from the time of installation until the completion of the Contract.

.5 The Contractor shall inspect all sediment control fences after each rainfall and at least daily during periods of prolonged rainfall.

.6 The Contractor shall immediately repair any damage to sediment control fences or parts thereof.

.7 The Contractor shall remove retained sediment prior to it having accumulated to a level approximately but not exceeding one-half of the height of the fence, and this sediment shall be disposed of at a location at least 30 m away from any watercourse, in such a manner that the sediment will not be returned to the Work Area or the watercourse.

.8 The Contractor shall remove all sediment control fence and the time of such removal shall be subject to the Engineer's approval but in all cases shall occur prior to the completion of the Contract.

- .1 Sediment control fence removed shall be the property of the Contractor and shall be disposed of outside the Work Site.

.9 The sediment control fence is to be installed upstream from the area to be protected, in order to prevent silt from being conveyed to an adjacent property or watercourse.

.10 Sediment control fence should be located so they are protected from damage by heavy equipment.

.11 If the barrier is to be constructed across a wide ditch or swale carrying low flow, ensure that the ends of the fence are keyed-in to the sides of the ditch to prevent end flow. If the side slopes of the ditch are steep, regrade to a more stable slope.

.12 Sediment control fence constructed on site shall be as per the description below:

- .1 Excavate a 100mm by 100mm trench in a crescent shape across the flow path, with ends pointing upslope.
- .2 Drive sturdy 50mm square wood stakes, spaced 1m apart, securely into the ground along the downslope side of the trench.
- .3 The filter fabric should be in a continuous roll and cut to its desired length.
- .4 Staple the filter fabric to the upstream side of the stakes, extending the bottom 200mm into the trench.
- .5 The sediment control fence should not exceed 900mm in height.
- .6 Backfill and compact the soil in the trench over the filter fabric.
- .7 Vegetate exposed soil immediately

.13 As required, water flow is to be slowed down through the use of sand bags/hay bales and cobble size sandstone laid along the drainage area.

.14 In areas of potential sheet flow runoff where construction activity may cause the drainage runoff to transport sediment(s), and the Contract Documents do not provide for sediment control fences in those areas, the Contractor shall ensure that sediment control fences are properly located for effective runoff control.

3.7 EROSION CONTROL STRUCTURE

.1 All erosion control structure(s) installed shall be NBDOT, Type “D”.

.2 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

.4 Erosion control structures to be located as shown on the Contract Drawings, or in areas of potential sheet flow runoff where construction activities may cause the drainage run-off to transport sediment(s).

.5 Erosion control structure(s) shall be maintained, including the removal of retained sediment deposits, in such a manner that the underlying geotextile and ground receive the minimum of disturbance.

.6 The Contractor shall inspect all erosion control structure(s) after each rainfall and at least daily during periods of prolonged rainfall.

.7 The Contractor shall remove retained sediment deposits prior to the level of the sedimentation reaching a point within 100 mm of the crest of the notch, and this sediment shall be disposed of at a location at least 30 m away from any watercourse, in such a manner that the sediment will not be returned to the Work Area or the watercourse.

.8 The Contractor shall remove all erosion control structure(s) and the time of such removal shall be subject to the Engineer’s approval but in all cases shall occur prior to the completion of the Contract.

.1 Erosion control structure(s) removed shall be the property of the Contractor and shall be disposed of outside the Work Site.

3.8 FIRE PROTECTION

.1 Provide supervision, attendance and fire protection measures as required.

3.9 TREE & PLANT PROTECTION

.1 Protect trees and plants on site and adjacent properties using method approved by the Engineer.

.2 Protect roots of trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.3 Minimize stripping of topsoil and vegetation.

.4 Restrict tree removal to areas indicated or designated by Engineer.

.5 Limbs of mature trees damaged by construction operations shall be cut clean with a sharp saw immediately after occurrence. The cut must then be sealed with an approved tree wound dressing in accordance with the manufacturer’s recommendations.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
330 Curbs, Gutters and Sidewalks
340 Asphalt Paving

1.2 REFERENCE

.1 Manual of Uniform Traffic Control Devices for Canada, latest edition.

.2 New Brunswick Department of Transportation Work Area Traffic Control Manual.

1.3 MEASUREMENT FOR PAYMENT

.1 All costs for traffic control flagging services, devices, warning signs, warning barrels, lights and other safety measures will be considered incidental to the project.

1.4 CONTRACTOR RESPONSIBILITY

.1 The entire work is at the contractor's risk and he will be held responsible for all accidents or injuries which may happen to the work or individuals until the job is formally taken over by the owner.

1.5 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul materials or equipment.

.2 When working on travelled way:
- .1 Place equipment in position to present minimum of interference and hazard to travelling public.
- .2 Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
- .3 Do not leave equipment on travelled way overnight.

.3 Do not close any lanes of roads or highway without approval of Engineer. Before re-routing traffic erect suitable signs and devices in accordance with instructions contained in Part D of MUTCD. Two lanes of traffic must be maintained at all times. Deviation from this must be approved 48 hours in advance.

4 Keep travelled way well graded, free of pot holes and of sufficient width that required number of lanes of traffic may pass.
- .1 Provide minimum 7m wide temporary roadway for traffic in two-way sections through work and on detours.
- .2 Provide minimum 5m wide temporary roadway for traffic in one-way sections

through work and on detours.

.5 Provide and maintain road access and egress to property fronting along work under Contract and in other areas as indicated, unless other means of road access exist that meet approval of Engineer.

1.6 INFORMATION AND WARNING DEVICES

.1 Provide, erect and maintain signs, flashing warning lights, warning barrels (plastic type) and other devices required to indicate construction activities or other temporary and unusual conditions resulting from project work which may require road user response.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in Part D, Temporary Conditions Signs and Devices, of MUTCD manual and in accordance with the NBDOT Work Area Traffic Control Manual.

.3 Place signs and other devices in locations recommended in MUTCD manual and by NBDOT practise.

.4 Meet with Engineer prior to commencement of work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Engineer.

.5 Continually maintain traffic control devices in use by:
- .1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
- .2 Removing or covering signs which do not apply to conditions existing from day to day.

1.7 CONTROL OF PUBLIC TRAFFIC

.1 Provide flag persons, trained in accordance with the NBDOT Certification, and properly as specified in, MUTCD manual in following situations:
- .1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.
- .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal is not in use.
- .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
- .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
- .5 For emergency protection when other traffic control devices are not readily available.
- .6 In situations where complete protection for workmen, working equipment and public traffic is not provided by other traffic control devices.
- .7 Delays to public traffic due to contractor's operations not to exceed 10 minutes.

1.8 TRAFFIC CONTROL PLAN

.1 Upon award of the work, develop a 1:1000 scale drawing showing the traffic control measures that will be maintained on the site. Along with this plan, prepare an inventory of all signs and equipment that will be used. Provide four copies of this plan to the Engineer for review.

.2 Designate one person who will be responsible for traffic controls.

.3 The completion of proper traffic control procedures will be the sole responsibility of the Contractor. Random inspections to assess conformity to the applicable regulations will be conducted. Failure to comply with the regulations and the reviews of "Traffic Control Measures Plan" will result in non-payment.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
120 Topsoil, Hydroseeding & Sodding
140 Clearing and Grubbing
150 Environmental protection
170 Traffic Control

Section 200: UNDERGROUND INFRASTRUCTURE
220 Sanitary Sewers
230 Storm Sewers
240 Manholes, Catch Basins & Sluice Boxes
250 Water Mains
260 Pipe Culverts

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
320 Crushed Rock Base & Sub Base Materials
330 Curbs, Gutters and Sidewalks
340 Asphalt Paving
350 Geotextile and Geogrid
370 Quality Control
380 Architectural Street Light

1.2 PROTECTION OF EXISTING FEATURES

.1 Existing buried utilities and structures:
- .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
- .2 Prior to commencing any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.
- .3 Confirm locations of buried utilities by careful test excavations.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated. Obtain direction of Engineer before moving or otherwise disturbing utilities or structures.
- .5 Advise Engineer and utility company to remove or re-route existing lines in area of excavation. Pay costs for such work.
- .6 Record location of maintained, re-routed and abandoned underground lines.
- .7 Damage to any existing features by the contractor, regardless of whether these features are shown of the plans or indicated otherwise, shall be repaired to a condition satisfactory to the owner and the contractor shall pay all related costs.

.2 Existing buildings and surface features:
- .1 Conduct with Engineer condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.
- .2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage from work.
- .3 Where excavation necessitates root or branch cutting, do so only when approved by the Engineer.
- .4 Engineer will have pre-construction photographs of site.

1.3 SHORING, BRACING AND UNDERPINNING

.1 Engage services of qualified professional engineer who is registered in the Province of New Brunswick to design and inspect cofferdams, shoring, bracing and underpinning required for work.

.2 At least 2 weeks prior to commencing work, submit design and supporting data to Owner's Engineer for review.

.3 Design and supporting data submitted to bear the stamp and signature of qualified professional engineer licensed to practice in New Brunswick.

.4 Professional engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of Contractor, in which case Contractor shall submit proof that work by professional engineer is included in Contractor's insurance coverage.

1.4 SAMPLES

.1 At least 1 week prior to commencing work, inform Engineer of proposed source of fill materials and provide access for sampling.

1.5 MEASUREMENT FOR PAYMENT

.1 Work performed under this Section will be incidental to work involved in Sections 120, 220, 230, 240, 250, 260 and 310.

.2 Dimensions of Trenches in Rock

- .1 Rock shall be excavated to a depth of at least 300 mm below the bottom of the pipe to be installed. Width of a single pipe trench excavation in rock shall be no greater than 600mm wider than the outside diameter of the pipe.
- .2 When two or more mains are in a common trench, the width of trench shall be as specified for a singe main plus 600mm clearance between pipes.
- .3 For a single service laterals; the maximum width of trench shall be the pipe outside diameter plus 600mm.
- .4 For any combination of two service laterals, the maximum width of trench shall be the two pipes outside diameter plus 800mm.
- .5 For three service laterals, the maximum width of trench shall be the three pipes outside diameter plus 900mm.

.3 Shoring, bracing, cofferdams, underpinning and de-watering of excavation will be incidental to work and will not be measured separately.

.4 Restoration of all trenches and any areas disturbed during the progress of the work including topsoil, seeding, road base, compaction, crushed stone, grading, lawns, driveways and all related work will not be measured but shall be considered as incidental to the work.

.5 Disposal of excess trench material will not be measured but will be incidental to the work. All excess fill material is to be trucked to the location mentioned in the Instructions to Tenderers then levelled to the satisfaction of the Owner.

.6 Topsoil stripping: see Section 120.

2 Products

2.1 BEDDING MATERIALS

.1 **Type 1 Granular Bedding** material to the following requirements;

.1 Crushed rock consisting of clean, hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified (0-25mm or 0-31.5mm) when tested to the latest version of ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on semi-log grading chart and shall conform to the latest standards in the NBDOT Standard Specification Item 415 and Table 210-1.

.2 **Type 4 Drainage Stone** (5mm-20mm)

.1 Clean, sound durable crushed rock, crushed gravel or pit-run gravel.

.2 Gradations to be within limits specified when tested to the latest version of ASTM C136 and to have a smooth curve without sharp breaks when plotted on semi-log grading chart. The specified gradation required is as per Table 210-1.

Table 210-1
Grading Limits

	Type 1	Type 1	Type 2	Type 4
	DOT Type A	DOT Type B		DOT Type C
ASTM Sieve Size	0-31.5 mm % passing	0-25 mm % passing	Sand % passing	5-20 mm % passing
90 mm	-	-	-	-
75 mm	-	-	-	-
63 mm	-	-	-	-
50 mm	-	-	-	-
37.5 mm	100	-	-	-
31.5 mm	95-100	100	-	-
25 mm	81-100	95-100	100	100
19 mm	66-90	71-100	100	90-100
12.5 mm	50-77	56-82	-	0-90
9.5 mm	41-70	47-74	50-100	0-60
4.75 mm	27-54	31-59	-	0-20
2.36 mm	17-43	21-46	30-90	0-8
1.18 mm	11-32	13-34	5-30	-
.300 mm	4-19	5-18	-	-
.075 mm	0-8	0-8	5	0-3

Table 210-2
Physical Properties - Granular and Sand Bedding

Test and Method	Aggregate Type	Maximum % Loss
Micro-Deval (MTO LS618)	**Bedding & Backfill**	**35**
Plasticity Index (ASTM D4318)	**Bedding & Backfill**	**6% max**

2.2 BACKFILL MATERIALS

.1 Trench excavated material shall be selected excavated pervious soil, free from roots, rocks larger than 75 mm, frozen particles and building debris.

.2 The surface layer of the trench shall conform to the requirements for the project. These may include the pavement structure, concrete surface, landscaped area of other area. Materials shall conform to the requirements of the plans, and specifications.

2.3 UNSHRINKABLE FILL MATERIALS

.1 Portland cement shall conform to the requirements of CAN/CSA A5, Type 10 or Type 30 (High early strength for winter construction).

.2 Supplementary cementing materials, when permitted, shall conform to CAN/CSA A23.5.

.3 Both fine and coarse aggregate shall conform to CSA A23.1. The gradation shall conform to Table 1 of the Standard for 10mm minus.

.4 Mixing water shall meet the requirements of CSA A23.1.

.5 Air-entraining admixtures shall conform to CSA A23.1 and ASTMC260.

.6 Mix Design:

.1	Maximum cement content:	25 kg/m^3
.2	Maximum compressive strength at 28 days:	0.40 MPa.
.3	Slump (in accordance with CSA A23.2):	150 - 200mm
.4	Air content (in accordance with CSA A23.2):	4% - 6%.

.7 Prior to the production of unshrinkable fill for use, the Contractor shall provide a certificate stating that the fill to be supplied conforms with the above requirements.

3 Execution

3.1 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly. Digging of asphalt by machine will not be permitted. ALL ASPHALT SURFACES SHALL BE NEATLY CUT USING WHEEL OR SAW OR JACK HAMMER PRIOR TO COMMENCING ANY EXCAVATION.

3.2 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil

structure is adversely affected.

.2 Commence topsoil stripping of areas after clearing and grubbing operations have been satisfactorily completed.

.3 Strip topsoil to depths of 200 mm below surface after clearing and grubbing is complete. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations indicated on drawings.

3.3 STOCKPILING

.1 Stockpile fill materials in designated areas. Stockpile granular materials in manner to prevent segregation. Protect fill materials from contamination.

3.4 COFFERDAMS, SHORING, BRACING, AND UNDERPINNING

.1 Construct temporary works to depths, heights, and locations as indicated. The works shall be excavated according to the requirements of the General Regulation 91-191 under the Occupational Health and Safety Act of the Province of New Brunswick, latest revision.

.2 During backfill operation:
- .1 Unless otherwise indicated or directed by Engineer remove sheeting and shoring from excavations.
- .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.3 When sheeting is required to remain in place, cut off tops at elevations indicated.

.4 Upon completion of substructure construction:
- .1 Remove cofferdams, shoring and bracing.
- .2 Remove excess materials from site and restore water courses to conditions indicated.

3.5 DEWATERING

.1 Keep excavations free of water while work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

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

3.6 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions indicated. All trenches shall be excavated according to the requirements of the General Regulation 91-191 under the Occupational Health and Safety Act of the Province of New Brunswick, latest revision.

.2 Remove concrete, masonry, pavement, walks, demolished foundations and rubble and other obstructions encountered during excavation.

.3 Excavation must not interfere with normal 45 deg. splay of bearing from bottom of any footing.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

.5 Do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Dispose of surplus and unsuitable excavated material in approved location off site.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Do not allow the contents of any sewer or sewer connection to flow into trench.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Notify Engineer when soil at bottom of excavation appears unsuitable.

.11 Remove unsuitable material from trench bottom to extent and depth directed by Engineer and place and compact suitable imported material.

.12 Where required due to unauthorized over-excavation, correct as follows at no expense to the Owner:
- .1 Fill under bearing surfaces and footings with fill concrete.
- .2 Fill under other areas with Type 1 Granular Bedding & Backfill compacted to minimum of 95% of the maximum dry density as determined by ASTM D698.

.13 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout.

3.7 PIPE BEDDING

.1 At least two (2) weeks prior to commencing work inform Engineer of proposed source of bedding and fill materials and provide access for sampling.

.2 Bedding methods and materials must conform with the pipe manufacturer's requirements.

.3 Do not place bedding material until trench is properly shaped and compacted and free from snow and ice.

.4 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.5 Place bedding in 150 mm lifts to a minimum height of 300 mm in rock and compacted to a minimum of 95% of the maximum dry density as determined by ASTM D698.

.6 Once the trench has been excavated to the required grade, place a minimum depth of 150 mm or 300mm in rock of bedding and compact to 95% of the maximum dry density as determined by ASTM D698.

.7 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.

.8 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.

.9 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.

.10 Pipe bedding material must not be placed in water or trenches having soft and unstable bottom conditions.

.11 Compacting equipment for pipe bedding material must be suitably sized to provide the specified degree of compaction without causing damage to or movement of the pipe.

.12 Bedding must meet the requirements for a Type 1 granular bedding on PVC, corrugated metal pipe, concrete pipe, ductile iron pipe as per Detail No. 1 and all lateral piping as per Detail No. 2 and 2-1.

3.8 BACKFILLING

.1 Do not proceed with backfilling operations until pipe grade and alignment has been inspected by the Engineer.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Backfilling around installations:
- .1 Place bedding and surround material as specified elsewhere, compact to 95% of the maximum dry density as determined by ASTM D698.
- .2 Do not backfill around or over cast-in-place concrete within 24 hrs after placing.
- .3 Place material by hand under, around and over installations until 600 mm of cover is provided. Dumping material directly on installations will not be permitted.

.5 Place backfill material in layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer to a minimum of 95% of the maximum dry density as determined by ASTM D698 before placing succeeding layer.

.6 Compacting equipment used during trench backfill operations shall be a sheep's foot compactor suitably sized to provide the specified degree of compaction required. In areas not accessible to compacting equipment a mechanical tamper shall be used.

.7 Backfilling operations must not be carried out in freezing weather without written approval from the Engineer. When backfilling is performed in freezing weather, neither the material being used nor the area being filled shall be frozen.

.8 Clean and properly disposed of excess backfill material at the end of each day.

.9 When the Engineer designates that unshrinkable fill is to be placed as backfill and when the utility has been repaired or installed, bedded and protected with sand as required, the trench shall be filled with the flowable, unshrinkable fill, up to the underside of the pavement materials. Internal vibrators or other methods of consolidation may be used to ensure that any undercut areas if pavement are fully supported.
- .1 If the excavation is within the traveled portion of the roadway, it shall be covered for at least 24 hours with a steel plate of sufficient strength to support traffic for this period. Where road traffic is not accommodated, it shall be covered with wooden planking or other protection for users until the unshrinkable fill will support the weight of an adult person.
- .2 When unshrinkable fill is being used in a water main trench, full-width horizontal 50mm polystyrene board insulation should be placed at approximately 100mm above the buried pipe.

3.9 INSPECTION AND TESTING

.1 Testing of materials and compaction will be carried out by an accredited testing laboratory. Frequency of tests will be determined by Engineer.

.2 Owner will pay costs for inspection and testing. If tests proves unsatisfactory then future tests will be at the expense of the Contractor.

3.10 RESTORATION

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects noted by Engineer.

.2 Replace topsoil as indicated.

.3 Reinstate pavement, driveways, sidewalks, and lawns etc to new condition and initial elevation which existed before excavation unless otherwise shown of drawings.

.4 Clean and reinstate areas affected by work.

.5 Reinstate driveways to original condition.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
130 Concrete
150 Environmental Protection
170 Traffic Control

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines
240 Manholes, Catch Basins & Sluice Boxes
270 Video Inspection

Section 300: STREETS & ROADWAYS
320 Crushed Rock Base & Sub Base Materials

1.2 MATERIAL CERTIFICATION

.1 At least 2 weeks prior to commencing work submit manufacturer's test data and certification that pipe materials meet requirements of this section.

1.3 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Maintain existing sewage flows during construction.

.3 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.4 MEASUREMENT FOR PAYMENT

.1 Supply and installation of sanitary sewer pipe including excavation, dewatering, bedding, backfilling, restoration, connection to manhole, connection to existing service laterals, testing, video inspection and all incidentals will be measured horizontally from manhole to manhole in linear metres of each size pipe supplied and installed.

.2 Sanitary service laterals including excavation, dewatering, bedding, supply and installation of the pipe, saddles, connection tees, bends, pipe caps, backfilling, marker stakes, connections, couplings, removals, disposal of excess or unsuitable materials, restoration, testing and all incidentals will be measured in lineal meters of each size pipe supplied and properly installed from the center of the sewer main to the end cap or connection at the property line..

.3 Connection of new sanitary service lateral to sewer mains and connection of new sanitary service lateral to existing service lateral via approved coupling will be considered incidental to the work.

.4 Pipe insulation shall be measured in square metres of insulation placed.

2 Products

2.1 SANITARY SEWER MAINS

.1 PVC - PVC (Polyvinyl Chloride) pipe: to ASTM D3034 and CSA B182.2.
.i Minimum sanitary sewer main diameter: 200mm

.ii Standard Dimensional Ratio (SDR): 35
.iii Locked-in gasket and integral bell system. Rubber gaskets to CAN/CSA A257.3
.iv Colour coded GREEN

.2 CONCRETE - RCP (reinforced concrete) pipe: to ASTM C76 and CAN/CSA A257.2.
.i Class: 65D or (ASTM Class III), 100D or (ASTM Class IV), 140D or (ASTM Class V) as indicated on the detail drawings.
.ii Locked-in gasket and integral bell system with flexible rubber gasket joints to CAN/CSA A257.3.

2.2 ACCEPTABLE PRODUCT WHEN APPROVED BY THE ENGINEER

.1 Dual wall corrugated PVC (Polyvinyl Chloride) pipe: to ASTM F794-97 and CAN/CSA B182.4.
.i Minimum sanitary sewer pipe diameter: 200mm.
.ii Locked in gasket and integral bell system with internal hydrostatic pressure of at least 100kPa (15psi)
.iii Colour coded GREEN

2.3 SANITARY SERVICE LATERALS

.1 PVC (Polyvinyl Chloride) pipe: to ASTM D3034 and CSA B182.2.
.1 Minimum sanitary sewer service lateral diameter: 100mm.
.2 Standard Dimensional Ratio (SDR): 35
.3 Locked-in gasket and integral bell system. Rubber gaskets to CAN/CSA A257.3
.4 Colour coded GREEN

.2 Tee connections and fittings to the PVC sanitary main to be PVC pipe DR35 to ASTM D3034 and CSA B182.2 complete with integral gaskets.

.3 Tee connections and fittings to the concrete sanitary main shall be “Inserta-tee” to ASTM and F477 and ASTM D3212 or “Quik Seal” with stainless steel clamp to ASTM C 923 complete with integral gaskets.

.4 Sanitary service saddles: with oil resistant gaskets, stainless steel clamp and oil resistant "0" rings in branch end may be utilized upon authorization of the Owner.

.5 Bends shall be of the long radius type only.

2.4 PIPE BEDDING

.1 Bedding material shall conform to the following specifications:
.1 PVC: Type 1 bedding material shall be as per Section 210 and Detail No. 1.
.2 Concrete Pipe: Type 1 bedding material as per Section 210 and Detail No.1.
.3 Type 4 drainage stone material as per Section 210 shall be used for wet trench conditions and may be used up to the spring line of the pipe with a non-woven geotextile filter fabric on top of drainage stone to hinder the migration of fine materials into the rocks as per section 350 as approved by the Engineer.

2.5 STYROFOAM INSULATION

.1 To have the following properties:
- .1 Compressive strength of 100 psi
- .2 Tensile strength of 125 psi
- .3 Shear strength of 50 psi
- .4 Flexural strength of 85 psi

.2 To be DOW HI-100 or approved equal

3 Execution

3.1 PREPARATION

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

3.2 TRENCHING AND BACKFILL

.1 Trenching and backfill work to be done in accordance with Section 210.

3.3 TYPE 1 GRANULAR BEDDING

.1 Place Type 1 granular bedding materials in accordance with Section 210.

.2 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with bedding material.

3.4 INSTALLATION

.1 Approved laser alignment equipment must be used to control line and grade during all pipe laying.

.2 Lay and join pipes in accordance with manufacturer's recommendations and in accordance with recognized good practice.

.3 Handle pipe with approved methods. Do not use chains or cables passed through pipe bore.

.4 Pipe shall be thoroughly inspected in the field before and after laying. Any defective or damaged pipe shall be immediately removed from the site and replaced with new sound material at the Contractor’s expense.

.5 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 and with uniform bearing throughout its full length. The Engineer will be the sole judge of the deviation and the required corrective work. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken out and re-laid at the Contractor’s expense.

.6 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.7 Trenches where pipe laying is in progress shall be kept dry and no pipe shall be laid in water or upon wet bedding. As the pipes are laid, they must be thoroughly cleaned and the bore protected from dirt and water. No length of pipe shall be laid until the preceding length has been thoroughly embedded and secured in place so as to prevent any

movement or disturbance of the pipe.

.8 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.9 Do not allow water to flow through pipe during construction, except as may be permitted by Owner.

.10 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.11 Position and join pipes by manufacturer's approved methods. Do not use construction equipment to force pipe sections together.

.12 Install PVC pipe and fittings in accordance with CSA B181.12.

.13 Pipe jointing:
- .1 Support pipes with bedding as required to minimize lateral pressure on the gasket and maintain concentricity until pipe is properly positioned.
- .2 Align pipes carefully before joining.
- .3 Maintain pipe joints free from mud, silt, gravel and other foreign material before joining.
- .4 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gasket; clean, lubricate and replace gasket before joining is attempted.
- .5 Complete each joint before laying next length of pipe.
- .6 Minimize joint deflection after joint has been made to avoid joint damage.
- .7 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.14 Block pipes when any stoppage of work occurs to prevent "creep" during down time.

.15 Cut pipes only 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 spigot end at right angles to axis of pipe.

3.5 SANITARY SERVICE LATERALS

.1 Install pipe to manufacturer's standard instructions and specifications and as indicated on the detail drawings.

.2 Maintain pipe grade at 2% minimum unless directed otherwise by Engineer.

.3 Sanitary service lateral connections to sanitary sewer main: approved Tee fittings or approved saddles.

.4 Sanitary service lateral connection pipe: not to extend into interior of sanitary sewer main.

.5 Make up required horizontal and vertical bends from 45° long radius bends or less.

.6 Plug sanitary service laterals with water tight caps or plugs unless service is presently active. If active make connection to existing sanitary sewer lateral.

.7 Place location marker at ends of plugged or capped unconnected sanitary service laterals. Each marker shall consist of 50 x 100 mm stake extending from pipe invert to 0.6m above final finished landscape grade. Paint exposed portion of stake red with designation SAN SWR in black.

3.6 FIELD TESTING

.1 Perform exfiltration testing as soon as practicable after pipe line section is complete, and service connections have been installed.

.2 Remove foreign material from sewers and related appurtenances by flushing with water.

.3 Video Inspections:
- .1 Contractor will carry out video inspection of sewer system in accordance with Section 270. Notify Engineer 24 hours in advance of inspection.

.4 Repair or replace pipe, pipe joint or bedding found defective.

.5 Do exfiltration testing as directed by Engineer. Perform tests in presence of Engineer. Notify Engineer 24 hrs in advance of proposed tests.

.6 Carry out tests on each section of sewer between successive manholes including service connections.

.7 Exfiltration Test (Air):
- .i When testing the sewer main with air, supply low pressure air to the plugged pipe sections and slowly fill until the internal air pressure is 25 kPa (4psi) above the average back pressure of any groundwater above the pipe.
- .ii Allow a minimum of two minutes for temperature stabilization.
- .iii Pipe section must maintain zero (0) pressure drop for one minute. Any drop in pressure will represent air lost from the test section.
- .iv Repair as necessary until there is no leakage.
- .v Test all pipe less than 375mm in diameter from manhole to manhole. Test pipes larger than 375mm or concrete pipe in accordance with the Engineer's direction.
- .vi Test will also be considered satisfactory, when approved by the Engineer, if the time required for the pressure to drop from 25kPa to 15kPa in the test length of pipe is not less than the time, t, in seconds calculated form the formula:

  T = 15 D x F, in seconds where
  D = inside pipe diameter in mm
  F = loss factor in cubic meters of air lost per cubic metre of internal pipe volume.
- .vii Repair and retest sewer line as required, until test results are within limits specified.
- .viii Perform Video Inspection of the sanitary sewer system in accordance with Section 270, after all repairs have been made (at the discretion of the Engineer). Notify Engineer 24 hours in advance of inspection.

END OF SECTION

1 General

1.1 RELATED WORK

Section 10: GENERAL CONDITIONS
130 Concrete
150 Environmental Protection
170 Traffic Control

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines
240 Manholes, Catch Basins & Sluice Boxes
270 Video Inspection

Section 300: STREETS & ROADWAYS
320 Crushed Rock Base & Sub Base Materials

1.2 MATERIAL CERTIFICATION

.1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section.

.2 Submit shop drawings of pipes larger than 1200 mm.

1.3 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Maintain existing flow during construction.

.3 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.4 MEASUREMENT FOR PAYMENT

.1 Supply and installation of storm sewer pipe including excavation, dewatering, bedding, backfilling, restoration, connection to manhole, video inspection and all incidentals will be measured horizontally from manhole to manhole in linear metres of each pipe size supplied and installed.

.2 Storm service laterals including excavation, dewatering, bedding, supply and installation of the pipe, saddles, connection tees, bends, pipe caps, backfilling, marker stakes, connections, couplings, removals, disposal of excess or unsuitable materials, restoration, testing and all incidentals will be measured in lineal meters of each size pipe supplied and properly installed from the center of the sewer main to the end cap or connection at the property line.

.3 Service lateral connection to storm sewer mains, connection of new service laterals or pipe to existing laterals via approved coupling will be considered incidental to the work.

.4 Catch basin leads, sluice box leads and ditch leads will be measured in lineal metres of each pipe size installed including excavation, dewatering, bedding, core drilling, supply and installation of pipe, inlet control devices, connections, elbows, couplings, gaskets, backfilling, capping and abandonment of existing catch basin leads, removal and disposal of all unsuitable and excess materials, and all incidental items.

.5 Installation of perforated drainage pipe will be measured in lineal metres acceptably installed.

.6 Pipe insulation shall be measured in square metres of insulation placed.

.7 Removal of existing storm lines shall be in lineal metres acceptably removed, including all excavation, backfilling, and restoration.

.8 Removal of existing storm outfalls shall be in units acceptably removed, including all excavation, concrete plugs, backfilling, and restoration.

2 Products

2.1 STORM SEWER MAINS

.1 PVC - PVC (Polyvinyl Chloride) pipe: to ASTM D3034 and CSA B182.2.
- .i Minimum storm sewer main diameter: 300mm.
- .ii Standard Dimensional Ratio (SDR): 35
- .iii Locked-in gasket and integral bell system. Rubber gaskets to CAN/CSA A257.3
- .iv Colour coded GREEN
- .v 100mm wide marker tape with the words “STORM SEWER” in 50mm letters at 1.0m intervals shall be installed on top of the crushed rock.
- .vi Plugs and caps shall be an approved PVC plug or cap complete with gasket seal and shall meet the requirements in section 2.2.1, 2.1.1.ii and 2.1.1.iii.

.2 CONCRETE - RCP (reinforced concrete) pipe: to ASTM C76 and CAN/CSA A257.2.
- .i Minimum storm sewer main diameter: 300mm.
- .ii Class: 65D or (ASTM Class III), 100D or (ASTM Class IV), 140D or (ASTM Class V) as indicated on the drawings.
- .iii Locked-in gasket and integral bell system with flexible rubber gasket joints to CAN/CSA A257.3.
- .iv Lifting holes:
  a) Pipe 900 mm and less diameter: no lift holes.
  b) Pipe greater than 900 mm diameter: lift holes not to exceed two per pipe.
  c) Provide pre fabricated plugs to effectively seal lift holes after installation of pipe.
- .vi Plugs and caps shall be an approved concrete plug or cap complete with gasket seal and shall meet the requirements in section 2.1.2, 2.1.2.ii and 2.1.2.iii.

2.2 ACCEPTABLE PRODUCT WHEN APPROVED BY THE ENGINEER

.1 Dual wall corrugated PVC (Polyvinyl Chloride) pipe: to ASTM F794-97 and CAN/CSA B182.4.
- .i Minimum storm sewer pipe diameter: 300mm.
- .ii Locked in gasket and integral bell system with internal hydrostatic pressure of at least 100kPa (15psi)
- .iii Colour coded GREEN
- .iv 100mm wide marker tape with the words “STORM SEWER” in 50mm letters at 1.0m intervals shall be installed on top of the crushed rock.
- .v Plugs and caps shall be an approved PVC plug or cap complete with gasket seal and shall meet the requirements in section 2.2.1, 2.2.1.ii and 2.2.1.iii.

.2 Profile High Density Polyethylene (HDPE) pipe: to CAN/CSA B182.8
- i. Minimum Storm Sewer pipe diameters: 300mm
- ii. Minimum pipe stiffness of 320Kpa
- iii. Type 1 (water-tight) joints, locked in gasket and integral bell system with internal hydrostatic pressure of at least 74kPa (10.7psi)

iv. 100mm wide marker tape with the words “STORM SEWER” in 50mm letters at 1.0m intervals shall be installed on top of the crushed rock.
v. Plugs and caps shall be an approved HDPE plug or cap complete with gasket seal and shall meet the requirements in section 2.2.3, 2.2.3.ii and 2.2.3.iii.
vi. Installation shall be in accordance with CSA B182.11

2.3 STORM SERVICE LATERALS

.1 PVC (Polyvinyl Chloride) pipe: to ASTM D3034 or ASTM F679 and CSA B182.1 or CSA B182.2.
- .1 Standard Dimensional Ratio (SDR): 28
- .2 Locked-in gasket and integral bell system. Rubber gaskets to CAN/CSA A257.3
- .3 Colour coded WHITE

.2 Tee connections and fittings to the PVC storm main to be PVC pipe tees DR35 to ASTM D3034 and CSA B182.2, or “Inserta-tee” with stainless steel clamp to F477 and ASTM D3212, or “Quik Seal” with stainless steel clamp to ASTM C 923 complete with integral gaskets.

.3 Tee connections and fittings to the HDPE storm main shall be “Inserta-tee” to ASTM and F477 and ASTM D3212 or “Quik Seal” with stainless steel clamp to ASTM C 923 complete with integral gaskets.

.4 Tee connections and fittings to the concrete storm main shall be “Inserta-tee” to ASTM and F477 and ASTM D3212 or “Quik Seal” with stainless steel clamp to ASTM C 923 complete with integral gaskets.

.5 Storm service saddles: with oil resistant gaskets, stainless steel clamp and oil resistant "0" rings in branch end may be utilized upon authorization of the Owner.

.6 Bends shall be of the long radius type only.

2.4 PERFORATED FLEXIBLE DRAINAGE PIPE

.1 Perforated drain pipe and fittings shall meet ASTM D3350 and be 100mm diameter (HDPE) Solflow by Soleno, Boss 1000 by Armtec or Heavy Duty Pipe by ADS, complete with factory installed non-woven polyester continuous filter sock. Pipe strength must meet or exceed a rigidity test of less than 5% deflection under 300kPa compression.

.2 Perforated drainage pipe to be individually connected directly to catch basins or storm manholes.

2.5 PIPE BEDDING

.1 Bedding material shall conform to the following specifications:
- .1 PVC Pipe: Type 1 bedding material shall be as per Section 210.
- .2 Concrete pipe: Type 1 bedding materials as per Section 210.
- .3 Type 4 drainage stone material as per Section 210 shall be used for wet trench conditions and may be used up to the spring line of the pipe with a non-woven geotextile filter fabric on top of drainage stone to hinder the migration of fine materials into the rocks as per section 350 as approved by the Engineer.

.2 Concrete required for cradles, encasement, and supports as per Section 130.

2.6 PIPE SIZES:

.1 The following minimum pipe diameters shall be utilized:

.1 300 mm – storm sewer mains
.2 200 mm – ditch leads
.2 150 mm – catch basin and sluice box
.3 100 mm – storm service laterals (residential) and valve chamber drains
.4 100 mm – perforated drainage pipe (edge drains)

2.7 STYROFOAM INSULATION

.1 To have the following properties:
  .1 Compressive strength of 100 psi
  .2 Tensile strength of 125 psi
  .3 Shear strength of 50 psi
  .4 Flexural strength of 85 psi

.2 To be DOW HI-100 or approved equal

2.8 INLET CONTROL DEVICES

.1 A PVC plug or cap inserted in the outlet pipe from the catch basin, held in place by friction or rubber coupling and strap. Plug or cap ICD's shall be made to fit the size and material of the proposed catch basin leads. ICD size to be as determined by the Engineer.

3 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 BACKFILLING

.1 Trenching and backfill work to be done in accordance with Section 210.

3.3 TYPE 1 GRANULAR BEDDING

.1 Place Type 1 granular bedding materials in accordance with Section 210.

.2 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with bedding material.

3.4 INSTALLATION

.1 Approved laser alignment equipment must be used to control line and grade during all pipe laying.

.2 Lay and join concrete pipes in accordance with manufacturer's recommendations and in accordance with ASTM C1479-00.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore.

.4 Pipe shall be thoroughly inspected in the field before and after laying. Any defective or damaged pipe shall be immediately removed from the site and replaced with new sound material at the Contractor's expense.

.5 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 and with uniform

bearing throughout its full length. The Engineer will be the sole judge of the deviation and the required corrective work. Any pipe which is not in true alignment or shows any undue settlement after laying shall be taken out and relaid at the Contractors expense.

.6 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.7 Trenches where pipe laying is in progress shall be kept dry and no pipe shall be laid in water or upon a wet bedding. As the pipes are laid, they must be thoroughly cleaned and the bore protected from dirt and water. No length of pipe shall be laid until the preceding length has been thoroughly embedded and secured in place so as to prevent any movement or disturbance of the pipe.

.8 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.9 Do not allow water to flow through pipe during construction, except as may be permitted by Owner.

.10 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.11 Position and join pipes by manufacturer's approved methods. Do not use construction equipment to force pipe sections together.

.12 Install PVC pipe and fittings in accordance with CSA B181.12.

.13 Pipe jointing:

- .1 PVC and Concrete pipe:
  - .1 Install gaskets as recommended by manufacturer if not pre-installed.
  - .2 Support pipes with bedding 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 and other foreign material before joining.
  - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gasket; clean, lubricate and replace gasket 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 ensure that joint is complete as outlined in manufacturer's recommendations.

.14 Block pipes when any stoppage of work occurs to prevent "creep" during down time.

.15 Plug lifting holes with approved prefabricated plugs, set in non-shrink grout.

.16 Cut pipes only as required for special inserts, fittings or closure pieces in neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave spigot end at right angles to axis of pipe.

.17 Make watertight connections to manholes, sluice boxes and catch basins. Manholes and catch basins shall have factory installed cast-in rubber gaskets to suit the pipes. Any additional holes required in the field shall be core-drilled and a "Kor-n-seal" connector inserted. Use non-shrink grout when suitable gaskets are not available.

.18 Use prefabricated saddles for connecting pipes to existing storm sewer pipes. Joint to be

structurally sound and watertight.

.19 Plug upstream ends of pipes with removable watertight concrete, steel or wooden bulkheads.

.20 Backfill around pipe and compact to 95% of the maximum dry density as outlined in Section 210.

.21 Perforated drainage pipe to be installed 0.30 metres behind the curb and 0.30 m below subgrade (both sides of street) connected to all catchbasins and storm manholes within curb line; pipe should be level and graded to match roadway (see DETAIL NO. 20).

3.5 INLET CONTROL DEVICES

.1 The orifice plate shall sit parallel with the inside of the catch basin.

3.6 STORM SERVICE LATERALS

.1 Install pipe to manufacturer's standard instructions and specifications and as indicated on the detail drawings.

.2 Maintain pipe grade at 2% minimum unless directed otherwise by Engineer.

.3 Storm service lateral connections to storm sewer main: approved Tee fittings or approved saddles.

.4 Storm service lateral connection pipe: not to extend into interior of storm sewer main.

.5 Make up required horizontal and vertical bends from 45° long radius bends or less.

.6 Plug storm service laterals with water tight caps or plugs unless service is presently active. If active make connection to existing storm sewer lateral.

.7 Place location marker at ends of plugged or capped unconnected storm servive laterals. Each marker shall consist of 50 x 100 mm stake extending from pipe invert to 0.6 m above final finished landscape grade. Paint exposed portion of stake red with designation STM SWR in black.

3.7 FIELD TESTING

.1 Remove foreign material from sewers and related appurtenances by flushing with water.

.2 Video Inspections:

.1 Contractor will carry out video inspection of sewer system in accordance with Section 270. Notify Engineer 24 hours in advance of inspection.

.3 Repair or replace pipe, pipe joint or bedding found defective.

.4 Repeat Video Inspection of the storm sewer system in accordance with Section 270, after all repairs have been made (at the discretion of the Engineer). Notify Engineer 24 hours in advance of inspection.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
130 Concrete
150 Environmental Protection
170 Traffic Control

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines
220 Sanitary Sewers
230 Storm Sewers
240 Water Mains

Section 300: STREETS & ROADWAYS
320 Crushed Rock Base & Sub Base Materials

1.2 MATERIAL CERTIFICATION

.1 At least 4 weeks prior to commencing work, submit manufacturer's test data and certification that materials meet requirements of this section. Include manufacturer's drawings, information and shop drawings for all manholes, chambers, catch basins and sluice boxes.

1.3 MEASUREMENT FOR PAYMENT

.1 Manholes, catch basins, and sluice boxes will be measured in units installed including supply, installation, excavation, dewatering, bedding, backfilling, ring, cover, frames, grating, any installation adjustments or materials required for the detailed elevations, testing, any restoration and all incidentals measured from top of cover or grating to lowest pipe invert.

.2 Adjusting tops of existing manholes, catch basins, or valve chambers including all excavation, backfilling, compaction, any required manhole sections, new frame and cover/grate, grouting, modifications and final structural adjustment to match finished grade, and removal and disposal of all unsuitable or excess materials will be measured by number adjusted within 450 mm. Beyond this adjustment force account basis will be utilized.

.3 Adjusting existing sluice boxes will be measured by number of units adjusted.

.4 Adjustments to C-50 type adjustable covers during the placement of asphalt pavement are considered incidental to the work.

2 Products

2.1 MATERIALS

.1 Concrete**:** to Section 130.

.2 Precast manhole sections: to ASTM C478M and CAN/CSA A257.4.

.3 Top sections: eccentric cone type with offset opening. A maximum of 600 mm of 750 mm

dia. riser shall be permitted.

.4 Precast catch basin sections: to ASTM C139 and CAN/CSA A257.4, ASTM C478M with pre-cast A-lok or integral gasket to suit pipe sizes.

.5 Precast sluice boxes: to ASTM C478 with pre-cut holes of sufficient size to suit the pipe lateral.

.6 Joints: watertight using integral rubber gaskets or Ram-nek gaskets as indicated meeting the requirements of CAN/CSA A257.3.

.7 Mortar:
- .1 Aggregate: to CSA A82.56.
- .2 Cement: to CAN3-A8.

.8 Adjusting rings: to ASTM C478M and shall be limited to 300 mm adjustments. A maximum of 600 mm of 750 mm diameter riser is permitted. Where adjustments of less than 150 mm are required only steel risers will be permitted.

.9 Drop manhole pipe: to be same as sewer pipe.

.10 Frames, gratings & covers when located in **STREETS** shall be to dimensions shown on the detail drawings and following requirements:
- .1 Adjustable manhole frames and covers shall be ductile iron and shall meet the requirements of the latest ASTM Standard A536 for ductile iron castings.
- .3 Castings to be coated with two applications of asphalt varnish sand blasted or cleaned and ground to eliminate surface imperfections.
- .4 Manhole covers shall be complete with two 20 mm round lifting holes.
- .5 Manhole frames: Top of manhole guide frame to be set level to top of crushed rock subgrade.
- .6 Catch basin covers shall be grated Wide Flange; heavy duty municipal type.

.11 Frames, gratings & covers when located **OFF-ROAD** shall be to dimensions shown of the detail drawing and following requirements:
- .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
- .2 Gray iron castings: to ASTM A-48, strength class 30B.
- .3 Castings to be coated with two applications of asphalt varnish, sand blasted or cleaned and ground to eliminate surface imperfections.
- .4 Manhole frames and covers: 411 Wide Flange; heavy duty municipal type. Cover cast with perforations and complete with four 25 mm round lifting holes.
- .5 Catch basin frames and covers shall be grated 411 Wide Flange; heavy duty municipal type.

.12 Manhole bases to match the details and drawings and shall be as follows:
- .1 Sanitary Sewer: Shall be pre-benched and include a push on rubber gasket or an "A-LOK" gasket insert connection. Any additional holes required in the field shall be core-drilled and a “Kor-n-seal” connector inserted.
- .2 Storm Sewer: Shall be pre-benched and include a push on rubber gasket or an "A-LOK" gasket insert connection and blind lift holes; to the specifications as indicated on the detail drawings. Any additional holes required in the field shall be core-drilled and a “Kor-n-seal” connector inserted. Where required, may have a maximum sump of 600mm below the pipe invert with a pre-cast homogeneous bottom.

.13 Refer to typical detail for manhole requirements.

3 Execution

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 210.

.2 Engineer must inspect outfall structures, manholes and catch basins, before installation.

3.2 CONCRETE WORK

.1 Do concrete work in accordance with Section 130.

3.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade. Complete units as pipe laying progresses.

.2 Pump excavation free of standing water and remove soft and foreign material before placing concrete base.

.4 Cast In-place units:
- .1 Set cast-in place concrete base on 150 mm minimum of well compacted granular material, compacted to 100% of the maximum dry density in accordance with ASTM D698.
- .2 Bench to provide a smooth U-shaped channel. Side height of channel to be 0.75 times full diameter of sewer. Slope adjacent floor at 1 in 10. Curve channels smoothly. Slope invert to establish sewer grade.
- .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.5 Pre-cast units:
- .1 Set pre-cast concrete base on 150 mm minimum of well compacted granular material. Compacted to 100% of the maximum dry density in accordance with ASTM D698.
- .2 Make each joint watertight with approved rubber ring gaskets or Ram-nek.

.6 For sewers:
- .1 Place stub outlets and bulkheads at elevations and in positions indicated.

.7 Installing units in existing systems:
- .1 Where a new unit is to be installed in an existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
- .2 Make joints watertight between new unit and existing pipe.
- .3 Where deemed expedient to maintain service around existing pipes and when systems, constructed under this project, are ready to be put in operation, complete installation with appropriate break outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.8 Place frame and cover on top section to elevation indicated. If adjustment required use approved cast iron risers.

.9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering pipe.

3.4 ADJUSTING TOPS OF UNITS

.1 Remove existing gratings, frames and deliver to the Town of Riverview Public Works garage or re-use at locations designated by Engineer.

.2 Manhole frames and covers in PAVED roadways shall be set 10 mm below finished grade and shall conform to the crown of the road.

.3 Manhole frames and covers in GRAVEL roadways shall be set 150 mm below crushed stone grade prior to winter snow removal operations.

.4 Manhole frames and covers located off travelled roadways shall be set 200mm above finished grade, and be complete with galvanized tie-down straps or lockdown covers and marker posts. Marker posts to be 100mm x100mm wood and shall be embedded 1 m in the ground, and protrude 1.5m above ground level and painted red.

3.5 ADJUSTING SECTIONAL UNITS

.1 Raise or lower straight walled sectional units by adding or removing pre-cast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section. When amount of raise is less than 150 mm use standard steel risers.

3.6 FIELD TESTING

.1 All sanitary sewer manholes placed shall be leakage tested either by water test or by air tightness test (vacuum test). All tests shall be conducted by the Contractor, in the presence of the Engineer. The Contractor shall notify the Engineer at least forty-eight (48) hours in advance of performing any tests. The Contractor shall follow the procedures for testing as outlined in Appendix "A - Manhole Leakage Test". The Contractor shall provide all labour, equipment and materials required to provide leakage tests on sanitary manholes. Should any sanitary manhole test prove unsatisfactory, the Contractor shall make repairs and retest at his own expense. The Contractor shall be responsible to ensure that the Appendix "A - Manhole Leakage Test" forms have been completed and submitted to the Engineer.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
130 Concrete
150 Environmental Protection
170 Traffic Control

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines
240 Manholes, Catch Basins and Sluice Boxes

Section 300: STREETS & ROADWAYS
320 Crushed Rock Base & Sub Base Materials

1.2 MATERIAL CERTIFICATION

.1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet the requirements of this section. Include manufacturer's drawings, information and shop drawings where pertinent.

.2 All materials and equipment that come into contact with potable water must meet the safety criteria and certification of NSF/ANSI Standard 61: Drinking Water System Components, or an equivalent food-grade standard, as approved by the engineer.

1.3 SHOP DRAWINGS

.1 Submit complete shop drawings and construction schedule for water mains 450mm diameter and larger.

.2 Submit shop drawings for gate valves, air release valves, fire hydrants, chambers and any special fittings.

1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by Engineer and adhere to interruption schedule as approved.

.3 The Contractor shall make arrangements with the Consultant at least 24 hrs prior to connecting to or locating existing water mains or in advance of any interruption in service.

.4 The Consultant shall coordinate with the Owner regarding schedules, methods and procedures to be followed for isolating sections of the water system and connecting to existing water mains.

.5 Notify Public Works @ **387-2025** (Emergency Number) & the Fire Department @ **387-2026** of any planned or accidental interruption of water supply.

.6 Advise local police department, ambulance operators, and fire department of anticipated interference with movement of traffic.

.7 Do not excavate near any existing water mains unless the exact location of all system

valves have been determined and these valves have been tested and operated by the owner.

.8 Under no circumstances whatsoever shall the contractor operate existing water main valves, fire hydrants, or make connections to existing water mains without the prior approval of the owner.

1.5 MEASUREMENT FOR PAYMENT

.1 WATER MAINS & FITTINGS

.1 Supply and installation of water main pipe, including excavation, dewatering granular bedding, backfilling, restoration, fittings, tie backs, including supply and installation of thrust blocks, anchors, connection to existing water main, flushing, testing, final connections to existing water mains, disinfection, de-chlorination, and any incidentals, will be measured in linear metres of each size of water main installed.

.2 All temporary works for the purpose of flushing, testing, and disinfecting including stand pipes, service tubing for injection and sampling, and chlorine shall be considered incidental to the work.

.3 Water mains shall be measured in linear metres measured horizontally, through valves and fittings, after work has been completed. The tender's list of materials and quantities will specify the water main materials to be utilized.

.4 All trench restoration and maintenance including asphalt, topsoil, sod, hydro-seeding, grading, crushed stone and driveway restoration shall be considered as incidental to the work.

.5 Water main insulation shall be measured in square metres of insulation placed.

.2 FIRE HYDRANTS

.1 Payment of fire hydrants shall be at the contract unit price for the total number of fire hydrants installed to grade, including excavation, fittings, tees, pipes, bedding, gate valve, valve box, supply and installation of thrust blocks, anchors, and mechanical restraining devices, backfilling, painting, extensions (where required) and testing.

.2 All trench restoration and maintenance including asphalt, topsoil, sod, hydro-seeding, grading, crushed stone and driveway restoration shall be considered as incidental to the work.

.3 Location and adjustment of existing fire hydrants and hydrant valve boxes shall be measured in units adjusted.

.3 WATER SERVICE LATERALS

.1 Water service laterals shall be measured in linear metres from the centre of the water main at the connection to the end of the lateral including the distance through the goose neck.

.2 Payment for water service laterals shall be at the contract unit price for water service laterals and the contract unit price for water service appurtenances

including excavation, dewatering, bedding, tapping, flushing, testing, disinfecting connecting to the main, supply and installation of main stop, service saddle, service lateral pipe, corporation couplings, curb stop and box backfilling, removal and disposal of all unsuitable or excess materials, and all incidentals.

.3 All trench restoration and maintenance including asphalt, topsoil, sod, hydro-seeding, grading, crushed stone and driveway restoration shall be considered as incidental to the work.

.4 Location and adjustment of existing curb boxes shall be measured in units adjusted including all incidentals.

.4 VALVE BOXES

.1 Location and adjustment of existing valve boxes shall be measured in units adjusted including all incidentals.

.5 GATE VALVES AND CHAMBERS

.1 Gate valves will be measured in units of each size installed including excavation dewatering, bedding, backfilling, removal and disposal of unsuitable or excess materials, supply and installation of valve, mechanical restraining devices, all fittings, and all incidentals.

.2 Valve chambers including supply and installation of the structure, excavation and backfilling, will be measured in units installed as per the details.

.3 Valve chamber drains will be measured horizontally in linear metres of pipe installed at the contract unit price for valve chamber drains including excavation, dewatering, bedding, backfilling and connecting to the storm sewer system.

.4 All trench restoration and maintenance including asphalt, topsoil, sod, hydro-seeding, grading, crushed stone and driveway restoration shall be considered as incidental to the work.

.5 Location and adjustment of existing valve chambers shall be measured in units adjusted including all incidentals.

.6 AIR RELEASE VALVES AND CHAMBERS

.1 Air release valves will be measured in units of each size installed including excavation and backfilling, and fittings.

.2 Valve chambers including supply and installation of the structure, excavation and backfilling, will be measured in units installed as per the details.

.3 Valve chamber drains will be measured horizontally in metres of pipe installed, at the contract unit price for valve chamber drains including excavation, dewatering, bedding, backfilling and connecting to the storm system.

.4 All trench restoration and maintenance including asphalt, topsoil, sod, hydro-seeding, grading, crushed stone and driveway restoration shall be considered as incidental to the work.

5 Location and adjustment of existing air release valve boxes, and air release valve

chambers shall be measured in units adjusted.

2 Products

2.1 WATER MAINS AND FITTINGS

.1 Minimum size of water mains shall be 200mm diameter.

.2 PVC PIPE

.1 Polyvinyl chloride pressure pipe meeting the requirements of AWWA C900 and CSA B137.3-M, Pressure Class 150, DR18, colour coded blue or Molecularly Oriented Polyvinyl Chloride (PVCO) pressure pipe meeting the requirements of the latest CAN/CSA Standard B137.3.1 and the latest AWWA Standard C909. PVCO shall be produced with cast-iron outside diameters (CIOD) in all sizes. PVCO pipe wall shall meet minimum thickness requirements for AWWA 909 Pressure Class 235 PSI (PC235), colour coded blue.

.2 Joints to be bell and spigot type with integral rubber gasket. This is a push-on joint and must be watertight. The bell will be an integral and homogenous part of the pipe barrel.

.3 Approved pipe up to and including 450mm diameter is to arrive on site with factory-installed end-caps on both pipe ends and a tamper evidence seal on the bell end only.

.4 Tamper evidence seals will display the manufacturer's name and/or logo. Seals will straddle the cap and/or tape and the pipe. Removal of the cap should render the tamper-evident seal unusable either by breaking the seal off or by leaving a message such as "Void" on the pipe.

.5 End-caps shall be installed at the factory and will be one of the following:

.1 White, clear, or black plastic discs or cone shaped plugs fastened with tape.
.2 Closed cell polypropylene foam (Charma Caps)
.3 Polyethylene pipe plugs (by Taylor Made)

.3 DUCTILE IRON PIPE

.1 Ductile iron pipe cement mortar lined meeting the latest requirement of AWWA C151 for ductile iron pipe pressure class 52, with cement mortar lining in accordance with the latest AWWA C104.

.2 Joints for ductile iron pipe will be push-on rubber gasket type meeting the requirements of the latest AWWA C111 for rubber gasket joints for ductile iron pressure pipe.

.4 FITTINGS & COUPLINGS

.1 All fittings (tees, crosses, bends, and caps) shall be ductile iron fittings meeting the requirements of AWWA C153, 2415 kPa class.

.2 Joints for ductile-iron will be a mechanical type meeting the requirements of the

latest AWWA C111 for rubber gasket joints for ductile-iron pressure pipe. Fittings will be complete with component parts.

.3 All iron fittings and fire hydrants shall be corrosion resistant, ductile-iron epoxy coated with steel tee bolts and nuts.

.4 Water main couplings shall be Dresser, Romac or approved equal. Couplings shall be epoxy coated ductile iron complete with steel bolts and nuts.

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2.2 VALVES AND VALVE BOXES

.1 Gate valves shall meet the requirement of the latest AWWA C509 or AWWA C515 resilient seated gate valves. Valves will be epoxy coated, iron body, brass mounted with non-rising stems, and come complete with steel tee bolts and nuts and a 50mm square operating nut. Valves to be McAvity, Mueller, or approved equal and are to open counter clockwise and be complete with component parts.

.2 Valves boxes will be , McAvity, Mueller, or approved equal.

.3 Cast iron valve boxes to be bituminous coated, three-piece screw type with minimum base diameter of 350mm. Top sections will have two lugs for turning. Valve boxes will be adjustable from 1.8m to 2.1m. Valve box adjusting threads shall be an integral part of the casting.

Or

Mueller MVB composite valve box or approved equal complete with 305mm or 686mm ductile-iron adjustable top and guide plate,

.4 Covers shall be Bibby VB_825 (112mm depth) or approved equal and have suitable openings to allow insertion of a pick for ease of removal.

2.3 AIR RELEASE VALVES

.1 Automatic air release valves shall meet the requirement of the latest AWWA C512-99 Standard for air-release valves for waterworks services. Valves will be gray cast-iron, brass or bronze with stainless steel float and designed for operating pressures less than 690 kPa, test pressure of 1000 kPa.

2.4 TAPPING SLEEVES

.1 Tapping sleeves shall be stainless steel with full seals around the circumference of the pipe. Tapping sleeves shall be Romac type SST or approved equal.

.2 Tapping valves shall be resilient seat type, meeting the requirements of AWWA C509 or AWWA C515 for gate valves. Tapping valves will be flanged to mechanical joint type.

.3 PVC tapping tees (for water service laterals only) shall meet the requirements of AWWA C907 and CSA B137.2, class 150.

2.5 VALVE CHAMBERS

.1 Precast reinforced concrete sections to ASTM C478M and CAN/CSA A257.4. Joints between sections will be rubber gasket or Ram-nek gasket as per the detail drawings.

Reference Section 240.

.2 Manhole base sections will be complete with “dog-house” openings appropriate for the size of water main and no bottom.

.3 Adjustable manhole frames and covers shall be ductile iron as per Town of Riverview Standard Municipal Specifications, Section 240 and shall meet the requirement of the latest ASTM Standard A536 for ductile iron castings. Standard off-road manhole frames and covers (411W) shall be cast iron as per Town of Riverview Standard Municipal Specifications, Section 240 and shall meet the requirements of the latest ASTM Standard A48 for gray iron castings.

2.6 WATER SERVICE LATERALS

.1 Service lateral piping shall be minimum 19mm diameter copper tubing, Type K to ASTM B88 or minimum 19mm Q-line service line to CSA B137.9, or minimum 19mm cross-linked polyethylene (PEX-A) pipe to CSA B137.5 complete with stainless steel liners at connections. Brass components shall be Mueller or approved equal meeting the requirements of ASTM B62 and threads to ASTM C800.

.2 Piping joints: compression type suitable for 1 MPa working pressure.

.3 Corporation stops: Mueller B25008 ball valve (19mm) or approved equal to ASTM B62 with inlet end having the standard corporation threads to AWWA C800 and outlet having copper or Q-line compression type connection. Product number~~s~~ show is for 19mm only.

.4 Curb stops: Mueller B25209 ball valve (no drain) (19mm) or approved equal to ASTM B62 both inlet and outlet ends having copper or Q-line compression type connections.

.5 Curb boxes for 19mm and 25mm services shall have a 25mm upper section and be adjustable to suit depth of bury, 1.8m to 2.1m, and shall be Mueller Type A-726 or approved equal, with stationary stainless steel rods (1.2m min.), stainless steel cotter pins and Type A-800 cover. Curb boxes and stem for 38mm and 50mm services shall meet the above requirements except that the model shall be Mueller Type A-728 or approved equal.

.6 Compression connections shall be the gripper ring type, having a minimum 1000 kg pull-out resistance.

.7 Service saddles for PVC pipe shall be cast bronze body with stainless steel straps and components.

2.7 FIRE HYDRANTS

.1 Fire hydrants shall be Clow Canada Brigadier M-67 or Mueller Century meeting the latest requirements of AWWA C502 designed for working pressure of 1723 kPa.

.2 Fire hydrants shall have two 65mm diameter male threaded hose outlets with caps and keeper chains and one 125mm diameter STORZ pumper outlet connection with cap and keeper chain.

.3 Pipe, gate valve, and riser barrel shall be 150 mm diameter.

.4 Outlet threads shall be as follows:

Hose nozzle: maximum OD – 2.962
maximum PD – 2.881

Threads per inch – 8
Pumper nozzle: 125mm diameter STORZ

.5 Hydrants to open counter clockwise (left) and close clockwise (right).

.6 Hydrants shall have a minimum depth of bury of 2.30m and shall be ordered to respect the lot grading plan finish grade elevation at hydrants. Hydrant drain hole to be plugged internally with brass plugs.

.7 After installation, repaint hydrants to the Town Standards.

.1 Description: Gloss enamel-paint with alkyd, urethane and silicone for exterior use.
.2 Brand: Corrostop Ultra or approved equal.
.3 Colors: Safety Red 4038-9000 for the body of hydrant,
Aluminium 9591-0 for the hydrant top and nozzle caps
Black for the Storz pumper nozzle cap

.8 Provide key operated gate valve and valve box located 1.5m from hydrant.

.9 All hydrant fittings shall be epoxy-coated**,** ~~with~~ ductile iron**,** mechanical-joint, fitted with steel tee bolts and nuts. Mechanical restraining devices shall be installed at the tee, gate valve (2 required), and fire hydrant as per Standard Municipal Specifications Detail Drawings No.19.

2.8 PIPE BEDDING MATERIALS

.1 Granular material to the requirements of Section 210. Drainage stone, (type 4) **shall not** be permitted for the installation of the waterworks system.

.2 Concrete required for cradles, encasement, supports, thrust blocks, all to Section 130.

2.9 RESTRAINING DEVICES

.1 To ASTM A536 Grade 65-45-12 for 50mm to 600mm diameter sizes and ASTM A-36 structural steel for 550mm to 700mm diameter sizes.

.2 Restraining devices shall incorporate a series of mechanical serrations on the inside diameter to provide positive restraint, exact fit, 360^{o} contact or wedge type and support of the pipe wall complete with steel bolts and nuts. They shall be corrosion resistant, ductile-iron epoxy coated, with steel tee bolts and nuts.

.3 Mechanical Joint restraint for PVC water main to be, GripRing Pipe Restrainer by Romac, Uni-Flange Series 1500 “Circle Lock” by Ford Meter Box, One-Lok Model SLCE by Sigma, PVC StarGrip Series 4000 by Star, or approved equal. Mechanical Joint restraint for PVCO water main to be PVC StarGrip Series 4000 by Star, Uni-Flange Series 1500 “Circle Lock” by Ford Meter Box, TufGrip Dual Wedge by Clow, or approved equal. Joint restraint for ductile iron water main to be wedge type, Megalug Series 1100 by EBAA Iron, One-Lok SLDE by Sigma, StarGrip Series 3000 by Star, TufGrip Dual Wedge by Clow, Uni-Flange Series 1400 by Ford Meter Box, or approved equal.

2.10 THRUST BLOCKS

.1 Thrust blocks shall be cast-in place concrete with a 28-day compressive strength of 32 Mpa.

.2 Concrete thrust blocks shall conform to the dimensions outlined on the detail drawings and shall be constructed of concrete in accordance with Section 130.

2.11 PIPE DISINFECTION

.1 Liquid chlorine to AWWA C651 to disinfect water mains.

2.11 STYROFOAM INSULATION

.1 To have the following properties:

.1 Compressive strength of 100 psi
.2 Tensile strength of 125 psi
.3 Shear strength of 50 psi
.4 Flexural strength of 85 psi

.2 To be DOW HI-100 or approved equal

2.12 PIPELINE CLEANER (SWAB)

.1 Cylinder with flat ends, or bullet shaped cylinder. Constructed from open-cell light-density 2 lbs/ft^3 polyurethane foam with a high-grade abrasion and chemical resistant polyurethane elastomer coating on rear.

3 Execution

3.1 PREPARATION

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

3.2 TRENCHING AND BACKFILLING

.1 Do trenching and backfill work in accordance with Section 210.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete work in accordance with Section 130. Place concrete to detail drawings indicated.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed. Pipes shall not be fully encased in concrete unless wrapped in polyethylene film.

.3 Do not backfill over concrete within 24 hours after placing concrete.

3.4 TYPE 1 GRANULAR BEDDING

.1 Place Type 1 granular bedding materials in accordance with Section 210.

.2 Fill any excavation below design elevation of bottom of specified bedding with crushed stone and compact in accordance with Section 210 at no expense to the Owner.

3.5 PIPE INSTALLATION

.1 The installation of all water mains and fittings shall be in accordance with the recommendations of the manufacturer and appropriate AWWA standards unless specified herein.

.2 Proper implements, tools and facilities shall be provided and used by the Contractor for the safe and efficient execution of the Work. All pipe and fittings shall be carefully lowered into the trench in such a manner as to prevent damage to them. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

.3 All pipe and fittings shall be thoroughly inspected for defects before and after laying. Any defective or damaged pipe and/or accessories shall be removed from the site and replaced with sound material.

.4 Handle and join pipe in accordance with the recommendations of the manufacturer and appropriate AWWA standards unless specified herein.

.5 Place appropriately sized and designated swabs into the pipe at as many locations as needed to ensure that every section of water main is swept by a swab when first charging the water main with water.

.6 Lay pipes on prepared bed, true to line and grade. The minimum depth of cover shall be 1.8m measured from finished grade to the top of the pipe. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Replace defective pipes. Correct pipes which are not in true alignment or grade. The pipes shall be laid with no reverse grades, humps or sags unless indicated on the drawings.

.7 Face bell ends of pipe in direction of laying. For mains on a grade of 2% or greater, face bell ends up-grade.

.8 There shall be no deflection allowed at the joints. The pipe shall not be bent. The pipe shall be laid true to line and grade.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials and block pipes in an approved manner to prevent creep during down time.

.10 Cut pipes in an approved 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.

.11 Support pipes with slings as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.12 Avoid displacing gasket or contaminating gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.13 Ensure completed joints are restrained by compacting bedding material alongside and over

installed pipes before laying next length of pipe or as otherwise approved by Engineer.

.14 Mechanical joint connections and tightening and torquing of bolts shall be in accordance with the manufacturer's instructions and recognized good practice.

.15 All tees and bends on water mains shall be provided with concrete thrust blocks and mechanical restraints in the locations and to the dimensions as indicated on the drawings. Thrust blocks shall extend to bear against undisturbed ground and shall be so placed that the pipe and fitting joints remain accessible.

3.6 CONNECTING TO EXISTING WATER MAINS

.1 Under no circumstances whatsoever shall the contractor operate existing water main valves or make connections to existing water mains without the prior approval of the owner.

.2 It is the contractor's responsibility to ensure that their operations do not contaminate the public water supply. If at any time, the water in the existing system becomes contaminated through actions by the contractor, whether or not due to negligence, the contractor shall be held financially accountable for any corrective action taken by the Town of Riverview, as well as for the cost of defending any settlement of all claims resulting from their negligence, including, but not limited to, costs and attorneys' fees.

3.7 GATE VALVE INSTALLATION

.1 Valves of the indicated size shall be installed at locations shown on the drawings.

.2 Valves and valve boxes or valve chambers shall be properly bedded with Type 1 granular bedding as per Section 210 to below the bottom flange of the valve assembly.

.3 Gate valves shall be properly joined to the mains with mechanical joint restraints connections according to the requirements of the manufacturer and recognized good practice. The valves shall be set so the valve stems are vertical and plumb.

.4 Valve boxes shall be set on gate valves as indicated in the detail drawings. The valve box shall be set so as not to transmit stress to the valve and shall be accurately centred over the operating nut of the valve, with the valve box set plumb. Valve boxes will not be required where valves are in chambers.

.5 Covers in valve boxes shall be set flush with the finish grade. On gravel roadways, the valve boxes shall be screwed down 100mm after final inspection.

3.8 AIR-RELEASE VALVE INSTALLATION

.1 Air-release valves and chamber c/w drain of the indicated size shall be installed at locations shown on the drawings.

.2 The air-release valve shall be installed in a valve chamber and shall be properly bedded with 0-31.5mm drainage stone to below the bottom flange of the valve assembly.

.3 The air-release valve shall be properly joined to the main according to the requirements of the manufacturer and recognized good practice. The valve shall be set so the valve is vertical and plumb.

3.9 VALVE CHAMBERS

.1 Use pre-cast units as approved by Engineer and as indicated on the detail drawings.

.2 Set bottom section of pre-cast unit in bed of compacted crushed stone (0-31.5mm) minimum 200mm. This stone shall be the same material as the pipe bedding.

.3 Place frame and cover on top section to elevation indicated.

.4 Clean valve chambers of debris and foreign materials; remove fins and sharp projections.

.5 Install chamber drains where indicated.

3.10 WATER SERVICE LATERALS

.1 Tapping of water mains shall be with use of proper tools and equipment and according to recognized good practice and in compliance with the pipe manufacturer's specifications unless specified herein.

.2 The water main shall only be tapped at the 2 and 10 o'clock positions from the centreline of the pipe and shall be at least 1m away from an adjacent service connection, joint, or fitting. A goose neck shall be provided in all service lateral piping, near the water main and laid on the horizontal. Leave corporation stop valve fully open.

.3 Tappings must use the following:

Pipe Diameter (mm)	Maximum Tap (mm)
100	25
150	40
200	50
250	50
300	75

.4 All tappings of PVC and ductile iron pipe shall be done with approved service saddles.

.5 Water service laterals shall extend at right angles from the water main and terminate with a curb stop situated on the property line at the approximate mid-point of the frontage of the property or lot being serviced, unless otherwise directed by the Engineer.

.6 Water service laterals shall be installed in a common trench with the sanitary service lateral and storm service lateral as shown on the detail drawing.

.7 New water service laterals shall be one continuous length of water service pipe from corporation stop to curb stop.

.8 .1 If building water service pipe has been extended to the property line and pressure and disinfection tests have been completed and passed, the building service pipe may be connected to the curb stop. The curb stop shall remain fully closed unless directed otherwise by the Engineer.

.2 If no building water service pipe is present, the curb stop outlet is to be capped or sealed and the curb stop is to be fully closed.

.9 Install service box plumb over curb stop and adjust top 300mm above rough grade at property line and where required, re-adjust flush to finished landscape.

.10 Service boxes and curb stops shall be supported by a 50mm X 200mm X 300mm block of preservative-treated wood or equivalent, placed directly underneath on compacted crushed stone

.11 Place temporary wooden marker post to locate pipe end. Marker post shall consist of 50x100mm stake extending from pipe end at pipe level to 0.60m above grade. Paint exposed portion of stake red with designation WATER in black.

3.11 FIRE HYDRANTS

.1 Hydrants shall be installed in accordance with AWWA Manual of Practice M-17 and at the locations as indicated on the drawings with normal spacing not to exceed 120m as measured along a linear distance along the curb. A hydrant or an air-release valve must be located at every high point in water main. A hydrant must be located at the very end of all temporary dead end mains.

.2 Hydrants shall be set plumb in all respects and oriented with front pumper connection facing the street.

.3 The bury line of the hydrant shall be set at grade as indicated on the lot grading plan.

.4 Hydrant extensions, Gradelok or equivalent, may be used as required to achieve specified elevations. These shall be installed at the bottom of the riser barrel.

.5 Hydrants shall be installed 3.5m from the back of the curb.

.6 Place concrete thrust blocks at all hydrant bowls and water main tees as indicated. Hydrant, tee, and valve to be secured to water main with mechanical joint restraints.

.7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.12 MECHANICAL RESTRAINING SYSTEMS AND THRUST BLOCKS

.1 Mechanical restraints will be the only acceptable restraining system to be used unless otherwise approved by the Engineer.

.2 Mechanical restraints must be installed for all hydrant valves, tees, plugs, caps, bends, reducers, hydrants and fittings. Concrete thrust blocks must also be used as approved by the Engineer. Do concrete work in accordance with Section 130.

.3 Place concrete thrust blocks for tees, plugs, caps, bends, reducers, hydrants and fittings as indicated. Joints and couplings are to be kept free of concrete and concrete is to extend from appurtenance to undisturbed ground. Do not backfill over concrete within 24 hours after placing.

3.13 PRESSURE AND LEAKAGE TESTING

.1 Upon completion of water main installation and prior to testing and disinfection, the newly installed water main pipe shall be flushed in accordance with the latest revision of AWWA C651 and Appendix “B”.

.2 The initial flushing will ensure that every section of water main is swept by a swab when the water is first charged into the system. Once completed, hydrant leads shall be

thoroughly flushed. Flushing shall be accomplished by opening and closing valves and hydrants several times using water under system pressure. Flush until water runs clear.

.3 Notify Engineer and/or Owner at least 24 hours in advance of all proposed tests. Perform tests in presence of Engineer.

.4 The contractor shall provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.5 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.6 Test pipeline in sections not exceeding 400m in length, unless otherwise authorized by Owner. Pressure and leakage tests shall be applied to all water mains including hydrant leads up to hydrant bowl and service laterals up to curb stops.

.7 A test pressure of at least 1000 kPa (145 psi) shall be applied to each section of the line as it is completed. The Contractor shall supply clean potable water for tests, either by gravity via water mains previously laid or by other means.

.8 Valves, appurtenances and water service laterals installed in the test section of water mains shall be tested in conjunction with the water mains. The gauge recording the pressure test shall be installed at the top of the section under the test, or the required test pressure to be shown on the gauge shall be increased to allow for the static head on the gauge from the water above.

.9 The test section of the pipe shall be filled slowly, taking care to expel all air from the line. When all air has been expelled, the test pressure shall be applied. If no means are available for air release at high points on the test section (hydrant or air release valves), the contractor shall install corporation stops at points of highest elevation to expel air before the test pressure is applied.

.10 After all air has been expelled and the test pressure applied, it shall be maintained above the minimum level for at least two hours by pumping the required additional water into the section under test. The amount of water added shall be measured by a method acceptable to the Engineer. The leakage, as measured by the amount of water added during the test, shall not exceed the amount given by the formula:

$$Q = \frac{LD\sqrt{P}}{795{,}000}$$

where Q = allowable leakage in litres per hour;
L = length of pipe tested, in meters (m)
D = nominal diameter of pipe in millimetres (mm);
P = test pressure in kilopascals (kPa).

.11 If the test is unsatisfactory, the source of failure shall be located and rectified. The test shall then be repeated at the Contractor's expense.

.12 Following successful completion of the hydrostatic test, each fire hydrant will be tested by applying system pressure to the complete hydrant barrel for a minimum period of 15 minutes. Any leakage, except for minor leakage at the caps, will be cause for rejection.

3.14 FLUSHING AND DISINFECTING

.1 Upon completion of water main testing, the completed section of main shall be suitably flushed with clean water, according to AWWA C651; flushing velocity not to be less than 0.75 m/s.

.2 The injection and sampling of the new water main shall be done by the installation of a 19mm service pipe and main stop with complete curb box installed within 3.0m of the connection to existing water main. A 19mm service tubing and standpipe shall be installed at every ends of the test sections.

.3 Notify the Engineer and/or Owner at least 4 days in advance of proposed date when disinfecting operations will commence. All flushing and disinfecting operations shall be under direct control of the Engineer.

.4 The contractor shall provide labour, pumps, other equipment and materials required to perform the flushing and disinfection work herein described.

.5 The contractor shall open and close all new valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been satisfactorily completed, introduce a strong solution of chlorine into water main and ensure that it is distributed throughout entire system. Liquid chlorine or other chlorine compound shall meet the requirements of the latest AWWA B300.

.7 Chlorine shall be injected within 3.0m from the point of water supply (connection to existing).

.8 After adequate chlorine residual of not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 hours. Operate valves, hydrants and appurtenances while water main contains chlorine solution.

.9 At the end of the 24 hours, the treated water shall be tested and contain not less than 10 parts per million (ppm) available chlorine or the procedure must be repeated. Following the disinfection procedure, the main shall be flushed until the residual chlorine is reduced to less than 3 ppm.

.10 After final flushing and before the water main system is activated; water samples will be tested for e-coli and total coliform by an approved laboratory. Sampling shall be done in accordance with AWWA C651. Two sets of samples shall be collected at least 24 hours apart.

.11 At least one set of samples shall be collected from every 366 metres of new water main and at every hydrant, and at the beginning and end of the new lines. Samples shall be taken by the Town of Riverview. If the results are not satisfactory, the Contractor shall carry out further flushing and disinfection of the water main, at the Contractor’s expense, until test results are acceptable.

END OF SECTION

1 General

1.1 RELATED WORK

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines
230 Storm Sewers

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction

1.2 MATERIAL CERTIFICATION

.1 At least 2 weeks prior to commencing work, submit manufacturer's test data and certification that pipe materials meet requirements of this section.

1.3 MEASUREMENT FOR PAYMENT

.1 Supply and installation of pipe culvert including excavation, dewatering, bedding, supply and installation of pipe, backfill, restoration and all incidentals will be measured in metres in place for each size and type of pipe.

.2 Removal of existing pipe culverts will be measured in lineal metres of culvert acceptably removed and delivered to a site designated by the Owner. The Engineer shall determine the reusable condition of existing pipe culverts.

2 Products

2.1 PIPE

.1 RESIDENTIAL DRIVEWAY ENTRANCES

Minimum pipe size 250mm diameter, up to 525mm diameter.

ALUMINIZED STEEL PIPE

Aluminized Type II steel pipe shall be round, 16 gauge aluminized steel meeting the requirements of the latest CSA Standard G401 and AASHTO M36 standards. Steel coupling bands will be used to join corrugated steel pipe and shall be of the same specifications as the pipe.

POLYETHYLENE PIPE

Polyethylene pipe shall be high density with smooth interior surface and a minimum ring stiffness of 320 kPa, meeting the requirements of the latest CAN/CSA B182.8 standards. Ends of pipe shall be plain end with proper couplings supplied by the manufacturer.

.2 ROADWAY CROSSINGS, COMMERCIAL, INDUSTRIAL, AND INSTITUTIONAL DRIVEWAY ENTRANCES

Minimum pipe size 600mm diameter.

CONCRETE PIPE

Reinforced Concrete pipe (RCP) meeting the requirements of the latest ASTM F794-97 and CAN/CSA A257.2 for class 65D, 100D, or 140D as indicated on the drawings.

(Equivalent to ASTM Class III, Class IV, and Class V) c/w locked-in gasket and integral bell system with flexible rubber gasket joints to CAN/CSA A257.3.
Minimum pipe size 600mm diameter.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to following requirements:
- .1 Aluminized steel pipe; shall utilize crushed stone Type 1 granular bedding.
- .2 Polyethylene pipe ; shall utilize crushed stone Type 1 granular bedding.
- .3 Concrete pipe; shall utilize Type 3 soil bedding.

3 Execution

3.1 TRENCHING AND BACKFILL

.1 Do trenching and backfill work in accordance with Section 210.

.2 Do not allow water to flow into trench.

.3 Trench line and depth require inspection prior to placing bedding material and pipe.

.4 Do not backfill until pipe grade and alignment have been checked by Engineer.

3.2 BEDDING

.1 Place granular bedding materials in accordance with Section 210.

.2 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber indicated, free from sags or high points. Compact full width of bed to at least 95% of the maximum dry density in accordance with ASTM D698.

3.3 LAYING ALUMINIZED STEEL PIPE

.1 Commence pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.4 Do not allow water to flow through pipes during construction except as permitted by Engineer.

3.4 LAYING POLYETHYLENE PIPE

.1 Commence pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Do not allow water to flow through pipes during construction except as permitted by Engineer.

3.5 LAYING CONCRETE PIPE

.1 Commence pipe placing at downstream end of culvert with bell end of first pipe section facing upstream.

.2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.

.3 Do not allow water to flow through pipes during construction except as permitted by Engineer.

3.6 JOINTS

.1 Aluminized Steel Pipe:
- .1 Match corrugations or indentations of coupler with pipe sections before tightening.
- .2 Tap couplers firmly as they are being tightened, to take up slack and ensure a snug fit.
- .3 Insert and tighten bolts.

.2 Concrete Pipe
- .1 Joints to be made with rubber gaskets and installed to manufacturer's recommendations. Ensure that spigot ends are fully entered into bell ends.

.3 Polyethylene Pipe
- .1 Joints to be made with rubber gasket and installed to manufacturer's recommendations. Ensure that spigot ends are fully entered into bell ends.

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END OF SECTION

1 General

1.1 SCOPE OF WORK

.1 The work covered by these specifications consists of all materials, equipment, labour, and supervision necessary for the closed-circuit television inspection of gravity sewer lines.

1.2 DEFINITIONS

.1 Sewer Line Section: shall mean the length of pipe connecting two manholes.

.2 Building service: shall mean the sewer line (lateral) extending from the building to the sewer main.

.3 Section Distresses: defined as:
- .1 Slope Irregularities; variance in grade of sewer line section.
- .2 Joint Separation; a gap or spread, offset or sign of infiltration.
- .3 Cracking; crushed, broken, cracked or sheared.
- .4 Sedimentation; gravel, roots or foreign debris which may impede the flow.
- .5 Deformation; deflection of the pipe diameter exhibited as oval or out of round pipe.
- .6 Pipe erosion; scour of the pipe walls.
- .7 Service obstruction; protruding service connection which impedes the flow.
- .8 Infiltration; extraneous flows entering the pipe.

1.3 QUALIFICATION OF INSPECTORS

.1 Inspectors must have obtained formal certification through the National Association of Sewer Service Companies (NASSCO) and be familiar with (PACP), Pipeline Assessment Certification Program sewer condition classification codes as described in the “Pipeline Assessment Certification Program”.

1.4 MEASUREMENT FOR PAYMENT

.1 When specifically tendered as a separate item, payment shall be made per lineal metre of gravity sewer or building service inspected as per the specifications.

.2 Video inspections required for newly installed sanitary or storm sewer pipes shall be considered incidental to the installation of the pipes and shall include all flushing and inspection activities.

.3 There will be no payment for delays to the schedule or for difficulty of access to the dwelling’s building service.

2 Equipment

2.1 CLOSED CIRCUIT TELEVISION EQUIPMENT

.1 Self-contained camera and monitoring unit with remote controlled lighting system capable of varying the illumination.

.2 Camera size shall permit passage through a 100 mm to 1200 mm diameter pipe range.

.3 Camera shall be self-propelled and have a self-contained, remotely controlled lighting system capable of illuminating the interior of the sewer line for inspection.

.4 Picture quality shall be such to produce a continuous 600 line resolution picture showing

the entire pipe periphery. Video picture shall be in colour.

.5 The equipment must be able to supply a digital recording on DVD format.

2.2 VIEWING ACCOMMODATION

.1 Vehicle must be large enough to accommodate at least two people for viewing the monitor while inspection is in progress.

3 Procedures

3.1 LINE FLUSHIING

.1 On existing lines, the Owner will flush the sewer where it is impassable due to debris or other foreign material.

.2 On newly installed sewers, the Contractor is responsible for flushing of debris or other foreign material, all sewers installed shall be flushed prior to video.

3.2 INSPECTION

.1 Inspect one sewer line section at a time.

.2 Have camera travel through pipe along axis of pipe.

.3 Perform inspection in forward direction only.

.4 Perform inspection in direction of flow.

.5 In sewers, where flow depth is above 1/4 of the pipe diameter, blocking or by-passing must be performed as described in Clause 3.5.

3.3 RECORDS

.1 Maintain an inspection record, in log form, showing clearly the exact location of each building service or incident of pipe line distress.

.2 Pipe reference location shall be in relation to the centre line of the adjacent manhole.

.3 Maintain accurate measurements of pipe line distresses by the use of a metering device. The location ID (MH # to MH #) and distance measured along the sewer line being inspected shall be visible on the video at all times.

.4 Photograph monitor during inspection operations at Engineer's request.

.5 A DVD format video and log form report shall be provided in typed or PDF format for all sewer line inspections.

.6 An audio description of each building service or incident of pipe line distress shall be provided on the section video.

.7 Provide on the video and in the log book the following information at the start of each sewer video:

- .1 Date and weather conditions
- .2 Location (Street, civic address, manhole number)
- .3 Size and pipe line material

.4 Length of line section
.5 Direction of travel

.8 Provide all reports in pdf format and videos on a USB flash drive or in a labelled binder bearing the project name, videos, photographs within 10 days of inspection.

3.4 TRAFFIC CONTROL

.1 Supply and maintain signs, barricades and flashers for traffic control as per section 170.

.2 Ensure all work is performed in accordance with the New Brunswick Occupational Health & Safety Act Regulations.

3.5 FLOW CONTROL

.1 When sewer flow depth exceeds 1/4 of the pipe diameter, plugging or by-passing is required:
- .1 Plugging; Plug sewer upstream of the sewer line section. Reduce or restrict flows for duration of video but release flow as required during inspection to avoid back-ups in upstream building services. Reinstate flow upon completion of inspection.
- .2 By-passing; When plugging is ineffective and with the approval of the Engineer, pumps or siphons shall be used to divert flows.

3.6 OBSTACLE

.1 If an obstacle is encountered which restricts the passage of the camera, notify the Engineer and record the exact meterage of the occurrence.

.2 Remove the camera and enter the sewer line section from the opposite end.

.3 On an existing sewer line, if a second obstacle is encountered on the same sewer line section, leaving less than 25% of the sewer uninspected, then the Contractor will be awarded the entire section's meterage as measurement for payment.

.4 For newly installed lines, the Contractor is responsible for the proper cleaning of the line to provide a complete continuous video of 100% of the newly installed sewer.

3.7 DEFECTIVE SEWERS IDENTIFIED DURING VIDEO INSPECTION

.1 Sewers shall be inspected for alignment and obstruction. **WATER PONDING IN GRAVITY SEWERS** that can not be eliminated by flushing and cleaning will be considered as evidence of pipe settlement. One hundred percent (100%) of the newly installed sewers will be video inspected by the Contractor. Any and all defects such as water ponding, exposed gasket, leaking joints, sags, improper grade or alignment, excessive deflection, obstructions, etc. shall be cause for rejection and such defects must be repaired by the Contractor at no expense to the Owner. The initial video inspection shall be at the cost of the Contractor and any costs for re-video of sewer mains required to inspect repaired defects will be at the Contractor’s expense.

END OF SECTION

1 General

Section 100: GENERAL CONDITIONS
120 Topsoil, Hydraulic Seeding & Sodding
140 Clearing & Grubbing
170 Traffic Control

Section 300: STREETS & ROADWAYS
320 Crushed Rock Base & Sub Base Materials
370 Quality Control

1.2 DEFINITIONS

.1 Excavation classes: only two classes of excavation will be recognized, rock excavation and common excavation:
  .1 Rock excavation: excavation of solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass for which drilling and blasting are required for removal, or rock fragments having individual volume in excess of 1 cubic metre.
  .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of solid rock, including dense tills, soft layered or broken rock, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.2 Top soil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding. See Section 120 for an expanded definition.

.3 Waste material: material unsuitable for use in work or surplus to requirements.

.4 Borrow material: material obtained from locations outside the immediate graded areas and from areas outside of the right-of-way required for construction of embankment or fill areas or for other portions of work. Borrow may be approved excavated material from other areas of the site or imported granular borrow.

.5 Embankment: material derived from excavation and placed above original ground or stripped surface up to subgrade elevation.

.6 Pavement structure: combination of layers of unbound or stabilized granular subbase, base, and asphalt or concrete surfacing.

.7 Subgrade elevation: elevation immediately below pavement structure.

.8 Weight certificate: a voucher, issued by the quarry or pit at the point of origin of a load to a truck driver and delivered to and verified by an Owner's representative at the Work Site.

1.3 MEASUREMENT FOR PAYMENT

.1 Rock Excavation**:**
  .1 Will be measured in cubic metres.
  .2 Volume excavated from solid rock masses will be calculated from cross sections of original rock surface and design grade line for excavation.
  .3 Volume of excavated boulders and rock fragments will be determined by measuring three maximum mutually perpendicular dimensions.
  .4 The quantity to be measured for payment shall be the number of cubic metres of solid rock removed and placed, stockpiled and/or disposed of in accordance with this item.
  .5 In the event there is no tendered price for rock excavation, the Engineer will

establish a fair price based on average prices currently in effect in the region.

.2 Common excavation:
- .1 Will be measured in cubic metres calculated from cross sections taken in areas of excavation.
- .2 In areas to be excavated where topsoil stripping or clearing and grubbing are to be performed the site will be cross sectioned after these operations and these elevations utilized in the open end area method computations.
- .3 In areas of excavation not provided by Engineer (borrow pits provided by Contractor), initial cross sections will be taken after necessary clearing, grubbing and topsoil stripping, and immediately prior to excavation of material to be incorporated into work.
- .4 The quantity to be measured for payment shall be the number of cubic metres of common material excavated and placed, stockpiled and/or disposed of in accordance with this item.

.3 Compaction of embankment will be considered incidental to the work. Proof rolling of all roadway areas will be considered incidental to the work.

.4 Sub-grade preparation and compaction will be considered incidental to the work.

.5 No measurement and payment will be made for:
- .1 Unnecessary excavations beyond lines established.
- .2 Extra handling of windrowed materials blended on embankment slopes.
- .3 Removal and correction of soft or unstable material.
- .4 Overhaul

.6 Topsoil stripping: (Where indicated on the drawings) shall be measured in square metres of topsoil stripped to a depth of 200 mm and including stockpiling in an area designated.

.7 Adjustment of roadway structures: see Section 240.

.8 Materials required (crushed stone, common excavation and asphalt pavement) for restoration of driveways will be measured as per Sections 310, 320 and 340.

.9 Disposal of all excavated materials will be at a site or sites referred to in the instructions to tenderers. Disposal of excavated material shall include all trucking, spreading, levelling, and compaction of fill dump site.

.10 The provision of traffic control will be considered incidental to the work.

.11 Weight Certificates: See Section 320 - Crushed Rock Base & Sub Base Materials for approved weight certificates for borrow material.

1.4 TRAFFIC PROVISIONS

.1 Provide and maintain roadways, walkways and detours, for vehicular and pedestrian traffic and access to fire hydrants at all times. Flag persons must be provided as required by NBDOT regulations, NB Highway & Safety guidelines and Section 170.

1.5 BURIED SERVICES

.1 Check with utility companies to locate and advise regarding buried pipes, cables, ducts or other services. Make good and pay for repair to services damaged during excavation.

.2 Size, depth, type and location of existing services shown on drawings are for guidance

only; completeness and accuracy are not guaranteed.

.3 Damage to any existing features by the contractor, regardless of whether these features are shown on the plans or indicated otherwise, shall be repaired to a condition satisfactory to the owner and the contractor shall pay all related costs.

2 Products

2.1 MATERIALS

.1 Embankment materials require approval by Engineer.

.2 Material used for embankment shall consist of soil and/or rock not to contain organic matter, frozen lumps, weeds, sod, roots, logs, stumps or any other objectionable matter.

.3 Mudstone, claystone and/or siltstone and any otherwise acceptable rock mixed with such materials or with clayey or silty soil, will not be acceptable.

.4 Granular road base materials shall conform to Section 320.

.5 Borrow materials shall be either granular imported material or suitable (salvaged) excavated material to the approval of the Engineer. Both are defined below;

On-Site Materials from the Excavation Stream: Excavated on-site selected material (approved by the Engineer) from excavation or other sources, unfrozen and free from rocks larger than 150 mm, cinders, ashes, sods, refuse or other deleterious materials. The grain size analysis as per ASTM C117 must indicate no more than 50% dust.

Granular Borrow: Imported “Sandstone” composed of clean uncoated particles free from clay, roots, stumps, organics and other deleterious substances with grain size analysis per ASTM C117 indicating not more than 25% dust.

2.2 COMPACTION EQUIPMENT

.1 Compaction equipment shall be equipped with sheep’s foot roller and must be capable of obtaining required densities in materials on project.

.2 Compaction equipment not specified herein is to be efficiency proved at no extra cost and written approval must be received from Engineer before use.

2.3 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

.2 Equip water distributors with easily visible gauges that indicate water level in tank.

3 Execution

3.1 STRIPPING OF TOPSOIL

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Commence topsoil stripping of areas as indicated, after area has been cleared and grubbed.

.3 Strip topsoil to depths specified. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as indicated.

3.2 ROADWAY EXCAVATING

.1 General:
- .1 Advise Engineer sufficiently in advance of excavation operations for initial cross sections to be taken.
- .2 Maintain crowns and cross slopes to provide good surface drainage.
- .3 Notify Engineer whenever unsuitable materials are encountered in cut sections and remove unsuitable materials to depth and extent directed.
- .4 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points.
- .5 Dispose of waste material.

.2 Unsuitable materials:
- .1 Remove materials unsuitable for embankments to lateral limits and depths directed.
- .2 Unsuitable materials excavated under subsection .1 to be stockpiled, placed in windrows outside toe of embankment or disposed of as indicated.

.3 Rock Excavation:
- .1 If during excavation, material appearing to conform to classification for rock is encountered, notify Engineer in sufficient time to enable measurements to be made to determine volume of rock.
- .2 Remove rock to 300 mm below sub-grade elevation indicated.
- .3 Provide effective drainage to ditches, leaving no undrained pockets in foundation.

.4 Do not excavate roadway or other areas under wet conditions where water is forming ponds or puddles.

.5 The Contractor shall maintain surface drainage during excavation of cuts and construction of embankments. Low spots and ruts that could pond water shall be removed no later than the end of each Day's Work or, if rain is imminent, as Work progresses during the day.

.6 Do not excavate and expose more than 200 m of sub-grade during the excavation process.

.7 All roadway subgrade must be covered by at least 150 mm of crushed stone during any precipitation events and prior to any expected precipitation at night or weekend.

.8 Hauling of common excavation over granular base and subgrade will not be permitted.

3.3 EMBANKMENTS

.1 Grading and excavation shall be done to the proper line and grade and the excavated material shall be placed in embankments or removed from the site.

.2 Embankments shall be constructed using earth from excavated or borrow pits. Topsoil and organic or deleterious material shall be stripped from all areas on which embankments are to be constructed.

.3 Embakments shall be placed and compacted in layers having a compacted thickness not

greater than 200mm.

.4 Throughout this work, the moisture content of the material shall not vary by more than 3% above optimum as determined by ASTM D698 (standard moisture-density relations test).

.5 At the completion of excavation and embankment construction, the sub-grade shall be shaped and rolled to give a smooth firm surface.

.6 Embankments shall be constructed such that the first lift when shaped forms the toe of the fore slopes and each successive lift shall be completed to the full width prior to placing the next lift.

.7 Where embankments are constructed against an existing earthen side hill having a slope steeper than 4:1, the following shall apply: The top 2.5 metre below subgrade shall be cut by the spreading equipment into the side hill as each lift of fill is placed so that the next lift is “keyed” into the side hill to a width not less than 1 metre,

.8 Where the work involves placement of material firstly along one side of the roadbed and then the other side, the spreading equipment shall cut into the edge of the previously built side of the roadbed as each lift of material is placed so that the next lift is “keyed” into the adjacent side of the roadbed or the existing roadway slope to a width not less than 0.5 metre.

3.4 SUB-GRADE INSPECTION & PROOF ROLLING

.1 Prior to placing the granular subbase and base course, proof rolling shall be carried out on the finished subgrade surface for the purpose of locating unstable areas. Do not place granular base until finished sub-grade surface is inspected and approved by Engineer. Proof rolling shall be carried out utilizing a fully loaded tandem axle truck having a gross weight not less than 25,000 kg and with the tires inflated to not less than 485 kPa.

.2 Proof roll at level in granular base as indicated. If alternative proof rolling equipment is authorized, Engineer will determine level of proof rolling.

.3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire, so as to determine that no deflection greater than 10mm occurs.

.4 Where proof rolling reveals areas of defective subgrade:

.1 Remove subgrade material to depth and extent as required to remove area of defective subgrade. Engineer to review Contractor’s actions and authorize any action to correct defective subgrade.

.2 Backfill excavated subgrade with borrow material and compact top 1000mm to 100% of the maximum dry density at no additional cost to the Owner.

3.5 FINISHING SUB-GRADE

.1 Remove soft or other unstable material that will not compact properly and fill resulting depressions with approved material.

.2 Shape and compact entire sub-grade to within 30 mm of design elevations but not uniformly high or low.

.3 Do scarifying, blading, compacting or other methods of work as necessary to provide thoroughly compacted roadbed shaped to grades and cross sections indicated.

.4 Finish back and side slopes of common material to neat condition, suitable for topsoil and

seeding, true to line and grade:

.1 Remove boulders encountered in cut slopes and fill resulting cavities with approved material.

.2 Hand finish slopes that cannot be finished satisfactorily by machine.

.5 Finish back and side slopes of rock material to a neat and safe condition, true to line and grade. For rock slopes greater than 1:1, scale slope by removing loose fragments.

3.6 PLACEMENT OF BORROW

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Begin spreading base material on a crown line or on high side of a one-way slope.

.3 Place using methods which do not lead to segregation or degradation of aggregate.

.4 Place material to full width in uniform layers not exceeding 200 mm compacted thickness. Engineer may authorize thicker lifts (layers) if specified compaction can be achieved.

.5 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.

.6 Remove and replace that portion of a layer in which material becomes segregated during spreading.

.7 If at any time during the work, the surface becomes rutted or displaced, the Contractor shall make all necessary repairs to reinstate the surface grade.

.1 The depth rutted and/or displaced shall be scarified, shaped and compacted to meet the requirements of this item.

.8 Low spots and ruts that could hold water shall be removed no later than the end of each Day's Work or if rain is imminent, as Work progresses during the day.

.9 Where the roadbed being constructed is subject to through traffic, the Contractor shall conduct his operations so that through-traffic does not travel directly on an undercut surface or subgrade, unless approved by the Engineer. Any surface subjected to through-traffic shall be maintained in a condition such that traffic can safely travel along it at the speed limit posted for the Work Area.

.10 Stockpiling of borrow or granular materials on site and intended to be incorporated into the Works, is not permitted without the written consent of the Engineer. Any borrow or granular materials placed in stockpiles on-site without the permission of the Engineer will not be considered for payment, regardless of whether the material is incorporated into the Work.

3.7 COMPACTION

.1 Compact to density not less than 100% of the maximum dry density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with approved

mechanical tampers.

3.8 FINISH TOLERANCES

.1 Finished base surface shall be within plus or minus 30mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.3 Deviation from the grades on the plans will result in regrading of the unacceptable areas at the contractor's expense.

3.9 MAINTENANCE

.1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until Final Acceptance.

.2 Lower manholes covers, valves covers, and other utilities to 150mm below crushed rock surface on roadways which are to be operational during winter conditions in preparation for snow ploughing operations.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
170 Traffic Control

Section 300: STREETS & ROADWAYS
340 Asphalt Paving

1.2 SCOPE

This section consists of the removal, haulage and stockpiling or disposal of existing asphalt or concrete.

1.3 MEASUREMENT FOR PAYMENT

.1 The quantity to be measured for payment shall be the number of square metres of asphalt cut and removed, square metres of asphalt milled, square metres of sidewalk removed, and linear metres of curb and gutter acceptably removed, hauled, stockpiled, or disposed of in accordance with this item.

.2 Where material is salvaged for use by the Town, the cost of overhaul to the site designated in the specifications will be included in the price for removal. Where material is not salvaged by the Town and becomes the property of the Contractor, payment for overhaul and disposal at the Contractor's site will be included in the price for removal.

.3 No measurement or payment will be made for:
- .1 Unnecessary cold milling beyond lines or depth established.
- .2 Extra hauling of materials blended or temporarily stockpiled on site.
- .3 Off-site disposal of removed material.
- .4 Any associated disposal or recycling fees.

.4 Disposal of all cold milled asphalt concrete materials will be at a site or sites referred to in the instructions to tenderers.

.5 The provision of traffic control will be considered incidental to the work.

1.4 TRAFFIC PROVISIONS

.1 Provide and maintain roadways, walkways and detours, for vehicular and pedestrian traffic and access to fire hydrants at all times. Flag persons must be provided as required by NBDOT regulations, NB Highways & Safety guidelines.

2 Products

Not applicable

3 Execution

3.1 CONSTRUCTION METHODS FOR CUTTING AND REMOVAL OF ASPHALT OR CONCRETE

.1 The Contractor shall cut and remove all asphalt or concrete as marked or specified, within the limits of the proposed work.

.2 In order to facilitate removal and prevent lifting or damage to adjacent asphalt, concrete or structures during excavation, cuts shall be made with appropriate equipment such as cutting wheels, saws, etc., in a manner so as to provide a straight line and proper transition between material that is to remain and what is to be removed and must be done in a manner which leaves the sub-base undisturbed insofar as possible.

.3 Under no circumstances will the cutting of asphalt be allowed by the use of excavators or backhoe buckets, etc.

.4 Where concrete sidewalk has been overlayed by a layer of asphalt, the removal will be considered as removal of concrete only.

.5 Where excavated materials are to be recycled for Town use, they will remain the sole property of the Town of Riverview and any use, disposal or sale thereof, not specifically approved in writing is strictly forbidden.

.6 All concrete materials excavated shall become the property of the Contractor and shall be disposed of outside the Work Site.

3.2 CONSTRUCTION METHODS FOR COLD MILLING OF ASPHALT CONCRETE

.1 The Contractor shall provide, in partial depth removal, equipment with automatic controls for the control of longitudinal grade and transverse slope.

.2 In full depth removal, care must be taken not to contaminate the reclaimed asphalt concrete pavement (RAP) with the underlying aggregate material. When partial depth removal is performed on a roadbed with paved shoulders, and some or all of the shoulder is to remain, the Contractor shall provide for drainage.

.3 All loose material remaining after cold milling shall be swept to a granular shoulder or picked up from paved shoulders or gutters before re-opening to traffic.

.4 The Contractor shall remove all asphalt concrete from the faces of gutter, catch basins or manholes and other structures abutting the work, in such a manner that the structures are not damaged, and the area after removal matches the grade of the adjacent removal area. Any RAP that falls into structures shall be removed.

.5 The Contractor shall continuously maintain the work site, in a condition to provide for the safe and efficient flow of traffic, free of potholes and any sharp transitional edges, from the time of removal until such time as the new asphalt concrete is placed.

3.3 REMOVAL AND STOCKPILING OF MATERIALS

.1 Where excavated materials are to be retained for Town use, they will remain the sole property of the Town of Riverview and any use, disposal or sale thereof, not specifically approved in writing is strictly forbidden. All RAP shall be loaded, hauled and spread at sites designated by the Engineer.

.2 Where materials are not designated for recycling, they will become the property of the Contractor and may be used or disposed of in accordance with all regulations, by-laws etc., pertaining to these materials.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation, Trenching, Bedding & Backfilling of Pipelines
220 Sanitary Sewers
230 Storm Sewers
240 Manholes, Catch Basins & Sluice Boxes
250 Water Mains

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
330 Curbs, Gutters & Sidewalks
340 Asphalt Paving
370 Quality Control

1.2 MEASUREMENT FOR PAYMENT

.1 Granular base (0-31.5mm) and sub base (0-75mm) for roadway, curb and sidewalk work will be measured in tonnes including loading, weighing, supply, placement, compaction, trucking, and overhaul and all associated incidentals.

.2 Crushed rock placed in excess of 110% of the theoretical quantity, based on the specified measurements indicated on the detail drawings, or as determined by final measure, shall not be included for payment.

.3 Adjustments of roadway structures: see Section 240. Temporary lowering and re-adjusting of the roadway structures shall be incidental to the work.

.4 Maintenance grading on granular road surfaces will be considered incidental to the work.

.5 Dust control will be considered incidental to the work.

.6 Granular base and subbase required for restoration of any damaged surfaces shall be considered incidental to the work involved in Sections 220, 230, 240, 250, and 260.

.7 Weight Certificates
- .1 Only original digitally printed vouchers from the quarry or pit of material origin will be accepted and used as basis for payment. Hand written weight certificates and copies of weight certificates will not be accepted by the Engineer.
- .2 Contractor shall submit daily summary sheets tallying the total material deliveries for each Work Day. The daily summary sheet shall record each weight certificate, the type and size of each material, the weight of material delivered to site and shall correspond to the weight certificates that the Engineer receives from each material delivery.
- .3 Failure to provide the original weight certificates and the daily summary sheets shall result in non-payment for materials delivered.

.8 Gravel driveway and walkway restoration work will be measured in square meters including excavation to subgrade, removal and disposal of existing materials, subgrade preparation as well as loading, weighing, supply, placement, fine grading, compaction, trucking, and overhaul of gravels and all associated incidentals.

2 Products

2.1 MATERIALS

.1 Granular base and subbase materials shall be to the following requirements:

.1 Crushed stone or gravel consisting of clean, hard, sound, durable, angular and uncoated particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to the latest version of ASTM C136 and ASTM C117 and to have a smooth curve without sharp breaks when plotted on semi-log grading chart.

.3 Crushed rock/gravel base and subbase shall conform to the latest edition of the NBDOT Standard Specification Item 201 and Table 320-1.

Table 320-1
Grading Limits

	Aggregate Base		Aggregate Sub Base	
ASTM Sieve Size	**0-25 mm % passing**	**0-31.5 mm % passing**	**0-50 mm % passing**	**0-75 mm % passing**
90 mm	-	-	-	100
75 mm	-	-	-	95-100
63 mm	-	-	100	85-100
50 mm	-	-	95-100	73-95
37.5 mm	-	100	76-100	58-87
31.5 mm	100	95-100	-	-
25 mm	95-100	81-100	60-84	-
19 mm	71-100	66-90	50-76	35-69
12.5 mm	56-82	50-77	-	-
9.5 mm	47-74	41-70	32-61	25-54
4.75 mm	31-59	27-54	21-49	17-43
2.36 mm	21-46	17-43	15-40	12-35
1.18 mm	13-34	11-32	10-32	8-28
.300 mm	5-18	4-19	4-18	4-16
.075 mm	0-8	0-8	0-9	0-9

3 Execution

3.1 INSPECTION OF UNDERLYING SUBBASE OR SUBGRADE

.1 Do not place granular base until finished sub-grade surface is inspected and approved by the Engineer.

3.2 PLACING

.1 Place material only on a clean unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Begin spreading base material on a crown line or on high side of a one-way slope.

.3 Place using methods which do not lead to segregation or degradation of aggregate.

.4 Place material to full width in uniform layers not exceeding 200 mm compacted thickness.

.5 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.

.6 Remove and replace that portion of a layer in which material becomes segregated during spreading.

.7 Remove and replace any crushed rock which have been contaminated by traffic or construction vehicle at no cost to the owner.

.8 Any surface subjected to through-traffic shall be maintained in a condition such that traffic can safely travel along it at the speed limit posted for the Work Area.

.9 Stockpiling of crushed rock base and sub base materials on site and intended to be incorporated into the Works, is not permitted without the written consent of the Engineer. Any crushed rock base and sub base materials placed in stockpiles on-site without the permission of the Engineer will not be considered for payment, regardless of whether the material is incorporated into the Work.

.10 Unless otherwise noted, the minimum granular base depths required for restoration shall be 500 mm on local roads, 550 mm on collector and 600 mm on arterial roads, and 300 mm on driveways and sidewalks.

3.3 COMPACTING

.1 Compact granular materials to density not less than 100% of the maximum dry density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

.5 Excavate any soft areas in accordance with Section 310.

3.4 FINISH TOLERANCES FOR BASE AND SUBBASE

.1 Finished base surface shall be within plus or minus 12 mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.3 Deviation from the grades on the plans will result in re-grading of the unacceptable areas at the contractor's expense.

3.5 MAINTENANCE OF GRANULAR SURFACES

.1 Maintain finished base in a condition conforming to this section until succeeding material is applied or until acceptance.

.2 Lower manhole covers, valve covers, and other utilities to 150mm below crushed rock surface on roadways which are to be operational during winter conditions in preparation for snow ploughing operations.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
120 Topsoil, Hydraulic Seeding & Sod
130 Concrete

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
320 Crushed Rock Base & Sub Base Materials
370 Quality control

1.2 MEASUREMENT FOR PAYMENT

.1 Excavation: will be classified as per Section 310 and will be considered incidental to the price for installation of curbs and gutters and concrete sidewalks.

.2 Granular base: will be measured as per section 320.

.3 Concrete sidewalks: will be measured in square metres including excavation, all treatments, insulation, finishing, felt expansion joints, detailed reinforcement, expansion boards, curing, any required backfilling and all incidentals.

.4 Concrete curbs and gutters: will be measured in linear metres including excavation, forming and form work, treatments, insulation, finishing, expansion joints, expansion board, curing and any required backfilling including fill material and all incidentals.

.5 Concrete will not be measured but will be considered incidental to the work.

.6 Restoration of any curb and gutter, sidewalks or any concrete work damaged or removed due to pipe installation shall be considered incidental to the pipe work.

.7 Any protection required for cold-weather concreting will be considered as incidental to the Work.

1.3 RESTORATION

.1 All properties within or adjacent to the construction area affected by the Contractor's operations shall be restored to their original or better conditions as per Section 120.

1.4 ADJUSTMENT OF EXISTING STRUCTURES

.1 Adjustment of existing structures (catchbasins, manholes, valve chambers, sluice boxes, etc.) shall be at the contract unit price for each structure adjusted as per section 240.

1.5 REDUCED PAYMENT SCHEDULE

.1 Concrete Strength
- .1 The Owner will reduce payment on the unit bid item of concrete if the 28 day strength of test cylinders is less than the minimum 32 MPa.
- .2 The Owner will not accept any concrete that has a strength less than 28.0 MPa. All such concrete work will be replaced at the contractor's expense.
- .3 The table below lists the rates that the Owner will pay for strength reductions based on concrete test cylinders at 28 days.

	COMPRESSIVE STRENGTH	PAY PERCENTAGE OF UNIT BID
i)	30.0 MPa < X ≤ 32.0 MPa	90% of unit bid
ii)	28.0 MPa < X ≤ 30.0 MPa	75% of unit bid
iii)	X < 28.0 MPa	Total replacement at Contractor's expense

.2 Scaling

.1 Individual concrete sidewalk blocks and curb sections showing evidence of scaling during the warranty period (prior to Final Acceptance) shall be noted according to severity of surface damage.

.2 The table below lists the rates that the Owner will pay for scaled concrete.

	PERCENT OF SURFACE DAMAGED	PAY PERCENTAGE OF UNIT BID
i)	< 10%	100% of unit bid
ii)	10% to 25%	75%
iii)	25% to 50%	50%
iv)	> 50%	Total replacement at Contractor's expense

2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: to Section 130.

.2 Joint filler and curing compound: to Section 130.

.3 Granular base: See Section 320.

.4 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.

.5 Surface curing products, joint filler, air-entraining admixtures, forms and other concrete materials shall conform to Section 130.

.6 150mm x 150mm steel mesh, or 10mm rebar.

.7 Expansion joint material shall be pre-moulded, asphalt-saturated, cane fibreboard - "Flexicell" as manufactured by Sternson Limited or approved equal. Thickness shall be

13mm and shape shall conform to the section of the sidewalk and curb and gutter with which it is to be used.

3 Execution

3.1 PREPARATION

.1 Excavation for curb & gutter and sidewalk shall be to the depth and width as shown on the plans and drawings.

.2 Disturbed material in the bottom of excavations shall be compacted to 95% of the maximum dry density as determined by ASTM D698. Where existing curb & gutter and sidewalk is to be removed, the removal shall be done in a manner which leaves the subbase undisturbed in so far as possible.

.3 The subgrade shall be excavated or filled to proper line, grade and cross-section to provide a firm, smooth surface compacted to at least 95% of the maximum dry density as determined by ASTM D698.

.4 All soft and yielding material or other portions of the subgrade that will not compact readily when rolled or tamped shall be removed and replaced with approved borrow material and compacted to 95% of the maximum dry density.

.5 Obtain Engineer's approval of subgrade before placing granular base.

3.2 DISPOSAL OF EXCAVATED MATERIALS

.1 Excavated materials, where suitable, shall be used as backfilling material for the works included in the contract. Excavated materials shall be considered in the custody of the Contractor until delivered at the place designated.

.2 Excess excavated materials are the property of the contractor and must be removed and disposed of at the cost of the contractor.

3.3 CONCRETE PLACEMENT

.1 Obtain Engineer's approval of granular base and reinforcing steel prior to placing concrete.

.2 Do concrete work in accordance with Section 130 and as specified herein. Forms shall conform to the requirements of CAN/CSA-A23.1 and shall produce a final cross-section in compliance with the detail drawings.

.3 Place concrete to proper line and grade to give the section required by the plans and typical sections.

.4 Moisten sub-base immediately prior to placing concrete. Water to be supplied by the Contractor as incidental to the Work.

.5 Place concrete as close to its final position so as to minimize rehandling. It shall be placed and struck off in a manner which does not result in segregation. When required, hand spreading of concrete shall be done with shovels, not rakes.

.6 Concrete shall be thoroughly consolidated against and along the face of all forms and into the face of previously placed concrete.

.7 After placing, the concrete shall be levelled or screeded to proper grade, then floated using an aluminum or magnesium float to eliminate unevenness. Floating is to be completed before bleed water accumulates to the surface. Wood floats are not permitted. Steel trowels shall not be used.

.8 Edging is required along all edge forms and at isolation/expansion and construction joints. Edging shall begin after evaporation of bleed water. Round edges, including edges of joints, with 6 mm radius edging tool.

.9 All controlled joints (between expansion joints) shall be saw cutts .

.10 Finish surfaces to within 3mm in 3m from line, level or grade as measured with a straightedge placed on surface.

.11 Adding water to the surface of the concrete to assist in the finishing operation is not permitted.

.12 Adequate material and labour shall be at the site prior to placement to carry out finishing and curing, including material to protect the concrete from damage by rain. These shall include waterproof paper or plastic sheeting. The plastic sheeting shall not be left to continue as the curing material.

.13 ALL CURB & GUTTER CONSTRUCTION MUST BE PERFORMED BY A SLIP FORM MACHINE. NO FORM WORK PERMITTED, unless Approved by Engineer. The slip-form machine must meet the approval of the Engineer and this approval process may require the casting of a test section to confirm the cross section and final product conforms to the Standard Section. The casting of a trial section shall be at no cost to the Owner.

.14 Placement of the slip-form machine guide markers shall be the responsibility of the Contractor. Any adjustment required prior to placement shall be carried out at not cost to the owner.

.15 Pedestrian traffic shall not be allowed on newly placed concrete for a minimum of 24-hours. Light passenger vehicular traffic shall not be allowed on newly placed concrete for a minimum of seven (7) days. Truck traffic shall not be allowed on newly poured concrete for a minimum of twenty-eight (28) days.

3.4 EXPANSION AND CONTRACTION JOINTS

.1 Curb & Gutter:
- .1 Control joints shall extend completely through the curb height and 1/4 into the gutter section and have a width not greater than 6 mm. They shall be spaced at intervals of 3.0 metres along the length of the curb and gutter. Control joints may be saw cut with written permission of the Engineer.
- .2 Expansion joints shall be formed using expansion joint material at locations where the curb and gutter abuts structures.

.2 Sidewalks:
- .1 The depth of forms shall be at least 125 mm and not less than the thickness of any other concrete sidewalk required.
- .2 Control joints having a depth of not less than one third (1/3) of the slab and width not greater than 6mm shall be saw cuts at intervals of 1.5 metres along the length of the sidewalk.
- .3 Expansion joints shall be formed using expansion joint material at locations where

the sidewalk abuts curb and gutter, buildings, or other structures and at 6 metre intervals. Joints and edges shall be tooled to give a radius of 6mm.

.4 Following floating, the slab shall be given a skid-resistant texture by lightly scoring it in the transverse direction using a broom. Broom finish shall be parallel to curb at wheelchair ramps.

.5 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

.6 The spacing of control joints shall vary to coincide with the centre of manholes or other structures.

.7 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structures.

3.5 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill to designated elevations with Type 3 soil backfill material (as per Section 210), compact and shape to required contours as indicated.

3.6 CURING OF CONCRETE

.1 As soon as practical after the texturing operation is completed, the entire surface, including exposed sides shall be cured by protecting it against loss of moisture, rapid temperature change, in accordance with the requirements of CSA A23.1. In any case, curing shall start no later than two (2) hours after the concrete has been placed. Complete and uniform coverage shall be at the rate specified by the manufacturer. The compound shall be kept agitated to prevent pigment from settling. Membrane forming curing compound shall not be permitted following October 1, after which time moisture-proof paper shall be used.

.2 Protect surface from damage by traffic for a period of at least seven (7) days.

.3 The period for which moisture is applied or retained in the concrete surface shall not be less than seven (7) days immediately following the placing of the concrete.

.4 Where daily maximum outside air temperature exceeds 27 degrees Celsius an initial period of continuous moist curing is required. Such initial curing period shall not be less than twenty-four (24) hours.

.5 Use moisture proof paper or curing compound to cure the concrete. Paper shall be a minimum width of 2 metres for both sidewalk and curb & gutter applications.

.6 Polyethylene is not permitted. Edges of the curb and gutter or sidewalk shall be covered to prevent evaporation and all joints lapped 300 mm and adequately anchored to prevent displacement or billowing due to wind. Material folded down over the edges shall be secured by a continuous bank of earth. Tears or holes appearing in the curing paper during curing period shall be repaired immediately. Curing paper shall not be reused once it has been installed.

.7 Where daily maximum outside air temperature is less than 27 degrees Celsius the application of moisture may be omitted but a moisture proof paper or curing compound must be used for curing and shall be applied before there is any evidence of drying of the concrete surface.

3.7 COLD WEATHER REQUIREMENTS

.1 Moisture-proof paper shall be used when the forecasted nightly low temperature is at or below 5°C.

.2 When the outside air temperature is at or below -5°C, the concrete must be protected by adequate insulation or supplementary heating for a minimum 7 days.

.3 To protect the concrete from cold weather, the Contractor shall provide fibreglass batt insulation over the surface of the concrete to produce a minimum R value of 10. The insulation shall be placed over the moisture-proof paper and covered with 6 mil polyethylene. Care shall be taken to lap all joints and secure edges from heat loss. The Contractor shall prevent any removal of the completed system and shall replace at no extra cost all uncovered areas regardless of the cause of removal.

.4 In cold weather, the placing temperature of concrete shall be between 10°C and 25°C. The Contractor may heat water, or water and aggregate to ensure that these temperature limits will be met.

.5 To avoid cracking of the concrete due to sudden temperature change near the end of the curing period, the protection shall not be completely removed until the concrete has cooled to a permissible temperature differential.

.6 Concrete shall not be placed when air temperature is below 4°C or when there is a probability of it falling below that limit within twenty-four (24) hours of placing unless the temperature of the concrete in place is kept within the limits of 13°C and 32°C.

.7 No ice or snow shall be permitted on the placing surface. Concrete shall not be placed on, or against any surface that will lower the temperature of the concrete below 10°C. Under no circumstances shall concrete be placed over frozen ground.

3.8 DEFECTIVE CONCRETE

.1 If the concrete has been damaged in any way before complete set has taken place, or if any defects are discovered at any time prior to final acceptance of the work, i.e. cracking, vandalism, footprints, etc. or if the test on samples taken from the work fails to meet the specification requirements, the defective concrete shall be entirely removed to sub-grade and replaced with new concrete at the expense of the Contractor. Concrete not placed to the required minimum thickness or width shall be removed and replaced at the Contractor's expense.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
100 General Conditions
170 Traffic Control
Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
315 Removal and Disposal of Existing Asphalt and Concrete
320 Crushed Rock Base & Sub Base Materials
350 Geotextile & Geogrid
370 Quality Control

1.2 MATERIAL CERTIFICATION & SUBMISSION

.1 Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this section.

.2 Laboratory proofs of aggregate characteristics, mix designs, combined aggregate gradation and recent testing of plant mixes shall be submitted upon request of the Engineer.

1.3 DEFINITIONS

"Design Mix Formula (DMF)" means the laboratory determination of the precise proportions of asphalt binder and aggregates to be blended together to meet the specified properties for the asphalt concrete mix.

"Job Mix Formula (JMF)" means the establishment of the single definite percentage passing the 16 mm (9.5 mm for Type C and Type D mixes), 4.75 mm, 600 µm and 75 µm sieve fraction of aggregate and the asphalt binder content that shall produce the desired mix properties under field conditions. The percentage of constituent materials is to be listed on the JMF sheet.

"Asphalt Binder Content"

- Design Asphalt Binder Content is the asphalt binder established by the DMF.
- Approved Asphalt Binder Content is the asphalt binder content determined by the JMF.
- Actual Asphalt Binder Content is the amount of asphalt binder content in the mix in as determined by ASTM D2172.

"Modified Lot" means a portion of the Work being considered for acceptance, specifically, for a plant production of 500 tonnes +/-50 tonnes for which approved changes to the JMF have not occurred.

"Stratified Random Sample" means the division of the Lot into 3 or more areas or segments; a random sample is taken from each area or segment in an unbiased way.

"Sample Mean" is the arithmetic mean of a set of 3 or more test results constituting the sample.

"Specified Thickness" means the specified application rate divided by the bulk relative density obtained from the core samples.

1.4 MEASUREMENT FOR PAYMENT

.1 Asphalt paving will be measured in tonnes of asphalt concrete of the appropriate type in place specifically measured including all incidentals.

.2 Adjustments shall be measured in accordance with Section 240.

.3 Subgrade preparation and fine grading shall be considered incidental to the placement of the asphalt.

.4 The supply and placement of tack coat shall be considered incidental to the work.

.5 Asphalt patching will be measured in tonnes of asphalt concrete of the appropriate type placed including excavation, cutting, granular base, compaction, disposal of all excavated materials, tack coat and all other preparatory work.

.6 Asphalt patching or spreading in driveways or roadways or in other areas for restoration of a pipe installation will not be measured but considered incidental to the work.

.7 Minimum compacted asphalt thicknesses shall consist of the following (unless otherwise noted on the contract drawings):

	Type "B"	Type “D”	Type “E”
Parking lots	60 mm	40 mm	
Driveways	40 mm		25 mm
Local streets	60 mm	40mm	
Collectors	100 mm	40mm	
Arterials/Industrial	110 mm	40mm	

.8 Existing thickness shall be matched if they are greater than depths outlined in above .7.

.9 Pavement reinforcement will be measured in square metres of the appropriate type supplied and placed including base repairs, crack sealing, pothole filling, levelling or padding course application, including all incidentals.

.10 Key joint shall be constructed between existing and new asphalt concrete pavement at the beginning and at the end of the project and other locations where the new pavement terminates against existing pavement and shall be considered incidental to the asphalt paving.

2 Products

2.1 MATERIALS

.1 All materials shall be supplied by the Contractor and must meet or exceed all requirements of the New Brunswick Department of Transportation as stipulated in their Standard Specifications, 2015 edition, unless these specifications provide otherwise.

The Work included in this Section consists of the supply of all labour, materials and equipment necessary for the placement of hot mixed asphalt concrete pavement as per the Drawings and Specifications.

The asphalt concrete shall be identified by the following mix designations:

- Hot mixed asphalt concrete base mix – Type B.
- Hot mixed asphalt concrete surface mix – Type C.
- Hot mixed asphalt concrete surface mix – Type D.
- Hot mixed asphalt concrete sand seal mix – Type E.

It shall be the Contractor's responsibility to provide an acceptable product as specified. The Contractor shall implement and maintain a quality control system that shall provide assurance that all components, submitted to the Owner for acceptance, conform to the Contract requirements. This responsibility is without regard to whether the products are manufactured by the Contractor or purchased from suppliers or subcontractors.

Quality assurance tests shall be performed by the Engineer, on random samples taken either at the job site or at the supplier's plant.

.2 Coarse Aggregate

The coarse aggregate shall be prepared by crushing rock or gravel and shall consist of hard, sound, durable particles, free from adherent coatings, shale, clay, loam, schist and other soft or disintegrated pieces, or other deleterious substances.

Coarse aggregate is the portion retained on the 4.75 mm sieve when tested in accordance with ASTM C136, and shall meet the physical requirements of Table 340-1.

Coarse aggregate may be produced from pit run gravel by crushing the fraction retained on the 31.5 mm sieve, provided that no more than 10 % of the retained material passes the 31.5 mm sieve, in accordance with ASTM C117 and C136.

Coarse aggregate may also be accepted or rejected on the basis of past performance.

.3 Fine Aggregate

Fine aggregate shall be prepared by crushing rock or gravel or screening a manufactured sand and shall consist of hard, sound, durable particles, free from adherent coatings, shale, clay, loam, schist and other soft or disintegrated pieces, or other deleterious substances.

Fine aggregates shall be the portion passing the 4.75 mm sieve when tested in accordance with ASTM C117 and C136, and shall meet the physical requirements of Table 8-2.

Fine aggregate may be produced from pit run gravel by crushing the fraction retained on the 6.3 mm sieve, provided that no more than 5 % of the retained material passes the 31.5 mm sieve, in accordance with ASTM C117 and C136. Material produced as per section 2.1.2 and passing the 4.75 mm sieve, may be used as fine aggregate.

Fine aggregate may also be accepted or rejected on the basis of past performance.

Washed materials shall be stockpiled for at least 24 hours to allow free water to drain from the aggregate and to allow the material to attain uniform moisture content.

The production of aggregate shall be as per item 260.2.2 of the 2015 edition of the NBDTI Standard Specifications. The grading limits of combined aggregates shall be as per Table 340-1 for Types 'B', 'C', 'D' and 'E'.

TABLE 340-1
Superpave Asphalt Concrete Mix Requirements

Sieve Size ASTM Designation		Type B	Type C	Type D	Type E
		% (by mass) Passing Each Sieve			
Coarse Aggregate	25.0 mm	100.0		-	-
	19.0 mm	84.0-98.0		-	-
	16.0 mm	72.0-94.0	100.0	-	-
	12.5 mm	60.0-87.0	88.0-98.0	100.0	-
	9.5 mm	51.0-75.0	68.0-90.0	76.0-98.0	
	6.3 mm	41.0-66.0	54.0-77.0	60.0-84.0	100.0-
Fine Aggregate	4.75 mm	34.0-60.0	46.0-69.0	52.0-70.0	85.0-100.0
	2.36 mm	22.0-50.0	28.0-58.0	36.0-65.0	65.0-85.0
	1.18 mm	12.0-42.0	20.0-50.0	25.0-55.0	45.0-70.0
	600 µm	6.0-32.0	13.0-40.0	16.0-44.0	30.0-55.0
	300 µm	3.0-20.0	7.0-27.0	8.0-26.0	15.0-35.0
	150 µm	2.0-8.0	3.0-10.0	4.0-12.0	5.0-20.0
	75 µm	2.0-6.0	2.0-6.0	2.0-6.0	3.0-8.0

Physical Requirements for Coarse Aggregate					
Freeze/Thaw % (max)	DTI Method				
0.3 to < 3 million Design ESALs		16.0	14.0	14.0	
≥ 3 million Design ESALs		14.0	12.0	12.0	
Micro-Deval % (max)	MTO LS – 618				
0.3 to < 3 million Design ESALs		20.0	16.0	16.0	
≥ 3 million Design ESALs		18.0	15.0	15.0	
Petrographic No. (max)*	MTO LS - 609				
0.3 to < 3 million Design ESALs		250	200	200	
≥ 3 million Design ESALs		230	180	180	
Flat & Elongated Particles % (max @ 4:1)					
	DTI Method				
0.3 to < 3 million Design ESALs		25.0	20.0	20.0	
≥ 3 million Design ESALs		20.0	15.0	15.0	
Crushed Particles	DTI Method				
0.3 to < 3 million Design ESALs		60	70	70	
≥ 3 million Design ESALs (min % by wt, one face)		95	95	95	
≥ 3 million Design ESALs (min % by wt, two face)		80	80	80	
Absorption % (max)		1.50	1.50	1.50	
*Note: Not mandatory, the Owner reserves the right to obtain a Petrographic No.					
Physical Requirements for Fine Aggregate					
Micro-Deval % (max)	MTO LS – 619				
0.3 to < 3 million Design ESALs		22.0	18.0	18.0	
≥ 3 million Design ESALs		20.0	17.0	17.0	
Uncompacted Void Content % (min)		45.0	45.0	45.0	
*Note:	The allowable Micro-Deval surface Fine Aggregate shall be Max % Loss=19.0, if the Micro-Deval on Coarse Aggregate is ≤12.0, provided that the Coarse Aggregate is from the same source.				

.4 Blending of Aggregates

Blending of aggregates shall be allowed only to meet the grading requirements and/or to increase the percentage of crushed particles.

Blending shall be performed at the asphalt plant cold feed units to produce a consistently graded product.

.5 Blending Sand

Blending sand shall be used to obtain acceptable physical asphalt concrete mix properties as outlined in Table 340-1.

The maximum mass of blending sand to be used in the total asphalt concrete mix shall not exceed 10 % of the total mass.

Blending sand shall have 100 % passing the 9.5 mm sieve prior to the introduction into the cold feed units at the plant.

.6 Asphalt concrete pavement shall be dense graded hot laid plant mix conforming to the requirement of the 2015 edition of the NBDTI Standard Specifications, Section 260.2.3 (Asphalt Concrete mix) for Type "B" Base Course, Type "C" Base or Surface Course, Type "D" Surface Course, or the requirement of these specifications (Marshall mix) for Type "E" Sand Seal Surface Course.

Finished pavement shall conform to the lines, grades, dimensions and cross-sections as specified herein, or as set in the field, or in the case of patching or utility cuts, to the surrounding pavement conforming to the existing roadway crown and slope.

.7 Asphalt binder shall be supplied by the Contractor and shall be Performance Grade (PG 58-28S) asphalt binder, and shall meet the requirements of AASHTO M320, Table 1 – Performance Grade Asphalt Binder Specification and Table 340-2. The asphalt binder grade may be increased to a higher traffic designation as specified in the Drawings and specifications.

Certified producer's test data or representative samples shall be supplied on request.

Table 340-2
MSCR % Recovery Requirements

Traffic Designation	J_{nr} (@ 3.2 kPa)	% Recovery (min)
S	≤ 4.5 kPa^{-1}	-
H	≤ 2.0 kPa^{-1}	30%
V	≤ 1.0 kPa^{-1}	35%
E	≤ 0.5 kPa^{-1}	45%
	≤ 0.25 kPa^{-1}	55%

When anti-Stripping admixtures are required, the asphalt binder grade shall meet the specified requirements of AASHTO M332, Table 1 – Performance Graded Asphalt Binder Specification and Table 340-2, after the addition of the required admixtures.

For the purpose of establishing the Unit Bid Price for asphalt concrete the Bidder shall assume an asphalt binder content for the asphalt concrete mix as follows:

- Asphalt concrete “B”: 5.0 % of the total specified tonnage
- Asphalt concrete “C”: 5.7 % of the total specified tonnage
- Asphalt concrete “D”: 6.2 % of the total specified tonnage
- Asphalt concrete “E”: 6.0 %-8.0% of the total specified tonnage

..8 Bituminus Tack coat

Tack Coat shall be a non-tracking emulsion. Non-tracking emulsion shall meet the requirements of Table 340-3.

Non-tracking emulsion may be applied in dilute or concentrate form. When non-tracking emulsion is applied in dilute form, it shall be diluted with 40% water. Dilution of the emulsion shall be permitted at the terminal only.

Table 340-3
Non-tracking Emulsion Requirements (Prior to Dilute)

Test Type	Specification Range
Test on Emulsion	
SF Viscosity, 25°C, SFs	20 (minimum)
Sieve Test, 850µm, %	0.1 (maximum)
Dist. Residue, 260°C	55 (minimum)
Oil Portion of Dist., %	trace (maximum)
Particle Charge	(-) or (+)
Test on Residue	
Penetration, 25°C, dmm	20 - 55
Ash Content, %	1.0 (maximum)

..9 Anti-stripping admixtures

The requirement for an anti-stripping admixture is determined at the asphalt concrete mix design stage.

Approved anti-stripping admixtures are listed in Table 340-4:

Table 340-4
Approved Anti-stripping Admixtures

Product	
Redicote 82-S	Pave Bond T Lite
Redicote C-3082	Travcor 4505
Redicote C-2914	Innovalt W
Rediset LQ-1102	Evotherm M1
Ad-here LOF 65-00	Cecabase RT
Ad-here 7700	Zydex Zycotherm SP
Zydex Zycotherm	Road Science WarmGrip N1

The type and dosage of all asphalt binder anti-stripping admixtures shall be noted on the delivery slip.

..10 Asphalt Concrete mixes shall meet the physical requirements as specified in Table 340-5. The Physical requirement for Type "E" Sand Seal shall be as per Table 340-6.

TABLE 340-5
Physical Requirements for Asphalt Concrete Mix Design

Physical Requirements for Asphalt Concrete			
	Type B	**Type C**	**Type D**
Air Voids %	3.0-5.0	3.0-5.0	3.0-5.0
VMA % (min) for 100 gyration mix	13.5	14.5	15.5
VMA % (min) for 75 gyration mix	13.5-15.0	14.5-16.0	
Voids Filled with Asphalt %	70.0-75.0	70-75	70.0-77.0
TSR (Average of Conditioned & Freeze/Thaw TSR values) % (min) ASTM D4867	80.0	80.0	80.0
Dust to Binder Ratio	0.6-1.2	0.6-1.2	0.6-1.2

TABLE 340-6
Physical Requirements of Type 'E' Asphalt Concrete Mix Design

PROPERTY	**TYPE E SAND SEAL**
Stability, kN at 60°C (minimum)	4.5
Flow, mm	2 - 4
Percent Air Voids in Mixture	3 - 6
Percent Voids in Mineral Aggregate (minimum)	17±1
Asphalt Cement Content (%)	6.0 – 8.0
Theoretical Density for Calculation Purposes	2.35

In determining these properties, the ASTM bulk specific gravity for the aggregate shall be used and allowance shall be made for asphalt cement absorbed by the aggregate.

TABLE 340-7

Asphalt Type	**DMF Cement Content (%)**	**Theoretical Density (Tonnes/cu.m.)**
Type B – Base Course	5.0 – 6.5	2.40
Type C – Base or Surface Course	5.0 – 7.0	2.40
Type D – Surface Course	5.5 – 7.5	2.35

.11 Water required for the works shall be supplied by the Contractor. The Contractor will not

be permitted to use the Owner's hydrants.

.12 Pavement reinforcement mesh shall be self-adhesive GlasGrid Type 8501 (for full width reinforcement) or 8502 (for joints and major intermittent transverse cracks), or approved equal. Full width reinforcement shall have a minimum tensile strength of 100kN/m across width and along length. Detail repair reinforcement shall have a minimum tensile strength of 200kN/m across with and 100kN/m along length.

2.2 MIX DESIGN

.1 At least two weeks prior to the date paving operations are to commence, the Contractor shall present information in writing outlining the proposed mix and job mix formula based on the use of aggregate stockpiles which are representative of those to be used for the work.

.2 The submitted Design Mix Formula (DMF) shall include the following:

.1 Asphalt concrete mix design summary sheet which has been signed and dated by the laboratory manager or a designated person, and includes the following:

- Type of mix;
- Mix design laboratory;
- Contract/project Identification;
- Location of plant; and
- Date of mix design completion.

.2 Mix design test results, worksheets and graphs developed at the mix design stage.

.3 All Superpave mix design characteristics, including %Gm @ Nini, %Gm @ Ndes, %Gm @ Nmax, bulk relative density specimen mass, graphs used in arriving at the final asphalt concrete mix design, the bulk relative density of each individual material and the combined aggregates, and the asphalt absorption of the combined aggregates.

.4 Mix bulk specific gravity by AASHTO T166. If the percent of water absorbed by the specimen is found to exceed 2% by volume, as described in AASHTO T166, then the bulk specific gravity should be carried out in accordance with AASHTO T275 or ASTM D6752;

.5 The theoretical maximum specific gravity of the mix in accordance with AASHTO T209;

.6 The typical mix weight to produce a gyratory specimen with a height of 115 mm ±5 mm;

.7 Asphalt Concrete mix consensus properties (OPSS 1003 – Table 2):

- Coarse aggregate angularity;
- Flat and elongated particles content;
- Uncompacted voids content (fine aggregate angularity); and
- Sand equivalent.

.8 Designations of coarse, fine aggregates and RAP and the respective gradations for each prior to blending;

.9 Material proportions and sources, for aggregates (including RAP) and anti-stripping additive;

.10 Other physical properties of coarse and fine aggregate required by the specification;

.11 Type of Performance Graded-Asphalt Cement (PGAC), its source, and its percentage by weight of mix;

.12 Information on the percentage of fines which were returned to the mix and the resulting affect on the aggregate gradation;

.13 Aggregate absorptions (apparent and bulk);

.14 Bulk relative density and percentage of asphalt cement in the RAP used in the mix;

.15 Moisture susceptibility reports showing the tensile strength ratio (TSR) of the asphalt concrete without the anti-stripping additive and with the addition of anti-stripping additive at its required dosage;

.16 The mixing and compaction temperature of the briquettes during sample preparation;

.17 The job mix formula (JMF);

.18 The results of mix design verification by an independent consultant; and

.19 A temperature-viscosity graph which should be provided to the contractor by the supplier of the asphalt cement indicating the optimum compaction and mixing ranges unique to the asphalt cement used in the mix.

.3 The mix design documentation shall be reviewed by the Engineer. If the submission meets all the requirements of the project and/or the Specifications, the Engineer shall provide a signed letter or technical memorandum stating its acceptance. Should the mix design be rejected, the contractor is then required to address the issue(s) and submit a new or corrected mix design with the required documentation. **The mix must be approved prior to the commencement of the paving operation.** A mix design should be submitted for each mix type used on a project. The mix design should be current (completed within the last 12 months).

.4 The laboratory tests shall be done using aggregate and asphalt cement representative of those proposed for use in the project. At the same time as the mix design information is provided, stockpiles of aggregates proposed for use in asphalt concrete for the project shall be available for sampling to permit checking of the mix design. Checking of the mix design shall be at no expense to the Contractor except that sample of materials shall be provided free of charge.

.5 The Engineer or his authorized representative shall have access at any time to all parts of the paving plant for the verification of weights or proportions and character of materials and the determination of temperature used in the preparation of the mixture.

3 Execution

3.1 EQUIPMENT

.1 All equipment and construction methods shall conform with the requirements and practices of the New Brunswick Department of Transportation as stipulated in their Standard Specifications, latest edition, unless these specifications provide otherwise.

.2 All areas that are found to be loose, soft, spongy or composed of unsuitable material must be dug out, refilled with material as specified in section 320.

.3 When the rolling is completed, the surface must be nowhere more than 20 mm below, no more that 10 mm above the finished grade of crushed stone base either as set or in conformity with the Town's standard roadway cross section.

.4 Immediately prior to placing of the asphalt concrete base, the granular base material shall be reshaped and rolled in a manner which leaves the surface smooth, firm and true to

grade. When checked with a straight edge, the surfaces shall not vary more than 10 mm in 3 m.

.5 For the purpose of payment, subgrade preparation shall mean the excavation, removal and disposal of in-situ material to a maximum depth of 300 mm including backfilling, grading and compaction of crushed rock subbase material prior to paving. This shall also apply to widening of streets where a centre strip of asphalt exists.

.6 For the purpose of payment, fine grading shall mean grading of existing granular base material to a maximum depth of 100 mm including the disposal of excess material and compaction prior to paving.

.7 All structures such as manholes, inlets and valve boxes shall be adjusted to match the finished surface transverse and longitudinal grade.

.8 Structures that have been set to finished grade must not be disturbed. Damage to these structures due to grading or asphalting operations shall be repaired at the Contractor's expense.

.9 If crushed stone or asphaltic material should fall inside the structures, they shall be cleaned out immediately following occurrence.

3.2 PREPARATION OF SUBGRADE

.1 Reshape granular roadbed in accordance with Section 320.

.2 Apply asphalt tack coat to existing asphalt surfaces and edges prior to paving.

.3 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 PREPARATION OF EXISTING ASPHALT SURFACE

.1 Where asphalt concrete is placed as a resurfacing for existing pavement, all holes and areas showing signs of surface or base failure shall be cut out using a saw, cutting wheel or jack hammer to give a square edge for bonding.

.2 If the subbase granular material is excessively wet and/or does not meet minimum compaction requirements, the areas so affected shall be excavated, filled with new granular material and compacted all as per Section 320 of the technical specifications.

.3 The holes or excavated areas shall be brought level with the surrounding pavement with a layer of Type "B" Base Course material, placed and compacted to these specifications. The edge of the surrounding pavement must first be painted with tack coat. Disposal of the excavated material shall be incidental to the work. Thickness of asphalt placed shall be within the guidelines for the street designation.

.4 Where asphalt concrete paving is placed as a resurfacing layer over existing pavement, tack coat shall be applied at a coverage rate of 0.2 to 0.3 litres per square metre prior to placing new asphalt concrete. The full width of surface to be treated shall be cleaned with a power or hand broom, to remove all sand, gravel, mud, etc. from existing paved area. This shall be considered incidental to the work.

.5 Where asphalt widening is undertaken, the edges of existing asphalt shall be cut, removed, cleaned thoroughly and tack applied before new base asphalt is placed. The cuts shall be made with a cutting wheel giving a straight vertical face through the thickness of the pavement to provide a butt joint.

.6 Tack coat shall be applied in a uniform manner by means of approved pressure distributors. The use of brooms for manual application on patching contracts is acceptable. Temperature range of tack coat, when applied, shall be between 38°C and 66°C. The tack coat shall not be applied in wet weather or at an ambient temperature lower than 10°C.

.7 Distributors shall be equipped with a tank gauge and measuring stick graduated in litres; and a sampling valve. The Contractor may place the bituminous tack coat by hand at longitudinal joint locations. Tack shall be applied only when the surface to be treated is dry and swept clean over the full width of surfaces to be treated.

.8 The Contractor shall protect or cover concrete walks, top of curbs, walls, adjacent structures and other appurtenances, prior to spraying bituminous tack coat, to avoid over-spray of these sites. Any tack coat overspray adhering to concrete walks, top of curb or adjacent structures along the street shall be removed at the Contractor's expense.

.9 Traffic shall be diverted around freshly sprayed surfaces, if possible, until tack coat has set. Tack coat shall not be applied over an area greater than can be covered by the asphaltic concrete placed in the same day.

.10 The Contractor shall be responsible to reinstate, at his own expense, any bituminous tack-coated surface which has become fouled due to weather and/or traffic.

.11 Where the Engineer has designated use of pavement reinforcement, GlasGrid Type 8501 (or approved equal) for full width cracking shall be used unless otherwise specified. All remedial work such as base repairs, crack sealing, pothole filling, levelling or padding course application, etc. shall be performed prior to placing the reinforcement. Surface must be prepared as a clean, dry, even surface. On a milled or planed surface, a minimum 19mm levelling course of asphalt must be placed prior to the pavement reinforcement and final lift of asphalt.

3.4 TRANSPORTATION OF MIX

.1 Transport mix to job site in trucks with tight, metal boxes free of foreign materials.

.2 Loads shall be covered with tarpaulins of sufficient size to overhang the fully loaded boxes and be tied down on three sides and the front shall be tight to the box of the truck or shielded to prevent air infiltration. Tarpaulins shall be rolled back and the hot mix shall be uncovered immediately prior to dumping the load into the paver.

.3 Trucks may be lightly lubricated with an approved release agent, as required, but must be raised and drained after each application and before loading. No excess solution will be permitted.

.4 Schedule delivery of material for placing in daylight, unless Engineer approves artificial light.

.5 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.

3.5 PLACEMENT OF ASPHALT CONCRETE

.1 Asphalt Concrete base and surface course shall be placed to proper line and grade to give compacted depth, crown, profile, and cross-section as per these specifications and detailed drawings.

.2 Placing conditions:

.1 When placing asphalt concrete base mix the surface temperature of the material to be overlaid and the air temperature at surface of the road shall be a minimum of 2°C and rising.

.2 When placing asphalt concrete surface mix the surface temperature of the material to be overlaid shall be a minimum of 5°C and rising and the air temperature at surface of the road shall be a minimum of 7°C and rising.

.3 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.

.4 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp. Asphalt concrete shall not be placed when weather conditions of fog or rain prevail, nor when the pavement surface shows any signs of moisture.

.4 Place asphalt concrete in compacted lifts of thickness as follows:

.1 Levelling course(s) to thicknesses required but not exceeding 100 mm.

.2 Lower course in layers of 100 to 125 mm each.

.3 Surface course in layers of maximum 60 mm each.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less that 300 mm.

.6 Place individual strips no longer than 500 m.

.7 The mechanical spreader shall make 2 consecutive passes of equal width when placing pavement seal course in order to obtain a proper crown on the road surface. On parking lots commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.

.8 Spread and strike off mixture with self propelled mechanical finisher:

.1 Construct longitudinal joints and edges true to line markings. Lines for paver to follow will be established by Engineer parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.

.2 Correct irregularities in alignment left by paver by trimming directly behind machine.

.3 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.

.4 Do not throw surplus material on freshly screeded surfaces.

.9 When hand spreading is used**:**

.1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.2 Distribute material uniformly, do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a higher temperature than temperature of mix being placed.

.10 Temperature of the mixture shall not exceed 165°C and the minimum asphalt concrete temperature prior to placement shall be 115°C.

.11 Mixture that does not comply with specifications and mixture which cannot be incorporated

into the work shall be rejected.

.12 Along curb and gutter, sluice boxes, manholes and similar structures and places not accessible to roller, the mixture shall be thoroughly compacted by means of hot hand tampers and effectively sealed.

.13 Each course after compaction shall be smooth and true to required crown and grade. It shall have average thickness specified and shall vary no more than 6mm from specified thickness.

.14 The surface of finished pavement shall be free from depressions exceeding 3mm as measured with a 3m straight edge.

.15 Any part of pavement not meeting the requirements of specifications shall be removed by the Contractor and replaced with fresh, hot mixture compacted to conform with surrounding area and thoroughly bonded to it.

.16 Fuel spills from the Contractor's equipment shall be immediately repaired by the Contractor to the satisfaction of the Engineer.

.17 All placement, spreading, compacting and rolling shall occur only during daylight hours and any loads arriving at the Work Site such that these requirements cannot be met shall be rejected by the Engineer.

3.6 COMPACTING

.1 Roll asphalt continuously to a density between 92.5% and 96.5% of the maximum theoretical density (MTD) obtained with specimens prepared from samples of mix being used.

.2 Compaction equipment shall consist of at least one of each of the following and as many additional rollers as necessary to achieve specified pavement density:
- .1 Vibratory roller;
- .2 Pneumatic tire roller;
- .3 Finish roller

.3 Start rolling operations as soon as placed mix can bear weight of roller without undue displacement of material or cracking of surface.

.4 Operate roller slowly initially to avoid displacement of material. For subsequent rolling do not exceed 5 km/h for static steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing should not exceed compacted lift thickness.

.6 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled. No traffic shall be allowed on newly placed asphalt

concrete until finish rolling is complete and the finished mat has been permitted to cool to 60°C.

.10 After transverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.

.11 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.12 If damage to street components and/or adjacent property is occurring while using vibratory compaction equipment, the Contractor shall immediately cease using this equipment and proceed with the Work using static rolling equipment.

3.7 FINISH ROLLING

.1 Accomplish finish rolling with a steel drum roller, without vibration and exerting an initial contact pressure on compression roll of at least 3.0 kg/mm of drum width. Ensure material is still warm enough for removal of roller marks.

.2 Conduct rolling operations in close sequence.

3.8 JOINTS

.1 General:
- .1 Joints shall be constructed to ensure thorough and continuous bond and to provide a smooth riding surface.
- .2 Trim to vertical face to provide true surface and cross section against which new pavement may be laid. Dirt or other foreign and loose material shall be removed from the faces against which joints are to be made.
- .3 Paint existing asphalt joint edges with bituminous tack coat prior to placing adjacent pavement.
- .4 Overlap previously laid strip with spreader by 100 mm.
- .5 Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.
- .6 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.
- .7 Do not paint contact surfaces of existing structures such as manholes, catch basins with bituminous tack coat prior to placing adjacent pavement.
- .8 The Contractor shall remove and dispose of waste materials, resulting from joint construction before the end of each Work Day.

.2 Transverse joints:
- .1 A transverse construction joint shall be constructed at the end of each day's work and at other times when paving is halted for a period of time which will permit the asphalt to cool below 115°C.
- .2 On Arterial and Collector streets, where the asphalt concrete surface and/or base course has been terminated, the mat shall be tapered at 50:1 minimum. When paving resumes, tapers from surface courses previously laid shall be cut back to full mat thickness to expose fresh, straight vertical surfaces, free from broken or loose material and tacked in accordance with Construct and thoroughly compact transverse joints to provide a smooth riding clause 3.3.
- .3 A transverse key joint shall be constructed between existing and new asphalt concrete pavement at the beginning and at the end of the project and other locations where the new pavement terminates against existing pavement. If a key is cut in advance of paving the joint area, the Contractor shall construct a smooth taper at the joint area to a minimum slope of 50:1.

.4 Offset transverse joint in succeeding lifts by at least 600 mm.

.3 Longitudinal Joints:

.1 All longitudinal joints left exposed overnight or which are exposed to moisture from rain, all curbs and sluice boxes or other abutting structures, shall receive an application of tack coat.

.2 Longitudinal joints shall be constructed to ensure that maximum compression under rolling is achieved. There should not be any excess material scattered on the surface of the freshly laid mat and all excess material shall be carefully removed.

.3 When rolling with static roller, shift roller over onto previously placed lane in order that 100 to 150 mm of drum width rides on newly laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until thoroughly compacted neat joint is obtained.

.4 When rolling with vibratory roller, have most of drum width ride on newly placed lane with remaining 100 to 150 mm extending onto previously placed and compacted lane.

.5 Offset longitudinal joints in succeeding lifts by at least 150 mm.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade.

.5 Guarantee

- The Contractor shall, for a period of two (2) years after the completion of the work, guarantee all longitudinal joints against failure and defects.
- Failure and defects shall include but not be limited to pot-holing, ravelling and cracking along the joint.
- Cracking along the joint shall be repaired by routing and crack-sealing using a method, materials and schedule as submitted to and approved by the Engineer.
- The Contractor shall submit, in writing, his proposed method and schedule for the repair of all other failures and defects, for the Engineer's approval.
- The Contractor shall carry out the repairs at his expense in accordance with the approved submissions or as otherwise approved by the Engineer.

3.9 TEMPORARY TRAFFIC MARKINGS

.1 The Contractor shall place daily, temporary markings on newly constructed or milled pavement surfaces to be exposed to traffic, in areas designated by the Engineer.

.2 All materials for temporary traffic markings shall be supplied by the Contractor. Supply and placement of all temporary markings is incidental to the Work.

.3 Spacing for temporary traffic markings shall be 50 metre centre to centre on tangent sections and 25 metre centre to centre on curved sections.

3.10 FINISH TOLERANCES

.1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed in any direction.

3.11 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 rippling.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

.4 If, at any time before the work is finally accepted, any ravelling, shoving or other fault develops in the pavement as laid, all materials in such place shall be removed, the edges of the joints cut square and painted with tack coat and fresh mixture placed and compacted. All such removal and replacement of unsatisfactory material shall be done at the expense of the Contractor.

3.12 FINAL CLEAN-UP

.1 Immediately after the completion of the work, or any consecutive portion of it, the Contractor shall remove from the street all unused material, refuse and dirt placed by him on or in the vicinity of the work and leave the street in a neat and clean condition.

3.13 CONSTRUCTION OF SUBSTRUCTURES

.1 The right is reserved by the Town during the progress of the Work to construct, rebuild or replace with as little inconvenience to the Contractor as possible, any structures such as manholes, inlets, valve boxes and to make any necessary connections or renewals with sewers, water mains or gas pipes lying within the limits to be paved and the Town reserves the right to suspend the work at any time for the purpose above stated, without compensation to the Contractor other than extension of time for the completion of the work equal to the delay thereby caused.

4 Quality Control / Quality Assurance

4.1 QUALITY CONTROL

.1 Quality control (QC) shall be carried out by the contractor in order to assure that the hot-mix asphalt paving meets the requirements of this specification.

4.2 QUALITY ASSURANCE

.1 Quality assurance (QA) is carried out by the owner in order to assured that the hot-mix asphalt paving meets the requirements of this specification.

.2 Acceptance of the hot-mix asphalt paving will be based entirely on the results of the QA testing.

.3 The contractor can challenge the results of the QA testing for rejectable hot-mix asphalt paving within 5 working days. Referee samples can be taken for referee testing at the discretion of the Engineer. If the results of the referee testing are acceptable, the hot-mix asphalt paving represented by these results will be considered acceptable and the Owner will pay for the testing. If the results are not acceptable, the hot-mix asphalt paving represented by these results will be considered rejectable and the Contractor will be pay for the referee testing.

.4 Testing shall be based on the Modified Lot method as described in the sampling frequency

for QA testing in Section 370.

.5 The QA results will be used to determine if the paving is acceptable with or without unit price adjustment as per section 340 at item 4.4 PRICE ADJUSTMENT OF THE LOT, or rejectable. If the paving is rejectable, the Contractor shall remove it and replace with new paving meeting the requirements of this specification at no additional cost to the Owner.

4.3 PHYSICAL REQUIREMENTS FOR ASPHALT CONCRETE

.1 Once the JMF has been designated by the Engineer, the Contractor shall produce an asphalt concrete mix to the mix control tolerances as shown in Table 340-1, 340-8. For all Asphalt Concrete Mix Requirements, refer to NBDTI 2015 Standard Specifications Table 260-1 and 260-3.

TABLE 340-8
Acceptance Criteria

Test Properties	Criteria
Air Voids (%)	3.0% to 5.0%
Asphalt Binder Content	JMF ± 0.40% (type B), ± 0.30% (type C, D)
Percent Passing 4.75mm Sieve	JMF ± 6.0% (type B), ± 5.0% (type C, D)
Percent Passing 75 µm Sieve	JMF ±0.8% (type B), ± 0.50% (type C, D)

4.4 PRICE ADJUSTMENT FOR THE LOT

The unit price adjustment UPAs for asphalt concrete are shown in tables 340-8 (Density), 340-9 (Asphalt Content), 340-10 (Gradation), and 340-11 (Air Voids).

The Unit Price (UP) for asphalt concrete base or surface mixes shall be adjusted for each Lot as follows:

$$UP_{Lot} = UP + \Sigma (UPA_{Density} + UPA_{Asphalt\ Content} + UPA_{Gradation} + UPA_{Air\ Voids})$$

.1 Compaction testing shall be based on the modified lot average method. Table 340-9 shows the unit price adjustment for field compaction based on a modified lot average method.

Table 340-9
Unit Price Adjustment for Field Compaction ($UPA_{Density}$**)**

% of Maximum Theoretical Density (Lot Average)	Unit Price Adjustment $ per Tonne
≥92.5	0.0
92.5 to 92.0	-2.0
92.0 to 91.5	-4.0
91.5 to 91.0	-8.0
91.0 to 90.5	-16.0
90.5 to 90	-20.0
89.9 to 89.5	-22
89.5 to 89.0	-24
<89.0	rejectable

.2 **Table 340-10**
Unit Price Adjustment for Asphalt Content (UPA $_{\text{Asphalt content}}$)

Mean of the Deviations of Actual Asphalt Content form the Approved Asphalt Content		Unit Price Adjustment $ per Tonne
Type B	0.00 to 0.40	0.0
	0.41 to 0.45	-1.00
	0.46 to 0.50	-2.00
	0.51 to 0.55	-3.00
	0.56 to 0.60	-4.00
	0.61 to 0.65	-5.00
	>0.65	rejectable
Type C Type D	0.00 to 0.30	0.0
	0.31 to 0.35	-1.00
	0.36 to 0.40	-2.00
	0.41 to 0.45	-3.00
	0.46 to 0.50	-4.00
	>0.50	rejectable

.3 **Table 340-11**
Unit Price Adjustment for Gradation (UPA $_{\text{Gradation}}$)

Sieve Size ASTM Designation	Mean of the Deviations of the Gradation from the JMF		Unit Price Adjustment For Gradation
	Type B	Type C / D	$ per Tonne
4.75 mm	0.0 to 6.0	0.0 to 5.0	0.0
	6.1 to 6.2	5.1 to 5.2	-0.25
	6.3 to 6.4	5.3 to 5.4	-0.50
	6.5 to 6.6	5.5 to 5.6	-0.75
	6.7 to 6.8	5.7 to 5.8	-1.0
	6.9 to 7.0	5.9 to 6.0	-1.25
	7.1 to 7.2	6.1 to 6.2	-1.50
	7.3 to7.4	6.3 to 6.4	-1.75
	7.5 to 7.6	6.5 to 6.6	-2.00
	7.7 to 7.8	6.7 to 6.8	-2.25
	7.9 to 8.0	6.9 to 7.0	-2.5
	8.1 to 9.0	7.1 to 8.0	-5
	9.1 to 10.0	8.1 to 9.0	-7.5
	>10.0	>9.0	rejectable
75 µm	0.0 to 0.8	0.0 to 0.5	0.00
	0.9	0.6	-0.25
	1.0	0.7	-0.75
	1.1	0.8	-1.50
	1.2	0.9	-2.50
	1.3	1.0	-3.75
	1.4 to 1.5	1.1 to 1.2	-6.0
	>1.5	>1.2	rejectable

In addition to the above acceptance/rejection requirements for gradation, the following shall apply:

a) if the lot average of Lot test results for the 4.75 mm sieve size falls outside the gradation limits of Table 340-8, the Lot shall be rejected.
b) If the average of Lot test results for the 75 µm sieve size exceeds 6.5%, the following shall apply:
   - 6.6% to 7.5% the Lot Payment shall be reduced by $10.00/t;
   - >7.5%, the Lot shall be rejected.

.4

Table 340-12
Unit Price Adjustment for Air Voids ($UPA_{Air\ Voids}$)

Mean of the Deviations of Air Voids form Target Value Air Voids (4.00%)	Unit Price Adjustment $ per Tonne
0.00 to 1.00	0.00
1.01 to 1.10	-0.50
1.11 to 1.20	-1.00
1.21 to 1.30	-2.00
1.31 to 1.40	-4.00
1.41 to 1.50	-6.00
1.51 to 1.60	-8.00
1.61 to 1.70	-10.00
1.71 to 1.80	-12.00
1.81 to 1.90	-14.00
1.91 to 2.00	-16.00
>2.00	rejectable

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
170 Traffic Control

Section 200: UNDERGROUND INFRASTRUCTURE
260 Pipe Culverts

Section 300: STREETS & ROADWAYS
360 Random Riprap

1.2 SAMPLES

.1 Submit to Engineer the following samples at least 2 weeks prior to commencing work.
  .1 Minimum of 1 m^2 of geotextile fabric.

1.3 REFERENCES

.1 CAN/CGSB-4.2, Textile Test Methods.

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Geomembranes.

.3 ASTM D4595, Test Methods for Tensile Properties of Geotextiles by the Wide Width Strip Method.

.4 ASTM D4751, Test Method for Determining the Apparent Opening Size of a Geotextile.

1.4 MILL CERTIFICATES

.1 At least 2 weeks prior to start of work, furnish Engineer with copies of mill test data and certificate that the geotextile fabric and geogrid delivered to job site meets requirements of this section.

1.5 APPROVAL

.1 Obtain written approval of Engineer for geotextile fabric and geogrid before installation of material in work.

1.6 MEASUREMENT FOR PAYMENT

.1 Supply and placing of geotextile fabric or geogrid will be measured in square meters of material incorporated into work and in place. All seam overlap allowances shall be incidental to the work.

2 Products

2.1 MATERIALS

.1 Geotextile: Type W1 (Terrafix 24-15 or equal) woven synthetic fibre fabric, supplied in rolls.
  .1 Width: 3.5m minimum
  .2 Length: 120m minimum
  .3 Composed of: minimum 85% by mass of polypropylene and/or polyester polyamide with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
  .4 Seams: lapped in accordance with manufacturer's recommendations.

.5 Grab tensile strength and elongation (in any principal direction): ASTM D4595.
.6 Grab tensile strength: minimum 400N, wet condition.
.7 Elongation at break: maximum 25%.
.8 Mullen burst strength: to CAN/CGSB-4.2, No. 11.1-94, minimum 1.50 MPa, wet condition.
.9 Apparent opening size (EOS): to ASTM D4751, maximum 840 μm.
.10 Permittivity: 0.01 sec^{-1} minimum.

.2 Geotextile: Type N1 (Terrafix 240R or equal) non-woven synthetic fibre fabric, supplied in rolls.
.1 Width: 3.5m minimum
.2 Length: 150m minimum
.3 Composed of: minimum 85% by mass of polypropylene and/or polyester polyamide with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
.4 Seams: lapped in accordance with manufacturer's recommendations.
.5 Grab tensile strength and elongation (in any principal direction): ASTM D4632.
.6 Grab tensile strength: minimum 400N, wet condition.
.7 Elongation at break: minimum 50%.
.8 Mullen burst strength: to CAN/CGSB-4.2, No. 11.1-94, minimum 1.10 MPa, wet condition.
.9 Apparent opening size (EOS): to ASTM D4751, 75 μm.
.10 Permittivity: 1.75 to 3.50 sec^{-1}.

.3 Geotextile: Type N2 (Terrafix 360R or equal) non-woven synthetic fibre fabric, supplied in rolls.
.1 Width: 3.5m minimum
.2 Length: 100m minimum
.3 Composed of: minimum 85% by mass of polypropylene and/or polyester polyamide with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
.4 Seams: lapped in accordance with manufacturer's recommendations.
.5 Grab tensile strength and elongation (in any principal direction): ASTM D4632.
.6 Grab tensile strength: minimum 600N, wet condition.
.7 Elongation at break: minimum 50%.
.8 Mullen burst strength: to CAN/CGSB-4.2, No. 11.1-94, minimum 2.20 MPa, wet condition.
.9 Apparent opening size (EOS): to ASTM D4751, 75 μm.
.10 Permittivity: 1.25 to 2.75 sec^{-1}.

.4 Geogrid: (Tensar BX1100 or equal) biaxially formed regular grid structure, supplied in rolls.
.1 Width: 3.0m minimum
.2 Length: 50m minimum
.3 Aperature size along roll length: 25mm minimum
.4 Open area: minimum 70%
.5 Rib thickness at ribs: 7.6 μm minimum
.6 Rib thickness at junctions: 27.9 μm minimum
.7 Polypropylene material: minimum 98% to ASTM D4101
.8 Carbon black material: minimum 0.5% to ASTM D4218
.9 Flexural rigidity along roll length: minimum 250,000 mg/cm to ASTM D1388
.10 Tensile modulus: 20,835 kg/m minimum
.11 Strength at junctions: 1,116 kg/m minimum to GRI GG2
.12 Efficiency at junctions: minimum 90% to GRI GG2
.13 Seams: installed in accordance with manufacturer's recommendations.
.14 Chemical resistance: resistant to all natural occurring alkaline and acidic soil conditions.
.15 Biological resistance: resistant to attack by bacteria and fungi.

3 Execution

3.1 INSTALLATION

.1 Place material by unrolling and retain in position with gravel material.

.2 Protect fabric from displacement or damage until and during placement of overlaid material layers.

.3 Place fabric in one continuous length, as shown on plans or directed by Engineer.

.4 Overlap each strip of fabric 600mm over previously laid strip.

.5 Remove and replace fabric damaged or deteriorated as directed by Engineer.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
150 Environmental Protection

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavating, Trenching, Bedding & Backfilling of Pipelines

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
350 Geotextile and Geogrid Fabric

1.2 DESCRIPTION

.1 This Item consists of the supply and placing of random riprap.

1.3 MEASUREMENT FOR PAYMENT

.1 The quantity to be measured for payment shall be the number of tonnes of random riprap placed in accordance with this item and as shown in the Contract documents.

1.4 MATERIALS

.1 All materials shall be supplied by the Contractor.

.2 Random riprap materials shall be a well graded mixture and shall conform to the grading limits shown in Table 360-1.

.3 Random riprap, each rock shall have both thickness and breadth greater than or equal to one-third of its length.

.4 Random riprap shall consist of clean, hard, sound, durable rock having a density of not less than 2.6 t/m^3.
- .1 The rock, when tested by the Micro-Deval test method in accordance with MTO LS-618, shall have a Micro-Deval loss not greater than 35%.
- .2 When tested by the Freeze/Thaw test method in accordance with MTO LS-614, the rock material shall have a Freeze/Thaw loss not greater than 15%.

.5 Random riprap used for back slope stabilization or in erosion control structures may have a Micro-Deval loss not greater than 70% and a Freeze/Thaw loss not greater than 30%.

.6 The acceptability of the rock will be determined by the Owner's service records and/or by laboratory and/or field testing procedures carried out by qualified personnel.

.7 Random Riprap Mixed
- .1 Random riprap mixed shall be noted in the Contract Documents as R-# mixed and shall consist of a random riprap material of the designated size (R-#) thoroughly mixed with a well graded granular material.
- .2 The Contractor shall produce a consistent mixed homogeneous blended supply of the specified mixture mixed at the proportion of approximately 20% by weight to the random riprap material indicated, to form a very dense material.

1.5 SUBMITTALS

.1 The Contractor shall notify the Engineer, in writing, for approval of the source of supply of rock or gravel/finely shattered rock material, at least 14 days in advance of obtaining material from the proposed source.

Table 360-1
Random Rip-Rap Grading Limits

MASS	SIZE (Note 1)	FINER BY MASS (%)			
(kg)	(mm)	R-5	R-25	R-50	R-100
300	600				100
250	570				
200	530				70 - 90
150	480			100	
100	420			70 - 90	40 - 55
75	380		100		
50	330		70 - 90	40 - 55	
25	260		40 - 55		
15	220	100			
10	190	70 - 90			0 - 15
5	150	40 - 55		0 - 15	
2.5	120		0 - 15		
0.5	70	0 - 15			
Thickness (mm) (Note 2)		300	500	600	800
Note 1		Approximate diameter (for information only)			
Note 2		Measured perpendicular to the prepared surface			

1.6 CONSTRUCTION

.1 The Contractor shall carry out the Work as indicated in the Contract Documents and/or as specifically directed by the Engineer.

.2 The Contractor shall clear the Work Area of all driftwood, debris, snow, ice and all other objectionable materials.

.3 Control of the gradation shall be by visual examination.

.1 Any difference in opinion between the Engineer and the Contractor shall be resolved by testing in accordance with ASTM D5519.

.2 The Contractor shall provide the equipment, a sorting site and the labour required to undertake the testing required.

.4 The Contractor shall place the random riprap material by approved procedures such that the underlying slopes are not disturbed and riprap material is not wasted.

.5 The Contractor shall immediately repair any damage to the underlying materials and grade resulting from the placement of the random riprap.

.6 The Contractor shall tamp random riprap mixed during placement.

END OF SECTION

1 General

1.1 RELATED WORK

Section 100: GENERAL CONDITIONS
130 Concrete

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavating, Trenching, Bedding & Backfilling of Pipelines

Section 300: STREETS & ROADWAYS
310 Roadway Excavation, Embankment & Compaction
320 Crushed Rock Base & Subbase Materials
330 Curbs, Gutters & Sidewalks
340 Asphalt Paving

1.2 DESCRIPTION

.1 The Work shall be the best of the respective kinds as described in the specifications and in accordance with the manufacture's instructions. The Work shall be subject from time to time to such standard tests as the Consultant may direct and shall meet the minimum requirements as described herein.

.2 The contractor shall provide such assistance, instruments, machines, labour and materials as are normally required for examining, measuring and testing the works and the quality, weight or quantity of any materials used and shall supply samples of materials before incorporation in the works for testing as may be selected and required.

1.3 MEASUREMENT FOR PAYMENT

.1 SUBDIVISION AND LAND DEVELOPEMENT

.1 The Developer shall appoint and pay for the services of testing laboratory acceptable to the Consultant.

.2 Costs of such all testing requirements shall be borne by the Developer. If tests fail, further testing will be carried out at the expense of the Contractor under the direction of the Consultant.

.2 CAPITAL PROJECTS

.1 QUALITY CONTROL

Quality control (QC) shall be carried out by the contractor in order to assure that the requirements of this specification are met and all associated costs shall be borne by the Contractor.

.2 QUALITY ASSURANCE

Quality assurance (QA) is carried out by the owner in order to assure that the work and materials meets the requirements of this specification.

.1 Acceptance of the materials and testing results will be based entirely on the results of the QA testing.

.2 The contractor can challenge the results of the QA testing for rejectable results within 5 working days. Referee samples can be taken for referee

testing at the discretion of the Engineer. If the results of the referee testing are acceptable, the materials represented by these results will be considered acceptable and the Owner will pay for the testing. If the results are not acceptable, the materials represented by these results will be considered rejectable and the Contractor will be pay for the referee testing.

.3 The QA results will be used to determine if the tested material is acceptable with or without unit price adjustment as per material section or if rejectable. If the material is rejectable, the Contractor shall remove it and replace with new material meeting the requirements of this specification at no additional cost to the Owner.

1.4 MATERIALS

.1 All materials shall be supplied by the Contractor.

.2 Testing of materials and compaction will be carried out by an accredited testing laboratory.

1.5 SUBMITTALS

.1 The Consultant shall confirm that all materials to be incorporated in the Work and supplied by the Contractor conform to the criteria defined in the latest edition of the Town of Riverview Standard Municipal Specifications. Submissions are to be in accordance with General Condition - Submittals.

.2 The Consultant shall confirm that all materials incorporated in the Work have been installed in accordance with the criteria defined in the latest edition of the Town of Riverview Standard Municipal Specifications.

Execution

3.1 FIELD INSPECTION

.1 Provide Testing Agency and Consultant with access to the Work, and to locations where products to be incorporated into the Work are being prepared.

.2 Cooperate with and assist Testing Agency and Consultant in conducting necessary tests.

.3 Notify Consultant in advance of requirements for tests and inspections.

.5 Do not bury pipe work and appurtenances or other portions of the Work until Consultant has advised that necessary tests or inspections are completed.

.6 Consultant may order any buried work to be uncovered for examination. Defective work shall be repaired by Contractor.

3.2 TESTING AGENCY

.1 Testing Agencies will be engaged by the Developer for the purpose of inspecting and/or testing portions of Work.

3.3 SAMPLING FREQUENCY

.1 Trench Work – Bedding

.1 Testing not required

.2 Trench Work – Backfill
- .1 Minimum of one (1) Proctor test is required per material type prior to placement. Retest when a change in material type is noted.
- .2 Minimum of one (1) nuclear density test in accordance with ASTM D2922 to develop a definite compaction procedure based on equipment, lift thickness, moisture content and number of passes required to produce the desired density.
- .3 Minimum of one (1) nuclear density test per 100m of trench work, for each 300mm lift.

.3 Road Subgrade – Borrow or Fill Sections
- .1 Minimum of one (1) Proctor test is required per material type prior to placement. Retest when a change in material type is noted.
- .2 Minimum of one (1) nuclear density test in accordance with ASTM D2922 to develop a definite compaction procedure based on equipment, lift thickness, moisture content and number of passes required to produce the desired density.
- .3 Minimum of one (1) nuclear density test per 50m of street, for each 300mm lift.

.4 Road Subgrade – Cut Sections
- .1 Carry out visual proof rolling inspection of all subgrade surfaces with a fully loaded tandem truck. See Section 310 on subgrade inspection & proof rolling.

.5 Granular Base and Subbase
- .1 Minimum of one (1) Proctor test is required per material type prior to placement. Retest when a change in material type is noted.
- .2 Minimum of one (1) sieve test to ASTM C117 and C136 prior to placement.
- .3 Minimum of one (1) nuclear density test in accordance with ASTM D2922 to develop a definite compaction procedure based on equipment, lift thickness, moisture content and number of passes required to produce the desired density.
- .4 Minimum of one (1) nuclear density test per 50m of street or per 500 tonnes placed, for each 300mm lift.

.6 Concrete Curb & Gutter
- .1 Minimum of one (1) nuclear density test on granular base underlying new concrete curb & gutter per 50m of curb & gutter.
- .2 Minimum of one slump, air and compressive strength test (3 cylinders) per 25 m^3 of concrete placed or 200m of new curb & gutter.

.7 Concrete Sidewalk
- .1 Minimum of one (1) nuclear density test on granular base underlying new concrete sidewalk per 50m of sidewalk.
- .2 Minimum of one slump, air and compressive strength test (3 cylinders) per 50 m^3 of concrete placed or 200m of new sidewalk.

.8 Asphalt Concrete
- .1 Minimum of one (1) Asphalt Concrete Mix Test per full day of asphalt production per HM type or 500 tonnes per HM type placed. There shall be a minimum of three (3) tests per lot/street per HM type placed carried out by the Testing Agency even when quantities placed are less than the threshold increment.
- .2 Minimum of one (1) Core sample per 200m of street. There shall be a minimum of three (3) cores performed per street.
- .3 Refer to Section 340, item 4. Quality Control / Quality Assurance

The asphalt concrete test methods indicated in the following Table 370-1 shall be used to determine material characteristics.

Table 370-1
Test Methods

Test Description		Test Method
Sampling Mixes		ASTM D 979
Coring		ASTM D 5361
Ignition Method		DTI Asphalt Concrete Quality Assurance Technician Certification Manual, Procedure # 9
Percent Fracture		DTI Method
Sieve Analysis		ASTM C 136 / ASTM C 117
Bulk Relative Density		ASTM D 2726
Theoretical Maximum Relative Density		AASHTO T 209
Voids Calculations, Asphalt Concrete Specimens		ASTM D 3203
Percent Compaction, Asphalt Concrete pavement		ASTM D 2726
Forming Superpave Specimens, Field Method		AASHTO T 312
Moisture Content, Oven Method Asphalt Concrete Mix		ASTM D 2172
Stratified Random Test Sites for A.C.P. Projects		ASTM D 3665
Asphalt Binder:	Flash and Fire Points	AASHTO T 48 or ASTM D 92
	Viscosity	AASHTO T 316 or ASTM D 4402
	Rheological Properties	AASHTO T 315
	Rolling Thin Film Oven	AASHTO T 240
	Accelerated Aging (PAV)	AASHTO R 28
	Flexible Creep Stiffness	AASHTO T 313
TSR (Average of Conditioned & Freeze/Thaw TSR Values)		ASTM D 4867
In all test methods used as reference in this specification, metric sieves as specified in ASTM E11 shall be substituted for any other specified wire cloth sieves.		

Frequency or numbers of tests may be increased at any time by the Engineer when deemed necessary or if unfavorable results are recorded.

All test results shall be emailed to the Engineer (Town of Riverview) and to the Contractor.

When conducting testing for subdivision development, all test results shall be reported to the Engineer (Town of Riverview), the Consultant, the Contractor, and to the Developer (Owner).

END OF SECTION

1 General

1.1 GENERAL

This section covers items common to Sections of Division 16 and comprises the basic requirements for the installation of architectural street lights in the Town of Riverview.

1.2 RELATED WORK

Section 100: GENERAL CONDITIONS
130 Concrete

Section 200: UNDERGROUND INFRASTRUCTURE
210 Excavation and backfilling

1.3 SHOP DRAWINGS

.1 Two (2) weeks prior to installation of street lights, submit shop drawings for all equipment and materials to the Engineer for review.

.2 Notify the Engineer of any changes required by the Province of New Brunswick prior to making the changes.

1.4 CODES AND STANDARDS

.1 Do complete installation in accordance with C22.1-1990 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA C22.3 No. 1-M87 and CAN3-C22.3 No. 7-M86 except where specified otherwise.

.3 Abbreviations for electrical terms: to CSA Z85-1983.

.4 CSA C22.2 No. 65-M1988 Wire Connectors.

1.5 COORDINATION

.1 Coordinate all activities with the NB Electric Power Commission, Town of Riverview Engineering Department, civil site contractor, and all other local officials.

1.6 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.7 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Section 2 – Products.

.2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment which is not CSA certified, obtain special approval from the Province of New Brunswick.

.3 Factory assemble control panels and component assemblies.

1.9 FINISHES

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original.

1.10 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.2 Nameplates:
Lamicoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Wording on nameplates and labels to be approved by the Engineer prior to manufacture.

.4 Allow for average of twenty-five (25) letters per nameplate.

.5 Identification to be English.

.6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.7 Disconnects and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

1.11 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1-1986.

1.12 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

1.13 MANUFACTURERS AND CSA LABELS

.1 Visible and legible after equipment is installed.

1.14 WARNING SIGNS

.1 As specified and to meet requirements of the Province of New Brunswick.

1.15 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished grade to bottom of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

1.16 LOAD BALANCE

.1 Where applicable, measure phase current to panel boards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Where applicable, measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

1.17 CONDUIT INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50 mm.

1.18 FIELD QUALITY

.1 Conduct and pay for following tests:
- .1 Circuits originating from branch distribution panels where applicable.
- .2 Lighting and its control.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 Insulation resistance testing.
- .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
- .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
- .3 Check resistance to ground before energizing.

.4 Carry out tests in presence of Engineer.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Submit test results for Engineer's review.

1.19 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as over-current trips, relays and fuses are installed to required values and settings.

1.20 MEASUREMENT FOR PAYMENT

.1 Connection to main power source, all required equipment, including disconnect switch, permits, and all incidentals shall be measured as a lump sum item.

.2 Supply and Installation of underground conduit including trenching, bedding, backfilling restoration of all surfaces, all conductors, electrical equipment and incidentals will be measured in linear meters acceptably installed.

.3 Decorative poles and bases and connection to electrical supply shall be measured in units supplied and acceptably installed.

.4 Supply and installation of Luminaires and Lamps shall be measured as one item in units acceptably installed.

2. Products

2.1 PVC DUCTS AND FITTINGS (Concrete Encased)

.1 PVC ducts, type EB1, encased in reinforced concrete.

.2 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

.3 Expansion joints as required.

.4 Rigid PVC 5° angle couplings as required.

2.2 PVC DUCTS AND FITTINGS (Direct Bury)

.1 Rigid PVC ducts for direct burial: minimum wall thickness at any point of 3.0 mm. Nominal length: 3 m plus or minus 12 mm.

.2 Rigid PVC couplings, solvent weld, reducers, bell end fittings, plugs, caps adaptors as required to make complete installation.

.3 Rigid PVC 90° and 45° bends as required.

.4 Rigid PVC 5° angle couplings as required.

.5 Expansion joints as required.

2.3 PLASTIC POLYETHYLENE PIPE (Direct Bury)

.1 Flexible plastic polyethylene pipe with approved couplings and fittings required to make a complete installation.

2.4 CABLE PULLING EQUIPMENT

.1 6 mm stranded polypropylene pull rope tensile strength 5 kN.

2.5 CABINETS

.1 EEMAC 3 sheet steel welded cabinet, baked enamel interior/exterior finish, steel baked white enamel backplate, piano hinged neoprene gasketed screw-on lockable door.

2.6 CONDUCTORS

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 6 AWG

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RWU90.

2.7 CONDUIT BOXES

.1 Size boxes in accordance with CSA C22.1.

.2 Blank neoprene gasketed feraloy cover plates for conduit boxes without wiring devices.

.3 Cast FS feraloy boxes with factory-threaded hubs and mounting feet.

2.8 FITTINGS – GENERAL

.1 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

2.9 WIRE AND BOX CONNECTORS 0-1000 V

.1 Pressure type wire connectors: with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper alloy sized to fit copper conductors 6 AWG or less.

2.10 MOULDED CASE CIRCUIT BREAKERS

.1 Bolt-on moulded case enclosed circuit breaker: rated as indicated quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40° C ambient.

.2 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.3 Weatherproof enclosures sized to accommodate ancillary equipment as indicated.

2.11 CONTACTORS

.1 Contactors: to EEMAC No. 1CS-1970.

.2 Electrically held controlled by pilot devices as indicated and rated for type of load controlled. Half size contactors not accepted.

.3 Complete with 2 normally open and 2 normally closed auxiliary contacts unless indicated otherwise.

.4 Mount in CSA Enclosure as indicated.

.5 Include following option in enclosure:
.1 Hand-Off-Auto selector switch.

.6 Control transformer: required for other than 120 V.

2.12 AC CONTROL RELAYS

.1 Convertible contact type: contacts field convertible from NO to NC, electrically held with dust cover and 4 poles. Coil rating: 120 V. Contact rating: 120 V, Amp. As indicated.

.2 Fixed contact type: general purpose with 2 poles. Coil rating: 120 V. Contact rating: 120 V, Amp. as indicated.

2.13 PHOTOCELL

.1 Sealed polycarbonate weatherproof case with light level adjustment slide, threaded stem, locknut and neoprene gasket. Rated 1800 W tungsten, 120 V.

2.14 OVERHEAD

.1 Service mast: rigid PVC conduit suitable for attachment of support clamps, and weatherhead.

.2 Service mast support devices.

.3 Weatherhead: PVC plastic.

2.15 GROUNDING - SECONDARY EQUIPMENT

.1 Rod electrodes, copper clad steel 19 mm dia by 3 m long.

.2 Insulated grounding conductors: green, type RWU90.

.3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
.1 Grounding and bonding bushings
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Bonding jumpers, straps.

2.16 CONCRETE POLES

.1 Concrete poles: to CSA A14-M1979, tapered, hexagonal cross-section, designed for underground wiring.

.2 Direct buried, overall length 18’ – 0”.

.3 Eclipse S-11 polished finish.

.4 Non-rusting nameplate, handhole with non-rusting coverplate and screws, wiring aperture, located as detailed.

.5 Handhole sized for wiring connections and containing ground lug for conductor size 6 AWG.

.6 Tenon size to accommodate luminairies.

.7 Traditional style ladder rest, type LRN, black finish.

.8 Acceptable Product:

- Stress/Crete Limited
  Model TEC 18 ALPH-CSA
  Style 140
  603-7-100-BF Eclipse S-11

2.17 LUMINAIRIES

.1 Traditional style luminaire with aluminum 14 gauge formed sheet upper assembly and single piece molded polycarbonate lens lower assembly.

.2 The upper enclosure with black finish hinged to the lower enclosure shall have an external ornamental design and contain an auxiliary collecting reflector, framework, neoprene foam gaskets and locking screws.

.3 The lower enclosure lens fits securely within the corner frames of the upper frame support; gaskets provide a weather tight enclosure.

.4 The luminaire support assembly of aluminum construction with black finish contains the cast aluminum ballast housing and cast aluminum slip fitter to accommodate tenon. The removable ballast shall be accessed through a door in the housing.

.5 High pressure sodium ballast: to ANSI C82.4-1985

.1 Rating 240 V 60Hz, for use with 150 HPS lamp.
.2 Designed for exterior ambient temperature.
.3 Power factor: 95% of rated lamp lumens.
.4 Type: CWA, HP factor with matching igniter.
.5 Capacitor: non-PCB.
.6 Input voltage range: plus or minus 10% of nominal
.7 Minimum starting temperature: minus 34 deg. C. at 90% line voltage.
.8 Intregal mounting.

.6 Fixtures shall be finished with an electrostatically applied thermostat polyester powder coat with a rust inhibiting process. Color: Black.

.7 Acceptable Products:
.1 Lumec Ancestra Series No. AT20-SCB
.2 Moldcast Perciline Traditional Series 73000

2.18 LAMPS

.1 High pressure sodium mogul base, BT-150W, clear, 16000 lumen, 24000 hour.

.2 Acceptable Products:
Phillips Electronics Limited
Sylvania GTE Canada Limited
Canadian General Electric

2.19 ALUMINUM POLES

.1 Aluminum poles: To meet or exceed current ASTM, CSA, and UL Standards.

.2 Poles to be 4" Dia. round profile, seamless, not tapered aluminum extrusion designed for underground wiring.

.3 Overall length: 14 Feet

.4 Poles shall be designed and constructed to withstand winds of up to 160 Km/Hour.

.5 Handhole shall be 2 ½" x 4" and shall be complete with aluminum access door and shall contain grounding lug.

.6 Tenon: 2 3/8" outside diameter x 4" high.

.7 Base Cover: Round, two piece aluminum, mechanically fastened with stainless steel screws to completely conceal welds and anchorage.

.8 Finish: Electro statically applied thermoset polyester powder coat with a rust inhibiting process. Color to be black.

.9 Anchor bolts, nuts and washers: Galvanized steel.

.10 Traditional style ladder rest, type LRN, black finish.

.11 Duplex receptacle (120 v line voltage only).

.12 Acceptable Products: Lumec APR4
Moldcast Series PR4

3. Execution

3.1 INSTALLATION OF DIRECT BURIED CABLE DUCTS

.1 Install duct in accordance with manufacturer's instructions.

.2 Clean inside of ducts before laying.

.3 Ensure full, even support throughout duct length.

.4 Slope ducts with 1 to 400 minimum slope.

.5 During construction, cap ends of ducts to prevent entrance of foreign materials.

.6 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.7 In each duct, install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 CONDUITS IN CAST-IN-PLACE CONCRETE

.1 Locate to suit reinforcing steel.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Use cold mastic between sleeve and conduit.

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 After installation of cables, seal duct ends with duct sealing compound.

.6 Perform tests in accordance with PART 1 – General.

.7 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.8 Check and identify each phase conductor.

.9 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

10. Pre-acceptance tests.
    - .1 After installing cable but before splicing and terminating, perform insulation resistance test with megger on each phase conductor.
    - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

3.4 CABINET INSTALLATION

.1 Install boxes and cabinets as indicated on plans in inconspicuous ladder accessible locations.

.2 Provide nameplates as per PART 1 – General.

3.5 WIRE AND BOX CONNECTORS – 0 – 1000 V INSTALLATION

.1 Remove insulation carefully from ends of conductors and:
- .1 Install mechanical pressure type connectors and tighten screws.
- .2 Install fixture type connectors and tighten. Replace insulating cap.

3.6 OVERHEAD SERVICE

.1 Install service mast, weatherhead.

.2 Allow adequate conductor length for connection to supply by power supply authority.

.3 Allow adequate conductor length for drip loops.

.4 Make grounding connections in accordance with Section 3.8 (Grounding – Secondary).

3.7 SERVICE EQUIPMENT

.1 Install circuit breaker service equipment.

.2 Connect to incoming service.

.3 Connect to outgoing load circuits.

.4 Make grounding connections in accordance with Section 3.8 (Grounding – Secondary).

3.8 GROUNDING SECONDARY

.1 Install complete permanent, circuit, equipment, grounding systems including, electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of Engineer and local authority having jurisdiction over installation.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Make buried connections to electrodes, using bolted type connectors.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Install separate ground conductor to lighting standards.

3.9 ELECTRODES

.1 Install rod, electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

.3 Use copper conductors for connections to electrodes.

.4 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.10 EQUIPMENT GROUNDING

.1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, outdoor lighting.

3.11 FIELD QUALITY CONTROL

.1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.2 Perform tests before energizing electrical system.

3.12 INSTALLATION OF POLES AND FIXTURES

.1 Install accessories on poles as indicated with ladder rest oriented 90° to street.

.2 Location – As indicated on Drawings.

.3 Install luminaries on poles, straight side parallel with street, connect to pole wiring, install lamps.

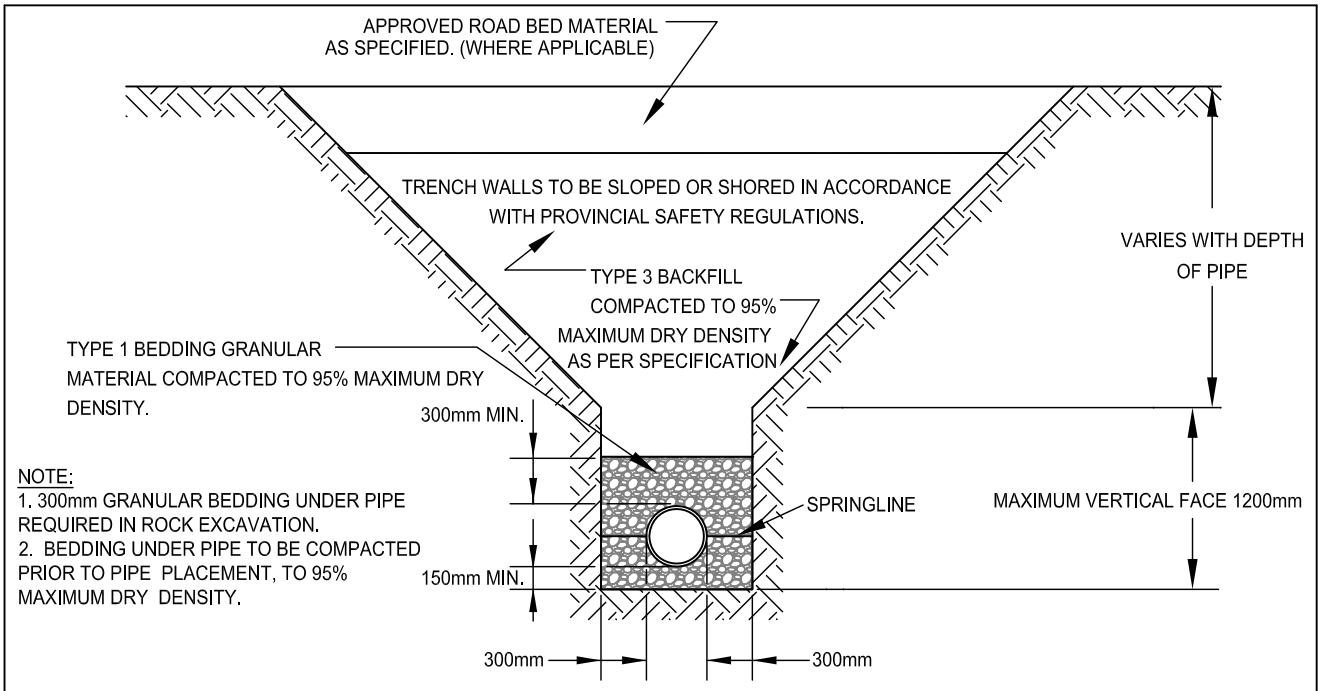
.4 Connect ground conductors.

.5 Connect pole power wiring to underground street lighting circuit in handhole at pole base.

.6 Perform test as specified by Engineer.

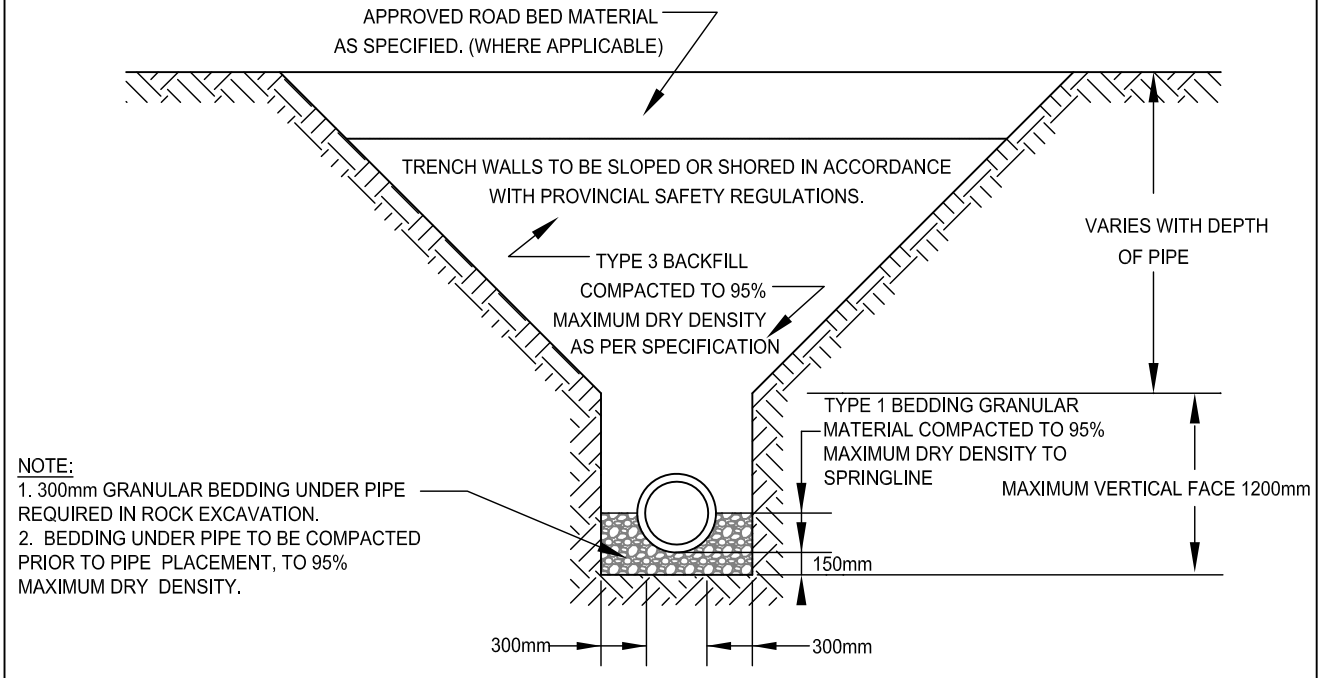
END OF SECTION

Index



NOTE:
1. 300mm GRANULAR BEDDING UNDER PIPE REQUIRED IN ROCK EXCAVATION.
2. BEDDING UNDER PIPE TO BE COMPACTED PRIOR TO PIPE PLACEMENT, TO 95% MAXIMUM DRY DENSITY.

PVC, HDPE AND DUCTILE IRON PIPE



NOTE:
1. 300mm GRANULAR BEDDING UNDER PIPE REQUIRED IN ROCK EXCAVATION.
2. BEDDING UNDER PIPE TO BE COMPACTED PRIOR TO PIPE PLACEMENT, TO 95% MAXIMUM DRY DENSITY.

CONCRETE PIPE

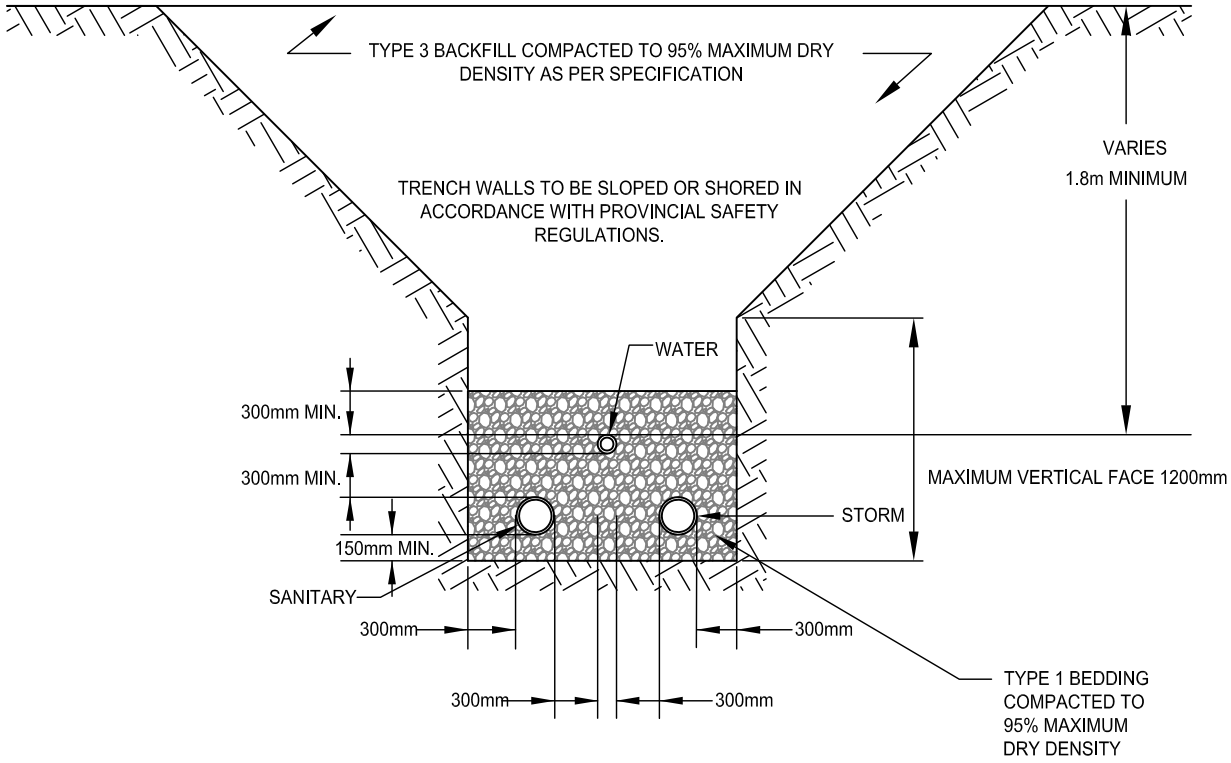
PIPE BEDDING AND BACKFILL

DATE: FEBRUARY, 2017

DETAIL NO: 1

Riverview

NOTE: THIS CROSS-SECTION IS A VIEW FROM THE STREET LOOKING TOWARDS THE HOUSE.



SCHEDULE OF MINIMUM REQUIREMENTS FOR SERVICE LATERALS			
CASE	WATER	STORM	SANITARY
SINGLE FAMILY RESIDENTIAL	19mmØ	100mmØ	100mmØ

NOTE: EACH DWELLING MUST HAVE INDIVIDUAL SERVICES

SEWER SERVICE LATERALS:
- STORM TO BE WHITE PVC DR28
- SANITARY TO BE GREEN PVC DR35

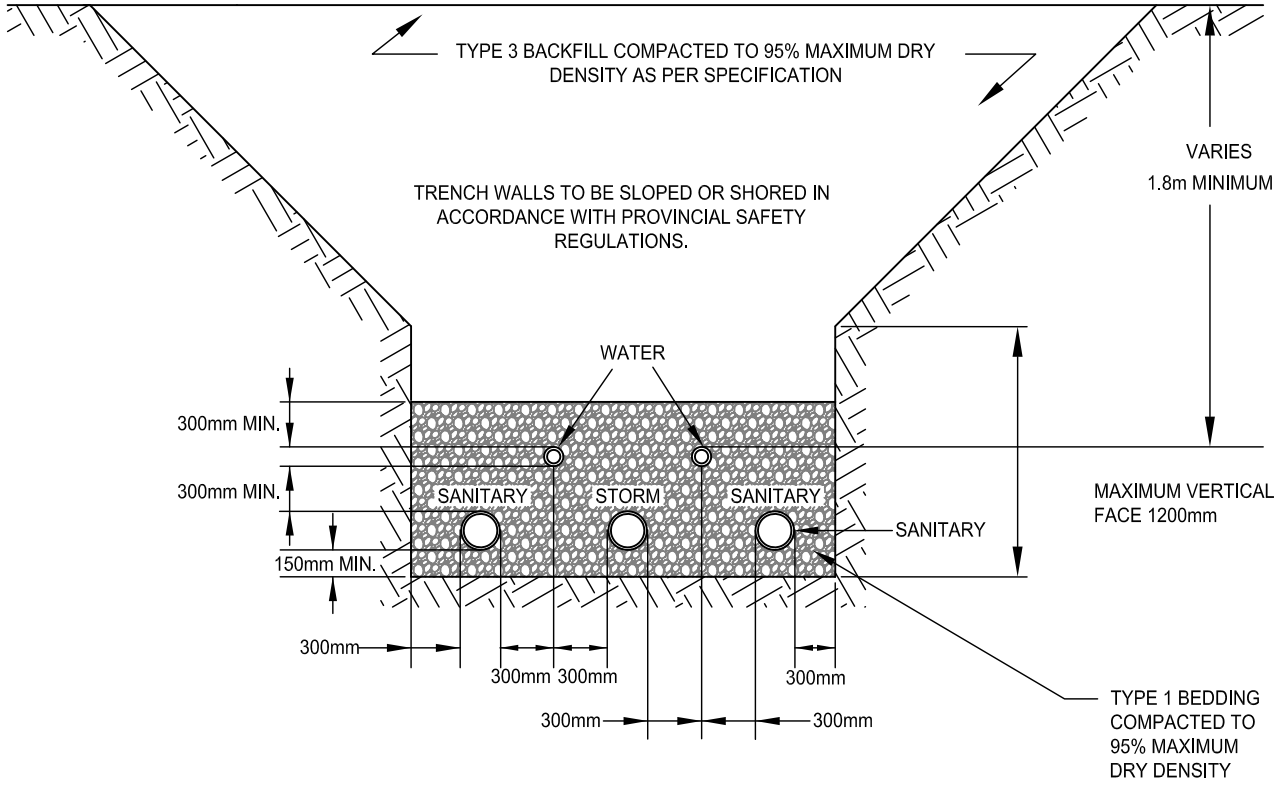
SINGLE RESIDENTIAL SERVICE TRENCH

DATE: FEBRUARY, 2017

DETAIL NO: 2

Riverview

NOTE: THIS CROSS-SECTION IS A VIEW FROM THE STREET LOOKING TOWARDS THE HOUSE.



SEWER SERVICE LATERALS:

- STORM TO BE WHITE PVC DR28
- SANITARY TO BE GREEN PVC DR35

SCHEDULE OF MINIMUM REQUIREMENTS FOR SERVICE LATERALS			
	WATER	STORM	SANITARY
SEMI-DETACHED	19mmØ	100mmØ	100mmØ
	19mmØ		100mmØ

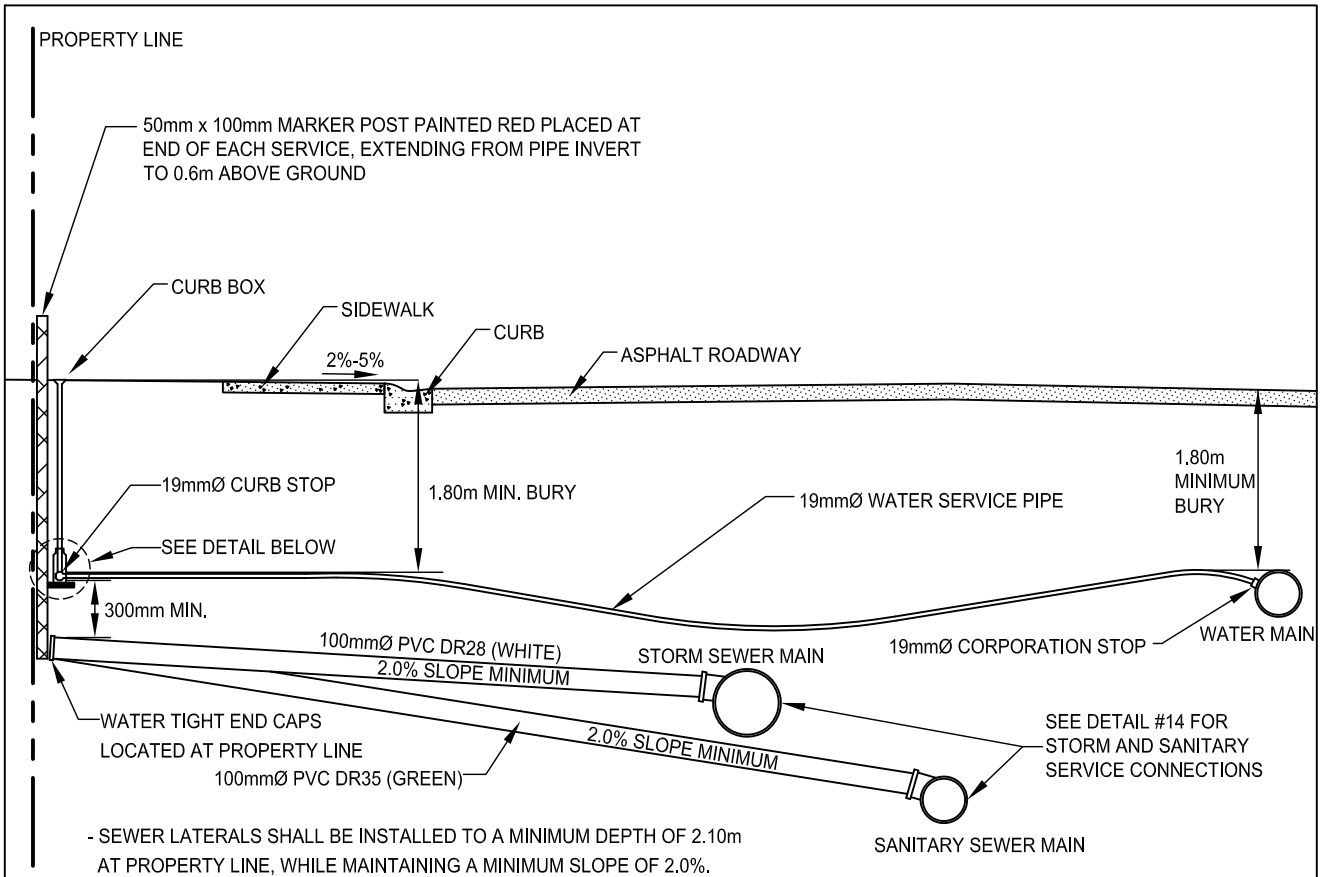
NOTE:
EACH UNIT MUST HAVE INDIVIDUAL SERVICES FOR WATER AND SANITARY.
MAXIMUM OF 2 UNITS SERVICED PER TRENCH

MULTI-UNIT SERVICE TRENCH

DATE: FEBRUARY, 2017

DETAIL NO: 2a

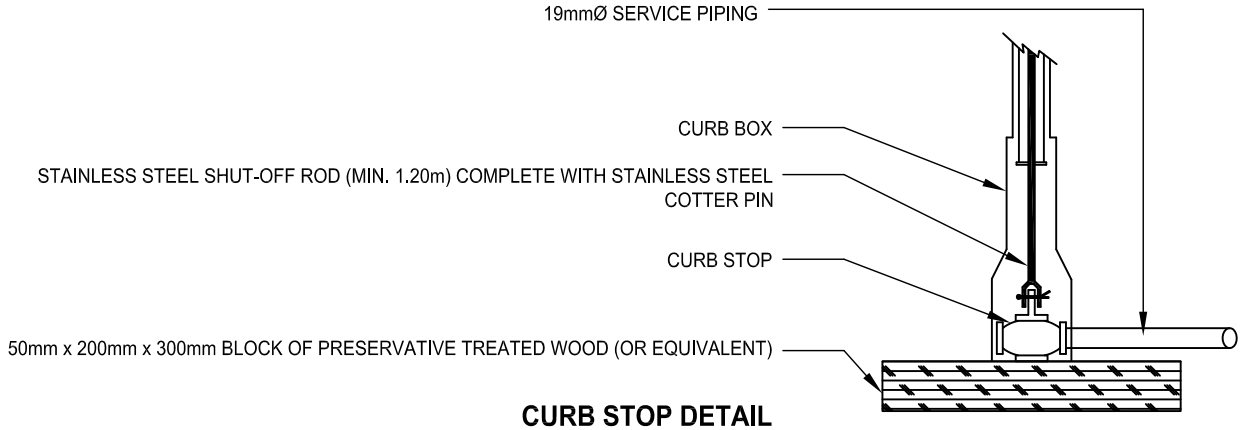
Riverview



- SEWER LATERALS SHALL BE INSTALLED TO A MINIMUM DEPTH OF 2.10m AT PROPERTY LINE, WHILE MAINTAINING A MINIMUM SLOPE OF 2.0%.
- BENDS SHALL BE OF LONG RADIUS TYPE ONLY.

- SERVICE SADDLES MUST BE USED ON ALL WATER SERVICE CONNECTIONS TO WATER MAIN.

- CURB BOX MUST BE PLUMB AND CENTERED OVER CURB STOP OPERATING NUT.

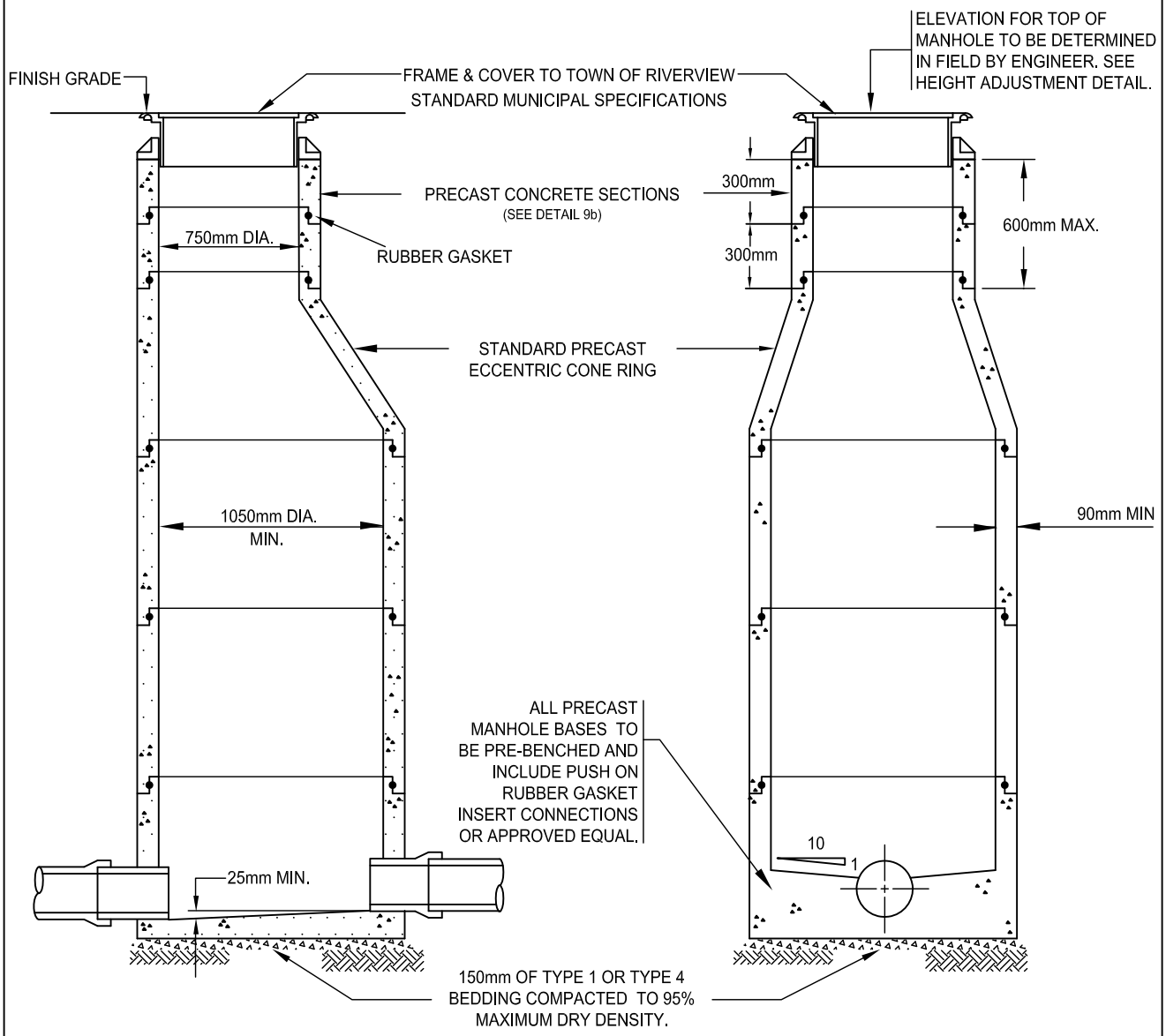


CURB STOP DETAIL

TYPICAL SERVICE LATERALS FOR RESIDENTIAL SERVICING

DATE:	FEBRUARY, 2017
DETAIL NO:	3

Riverview

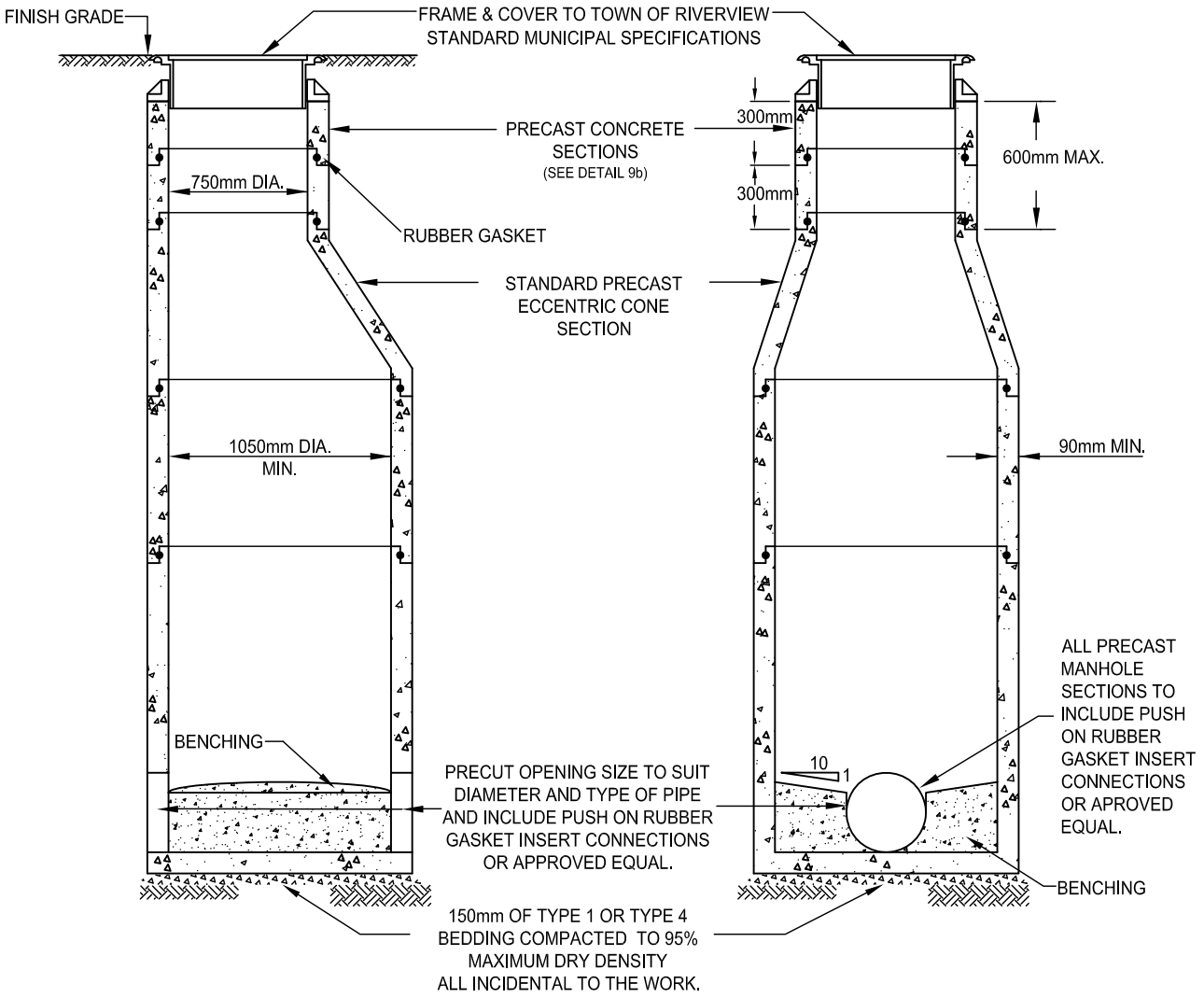


NOTES:
- PRECAST CONCRETE UNITS TO ASTM C478
- CONCRETE TO BE AIR ENTRAINED IN ACCORDANCE WITH CSA A23.1 - CONCRETE TO BE 32 MPa
- ALL JOINTS TO BE MADE WATER TIGHT WITH CONFINED "O" RING OR APPROVED EQUAL
- WHEN POSSIBLE LOCATE ECCENTRIC CONE ON THE OUTLET SIDE OF THE MANHOLE

SANITARY MANHOLE

DATE:	FEBRUARY, 2017
DETAIL NO:	4

Riverview

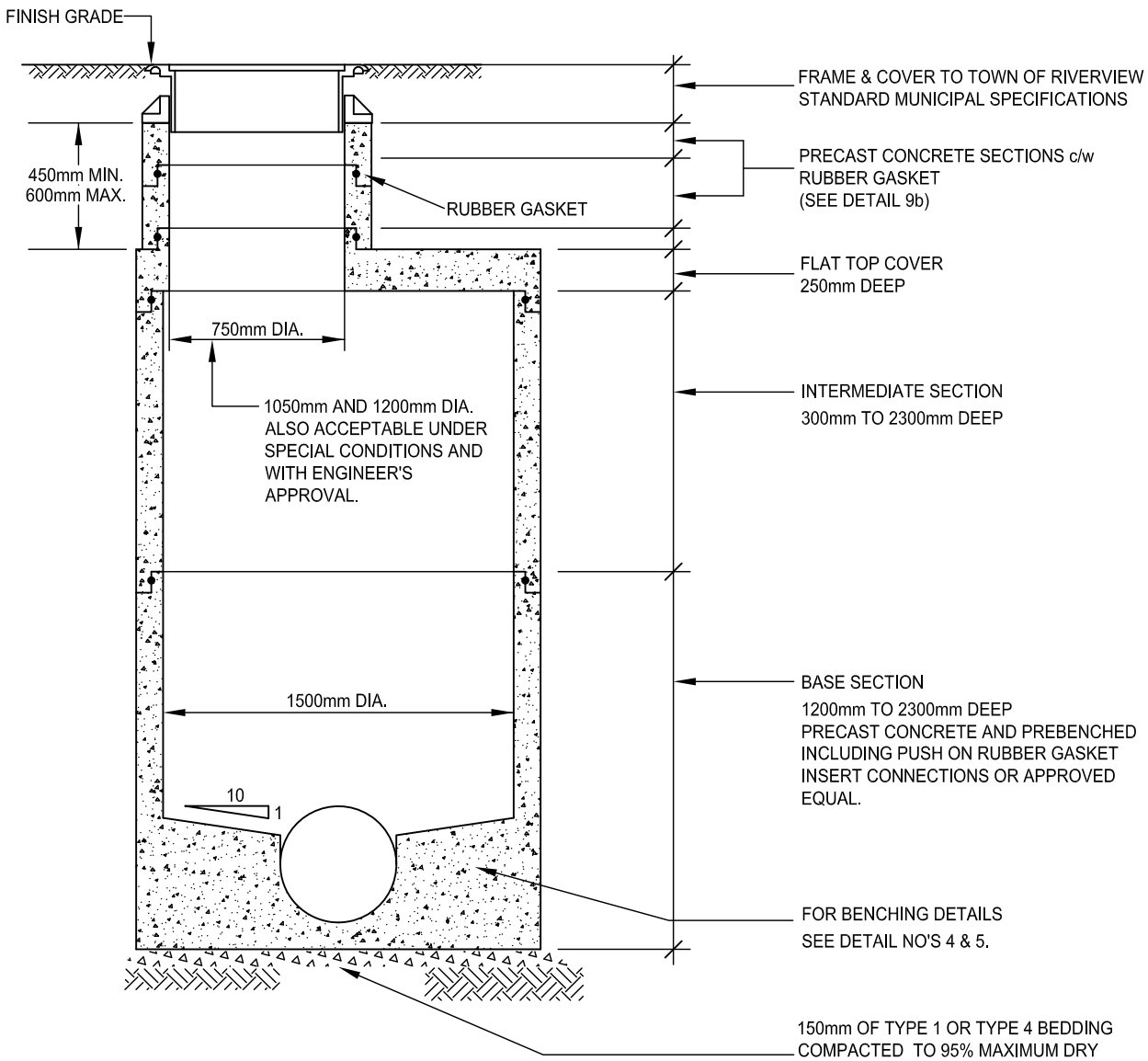


NOTES:
- PRECAST CONCRETE UNITS TO ASTM C478
- CONCRETE TO BE AIR ENTRAINED IN ACCORDANCE WITH CSA A23.1
- CONCRETE TO BE 32 MPa
- ALL JOINTS TO BE MADE WATER TIGHT WITH RUBBER GASKET/RAM-NECK OR ENGINEER APPROVED EQUAL
- WHEN POSSIBLE, LOCATE ECCENTRIC CONE ON THE OUTLET SIDE OF THE MANHOLE

STORM MANHOLE

DATE:	FEBRUARY, 2017
DETAIL NO:	5

Riverview



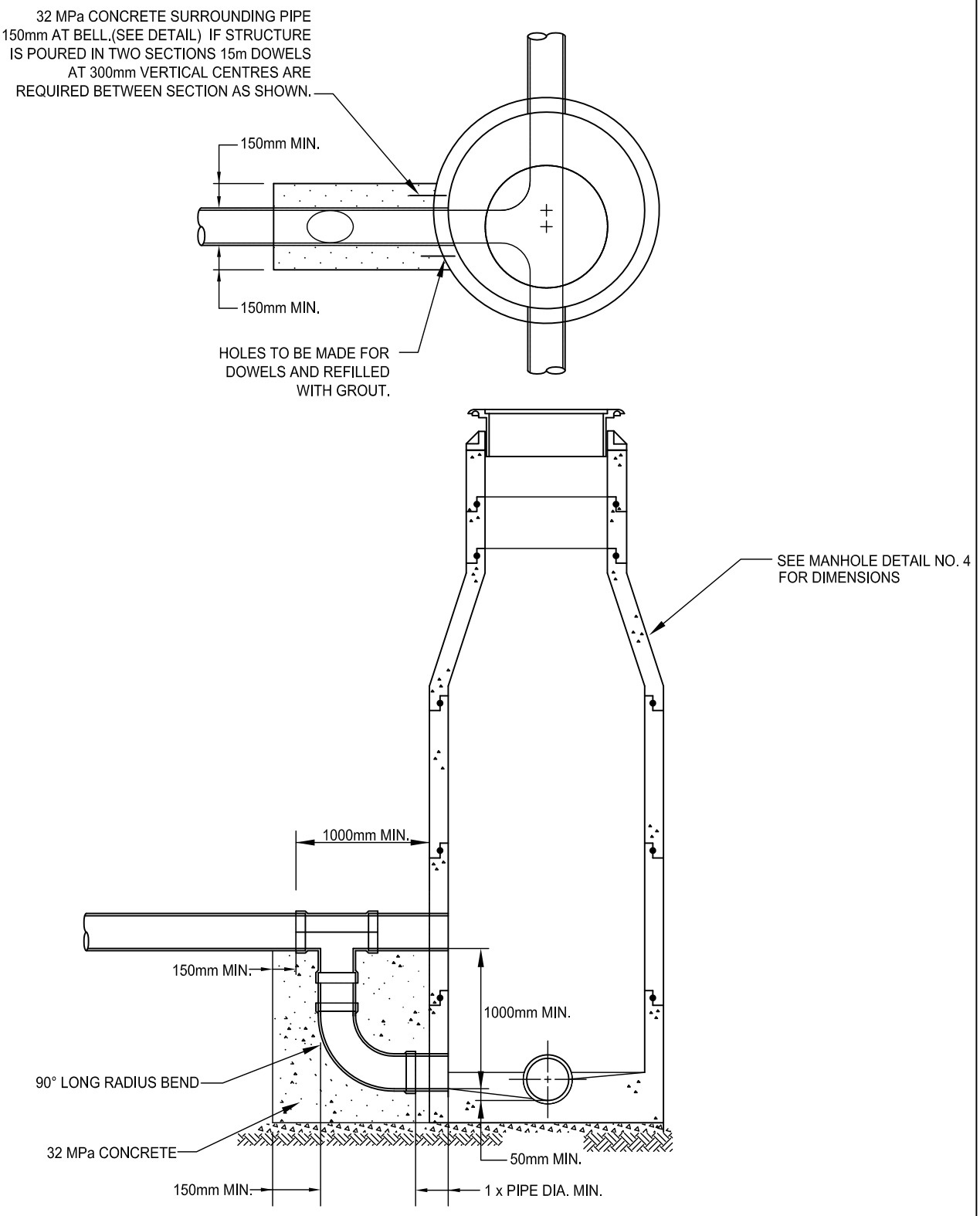
NOTES:
- PRECAST CONCRETE UNITS TO ASTM C478
- CONCRETE TO BE AIR ENTRAINED IN ACCORDANCE WITH CSA A23.1
- CONCRETE TO BE 32 MPa
- ALL JOINTS TO BE MADE WATER TIGHT WITH RUBBER GASKET, RAM-NECK OR ENGINEER APPROVED EQUAL
- WHEN POSSIBLE, LOCATE MANHOLE OPENING AT INLET SIDE

STORM MANHOLE (FLAT TOP)

(750mm TO 900mm DIA. STORM SEWERS)

DATE:	FEBRUARY, 2017
DETAIL NO:	6

Riverview

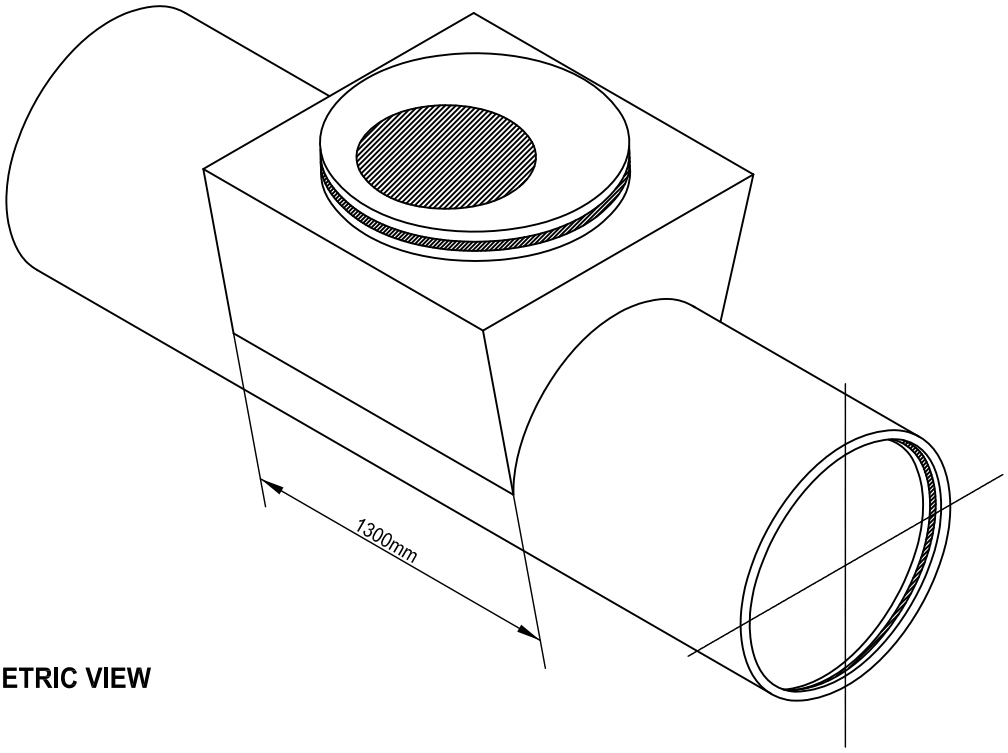


DROP MANHOLE

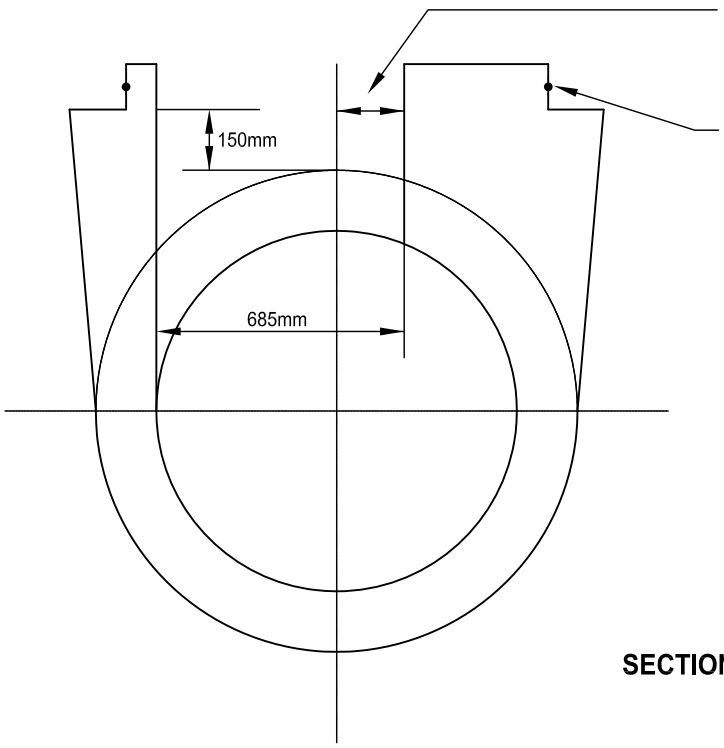
DATE: FEBRUARY, 2017

DETAIL NO: 7

Riverview



ISOMETRIC VIEW



180mm FOR PIPES LESS THAN 1200mm DIAMETER
250mm FOR PIPES 1200mm DIAMETER AND LARGER

SPIGOT TOP WITH RUBBER GASKET

PRECAST BASE DESIGNED TO ACCOMODATE
A STANDARD 1050mm DIAMETER MANHOLE SHAFT

SECTIONAL VIEW

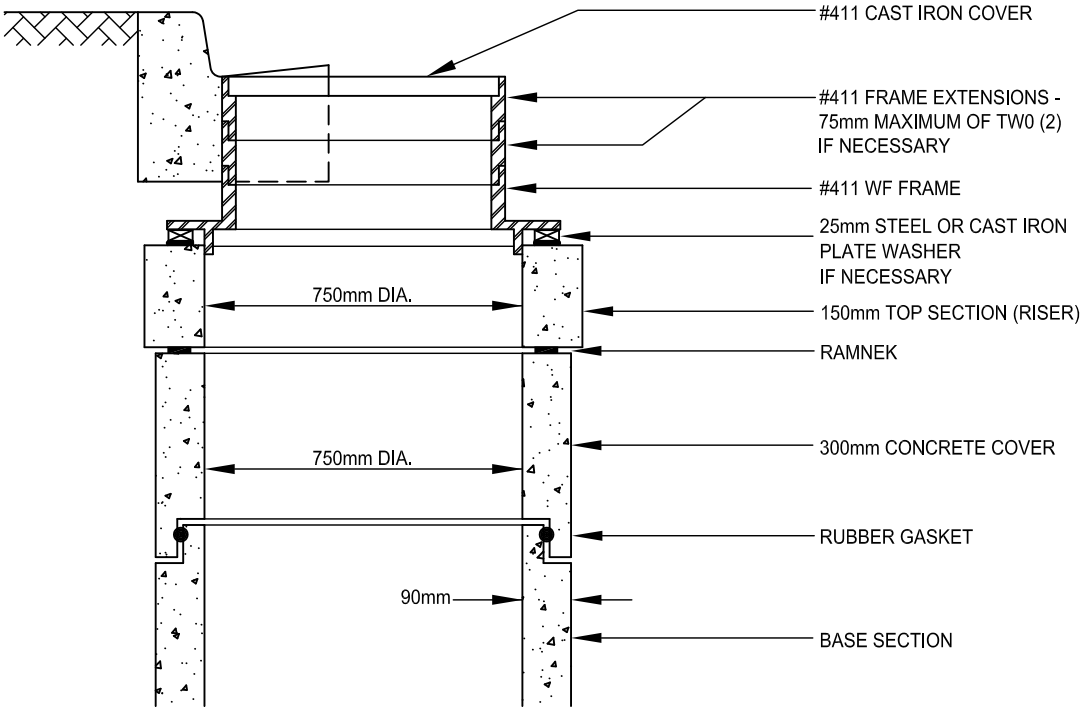
PRECAST MANHOLE TEE BASE

(PIPES 750mm DIAMETER AND LARGER)

DATE:	FEBRUARY, 2017
DETAIL NO:	8

Riverview

NOTE:
- ANY COMBINATON OF THE MATERALS BELOW MAY BE USED TO PROVIDE THE REQUIRED HEIGHT ADJUSTMENT, SUBJECT TO RESTRICTIONS AS SHOWN.
-ALL UNITS MUST BE INTERLOCKING c/w RUBBER GASKET



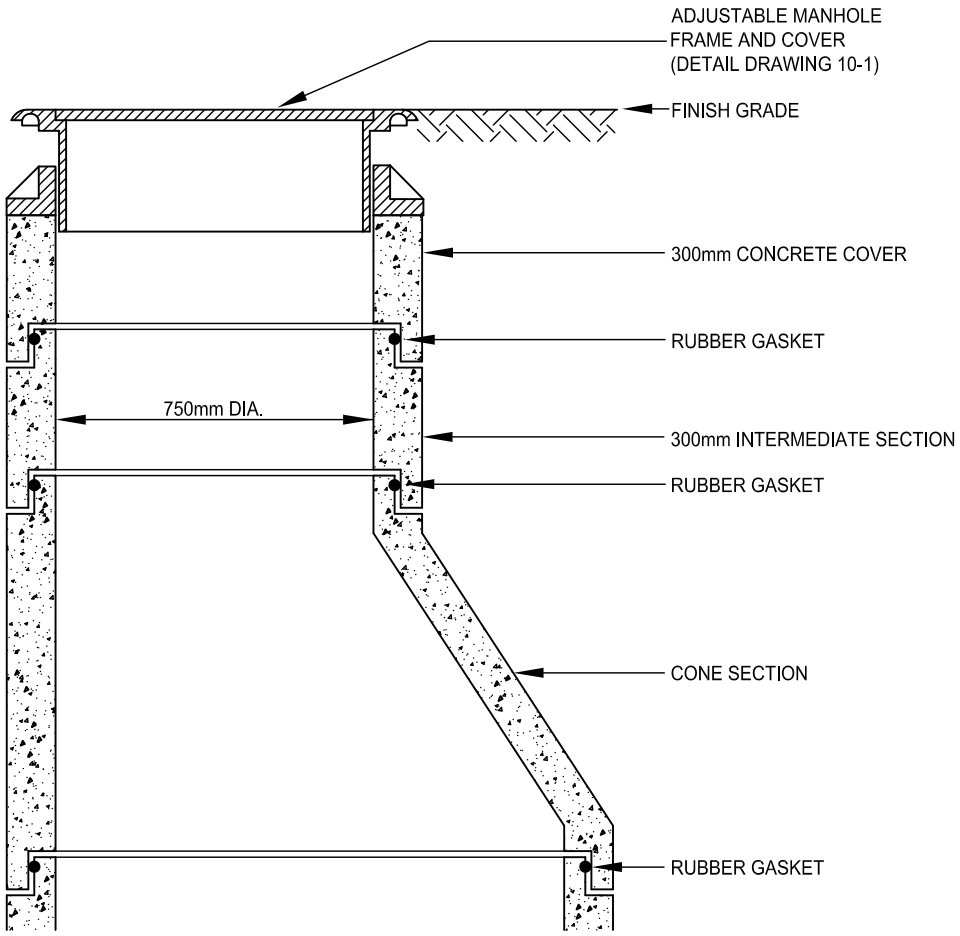
CATCHBASIN HEIGHT ADJUSTMENT

DATE: FEBRUARY, 2017

DETAIL NO: 9a

Riverview

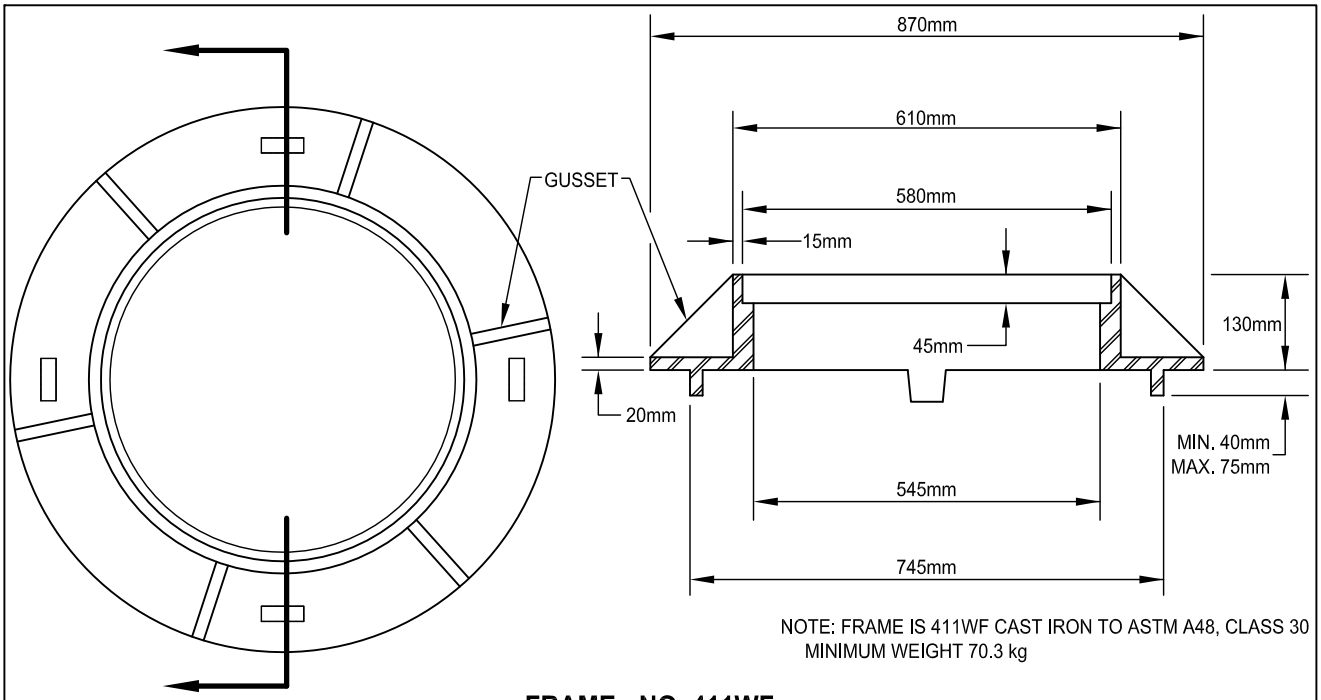
NOTE:
- CONCRETE SHAFT RINGS 150mm OR LESS IN HEIGHT ARE NOT PERMITTED
- ANY COMBINATON OF THE MATERALS BELOW MAY BE USED TO PROVIDE THE REQUIRED HEIGHT ADJUSTMENT, SUBJECT TO RESTRICTIONS AS SHOWN.
-ALL UNITS MUST BE INTERLOCKING c/w RUBBER GASKET
- COVER AND FRAME MUST BE SLOPED TO MATCH CROWN OF ROADWAY.



MANHOLE HEIGHT ADJUSTMENT

DATE:	FEBRUARY, 2017
DETAIL NO:	9b

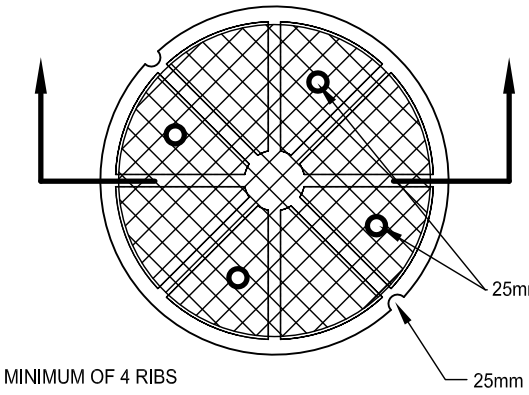
Riverview



NOTE: FRAME IS 411WF CAST IRON TO ASTM A48, CLASS 30
MINIMUM WEIGHT 70.3 kg

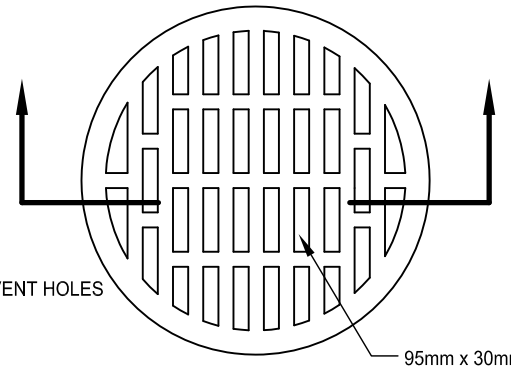
FRAME - NO. 411WF

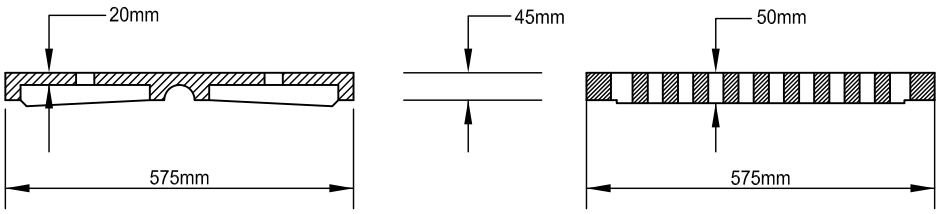
MANHOLE COVER - NO. 411 SOLID



MINIMUM OF 4 RIBS
DIAMETER OF HOLES - 25mm

CATCH BASIN COVER - NO. 411 GRATED





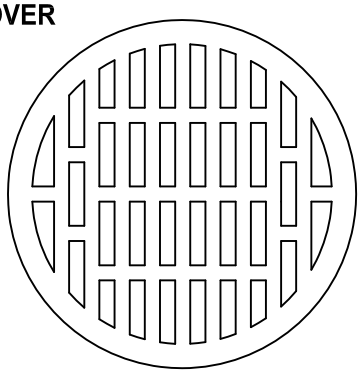
NOTE: COVERS ARE 411WF CAST IRON TO ASTM A48, CLASS 30B OF SNUG FIT AND RATTLE FREE
MANHOLE COVER MINIMUM WEIGHT 43.1 kg
CATCH BASIN COVER MINIMUM WEIGHT 52.2 kg

MANHOLE / CATCHBASIN FRAME AND COVERS

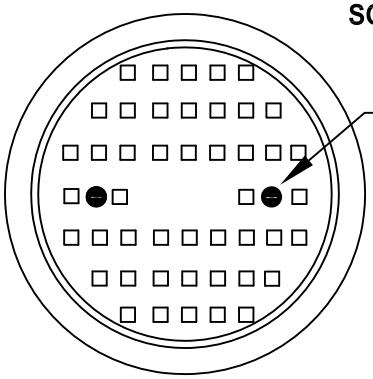
DATE: FEBRUARY, 2017
DETAIL NO: 10

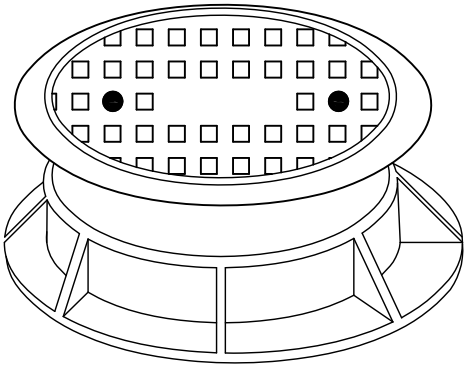
Riverview

GRATED COVER



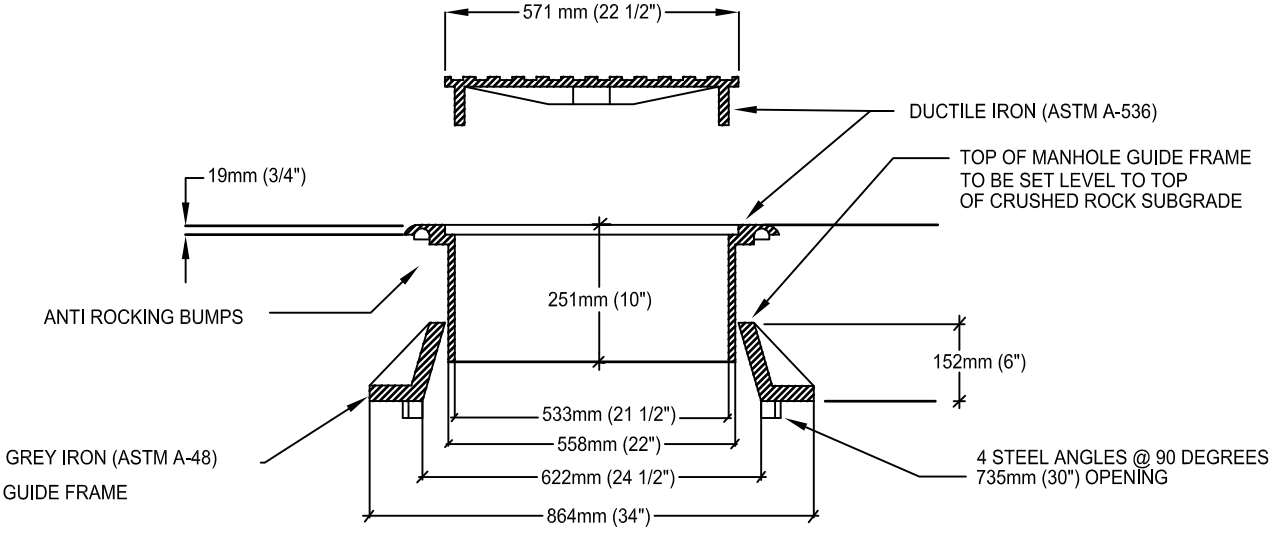
SOLID COVER





NOTES:

1. ADJUSTABLE FRAME AND COVER TO HAVE MACHINED SEATS.
2. ASPHALT DENSITY UNDER THE FRAME IS OF UTMOST IMPORTANCE.
3. MINIMUM SPACE OF 50mm (2") BETWEEN THE GUIDE AND ADJUSTABLE FRAME IS REQUIRED.



C-50 ADJUSTABLE MANHOLE FRAME AND COVER

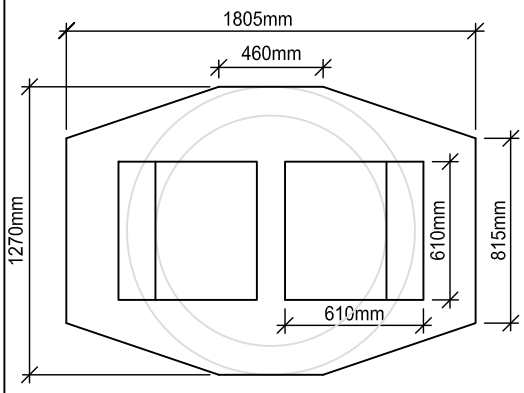
(FOR ROADWAY AREA ONLY)

DATE: FEBRUARY, 2017

DETAIL NO: 10-1

Riverview

COVER DETAIL



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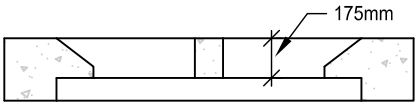
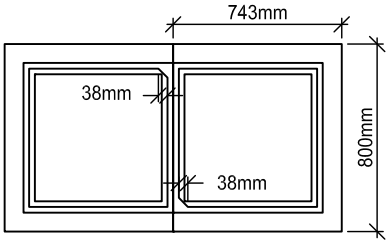


SECTION

FRAME DETAIL



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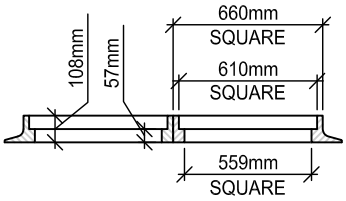
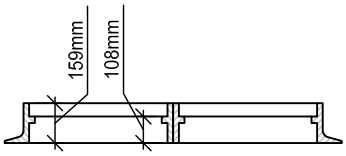
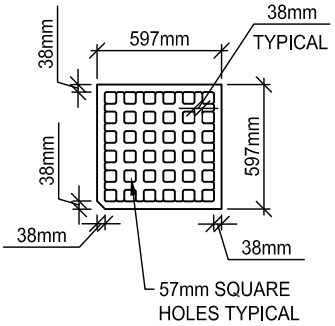


SECTION S 401

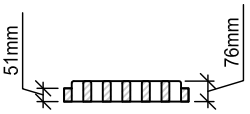


SECTION S 411

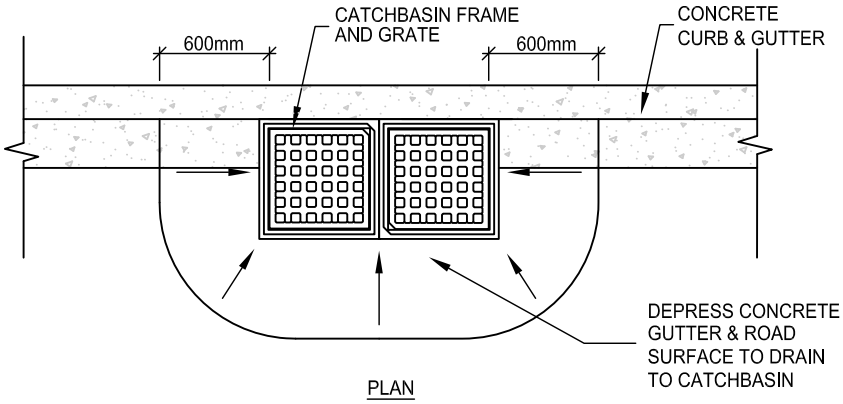
GRATE DETAIL



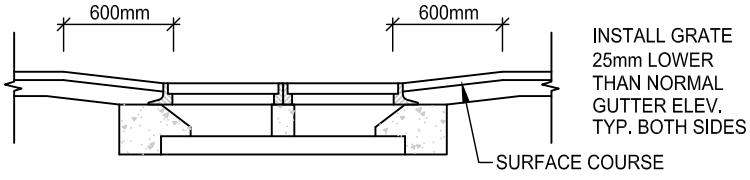
TOP



SECTION



PLAN



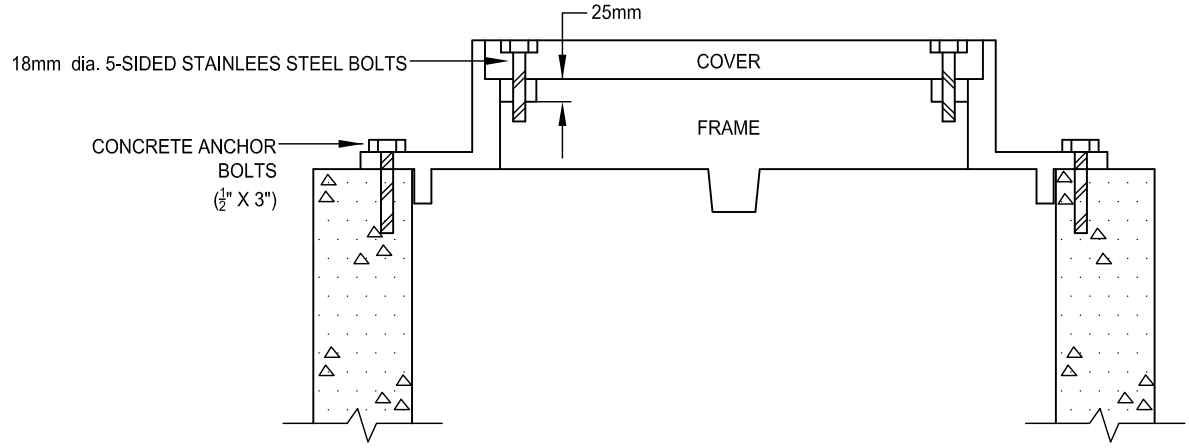
SECTION

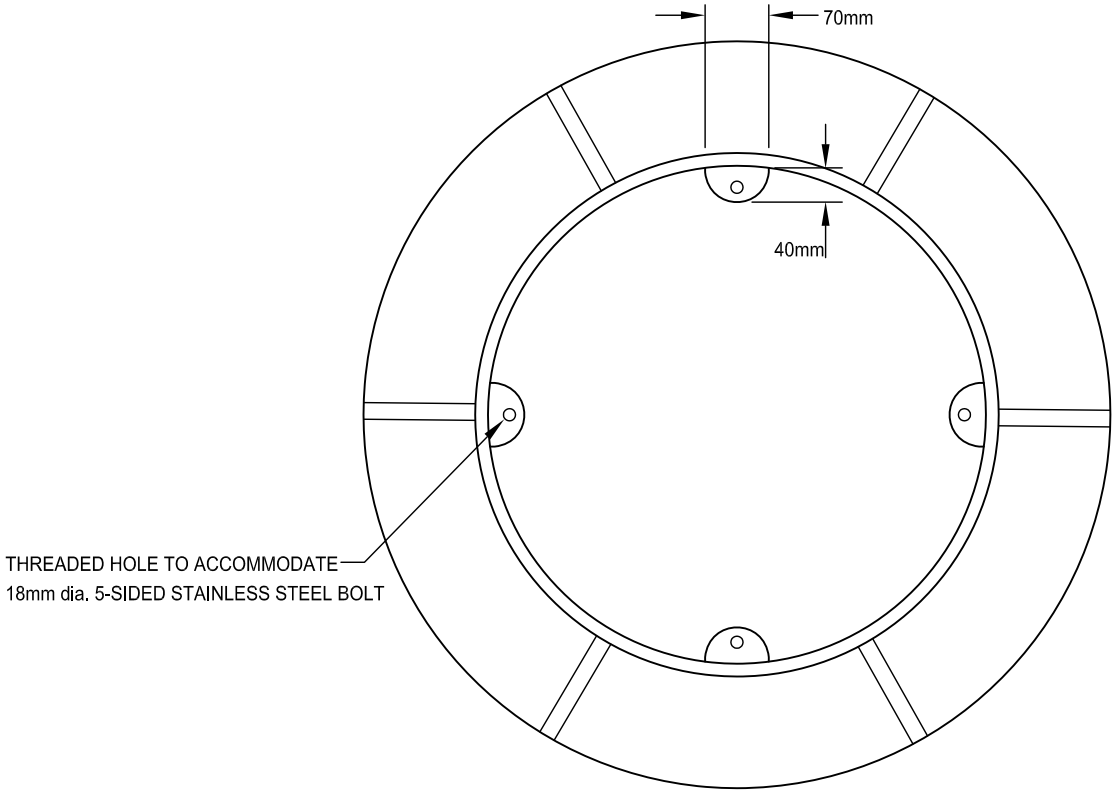
DOUBLE CATCH BASIN
FRAME AND COVER

DATE:
FEBRUARY, 2017

DETAIL NO:
10-2

Riverview



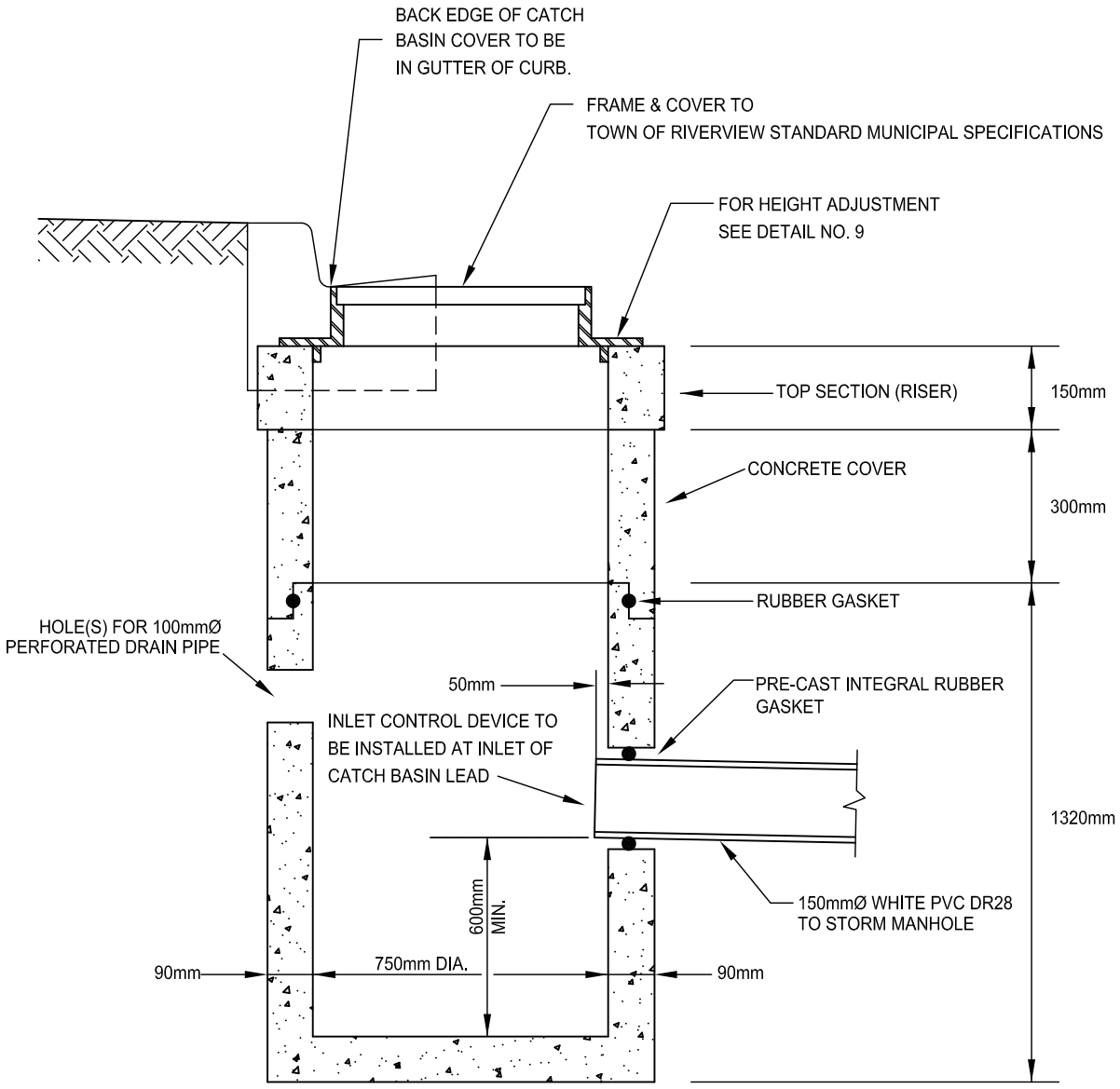


LOCK-DOWN FRAME AND COVER

DATE: FEBRUARY, 2017

DETAIL NO: 11

Riverview



NOTES: - PRECAST CONCRETE UNITS TO ASTM C478

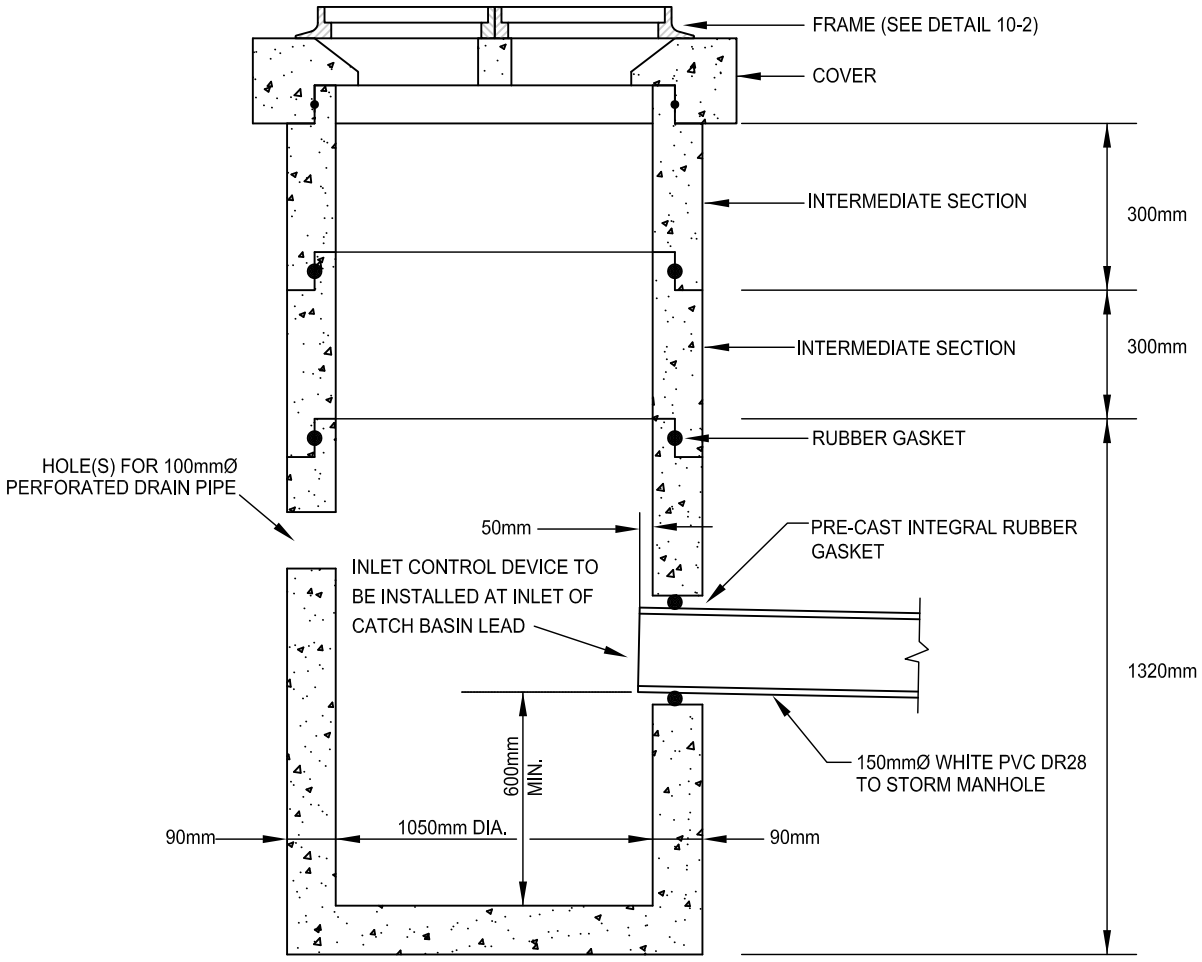
- CONCRETE TO BE AIR ENTRAINED IN ACCORDANCE WITH CSA A23.1
- CONCRETE TO BE 32 MPa
- ALL JOINTS TO BE MADE WATERTIGHT WITH RUBBER GASKETS, TO CAN/CSA A257.3 OR RAM-NEK GASKET.
- EACH PERFORATED DRAIN PIPE TO BE CONNECTED DIRECTLY TO CATCH BASIN, DO NOT "T" PIPES INTO CATCH BASIN.

CATCH BASIN

DATE: FEBRUARY, 2017

DETAIL NO: 12

Riverview



NOTES: - PRECAST CONCRETE UNITS TO ASTM C478

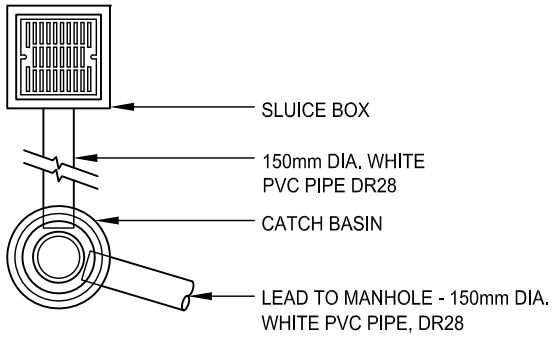
- CONCRETE TO BE AIR ENTRAINED IN ACCORDANCE WITH CSA A23.1
- CONCRETE TO BE 32 MPa
- ALL JOINTS TO BE MADE WATERTIGHT WITH RUBBER GASKETS, TO CAN/CSA A257.3 OR RAM-NEK GASKET.
- EACH PERFORATED DRAIN PIPE TO BE CONNECTED DIRECTLY TO CATCH BASIN, DO NOT "T" PIPES INTO CATCH BASIN.

DOUBLE CATCH BASIN

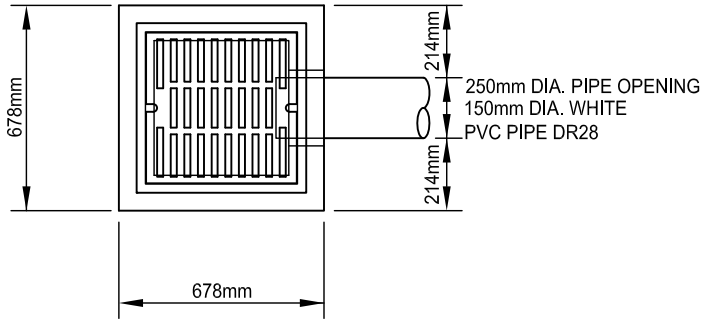
DATE: FEBRUARY, 2017

DETAIL NO: 12-1

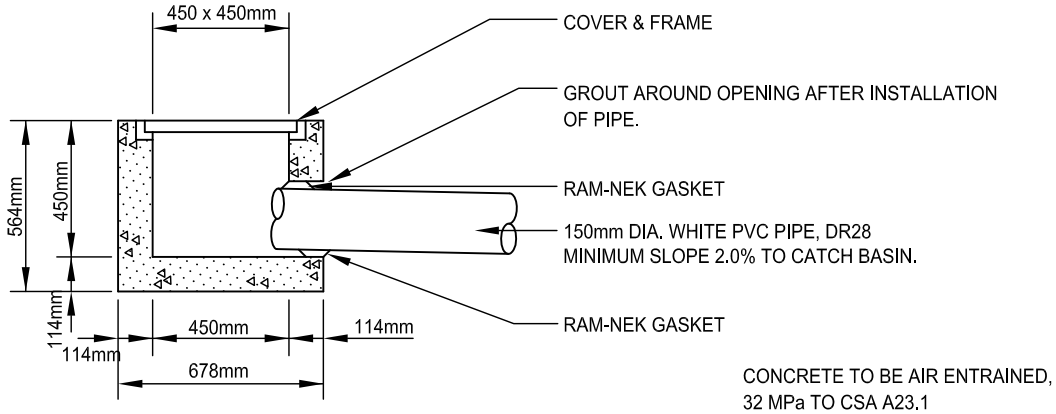
Riverview



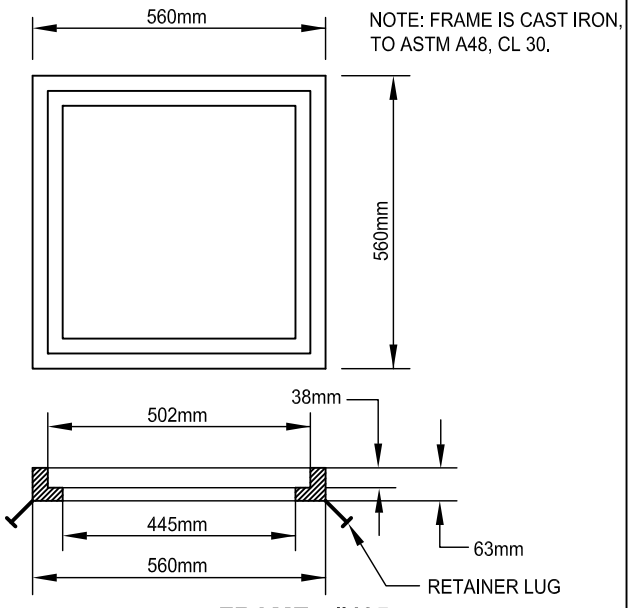
SCHEMATIC



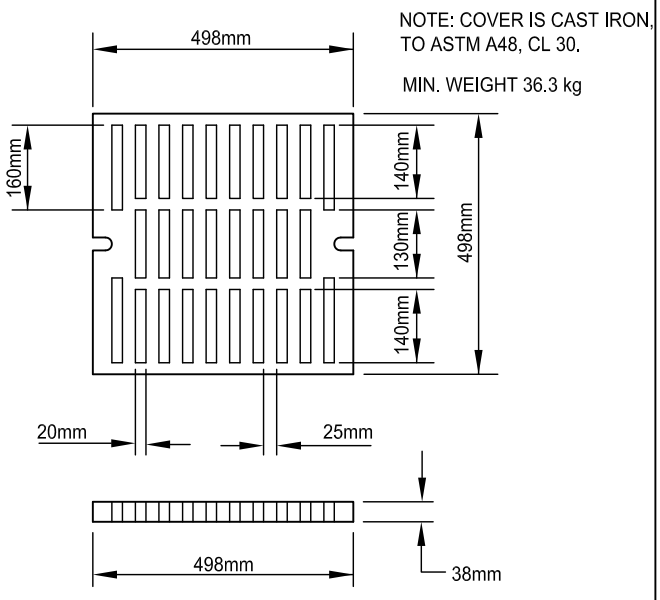
PLAN



CROSS - SECTION



FRAME - #405



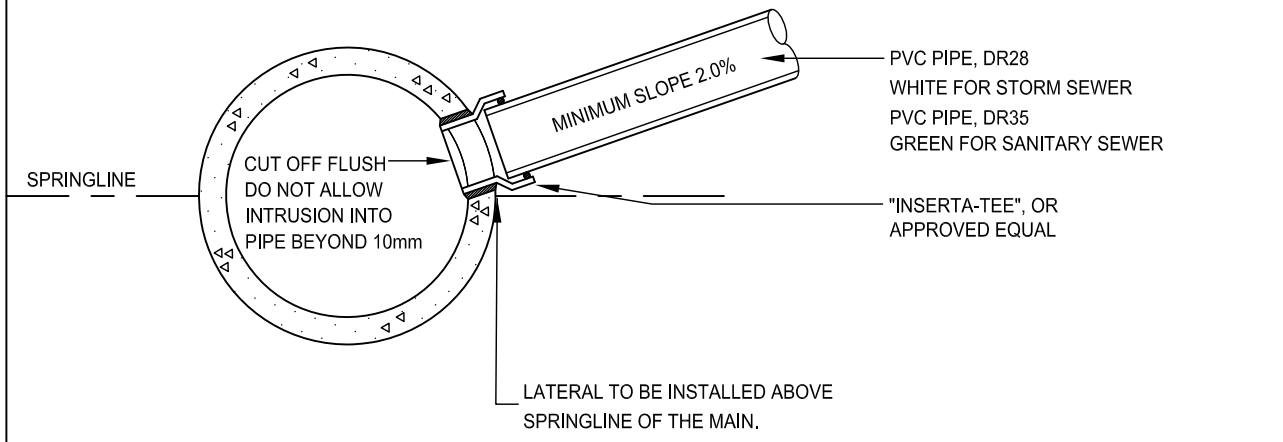
COVER - #405

SLUICE BOX

DATE: FEBRUARY, 2017

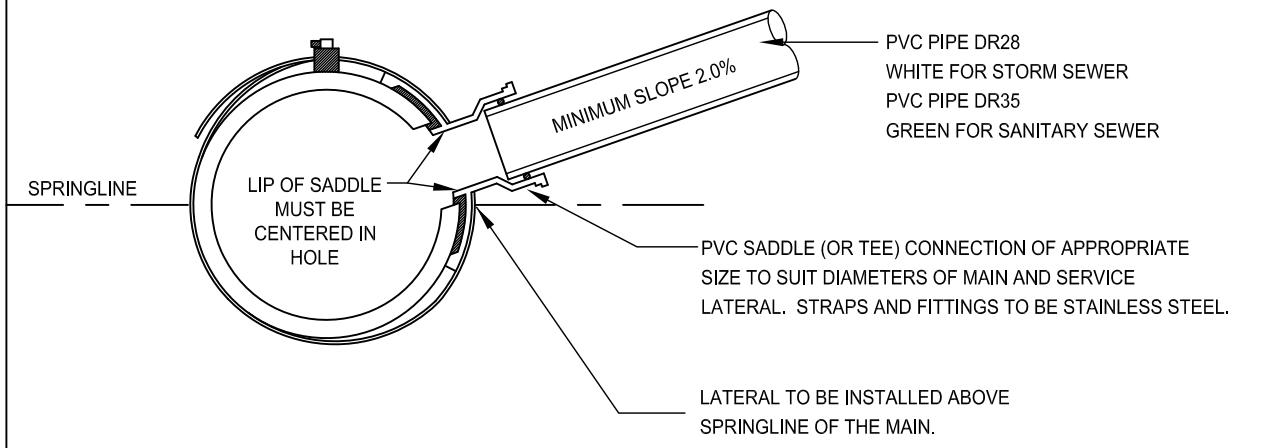
DETAIL NO: 13

Riverview



NOTE:
BENDS SHALL BE LONG RADIUS TYPE ONLY

HDPE & CONCRETE MAIN



NOTE:
BENDS SHALL BE LONG RADIUS TYPE ONLY

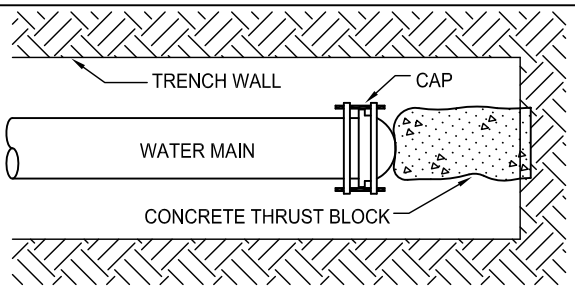
P.V.C. MAIN

STORM AND SANITARY SERVICE CONNECTIONS

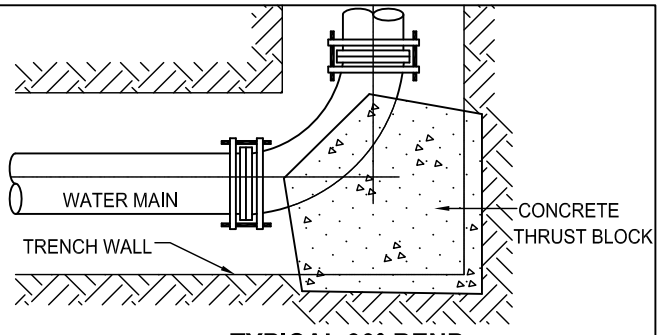
DATE:
FEBRUARY, 2017

DETAIL NO:
14

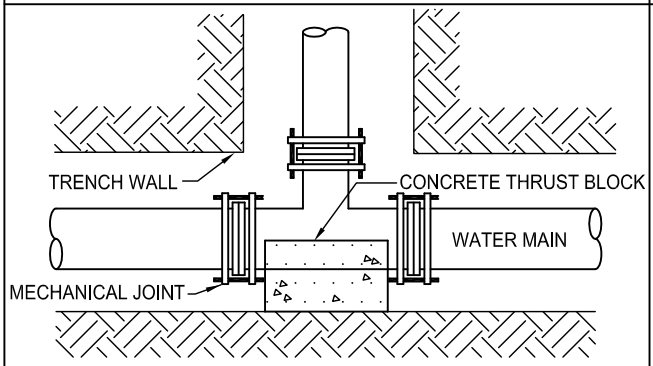
Riverview



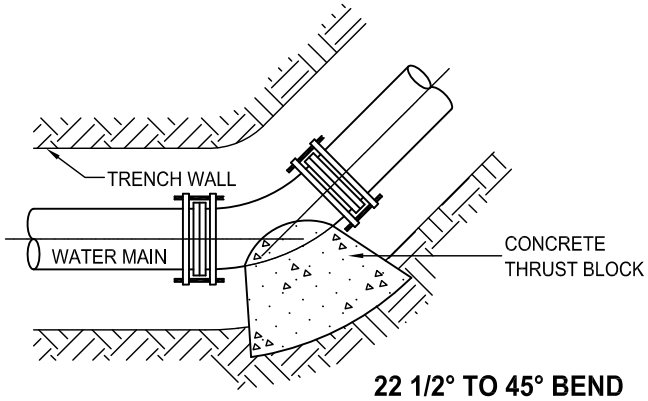
TYPICAL CAP OR PLUG DETAIL



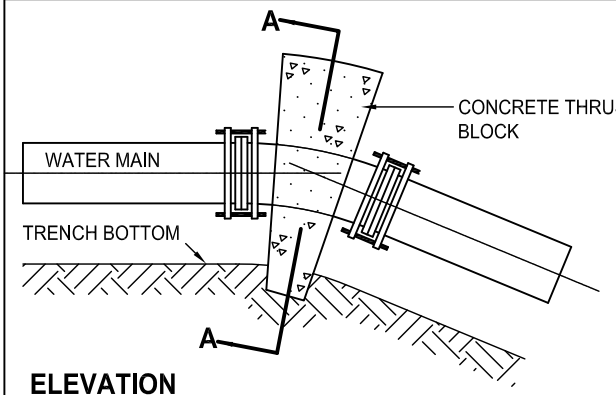
TYPICAL 90° BEND



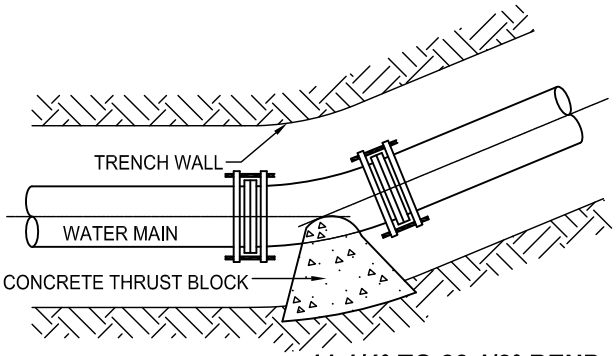
TYPICAL TEE DETAIL



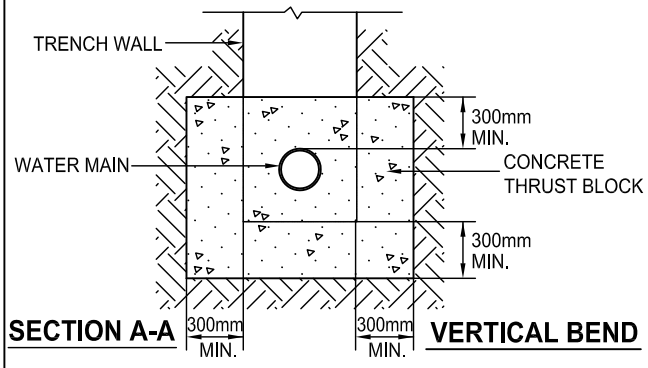
22 1/2° TO 45° BEND



ELEVATION



11 1/4° TO 22 1/2° BEND



SECTION A-A **VERTICAL BEND**

NOTES

1. CONCRETE FOR THRUST BLOCKS SHALL BE MINIMUM 32 MPa AT 28 DAYS.

2. THRUST BLOCKS TO EXTEND INTO BOTTOM AND BOTH SIDES OF TRENCH, AND ALSO ABOVE PIPE, A MAXIMUM OF 300mm.

3. ALL CONCRETE MUST RUN OVER, UNDER AND AGAINST THE BODY OF THE FITTING, AND INTO THE TRENCH WALL, HOWEVER, THE MECHANICAL JOINTS MUST BE LEFT EXPOSED.

4. THRUST BLOCK SIZE SHALL BE A FUNCTION OF THE PIPE DIAMETER.

5. FITTINGS SHALL ALSO HAVE MECHANICAL JOINT RESTRAINTS.

THRUST BLOCKS

(SEE DETAIL NO. 16 FOR THRUST BLOCK TABLE)

DATE: FEBRUARY, 2017

DETAIL NO: 15

Riverview

MINIMUM CONTACT AREAS FOR CONCRETE THRUST BLOCKS:

PIPE DIA.	AREA (m2) FOR SOIL SUPPORTING CAPACITY OF 100 kPa					
mm	CAP OR PLUG	TEE	90° BEND	45° BEND	22.5° BEND	11.25° BEND
150	0.48	0.48	0.64	0.40	0.24	0.16
200	0.80	0.80	1.12	0.64	0.32	0.16
250	1.28	1.28	1.76	0.96	0.48	0.24
300	1.76	1.76	2.56	1.44	0.72	0.40
350	2.40	2.40	3.52	1.92	0.96	0.48
400	3.20	3.20	4.48	2.56	1.28	0.64
450	4.16	4.16	5.76	3.20	1.60	0.80

NOTES:

1. SEE DETAIL NO. 15 FOR THRUST BLOCK CONFIGURATIONS.

2. THESE CHARTS ARE BASED ON SOIL SUPPORTING CAPACITIES OF 100 kPa AND AN INTERNAL PIPE PRESSURE OF 1050 kPa. WHERE DIFFERENT SUPPORTING CAPACITIES OR INTERNAL PRESSURES ARE ENCOUNTERED, CONTACT AREAS SHOULD BE CALCULATED ACCORDINGLY. SAFE SUPPORTING CAPACITY SHOULD BE DETERMINED BY THE DESIGN ENGINEER, AND INCLUDE AN APPROPIATE FACTOR OF SAFETY.

3. CONCRETE FOR THRUST BLOCKS TO BE A MINIMUM OF 32 MPa AT 28 DAYS.

4. THRUST BLOCKS TO EXTEND INTO BOTTOM AND SIDES OF TRENCH, AND ALSO ABOVE THE PIPE: A MINIMUM OF 150mm FOR HORIZONTAL BENDS AND A MINIMUM OF 300mm FOR VERTICAL BENDS.

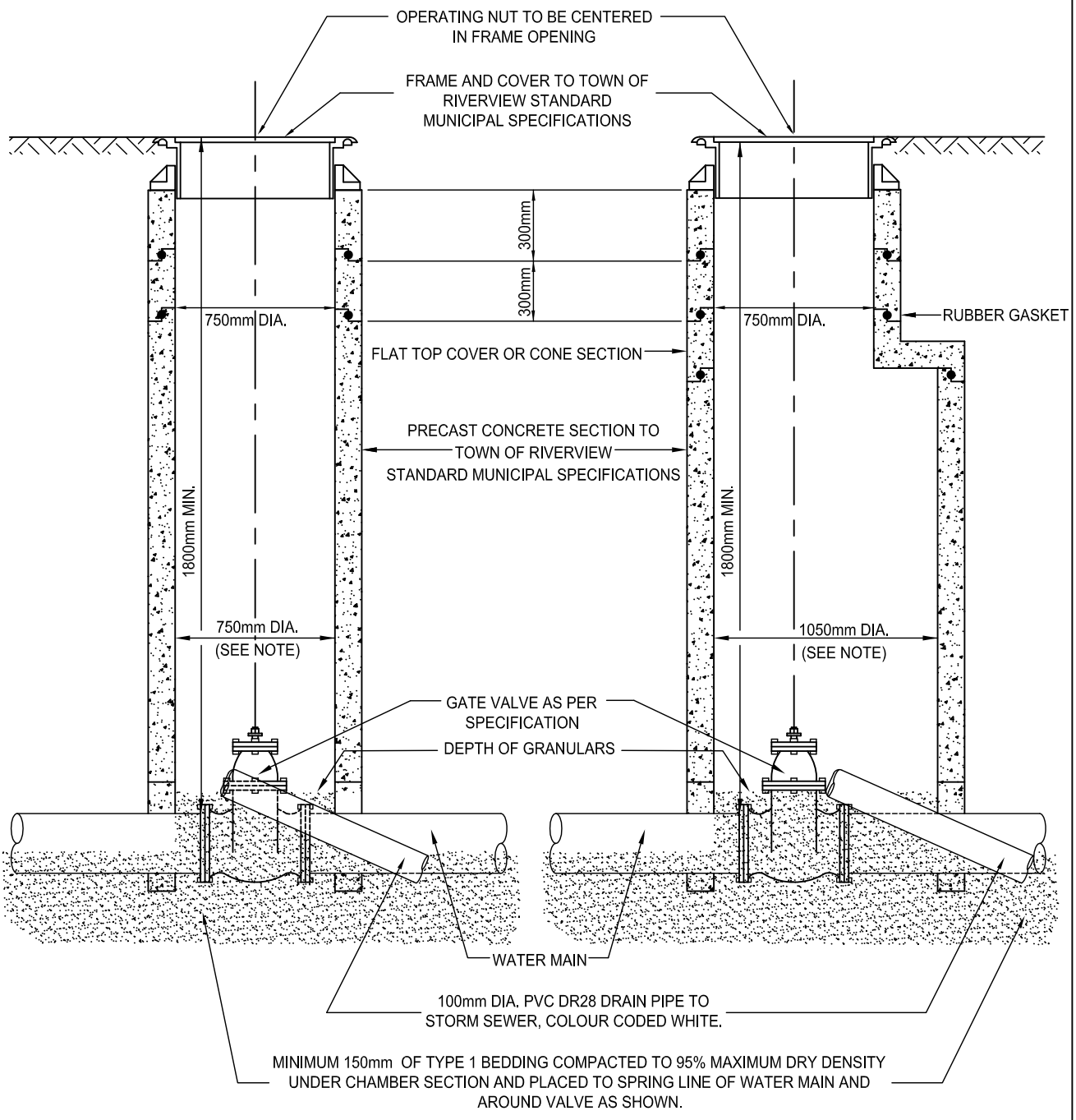
5. ALL CONCRETE MUST RUN OVER, UNDER AND AGAINST THE BODY OF THE FITTING, AND INTO THE TRENCH WALL: HOWEVER, THE MECHANICAL JOINTS MUST BE LEFT EXPOSED.

THRUST BLOCK CONTACT AREAS

DATE: FEBRUARY, 2017

DETAIL NO: 16

Riverview



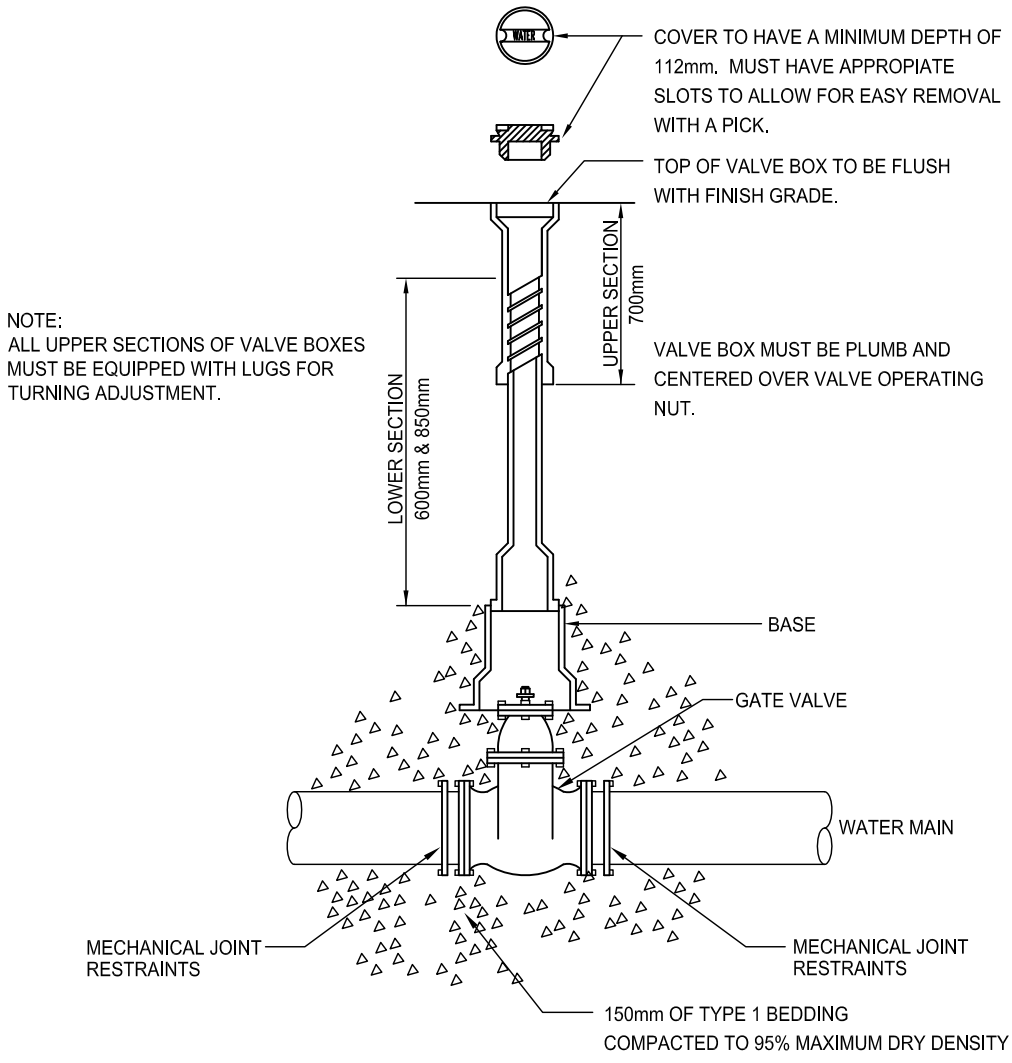
NOTE:

- FOR 150, 200 & 250mm DIA. GATE VALVES USE 750mm DIA. SHAFT SECTIONS.
- FOR 300mm DIA. & LARGER GATE VALVES USE 1050mm DIA. SHAFT SECTIONS.

VALVE CHAMBER

DATE:	FEBRUARY, 2017
DETAIL NO:	17

Riverview



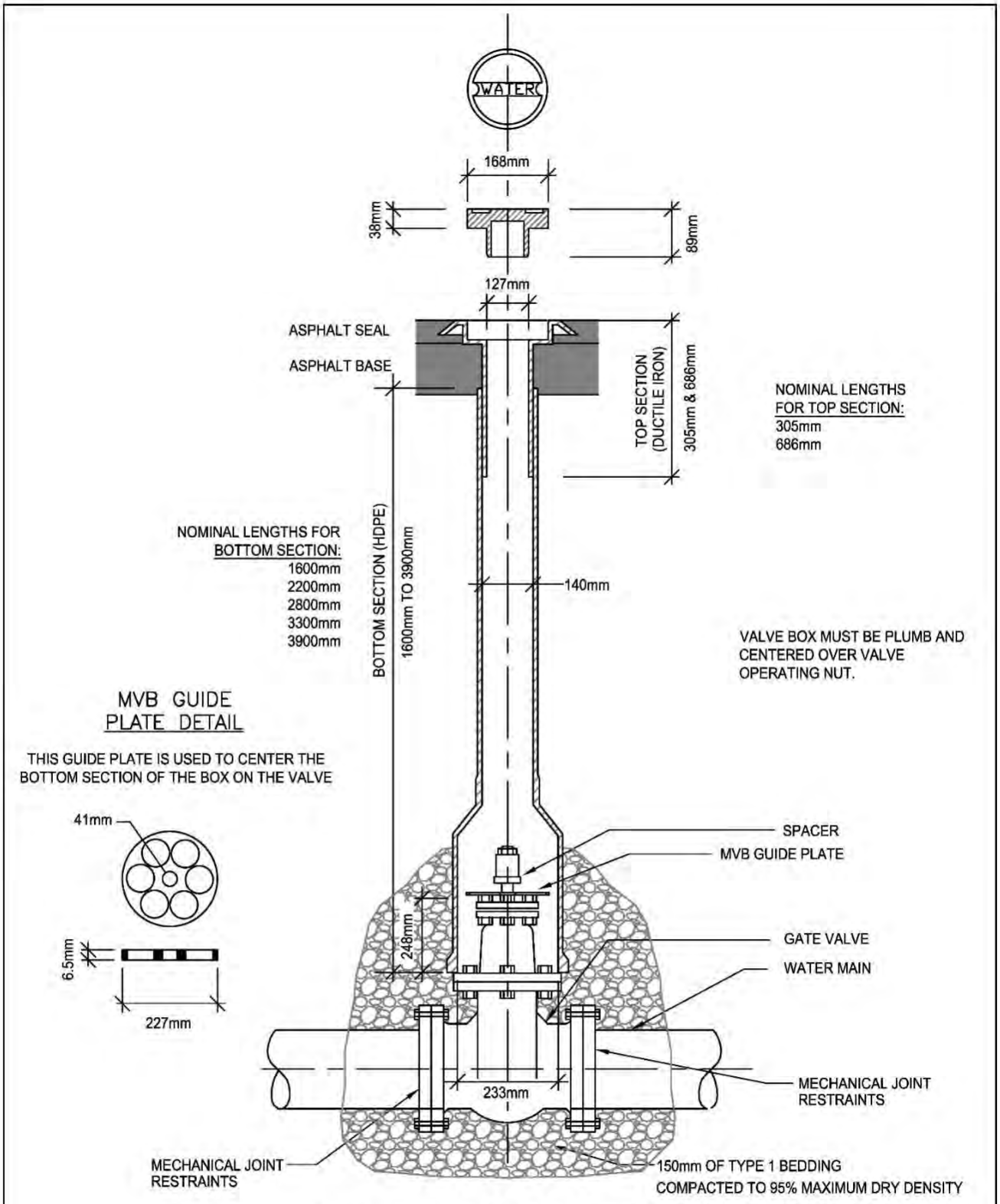
SCREW-TYPE VALVE BOX

VALVE BOX FOR FIRE HYDRANT VALVES & WATER SERVICE VALVES ONLY

DATE: FEBRUARY, 2017

DETAIL NO: 18

Riverview

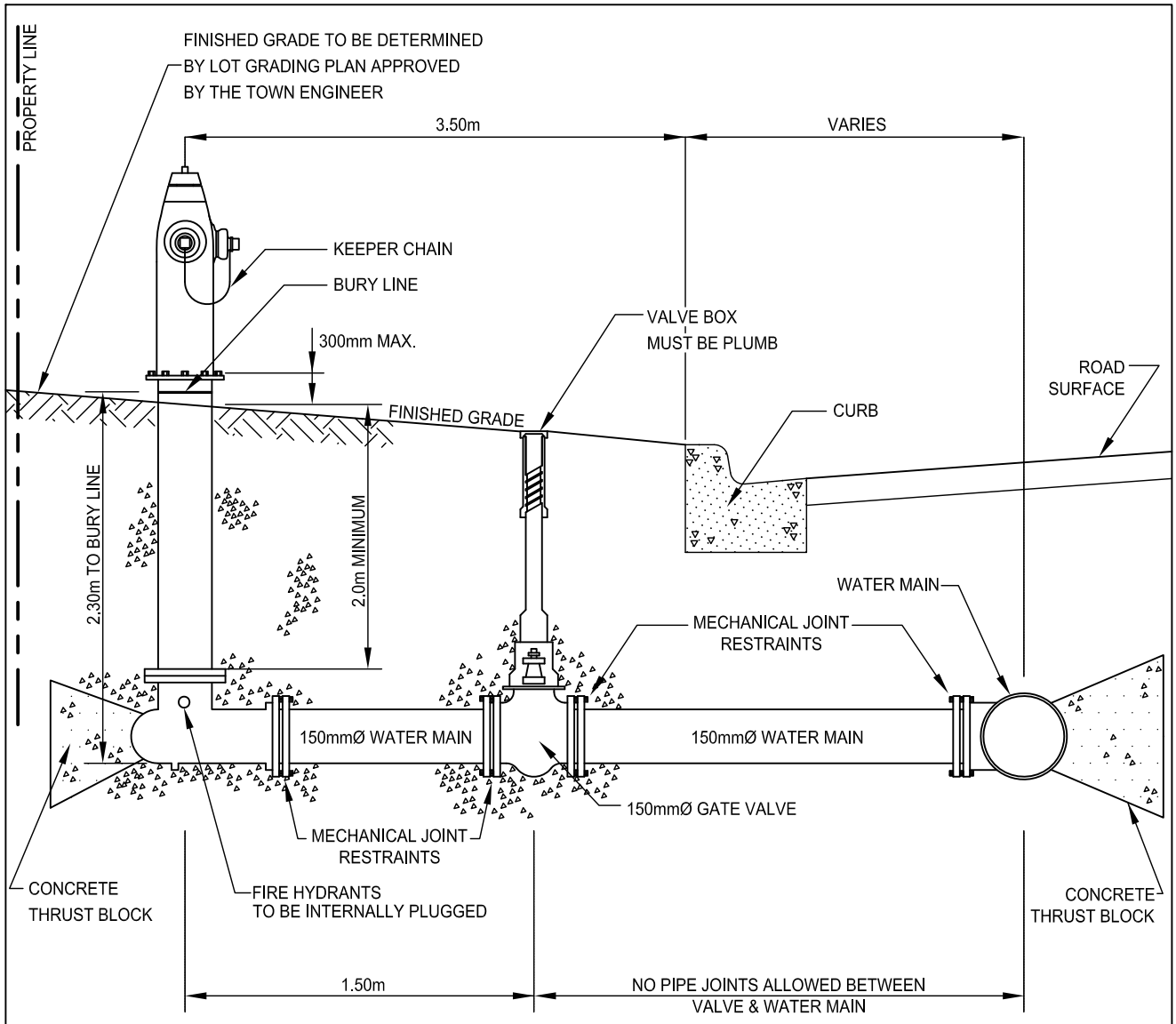


COMPOSITE SELF-LEVELING VALVE BOX

VALVE BOX FOR FIRE HYDRANT VALVES & WATER SERVICE VALVES ONLY

DATE:	FEBRUARY, 2021
DETAIL NO:	18A

Riverview



NOTES:

- HYDRANT TO BE PAINTED TO TOWN OF RIVERVIEW STANDARD MUNICIPAL SPECIFICATIONS.

- HYDRANT WITH ONE PUMPER CONNECTION AND TWO HOSE CONNECTIONS, (TOWN OF RIVERVIEW STANDARD MUNICIPAL SPECIFICATIONS) MUST BE PLUMB.

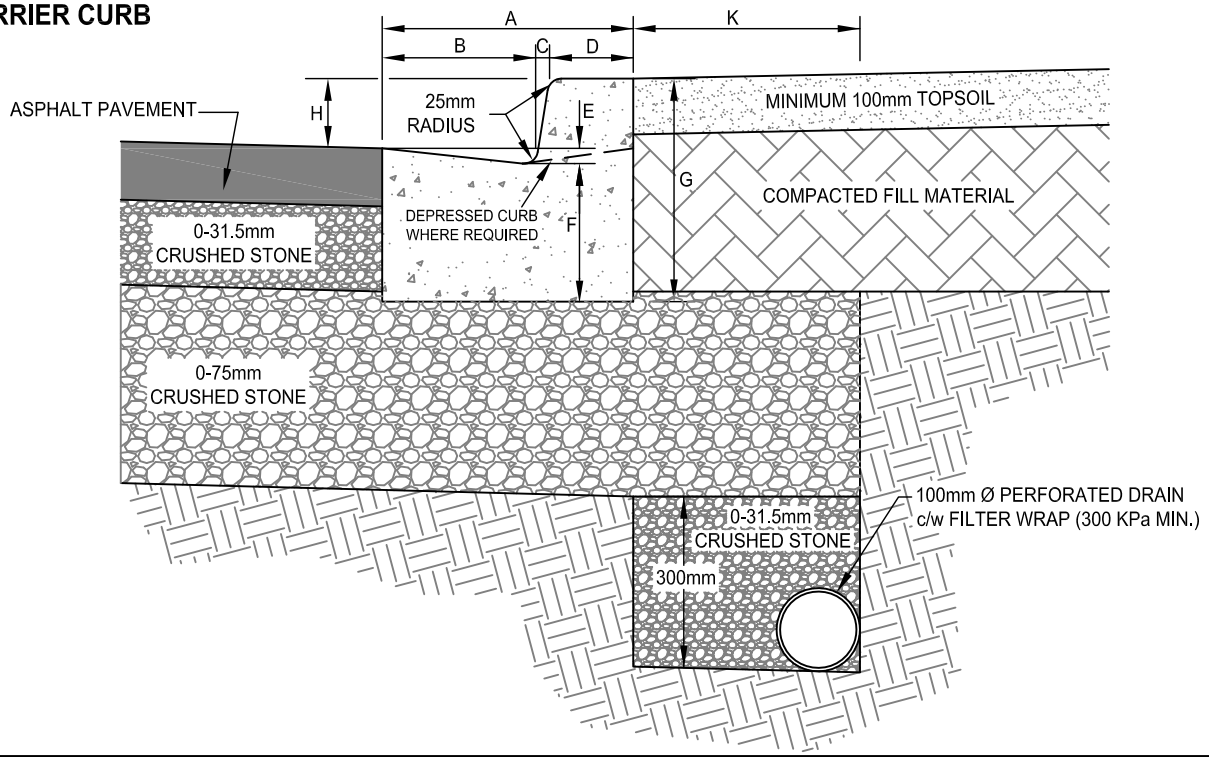
- HYDRANT AND VALVE TO BE TIED BACK TO WATER MAIN WITH MECHANICAL JOINT RESTRAINTS.

FIRE HYDRANT INSTALLATION

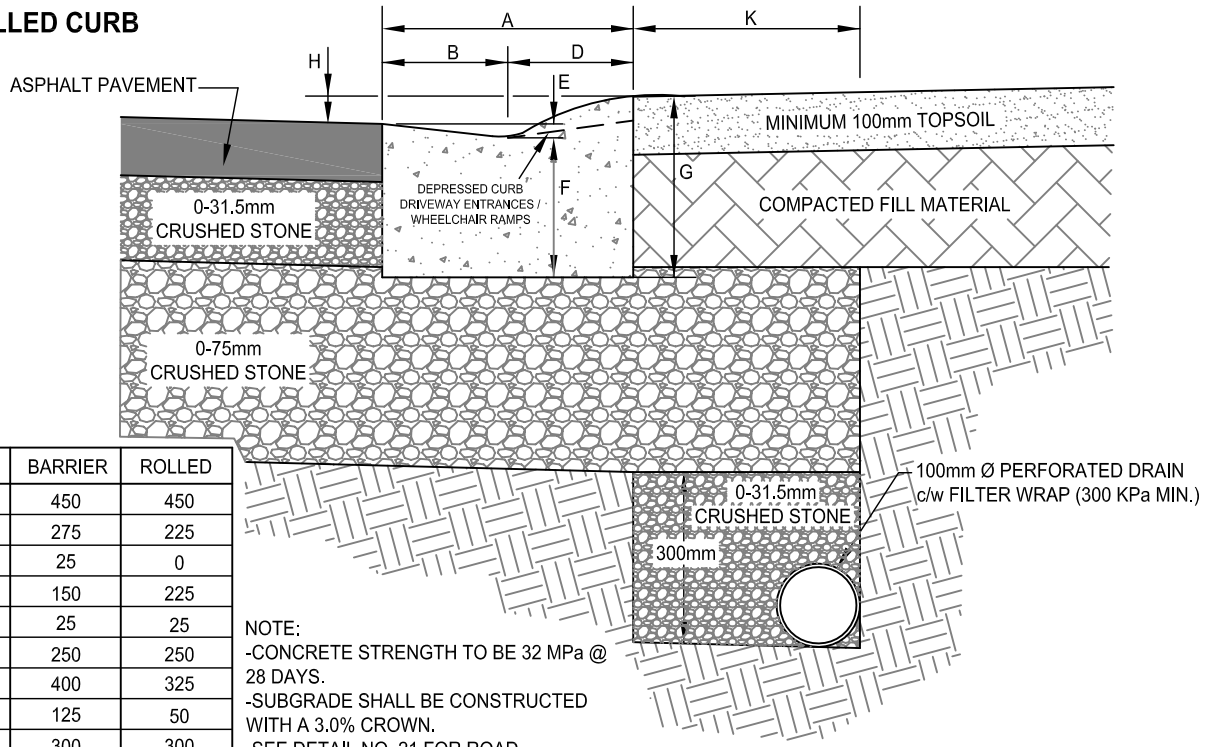
DATE:	FEBRUARY, 2017
DETAIL NO:	19

Riverview

BARRIER CURB



ROLLED CURB



	BARRIER	ROLLED
A	450	450
B	275	225
C	25	0
D	150	225
E	25	25
F	250	250
G	400	325
H	125	50
K	300	300

ALL DIMENSIONS ARE IN MILLIMETERS

NOTE:
-CONCRETE STRENGTH TO BE 32 MPa @ 28 DAYS.
-SUBGRADE SHALL BE CONSTRUCTED WITH A 3.0% CROWN.
-SEE DETAIL NO. 21 FOR ROAD STRUCTURE DETAILS AS PER STREET CLASSIFICATION

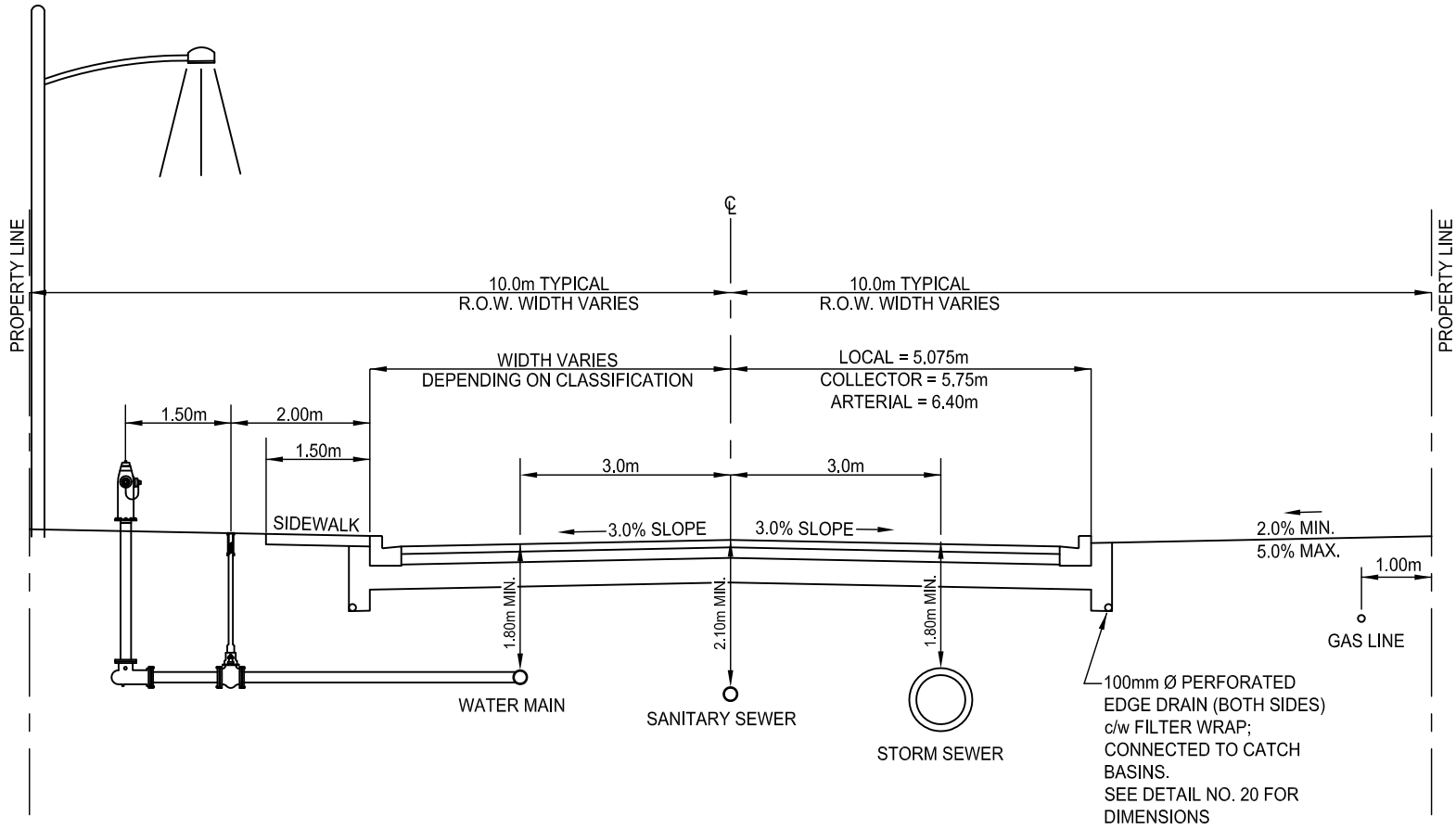
CURB DETAILS

DATE: FEBRUARY, 2017

DETAIL NO: 20

Riverview

TYPICAL ROAD CROSS-SECTION



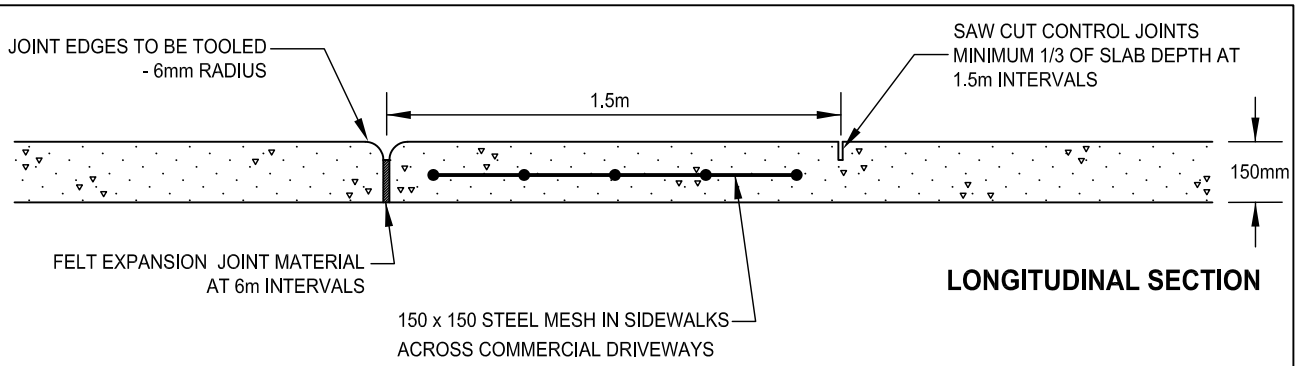
NOTE:
- ROADWAY TO BE CENTERED IN RIGHT OF WAY.
- SEE DETAIL NO. 20 FOR CURB DETAILS.
- SANITARY AND STORM DEPTHS TO ALLOW SERVICING OF ALL LOTS AS PER DETAIL NO. 3.

TYPICAL ROADBED CONSTRUCTION

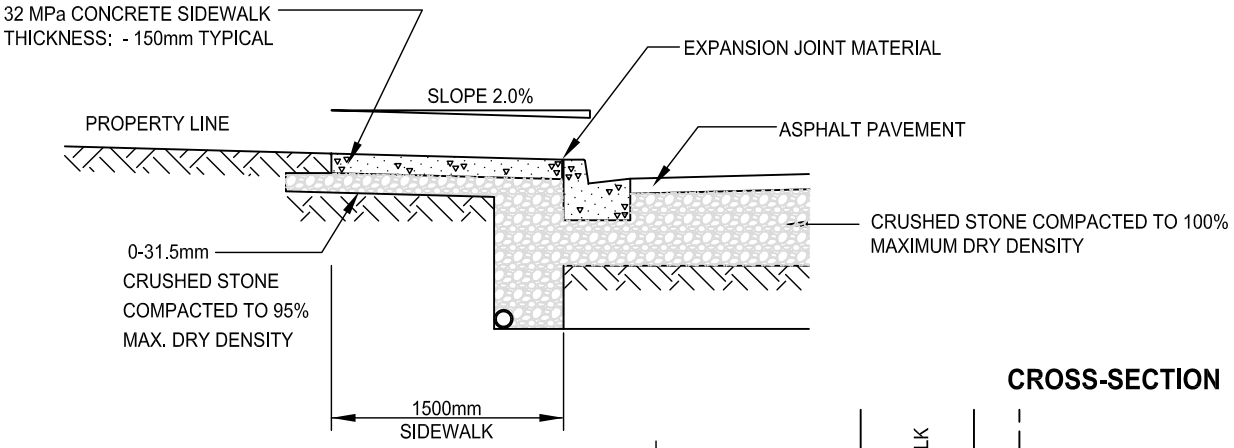
DESCRIPTION	LOCAL ROADWAYS	COLLECTOR ROADWAYS	ARTERIAL & INDUSTRIAL ROADWAYS
ASPHALT SEAL N.B.D.O.T. TYPE "D"	40mm	40mm	40mm
ASPHALT BASE N.B.D.O.T. TYPE "B"	60mm	100mm	110mm
CRUSHED ROCK 31.5mm MINUS	200mm	200mm	200mm
CRUSHED ROCK 75mm MINUS	300mm	350mm	400mm

DATE: FEBRUARY, 2017
DETAIL NO: 21

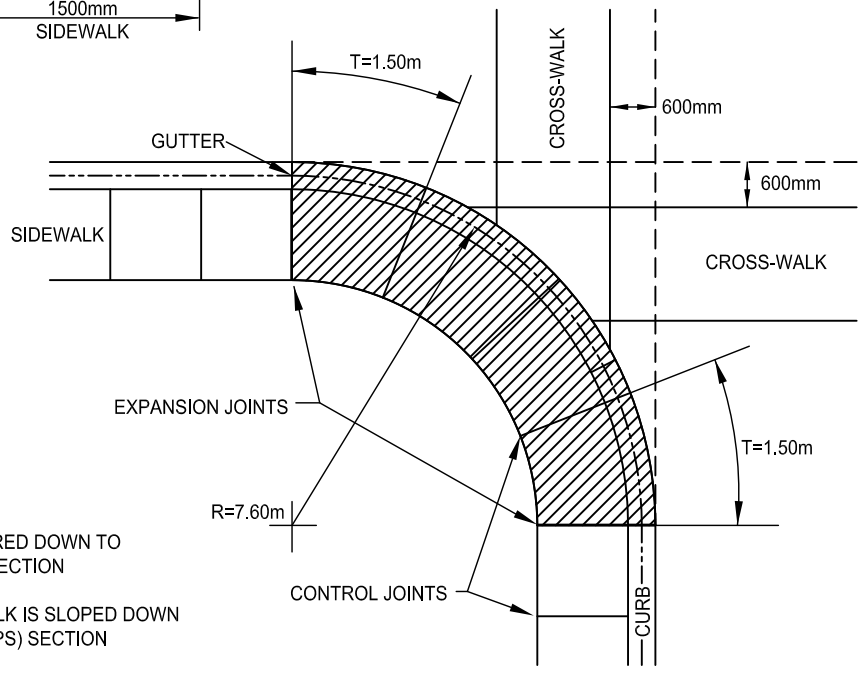
Riverview



LONGITUDINAL SECTION



CROSS-SECTION



PLAN

NOTES:

'T' DENOTES AREA WHERE CURB IS TAPERED DOWN TO DEPRESSED CURB (WHEELCHAIR RAMP) SECTION

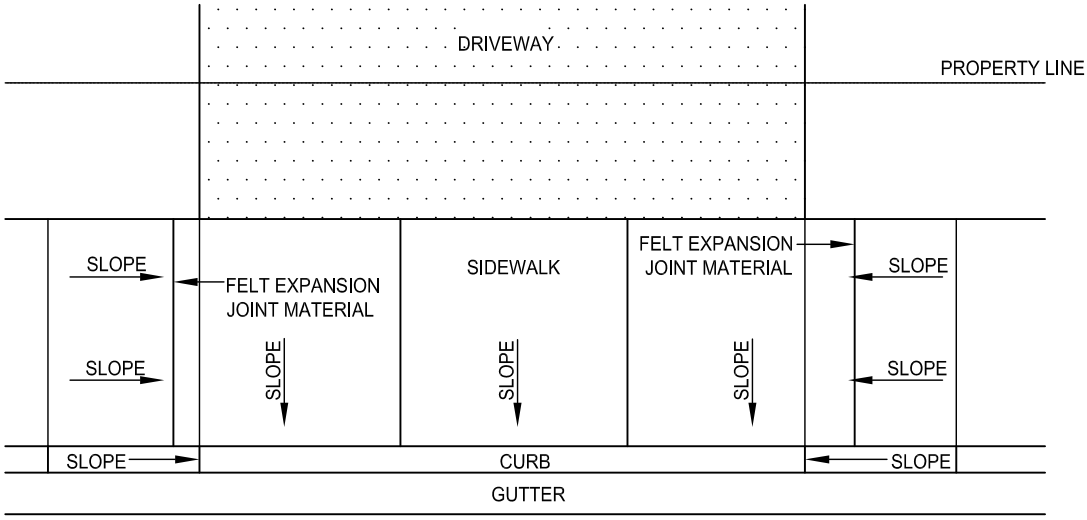
SHADING DENOTES AREA WHERE SIDEWALK IS SLOPED DOWN TO DEPRESSED CURB (WHEELCHAIR RAMPS) SECTION

SIDEWALK AND TYPICAL WHEELCHAIR RAMPS FOR LOCAL TO LOCAL STREET INTERSECTION

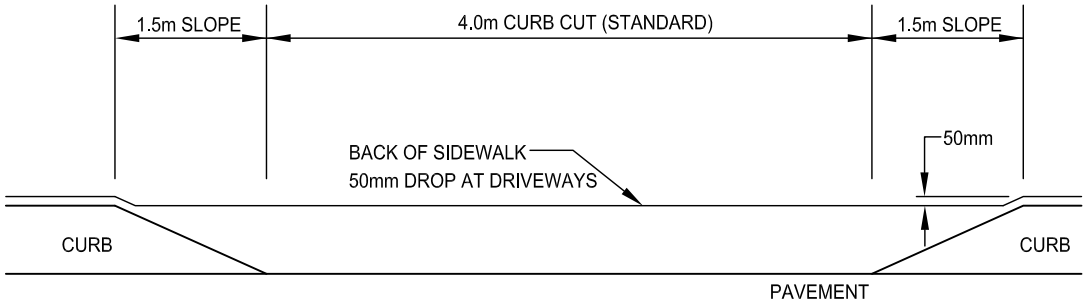
DATE: FEBRUARY, 2017

DETAIL NO: 22

Riverview



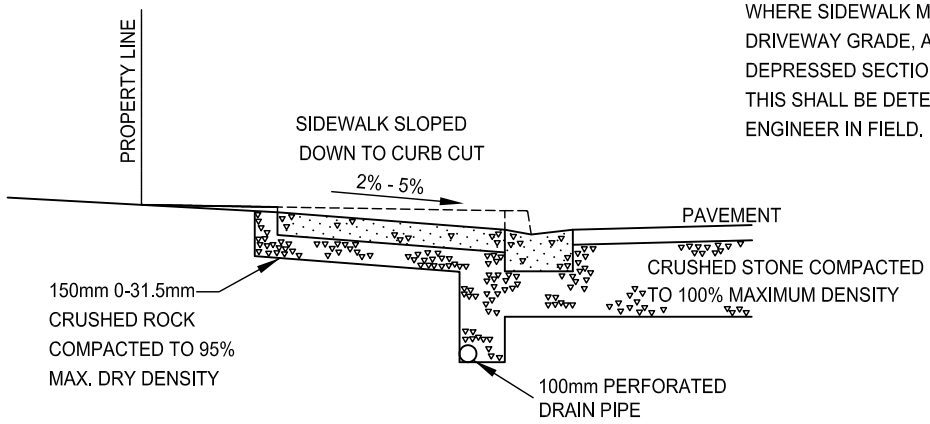
PLAN



ELEVATION

NOTE:

WHERE SIDEWALK MUST MATCH EXISTING DRIVEWAY GRADE, A FULL (FRONT TO BACK) DEPRESSED SECTION MAY BE REQUIRED. THIS SHALL BE DETERMINED BY ENGINEER IN FIELD.



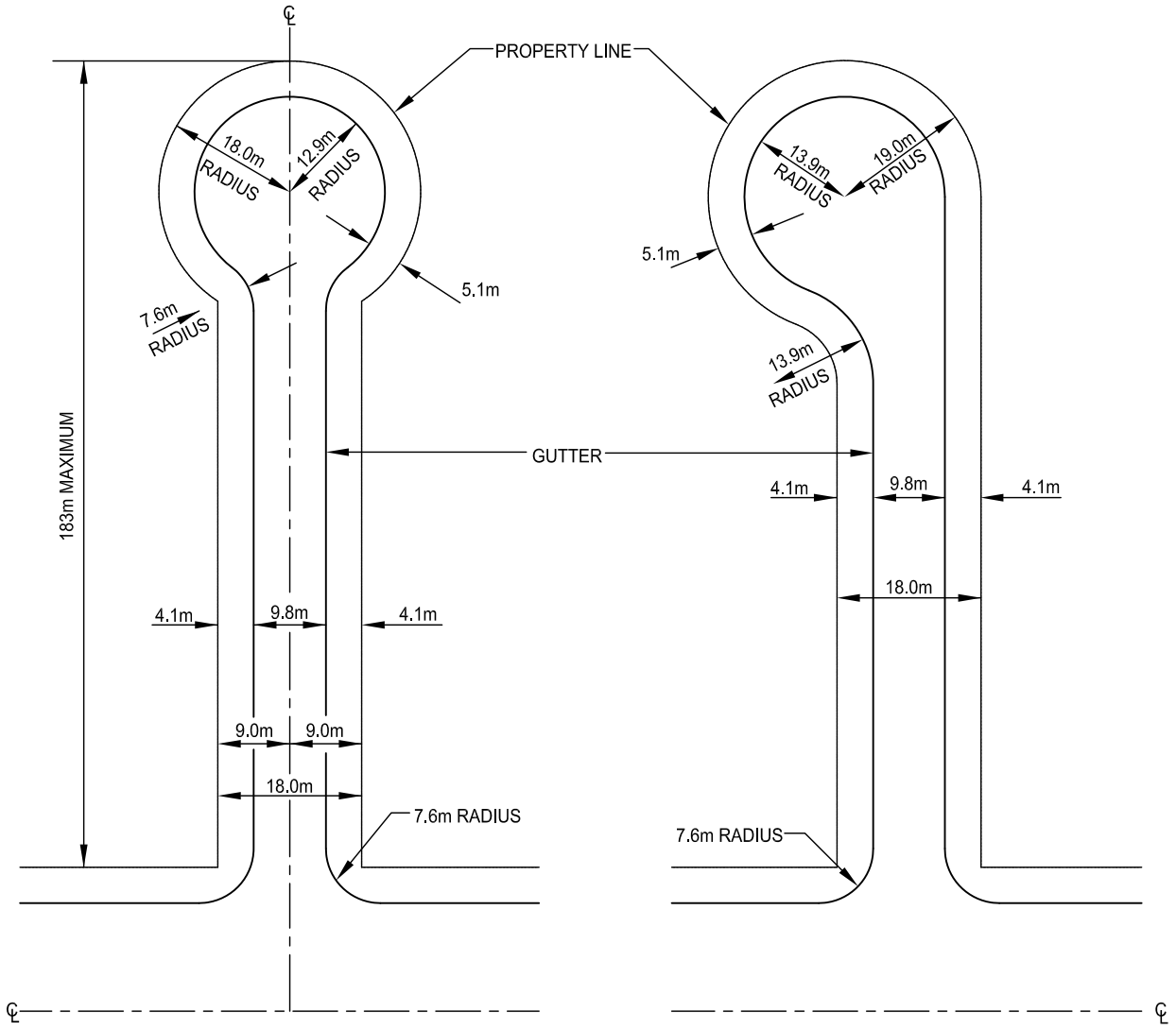
CROSS-SECTION

DRIVEWAY ENTRANCE WITH BARRIER CURB

DATE: FEBRUARY, 2017

DETAIL NO: 23

Riverview



TYPICAL LAYOUT

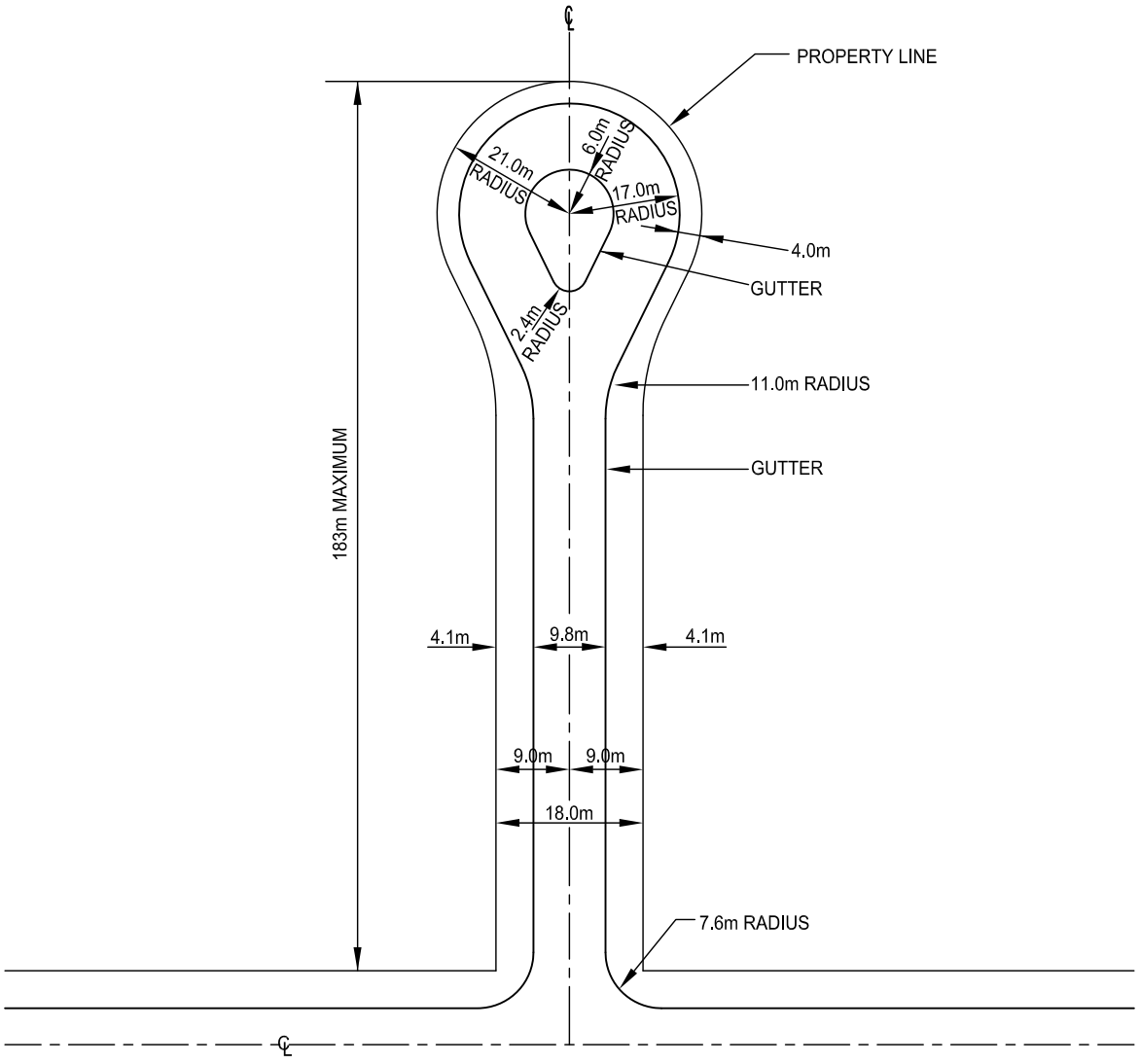
OPTIONAL LAYOUT

CUL-DE-SAC

DATE: FEBRUARY, 2017

DETAIL NO: 24

Riverview



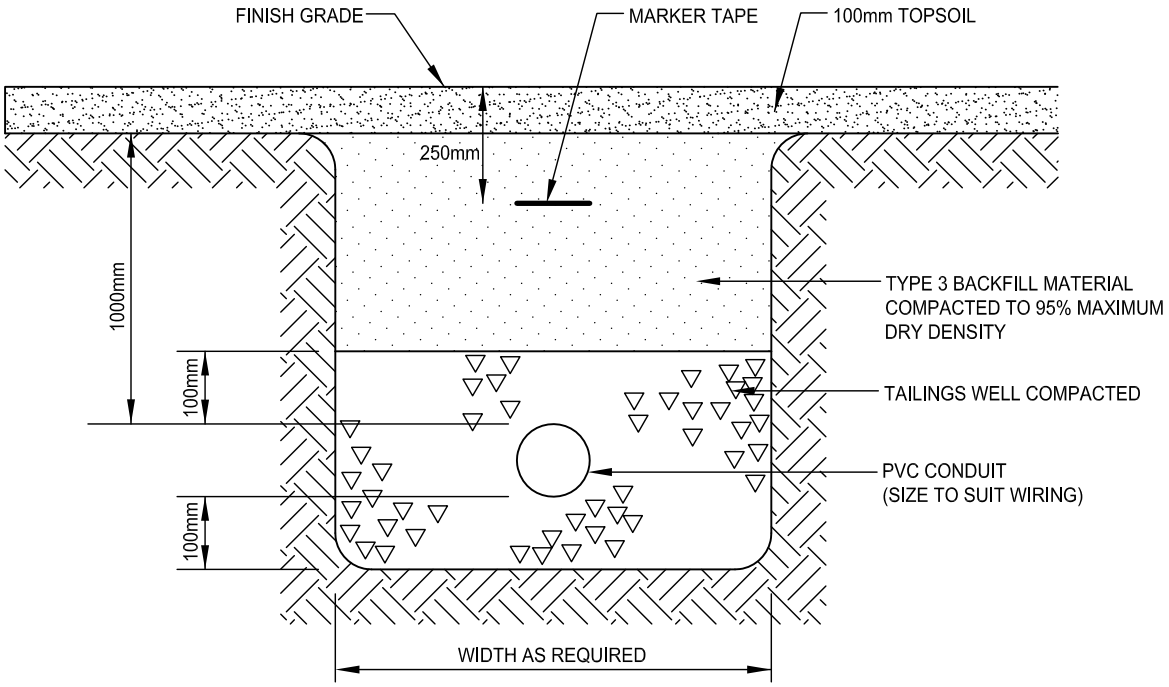
CUL-DE-SAC WITH ISLAND

DATE: FEBRUARY, 2017

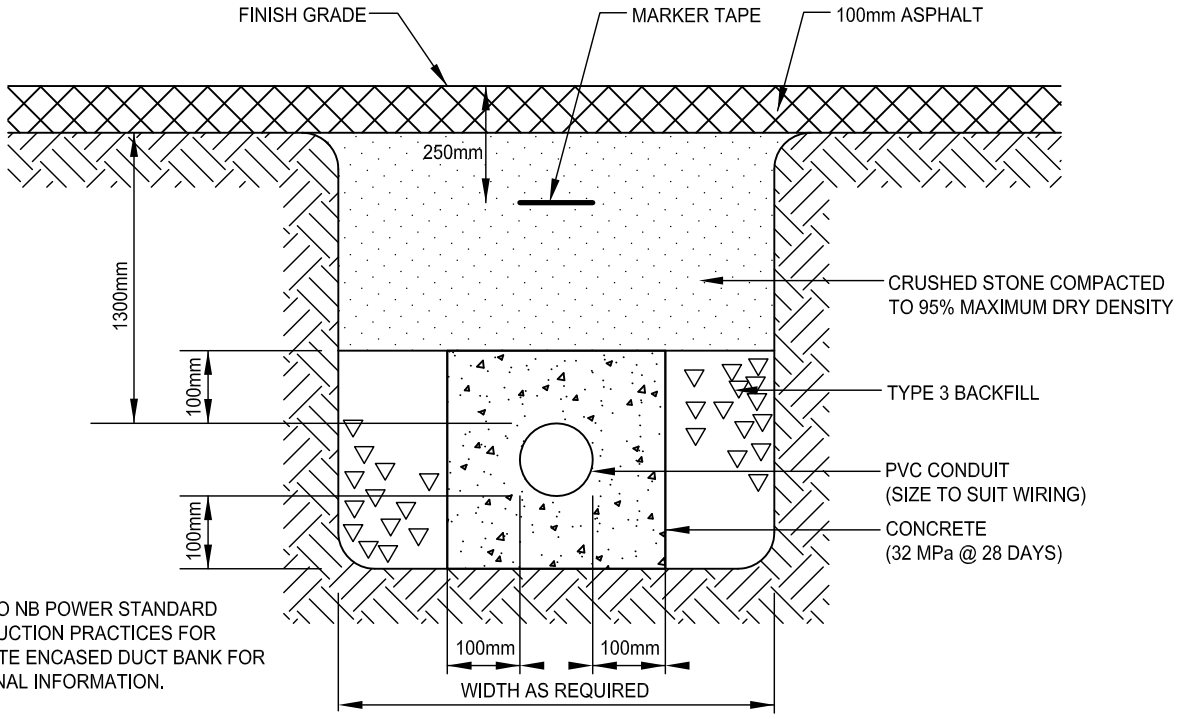
DETAIL NO: 24-1

Riverview

IN LANDSCAPED AREAS



UNDER ROADWAY



NOTE:

REFER TO NB POWER STANDARD CONSTRUCTION PRACTICES FOR CONCRETE ENCASED DUCT BANK FOR ADDITIONAL INFORMATION.

TRENCH FOR PVC CONDUIT

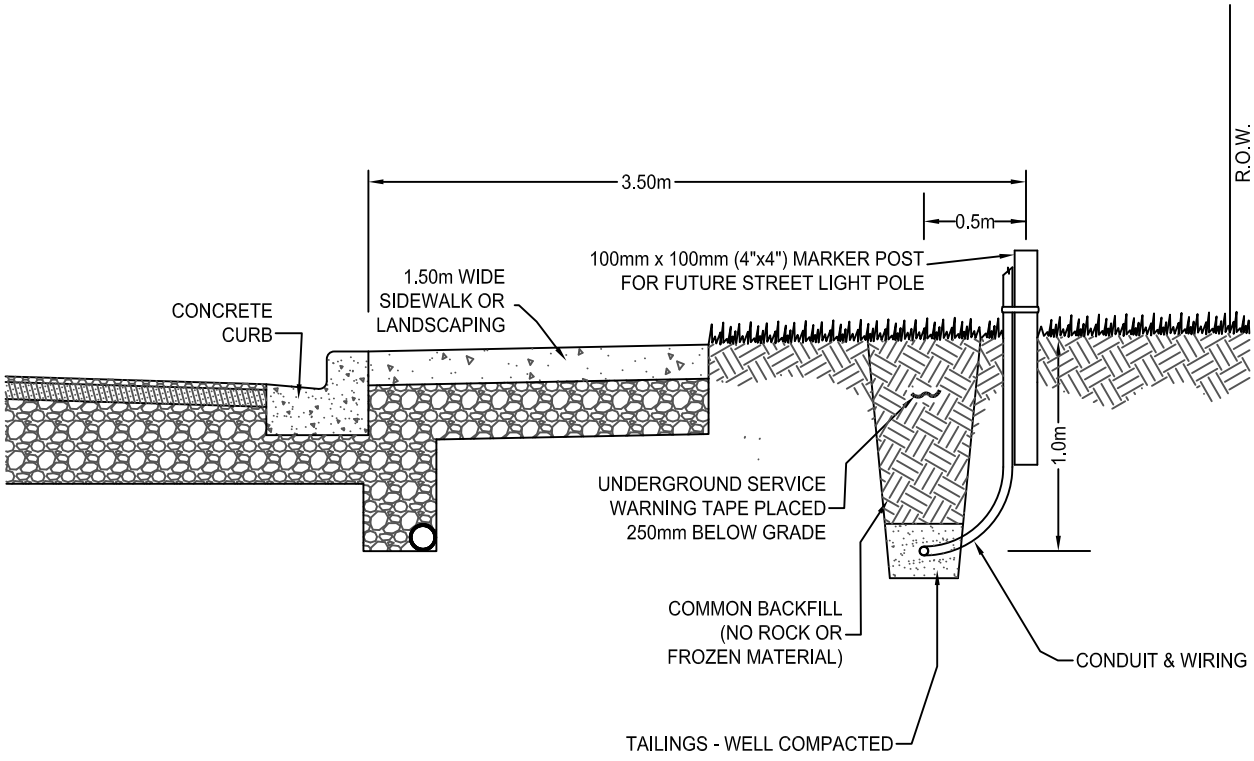
DATE: FEBRUARY, 2017

DETAIL NO: 26

Riverview

NOTES:

1. THE ENGINEER SHALL PROVIDE LINE AND GRADE PRIOR TO DUCT INSTALLATION.
2. THE CONTRACTOR SHALL ALLOW FOR 12m OF WIRE AT THE UTILITY POLE FOR FUTURE CONNECTIONS BY OTHERS AND 3m AT STREET LIGHTS. THESE MEASUREMENTS ARE ABOVE GROUND LEVEL.
3. THE CONTRACTOR SHALL CONTACT NBPOWER CORPORATION TWO (2) DAYS PRIOR TO THE START OF ANY DUCTWORK CONSTRUCTION.
4. DISTANCES FOR PAYMENT SHALL BE LINEAL BETWEEN STREET LIGHTS.
5. FOR CONCRETE STREET LIGHT POLES DIRECT BURIED:
   - CONDUIT: UTILITY "POLY" PIPE RATED AT 75 P.S.I. AND CSA APPROVED, MINIMUM SIZE 38mmØ.
   - WIRE: COPPER CONDUCTORS, TYPE TWU OR RWU90, MINIMUM SIZE #6 AWG.
6. FOR ALUMINUM LIGHT POLES MOUNTED ON CONCRETE BASES:
   - CONDUIT: RIGID PVC ELECTRICAL CONDUIT, MINIMUM SIZE 38mmØ.
   - WIRE: COPPER CONDUCTORS TYPE RW90, MINIMUM SIZE #6 AWG.
7. A TYPICAL INSTALLATION WOULD INCLUDE THE FOLLOWING NUMBER OF CONDUCTORS:
   2 - #6 AWG BLACK
   1 - #6 AWG WHITE
   1 - #6 AWG GREEN
8. THE CONDUIT AND WIRE SIZES SHOWN ARE THE MINIMUM ALLOWED. SOME INSTALLATIONS MAY REQUIRE ADDITIONAL CONDUCTORS, LARGER DIAMETER CONDUITS AND LARGER WIRE SIZES, DEPENDING ON THE TOTAL CONNECTED LOAD AND THE DISTANCE FROM THE SOURCE OF SUPPLY.
9. ALL WORK SHALL BE CARRIED OUT ACCORDING TO THE CANADIAN ELECTRICAL CODE (LATEST REVISION) AND THE NEW BRUNSWICK UTILITY SERVICE ENTRANCE STANDARDS (LATEST REVISION).

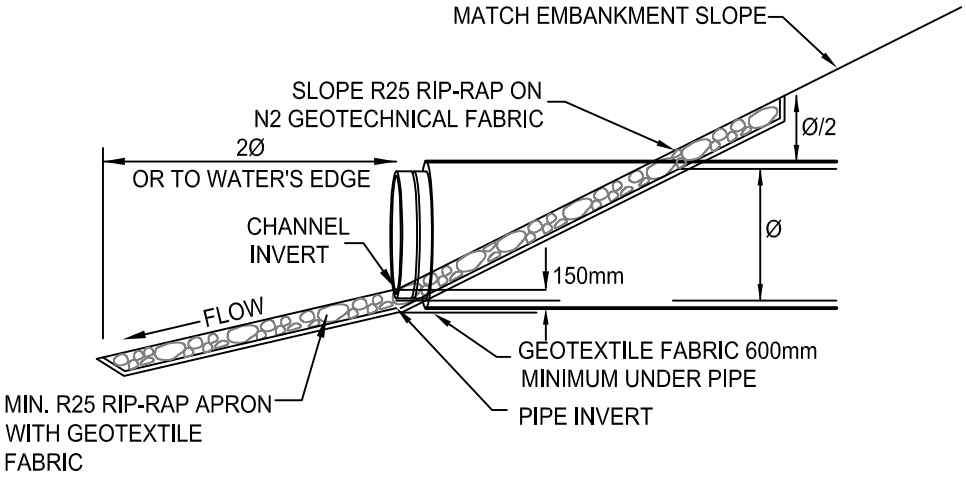


DECORATIVE STREETLIGHT DUCT

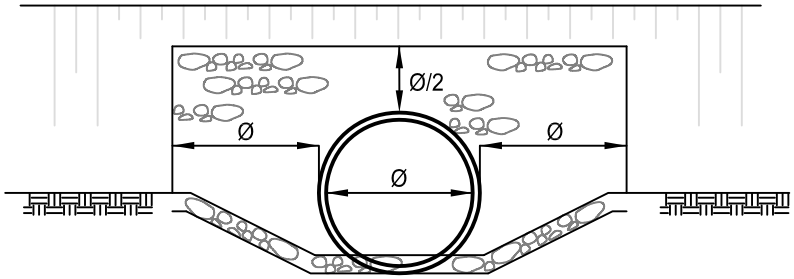
DATE: FEBRUARY, 2017

DETAIL NO: 26-1

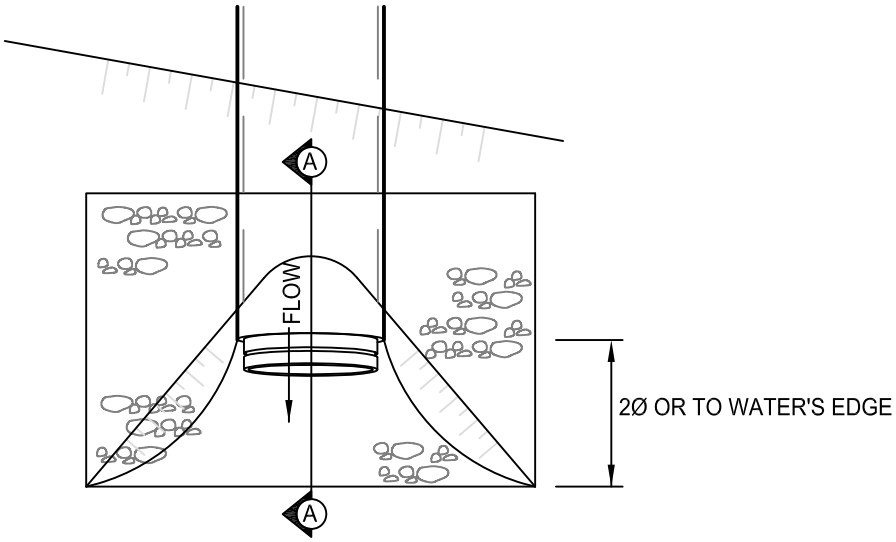
Riverview



SECTION A-A



FRONT VIEW



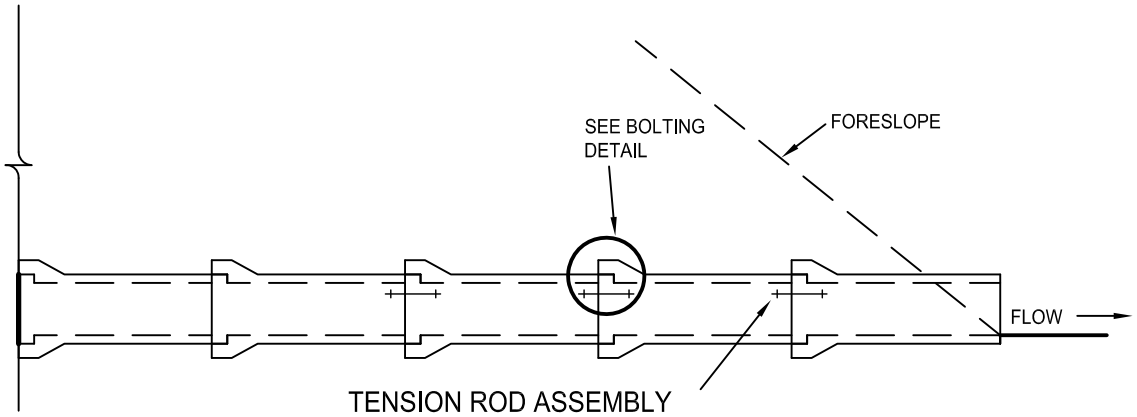
TOP VIEW

PIPE OUTLET DETAIL

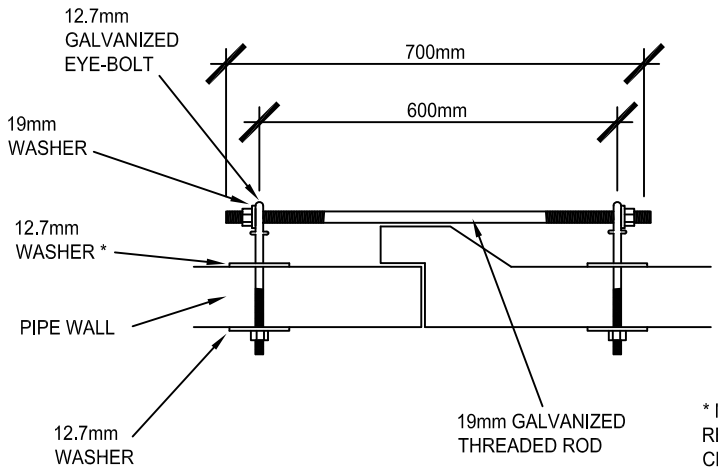
DATE: FEBRUARY, 2017

DETAIL NO: 27

Riverview

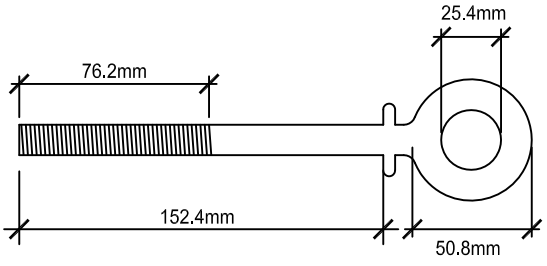


TENSION ROD ASSEMBLY
N.T.S.



* NOTE: MINIMUM ONE WASHER REQUIRED. ADD EXTRA WASHERS TO CLEAR BELL.

BOLTING DETAIL
N.T.S.

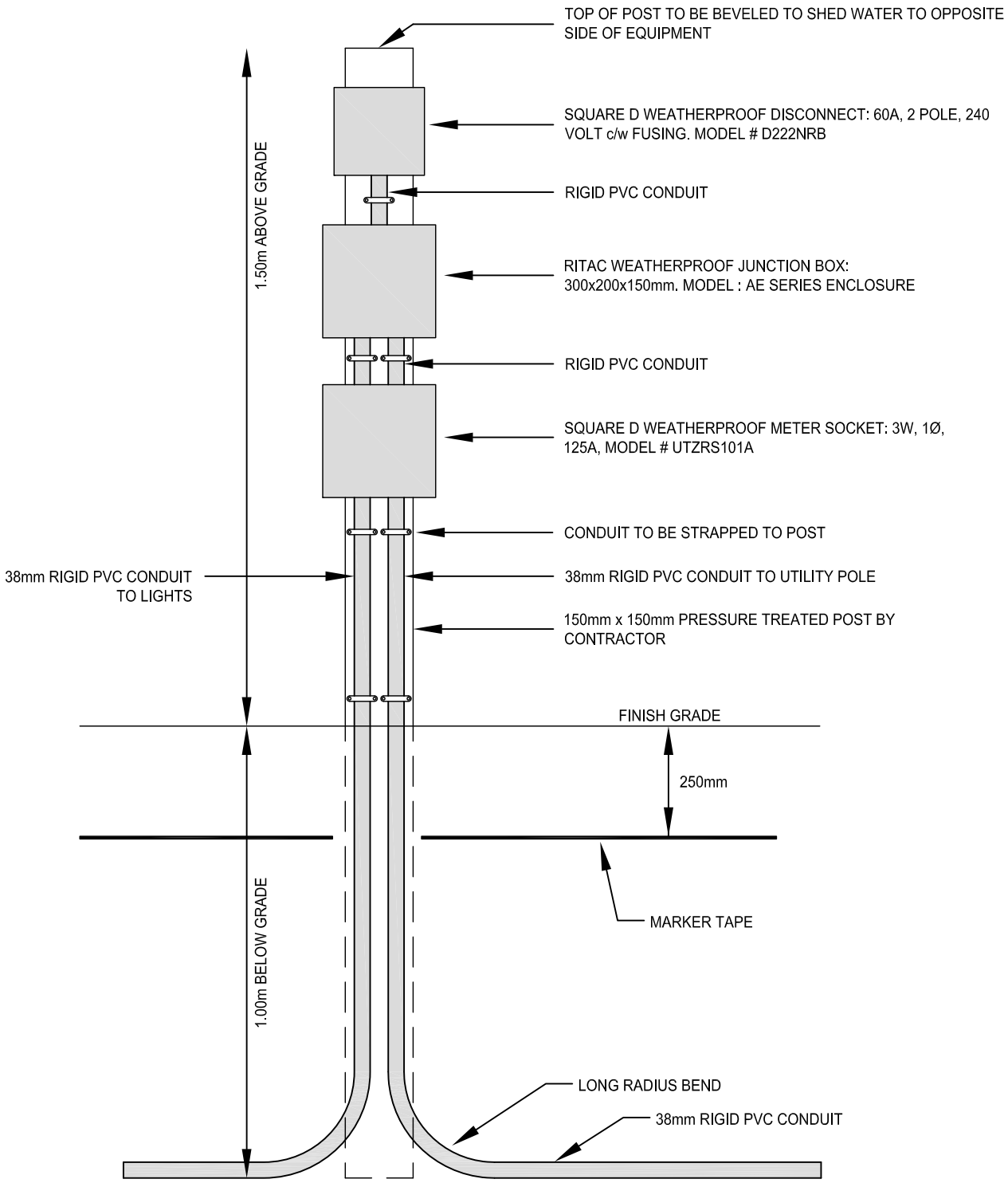


12.7mm GALVANIZED EYE-BOLT WITH SHOULDER
N.T.S.

PIPE OUTLET RESTRAINT DETAIL

DATE: FEBRUARY, 2017
DETAIL NO: 27-1

Riverview

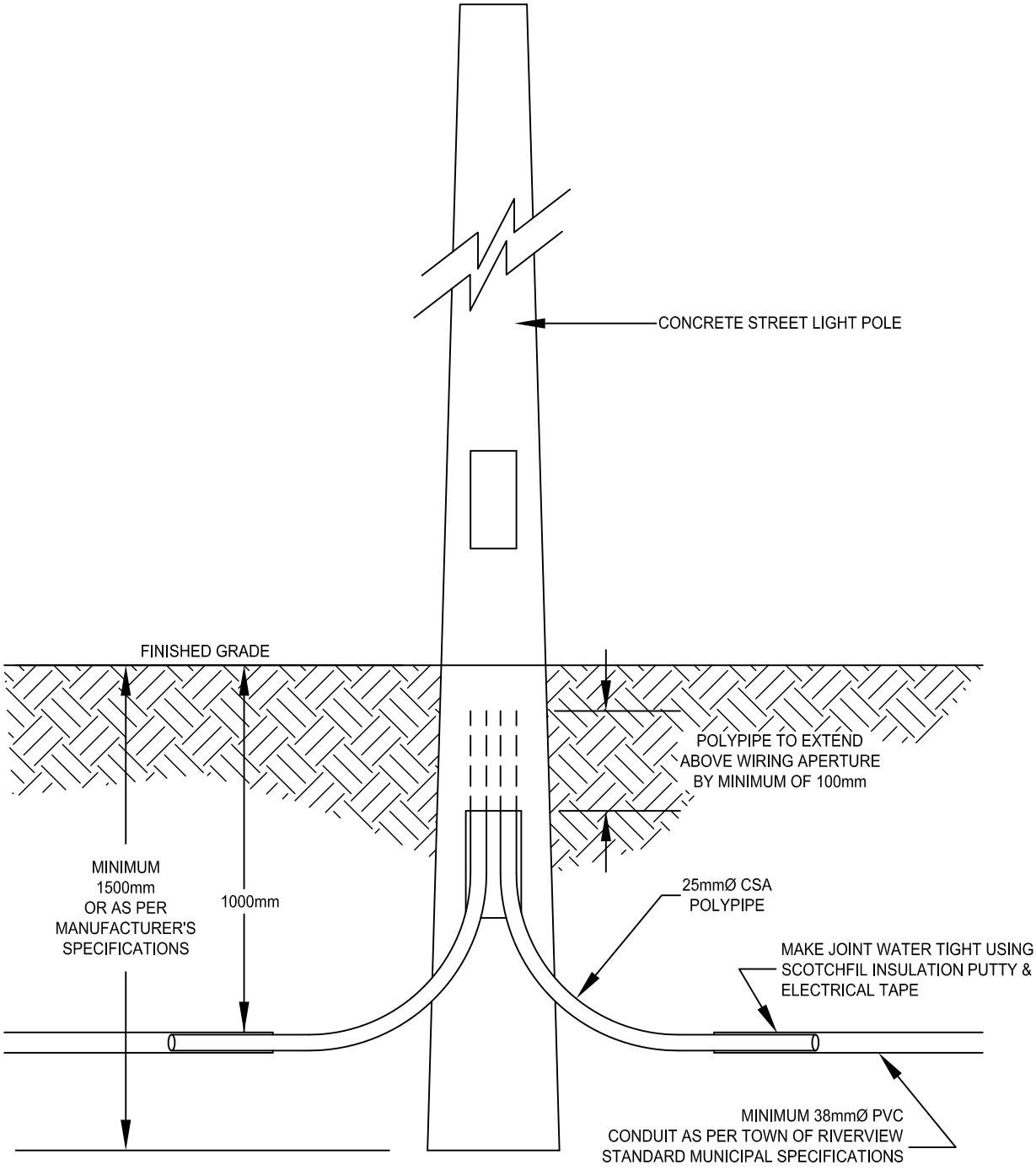


ELECTRICAL POWER DISCONNECT

DATE: FEBRUARY, 2017

DETAIL NO: 28

Riverview



DIRECT BURY CONCRETE STREET LIGHT POLES

DATE: FEBRUARY, 2017

DETAIL NO: 29

Riverview

APPENDIX "A" - PIPE LEAKAGE TEST

SANITARY SEWER – LEAKAGE TEST

GENERAL INFORMATION

CONTRACT: _____

CONTRACT NO: _____

JOB LOCATION: _____

TEST LOCATION: _____

FROM MH: _____ TO MH: _____

DATE: _____

CONTRACTOR: _____

CONTRACTOR'S REP: _____

INSPECTOR: _____

PIPE MATERIAL: _____ CLASS: _____

SANITARY SEWER EXFILTRATION TEST – ALLOWABLE EXFILTRATION

D = DIAMETER OF PIPE = _____ (mm)

L = LENGTH OF PIPE = _____ (m)

E_{ALL} = ALLOWABLE EXFILTRATION = _____ (L)

ALLOWABLE EXFILTRATION

$$E_{ALL} = \frac{D(mm)L(m)T(hr)}{1,296}$$

SANITARY SEWER EXFILTRATION TEST - RESULTS

T_1 = START TIME = _____ H_1 = start level _____ (m)

T_2 = STOP TIME = _____ H_2 = stop level _____ (m)

$T_1 - T_2$ = ACTUAL TIME = _____ (hr) $H_1 - H_2$ = level drop _____ (m)

NOTE: test duration = 2hrs E_{ACT} = _____ (L)

IF EACT < E ALL PASS ☐ IF EACT > E ALL FAIL ☐

$E_{ACT} = 785\ D^2\ (H_1 - H_2)$

D = manhole diameter (m)
H_1 = start level (m)
H_2 = stop level (m)

SANITARY SEWER AIR TEST - ALLOWABLE EXFILTRATION TIME

D = DIAMETER OF PIPE = _____ (mm)

F = LOSS FACTOR = _____ (0.0987)

T_{ALL} = ALLOWABLE TIME = _____ (min)

ALLOWABLE TIME

$$T_{ALL} = \frac{15\ D\ F}{60}$$

SANITARY SEWER AIR TEST RESULTS

T_1 = TIME STARTED AT 27.6 kPa (4.0 psi): _____

T_2 = TIME STOPPED AT 24.1 kPa (3.5 psi): _____

T_{ALL} = ALLOWABLE TIME = _____ (min)

IF $T_{ACT} > T_{ALL}$ PASS ☐

IF $T_{ACT} < T_{ALL}$ FAIL ☐

_____ INSPECTOR'S SIGNATURE

_____ FOREMAN'S SIGNATURE

Copies to: Project Engineer
Contractor

APPENDIX "A" - MANHOLE LEAKAGE TEST

SANITARY MANHOLE – LEAKAGE TEST

GENERAL INFORMATION

CONTRACT: _____

CONTRACT NO: _____

JOB LOCATION: _____

TEST LOCATION: _____

MANHOLE NO: _____

DATE: _____

CONTRACTOR: _____

CONTRACTOR'S REP: _____

INSPECTOR: _____

SANITARY MANHOLE EXFILTRATION TEST – ALLOWABLE EXFILTRATION

D = DIAMETER OF PIPE = _____ (m)

L = LENGTH OF PIPE = _____ (m)

E_{ALL} = ALLOWABLE EXFILTRATION = _____ (L)

ALLOWABLE EXFILTRATION

$$E_{ALL} = \frac{4\,D\,H}{1000}$$

SANITARY MANHOLE EXFILTRATION TEST - RESULTS

T_1 = START TIME = _____ H_1 = start level _____ (m)

T_2 = STOP TIME = _____ H_2 = stop level _____ (m)

$T_1 - T_2$ = ACTUAL TIME = _____ $H_1 - H_2$ = level drop _____ (m)

NOTE: test duration = 2hrs E_{ACT} = _____ (L)

IF $E_{ACT} < E_{ALL}$ PASS ☐ IF $E_{ACT} > E_{ALL}$ FAIL ☐

$$E_{ACT} = 785\,D^2\,(H_1 - H_2)$$

D = manhole diameter (m)
H_1 = start level (m)
H_2 = stop level (m)

SANITARY MANHOLE VACUUM TEST - ALLOWABLE EXFILTRATION TIME

T_{ALL} = THE ALLOWABLE EXFILTRATION TIME WHICH IS A FUNCTION OF MANHOLE DIAMETER, DEPTH AND GROUNDWATER. THE MANHOLE SHALL PASS IF THE TIME FOR THE VACUUM TO DROP MEETS OR EXCEEDS THE VALUES IN TABLE 1 (see reverse side)

MH DEPTH = _____ (m)

MH DIAMETER = _____ (mm)

T_{ALL} = _____ (SEC)

SANITARY MANHOLE VACUUM TEST RESULTS

T_1 = TIME STARTED AT 33.8 kPa (4.9 psi): _____

T_2 = TIME STOPPED AT 30.4 kPa (4.4 psi): _____

T_{ACT} = ACTUAL TIME = $T_2 - T_1$: _____ (sec)

IF $T_{ACT} > T_{ALL}$ PASS ☐

IF $T_{ACT} < T_{ALL}$ FAIL ☐

_____ INSPECTOR'S SIGNATURE

_____ FOREMAN'S SIGNATURE

Copies to: Project Engineer
Contractor

APPENDIX "A" - MANHOLE LEAKAGE TEST

Standard Practice for Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (and Manholes) ASTM C969M – 02

- Conduct testing one manhole at a time
- All lift holes shall be plugged, pipes entering the manhole shall be temporarily plugged.
- Fill the sanitary manhole with water to within 300mm of the top of the structure.
- Allow the sanitary manhole to remain saturated for a period long enough to allow water absorption (A period of 12 to 24 hours is recommended). After the absorption period, refill the sanitary manhole to the required test head.
- Measure the leakage loss over a two hour time period.
- The manhole shall pass if the actual leakage rate is less than the allowable leakage rate.

Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test ASTM C1244M – 04

- Conduct testing one manhole at a time
- All lift holes shall be plugged, pipes entering the manhole shall be temporarily plugged, taking care
- to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
- The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
- A vacuum of 33.8 kPa of Hg shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 30.4 kPa of HG.
- The manhole shall pass if the time for the vacuum reading to drop from 33.8 kPa of Hg to 30.4 kPa of Hg meets or exceeds the values indicated in Table 1.

TABLE 1 Minimum Test Times for Various Manhole Diameters in Seconds

	Diameter, mm								
Depth, m	**750**	**825**	**900**	**1050**	**1200**	**1350**	**1500**	**1650**	**1800**
	Time, in seconds								
2.4	11	12	14	17	20	23	26	29	33
3.0	14	15	18	21	25	29	33	36	41
3.7	17	18	21	25	30	35	39	43	49
4.3	20	21	25	30	35	41	46	51	57
4.9	22	24	29	34	40	46	52	58	67
5.5	25	27	32	38	45	52	59	65	73
6.1	28	30	35	42	50	58	65	72	81
6.7	31	33	39	46	55	64	72	79	89
7.3	33	36	42	51	59	70	78	87	97
7.9	36	39	46	55	64	75	85	94	105
8.5	39	42	49	59	69	81	91	101	113
9.1	42	45	53	63	74	87	98	108	121

APPENDIX "B"

STANDARD PROCEDURE FOR COMMISSIONING NEW WATERMAINS

All tests, disinfection and commissioning of water mains are to be in accordance with AWWA Standard C651 for Disinfecting Water Mains, the Town of Riverview Standard Municipal Specifications, and the following procedures.

- The Consultant shall make all arrangement with the Site Inspector and the Town's Engineering Department (contact Greg Garland at 387-2059) at least one full working day prior to the start of any testing.
- Town of Riverview Engineering Department will review the work and water main connection to the municipal water system prior to operating valves. Only **ONE** connection shall be allowed to the municipal distribution system per disinfection sequence. Any looping of the active water distribution system with new water main shall not be permitted.
- The Contractor is not to operate any existing valves or hydrants.
- The Contractor is to supply all labour, equipment and materials necessary to carry out pressure and leakage tests, swabbing, sterilization and flushing of all water mains and appurtenances.
- Swabs of appropriate size are to be installed at the first pipe section of new water main at the start of construction and for each pipe section to be tested.
- Initial flushing to remove swab requires a temporary pipe section at end of test section, to be brought up to grade with a 45° bend of pipe of same size and type as being installed, or a modified hydrant installed as a standpipe at the end of the main.
- At the discharge at the end of the main to be tested, if there is no hydrant available within the test section, the Contractor shall provide a temporary standpipe (see Figure 1 following), consisting of 63.5mm pipe with a smooth, unthreaded ½ inch sampling faucet so that water leaving the main can be tested without disturbing the flow, or a temporary modified hydrant.
- A completed water main Leakage Test and Disinfection form (Appendix "B" of Town of Riverview Specs) must be filled out.

GENERAL SEQUENCE FOR TESTING AND ACCEPTANCE

APPENDIX "B"

1. INITIAL INSPECTION

Town of Riverview Engineering Department will review the work and water main connection to the municipal water system prior to operating valves. A maximum of ONE connection shall be allowed to the municipal distribution system per disinfection sequence. Any looping of the active water distribution system with new water main shall not be allowed.

As per AWWA C651-99 and in order to protect the existing distribution system from backflow caused by hydrostatic pressure test and disinfection procedures, the Town may require that the water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection with backflow prevention between the new main and the active municipal water distribution system until satisfactory bacteriological testing has been completed and the disinfectant water flushed out.

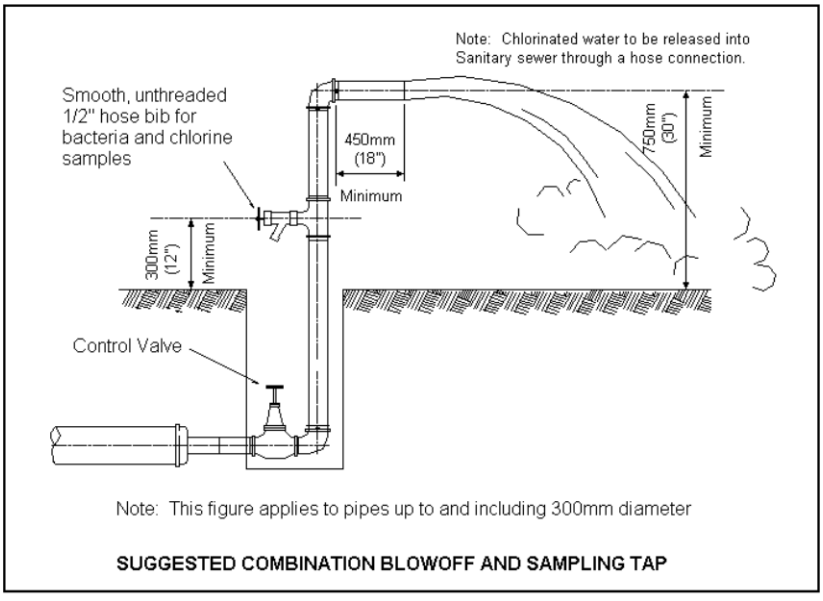
The final connections shall be made in accordance with section 4.6 of AWWA C651-99.

2. FILLING AND INITIAL FLUSHING

The Contractor is not to operate any existing valves or hydrants; Public Works staff will operate them.

Preliminary flushing shall be carried out in conjunction with swabbing operations, using relatively high flow rates (at least 0.75m/sec of 2.5 ft/sec) by the Public Works Department staff opening existing valves. End hydrant/modified hydrant/standpipe to be in open position; hydrant within test section are to be closed until swab is expelled. Once the swab is expelled, all hydrants within the section shall be opened in order to expel air.

As system fills, close fire hydrants from the low end to the high and flush main using the standpipe, or end hydrant. This standpipe or end hydrant is the last utility to be closed; it remains in the open position until all valves are closed so as not to have water from the new section of main mixing with the old water system.



SUGGESTED COMBINATION BLOWOFF AND SAMPLING TAP

APPENDIX "B"

3. PRESSURE AND LEAKAGE TESTS

The Contractor shall provide complete testing equipment (suitable pump and storage tank, pressure gauge, relief valve and check valve), and shall provide and install the necessary piping to connect to the main.

The water main shall be filled with water from the Town Distribution System by Town of Riverview's Public Works crew via a single connection to existing.

Apply hydrostatic pressure of 1000kPa (145 psi) for 2 hours. Measure water volume required to maintain this pressure and compare to allowable leakage. This can be done by measuring the amount of water reduction in the storage tank, or by means of a calibrated water meter.

Take readings every 15 minutes over a period of 2 hours. If the average leakage for 2-hour period exceeds the allowable rate, the Contractor shall examine all parts of the main for leakage and shall take the necessary steps to reduce the leakage to the allowable rate.

The "WATER MAIN - LEAKAGE TEST AND DISINFECTION" form of this Appendix "B" must be filled out by the Contractor's Foreman in conjunction with the Site Inspector, and signed by both.

4. DISINFECTION

Induce a controlled flow by opening the standpipe or end hydrant and cracking gave valve at beginning of new water main (slowly) to allow the air to escape at the hydrants and standpipe.

No valves are to be opened until hydrants and stand pipe are open.

Using the 19mm service tubing (previously installed by the Contractor), inject chlorine solution (Javex 12 + Water) into the new main immediately downstream of valve being operated. Continue to move highly chlorinated water through the new pipes until strong chlorine smell is detected at flowing hydrant(s). Each hydrant will be concurrently closed when chlorine smell is detected.

The Water Control Technician shall measure chlorine residual at the open hydrant(s); when it reaches 50ppm, shut down the valves and hydrants. The Contractor shall operate all valves and hydrants within the new section after the introduction of chlorine to ensure their disinfection.

Let stand for a minimum of 24 hours, at that time, The Water Control Technician will take samples and retest for chlorine residual from dead ends to confirm at least 10ppm free chlorine.

Note: Heavily chlorinated water shall never stand in the pipe for more than 48 hours, in order to prevent damage to the pipe lining or corrosion damage to the pipe itself.

5. FLUSHING

If greater than 10ppm, flush system down to 3ppm or less. Again, hydrants and standpipe must be open prior to opening valves. If less than 10ppm, repeat chlorination procedure. All costs of re-sterilization shall be borne entirely by the Contractor, including all Town of Riverview staffing costs.

Chlorinated water shall be discharged into the sanitary sewer via hose connections, unless written approval is received from the Engineer.

APPENDIX "B"

6. BACTERIOLOGICAL TESTING BY WATER CONTROL TECHNICIANS

Upon successful completion of disinfection and flushing, the Water Control Technician shall take water samples.

Samples will be taken from each branch (i.e. side streets) and at end of each section via 19 mm service tubing; second set 24 hours later. They will forward the samples to lab for testing of total coliform and e-coli. Recommended days for bacteriological tests are Tuesday and Wednesday, as test results take a minimum of 48 hours.

If test fails, flush and repeat chlorination and sampling procedures.

7. FINAL FLUSHING

Flushing shall be carried out at a minimum flow rate of 0.75 m/sec (2.5 ft/sec.)

8. COMMISSIONING

Advise all residents within the new area to flush their system prior to using it; there still may be larger than normal amounts of chlorine in their service line.

Call the Public Works Department to remove "out of service" hydrant markers and verify that all valves are fully open or closed as may be required, and to ensure that the system is fully operational and functional

9. REPAIRS - DISINFECTION PROCEDURES

If repairs are made with the line under full pressure, no disinfection is required.

In wet excavations, large quantities of hypochlorite must be applied to the open trench areas to lessen the danger of contamination. Tablets are the best method as they dissolve slowly and continue to release hypochlorite as the water is pumped from the excavation.

Spray the interior of all pipe, fittings and materials used in the repair with a 1 to 5% solution of chlorine at a pressure on 690 kPa (100 psi) as it is lowered into the trench. An ordinary pressure-type stainless steel fire extinguisher will do the job.

Flush the main.

10. CAULKED TAPPING SLEEVES - PROCEDURE FOR DISINFECTION

Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder or sprayed with a 1 to 5% chlorine solution.

APPENDIX "B"

WATER MAIN LEAKAGE TESTS & DISINFECTION

WATER MAIN LEAKAGE TEST

GENERAL INFORMATION

LOCATION _____

SECTION OF TEST _____

DATE _____ WEATHER _____

CONTRACTOR _____

CONSULTANT _____

ALLOWABLE LEAKAGE in LITRES

L = LENGTH OF PIPE (m) = _____

D = DAMETER OF PIPE (mm) = _____

P = AVG. TEST PRESSURE (kPa) = _____

Q = ALLOWABLE LEAKAGE (l/hr) = _____

$$Q = \frac{LD\sqrt{P}}{795{,}000}$$

TOTAL ALLOWABLE LEAKAGE _____ Litres

CONDITIONS FOR TESTING	**TEST RESULTS**
❒ Duration of test is 2 hours	TIME STARTED _____ rdg. _____ cm
❒ All water valves within test section are fully open	TIME FINISHED _____ rdg. _____ cm
❒ All main valves and hydrant valves operated by Public Work crew during test	difference in readings _____ cm
❒ All hydrants closed during test	$L_{actual} = \frac{\P\ r^2\ h}{1000} = \frac{3.14 (\quad cm)^2 (\quad cm)}{1000} =$ _____ **litres**

SECTION OF TESTS HAS: **PASSED** ❒ **FAILED** ❒ **INSPECTOR** _____
(PRINT BELOW)

FOR TOWN USE ONLY

HYDRANT	STATIC TEST		STORZ CHECKED		HYDRANT	STATIC TEST		STORZ CHECKED	
#	BY	DATE	BY	DATE	#	BY	DATE	BY	DATE

APPENDIX "B" WATERMAIN DISINFECTION

GENERAL INFORMATION

LOCATION _____

SECTION OF_TEST _____

DATE _____ **WEATHER** _____

CONTRACTOR _____

CONSULTANT _____

PART ONE - FLUSHING

All hydrants and branch lines shall be individually flushed using the main control valve to regulate the water flow through the hydrants.

WATERMAIN FLUSHED (See table "A") YES □ NO □ FLOW RATE _____ l/sec

PART TWO DISINFECTION

A sodium hypochlorite solution shall be injected into the watermain at a point not more than 3 metres from the main control valve. This injection shall be done with the watermain flushing through a hydrant carrying the solution throughout the watermain. The injection shall be complete when a concentration of 50ppm free residual chlorine is achieved through all the watermain. Free residual testing shall be done by the Town of Riverview. The disinfection period shall be 24 hours, after which, free residual testing shall again be done; all samples must have not less than 10ppm. All valves to be operated during the disinfection period.

where, Vp = Volume of pipe (cu.m.), r = radius (m), l = length (m)

primary watermain size, $Vp = \pi r^2 l$ =)(m) (m) _____ cu.m

secondary watermaln size, $Vp = \pi r^2 l$ = (m)(m) _____ cu.m

TOTAL _____ cu.m

where, Vc = Volume of chlorine needed to disinfect

$Vc = Vp \times 1{,}000 \text{ litres} \times \frac{50}{1{,}000{,}000} = \frac{Vp}{20} = \frac{(\quad)}{20} =$ _____ litres of 100% chlorine

where, x = % chlorine concentration (ex: 12% = 0.12)

Volume of chlorine required to disinfect according to % of concentration = $\frac{Vc}{x}$ = $\frac{(\quad)}{(\quad)}$ = _____ litres

Initial Free Residual Chlorine = _____ ppm (not less than 50 ppm)

Free Residual Chlorine after 24 hrs. = _____ ppm (not less than 10 ppm)

PART THREE BACTERIOLOGICAL TESTING

Water samples for bacteriological testing shall be taken by the Town after disinfection and flushing of the watermlans is successful. Free Residual Chlorine taken below to be less than 3 ppm

1•• Bacteriological Test Result passed ☐ failed ☐ ☐ Free residual Chlorine = _____ ppm

2"" Bacteriological Test Result passed ☐ failed ☐ ☐ Free residual Chlorine = _____ ppm

Attached bacteriological test results to this form ☐

Inspector signature _____

Inspector name _____

DATE WATERMAIN PLACED IN SERVICE _____ APPROVED _____

APPENDIX "B" WATERMAIN DISINFECTION

TABLE "A" - REQUIRED FLOWS TO PRODUCE 0.8m/s (2.5ft/s)

PIPE DIAMETER &		REQ'D FLOW 0.8m/s (2.5ft/s)		NUMBER OF 2 1/2 " HYDRANT OUTLETS
(m.)	(mm)	IGPM		
4	100	83	6.3	1
6	150	167	12.6	1
8	200	333	25.2	1
10	250	500	37.9	1
12	300	750	56.8	2
16	400	1330	100.9	2

TABLE "B" - PITOT GAUGE READING FOR FLOWS

PITOTGAUGE READING	·.· NOZZLE DIAMETER IN INCHES coeff= 0.99				coeff'= 0.90
(psi)	1-1/2	1- 3/4	2	2-1/2	2-1/2
5	124	169	222		313
6	136	186	243		343
7	147	201	262		370
8	157	214	280		396
9	167	227	297		420
10	176	240	314	488	442
12	193	264	342	538	485
14	208	283	370	577	524
16	223	303	396	618	560
18	236	322	420	655	594
20	249	339	443	690	626
30				846	767

TABLE "C" ·CHLORINE INJECTION CALCULATIONS

WATERMAIN DISCHARGE = 114 l/min (25igpm) or 227 l/min (50 igpm)

WATERMAIN DISCHARGE TIME = $\frac{\text{wateramin volume}}{\text{Wateramain discharge}}$

Example: $\frac{2650\ l}{114\ l/min}$ = 23 minutes

INJECTION RATE FOR CHLORINE SOLUTION = $\frac{\text{chlorine solution (l)}}{\text{discharge time (min)}}$

Example: $\frac{*\ 205}{23\ min}$ = 8.91 l/min (2igpm)

*Note: Chlorine solution mixed in 205 l (45 imperial gallon) drum

TABLE "D" ·SAMPLE DILUTIONS

Sample"volume (ml)	Deionized Water used to bring Volume to·	Multiplication Factor
25.0	0.00	1
12.5	12.50	2
10.0	15.00	2.5
5.0	20.00	5
2.5	22.50	10
1.0	24.00	25
.025	24.75	100

. Multiplication factors to beused whim sample is diluted to	
Sample Volume (ml)	Factors
1	100
2	50
5	20
10	10
20	4
30	2

Note:

The concentration of the sample is equal to the diluted sample reading multiplied by the multiplication factor. Example: A 2.5 ml sample was diluted with 22.5 ml of deionized water. The result was 0.35 mg/l. Concentration of this sample is 0.35 x 10 3.5 mg/l. More accurate dilutions can be done with a pipet and a 100 ml volumetric flask. Pipet the sample and dilute to volume and deionized water. Swirl to mix.

APPENDIX "C"

CERTIFICATE OF SUBSTANTIAL PERFORMANCE

(Form 7 – *Construction Remedies Act, S.N.B. 2020, c.29, s.42*)

Town in which land is located: Town of Riverview

County in which land is located: _____

Civic address/location of the land: _____

Contract Name/Description of the improvement: _____

_____

Contract No: _____

Name of the Owner: Town of Riverview
Address for service: 30 Honour House Court
Riverview, NB
E1B 3Y9
c/o Annette Crummey, Director/Town Clerk

Name of Contractor: _____
Address for service: _____
_____
_____

Name of Project Engineer (Payment Certifier): _____
Address: _____
_____
_____

I, _____, Project Engineer, as per the *Construction Remedies Act*, SNB 2020, c 29 (the "Act") do hereby certify that all works required under this contract are "Substantially Performed" as of the _____ day of _____ 20___. It is understood that the "warranty and maintenance period" commences as of this date and that the following contract requirements have been fully met;

a. All sewer mains have passed sewer leakage tests, which were carried out on _____. (Attach completed Appendix "A")

b. All required CCTV sewer video inspections were completed on _____ and the video and video reports have been distributed as required. I hereby certify that the condition of the sewer meets or exceeds the requirements as outlined in the latest edition of the Town of Riverview Standard Municipal Specifications.

c. All water mains have passed water pressure and bacteriological tests, which were carried out on _____. (Attach completed Appendix "B")

APPENDIX "C"

d. All product and material tests conducted throughout the works of this contract have been reviewed and submitted. I hereby certify that the condition of the works meets or exceeds the requirements as outlined in the latest edition of the Town of Riverview Standard Municipal Specifications.

e. Department of Environment Certificate of Approval, *if any,* and any applicable watercourse alteration approvals are attached.

f. A letter from the Workers Compensation Board is attached, stating that the contractor whose name appears on the Certificate of Substantial Performance is in good standing and has paid all required premiums in full.

2. A complete inspection of the works was carried out on _____, and those present were:_____
_____
_____
_____

The deficiency list was prepared. Yes _____ No _____ (If yes, please attach). All items on the attached deficiency list have been addressed by the contractor and an additional inspection conducted on _____, by_____
_____, confirmed that all deficiencies have been corrected and all work completed under this contract to date, meets or exceeds standards as required in the latest edition of the Town of Riverview Standard Municipal Specifications.

-OR -

3. The total contract price is:_____ and as per the Act, the contract is considered substantially performed when the cost to complete the contract and the cost to correct all know defect are less than the following:
(i) 3% of the first $250,000 of the contract price,
(ii) 2% of the next $250,000 of the contract price, and
(iii) 1% of the balance of the contract price.

Based on the above, the cost to complete the contract and the cost to correct all know defects are: _____which is less than _____.

4. Is this contract entirely complete? Yes _____ No _____.
If any portion of this contract is not entirely completed, a separate written list identifying all uncompleted items explaining the particulars must accompany this certificate.

7. The release of holdback will become due 60 days from the date of signing of this certificate, being the ____ day of _____ 20____.

Dated: _____ Signed: _____
Project Engineer

APPENDIX "C"

We, the undersigned, do hereby certify that all matters relating to this contract have been completed to our satisfaction and that this Certificate of "Substantial Performance" can be issued.

Date: _____ Signed: _____

Director Engineering & Works

Cc: Owner
Contractor
Consultant

APPENDIX "C"

CERTIFICATE OF COMPLETION OF CONTRACT

(Capital Works Project)

Contract Name: _____

Contract No: _____

Name of the Owner: Town of Riverview
Address for service: 30 Honour House Court
Riverview, NB
E1B 3Y9

Name of Contractor: _____
Address for service: _____

I, _____, Project Engineer, do hereby certify that as per the *Construction Remedies Act*, SNB 2020, c 29 all works required under this contract are completed as of the _____ day of _____, 20___.

1. The "Certificate of Substantial Performance" was issued on _____

2. A complete inspection of the works was carried out on _____ and those present were:

   _____

   _____

   _____

3. A deficiency list was prepared. Yes _____ No _____ (If yes, please attach)

4. All items on the attached deficiency list have been addressed by the contractor and an additional inspection conducted on _____, by _____

   _____, confirmed that all deficiencies have been corrected and all work completed under this contract to date, meets or exceeds standards as required in the latest edition of the Town of Riverview Standard Municipal Specifications.

APPENDIX "C"

7. Is this contract entirely complete? Yes _____ No _____
If any portion of this contract is not entirely completed, a separate written report explaining the particulars must accompany this certificate.

8. Calculation of completion date:

	As Specified	Revised	Actual
Start Date			
Completion Date			

Provide separate written explanation for date revision or reason for being behind schedule.
Days ahead/behind schedule _____.

Liquidated damages: _____ days x _____ per day = $_____ this amount will be calculated with the final payment certificate.

9. The Town's Finance Department has on record an outstanding amount of $_____ which will be deducted from any remaining holdback monies. (Provide details on separate sheet)

Dated: _____ Signed: _____
Project Engineer

We, the undersigned, do hereby certify that all matters relating to this contract have been completed to our satisfaction and that this Certificate of Completion can be issued.

Date: _____ Signed: _____
Director Engineering & Works

Cc: Owner, Contractor, Consultant

APPENDIX "D"

CERTIFICATE OF FINAL ACCEPTANCE

(Capital Works Project)

Contract Name: _____

Contract No.: _____

Contractor: _____

I, _____, Project Engineer, do hereby certify that all works required under this contract are accepted as of the _____ day of _____, 20___.

1. The "Certificate of Substantial Performance" was issued on _____.

2. The "Certificate of Completion of Contract" was issued on _____.

3. A final inspection of the works was carried out on _____ and those present were:

   _____

   _____

   _____

4. A deficiency list has been addressed by the contractor (see attached) and an additional inspection conducted on _____ by _____ confirmed that all items now meet town requirements.

5. Portion in dispute Yes _____ No _____

   Contract entirely completed Yes _____ No _____

   If any portion of the work completed and covered by this certificate is in dispute or not entirely completed, a separate written report must accompany this certificate, explaining the particulars.

6. The Town's Finance Department have on record an outstanding amount of $_____ which will be deducted from any remaining holdback monies.

Dated: _____

Signed: _____

Project Engineer

APPENDIX "D"

7. **DECLARATION**

I/We, the undersigned, declare that the firm of _____ has no further claims against the Town of Riverview.

I/We solemnly declare that all persons who have been employed upon the works or who have furnished equipment, materials or services for the works, or persons entitled to a lien under the Construction Remedies Act, have been fully paid.

Dated at _____ this _____ day of _____, 20___

Signature of Witness _____

Signature of Representative _____

Name (Printed) _____

Name (Printed) _____

Title (Printed) _____

Corporate Seal must be affixed

8. We, the undersigned do hereby certify that all matters relating to this contract have been completed to our satisfaction and that this certificate of "Final Acceptance" can be issued.

Date: _____ Signed: _____

Director Engineering & Works

Cc: Owner, Contractor, Consultant

APPENDIX "E"

CONTRACTOR SAFETY DOCUMENT

Construction Safety Checklist

General Instructions:

In conjunction with the Town of Riverview's Standard Municipal Specifications (SMS), latest revisions, Contractors shall review and submit a signed Construction Safety Checklist to the Engineer prior to commencing work on any Town of Riverview contract. Additionally, the Contractor is advised to make the following arrangements to ensure conformity with employee health and safety provisions as stated in the applicable Acts and Regulations.

Management and Supervision (by Contractor)

- Comply with all provisions of the Occupational Health and Safety Act of the Province of New Brunswick.
- Report all serious accidents in accordance with s43 of the Occupational Health and Safety Act to the Compliance Division of Worksafe NB.
- Communicate the "Right to Refuse", s19 – s23 of the Occupational Health and Safety Act, to all employees (the three rights). The right to know, the right to partake, the right to refuse.
- Ensure adequate supervision at all times on the jobsite.
- Comply with all provisions of General Regulation 91-191, Part XII, "Excavations and Trenches".
- Comply with all provisions of General Regulation 91-191, "Part XVII, "Confined Space".
- Comply with all other provisions of General Regulation 91-191, Occupational Health and Safety Act.

Employee Training (by Contractor)

- Ensure all flag-persons have been trained and certified in highway signaling within the last three (3) years.
- Ensure all flag-persons carry a current Highway Signaler Certification Card, signed by their supervisor (copy of each certification card to be provided to the Engineer).
- Ensure all operators of vehicles and equipment are properly qualified and licensed under the Motor Vehicle Act.
- Ensure all employees are competent to perform assigned work under the Occupational Health and Safety Act., Regulation 91-191.

Traffic Control (by Contractor)

- Ensure all work zone safety devices meet the Manual of Uniform Traffic Control Devices (MUTCD), Part D – Temporary Conditions.
- Provide the Engineer with a copy of the Contractor's traffic control plan prior to the commencement or work. This control plan can alternately be discussed at the preconstruction site meeting, or as directed by the Engineer.
- Provide well-defined safe lanes of transit (which can be satisfied by a combination of pylons and barricades, unless otherwise directed by the Engineer) for equipment and vehicles inside the work zone, adequately separated from employees on foot.
- Use arrow boards (where specified) of sufficient luminosity for all long-term work on multi-lane streets and high volume two (2) lane roadways.
- Ensure all jobs are properly secured at night and outside of working hours, including weekends and holidays.

APPENDIX “E”

Personal Protective Equipment (Contractor’s Employees)

- Ensure all flag-persons wear a reflective safety vest with reflective stripping front and back, CSA standard CAN/CSA-Z195, Grade I Safety boots, Class E, Type 1 headwear, and are equipped with the TC-65 Traffic Control paddle.
- Ensure all vehicles and equipment used in the work zone are equipped with properly functioning flashing lights and back-up alarms.
- Provide first aid kits on each Site.
- Provide portable eyewash stations on each Site. This can be satisfied by the “squeeze bottle” type as distributed by safety equipment suppliers. If an incident occurs, the individual must be immediately transported to a proper eyewash fountain, hospital, or as necessary.
- Ensure all employees on the jobsite are equipped with and wear at all times: safety vest with reflective, striping front and back, Class E, Type 1 headwear, CSA standard CAN/CSA-Z195, Grade I safety boots (6” High Boot).
- Ensure employees are equipped with and wear any additional personal protective equipment warranted by: environmental conditions, work process employed, and General Regulation 91-191 under the Occupational Health and Safety Act.

I have read and understand these requirements and I agree to comply fully.

_____ _____

Contractor’s Representative Date