2025

STANDARD CONSTRUCTION SPECIFICATIONS

Regional Municipality of Wood Buffalo

Tender Certification Letter

Date:_____
File: _____

Regional Municipality of Wood Buffalo
9909 Franklin Avenue
Fort McMurray, AB T9H 2K4

Re: TENDER CERTIFICATION LETTER
PROJECT NAME: _____

Project Title: _____

Project Number: _____

Consultant: _____

Lead Designer: _____

Email Contact Info: _____

Telephone Contact Info: _____

Tender Document Enclosed:

This Tender Certification Letter is provided to the Regional Municipality of Wood Buffalo to indicate:

- The tender package has been reviewed and conforms to the standards of the Regional Municipality of Wood Buffalo where possible.
- All changes to the Standard Construction Specifications conform to the Standard Construction Specifications Deviation process and have been approved by the Regional Municipality of Wood Buffalo's Project Manager with the approval of the Manager or Director of Engineering.
- The tender package has been reviewed and accepted by the Consultant.

Signature: _____ Signature _____

Print Name: _____ Print Name: _____

Consultant Project Manager **RMWB Project Manager**

DISCLAIMER

This document was developed for establishing standard construction specifications for the construction of public infrastructure within the Regional Municipality of Wood Buffalo. Care has been taken to confirm the accuracy of the information contained herein. The views expressed herein do not necessarily represent those of any individual or contributor. Public infrastructure construction continually evolves, and practices change and improve over time, so it is necessary to regularly consult relevant technical standards, codes, and other publications rather than relying on this publication exclusively.

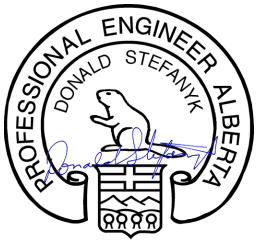
The Regional Municipality of Wood Buffalo and the authors of this document, Associated Engineering Alberta Ltd., want to convey that this document does not constitute project-specific construction specifications. As such, no part of this document alleviates the responsibility of the professionals retained to design and construct specific projects from taking full responsibility for and Authenticating their designs as required, in accordance with the requirements of Alberta Association of Landscape Architects, Association of Professional Engineers and Geoscientists of Alberta, Alberta Association of Architects, the *National Building Code of Canada – Alberta Edition*, and any other statutory requirements.

Specifications are provided to convey the Regional Municipality of Wood Buffalo's typical requirements. As such, these specifications are not suitable for integration into a specific design without review and modification and are only intended for use by a competent designer exercising professional judgement. The designer shall modify and supplement as necessary to provide a complete, properly functioning design that conforms, in all respects, to the Regional Municipality of Wood Buffalo's functional requirements. When integrated into a particular design, it is the designer's responsibility to ensure all components and specifications are suitable and safe for the use and location intended, and to ensure all applicable codes, legislative requirements, and the requirements of the authority(ies) having jurisdiction are adhered to. In addition, any accessibility, operational, and maintenance requirements must be met.

Deviations from these standard specifications, questions of intent or accuracy, or any other apparent conflicts, shall be reconciled with an appropriate Regional Municipality of Wood Buffalo representative. Finally, when employing any aspect of this document, the ultimately responsible professional designer shall remove any Authentication of the original author(s), note any provenance as appropriate, and apply their own Authentication as required.

END OF SECTION

CERTIFICATION PAGE

Professional Engineer Seal	Permit to Practice	Responsible for Sections
 2025-05-13 ID67380 Nelson Dos Santos, P.Eng. Civil Engineer; Contributor Supervisor	PERMIT TO PRACTICE ASSOCIATED ENGINEERING ALBERTA LTD. RM Signature _____ Owen Mierke ID 93223 2025-May-14 PERMIT NUMBER: P 03979 The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	Division 01 in its entirety. Division 02 in its entirety, Division 03 in its entirety, excluding those sections noted below as Geotechnical. Section 4 01 10, Section 4 01 30.
The Alberta Association of Landscape Architects Jason Bennett Jason Bennett, CSLA Landscape Architect; Contributor		Division 04 in its entirety, excluding Section 4 01 10 and Section 4 01 30.
 12 May, 2025 ID#33456 Don Stefanyk, P.Eng. Geotechnical Engineer; Contributor	**PERMIT TO PRACTICE** **THURBER ENGINEERING LTD.** RM SIGNATURE: _____ RM APEGA ID #: 33456 DATE: 12 May, 2025 **PERMIT NUMBER: P005186** The Association of Professional Engineers and Geoscientists of Alberta (APEGA)	Section 3 02 00, Section 3 02 30, Section 3 04 00, Section 3 05 10, Section 3 05 20, Section 3 05 30, Section 3 06 00, Section 3 07 00, Section 3 07 20, Section 3 07 30, Section 3 08 00, Section 3 08 20, Section 3 08 21, Section 3 08 24

END OF SECTION

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Part 1 General

1.1 WORKING NEAR EXISTING UTILITIES

.1 The Contractor shall contact the Municipality, Utility Safety Partners (formerly Alberta One-Call) and all other applicable utility owners without membership in Utility Safety Partners, for locations of underground utilities prior to commencement of any excavation.

.1 At the Owner's Representative's request, the Contractor shall coordinate a secondary locate sweep.

.2 The Contractor shall be responsible for the location and protection of all existing structures, utilities, appurtenances, signs, power poles, streetlights, transformers, pedestals, legal survey control monuments, buried utility conductors, shallow utility lines and water, sanitary, and storm sewer mains and services.

.3 Extreme caution is to be exercised at all times and damage is to be reported and repaired immediately. The costs associated with the protection and repair of all utilities shall be borne by the Contractor.

.4 The Contractor shall be required to contact all authorities having jurisdiction over the referred to infrastructure and services and shall satisfy itself as to the location of same. If it is necessary to relocate services because of the construction, the Contractor will coordinate with the authority concerned regarding costs, payment, and timing but this will not relieve the Contractor of their responsibility for damage caused thereto as referred to above.

.5 The Contractor shall provide sufficient notice of the requirement for the relocation to the owner of the utility services requiring relocation due to the construction. Existing utility services as shown on the Drawings are based on available information but are not guaranteed to be accurate or complete.

.6 If conditions on-site differ from those shown on the Drawings, notify the Owner's Representative.

.7 The Contractor shall be responsible for notifying the Municipality and appropriate utility companies of their intention to carry out construction operations in the vicinity of existing utilities and their appurtenances, structures, treed areas, and/or natural features, at least one week in advance of any such construction operations being carried out.

.1 The Contractor shall arrange a site meeting with the Owner's Representative, the Municipality, and one representative from each affected utility company.

.2 The following is a list of utility agencies commonly involved in the Municipality:

.1 Municipality: watermains, sanitary mains, storm sewer mains, streetlighting, traffic control systems, trees, natural features.

.2 ATCO Electric: overhead or underground electric power lines.

.3 AltaLink: overhead or underground electric power transmission lines.

.4 ATCO Gas: underground natural gas pipelines.

.5 Shaw: overhead or underground telecommunication lines, including fibre optic.

.6 Telus: overhead or underground telecommunication lines, including fibre optic.

.7 MTS Allstream (formerly AT&T): overhead or underground telecommunication lines, including fibre optic.

.8 Bell: overhead or underground telecommunication lines, including fibre optic.

.8 The Contractor, at their own expense, shall conduct construction operations in accordance with the requirements of the authorities having jurisdiction.

1.2 NOISE GENERATING WORK

.1 Carry out noise generating work in accordance with the Municipality's Community Standards Bylaw No. 21/010 and the Municipality's Design *Servicing Standards and Development Procedures*.

1.3 CONSTRUCTION NOISE AND VIBRATION MONITORING

.1 The Contractor is to ensure that construction noise and vibrations do not exceed the levels indicated in the project Noise and Vibration Control Study, if applicable.

.2 The Owner, at their discretion, may require that the Contractor engage a third party to monitor the noise and vibration levels generated at any stage during construction.

1.4 SPECIAL EVENTS

.1 The Contractor is advised that the Municipality has a number of special events that may be scheduled during the construction season. The Contractor is solely responsible to coordinate the Work to accommodate special events.

.2 Where access is required for residents using a wheelchair or other mobility device, asphalt millings shall be used for temporary access to properties.

.3 Coordinating the Work to accommodate special events shall be considered incidental to the Work and separate payment will be not made.

1.5 SCHOOL SITES

.1 No Work will be permitted in the vicinity of school sites during the regular school season. For the purpose of project planning, the Contractor shall schedule to commence and complete all Work in the vicinity of school sites within the period of July 1 to August 31.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 LOCATING EXISTING UTILITIES

.1 The locating of existing utilities shall be considered incidental to the Work. Separate payment will not be made for locating existing utilities. Include costs in related items.

4.2 CONSTRUCTION NOISE & VIBRATION MONITORING

.1 The Owner, at their discretion, may require that the Contractor engage a third party to monitor noise and vibration levels generated at any stage during construction. Include a provisional cash allowance for these items where noted on the Bid Form. Payment will be as per GC 5.10 Cash Allowances.

END OF SECTION

Part 1 GENERAL

1.1 PROGRESS CLAIMS

.1 Contractor's Responsibilities:

.1 Submit progress claims to the Owner’s Representative.

.2 Progress claims shall show an estimate of the percentage of Work completed for each lump sum bid item.

.3 Progress claims shall show the number of units completed for each unit rate bid item.

.4 Progress claims shall include all labour and materials incorporated into the Work and all materials stored at the Site.

.5 Progress claims shall include all agreed upon extras and deductions.

.6 To verify quantities, supply the required documentation including haul tickets, disposal receipts, purchase orders, and other relevant documentation.

.7 Supply documentation as required by the Owner’s Representative in support of each progress claim.

.2 Owner’s Representative's Responsibilities:

.1 Review the Contractor's progress claim, prepare a Progress Payment Certificate, and issue the Progress Payment Certificate to the Owner within 10 business days following receipt of the Contractor's progress claim.

.2 The Owner’s Representative's estimate of the percentage of Work completed will govern the calculation for payment on all Progress Payment Certificates.

.3 Inform the Contractor of any amendments to the progress claim by copy of the Progress Payment Certificate.

1.2 CHANGE ORDERS

.1 Complete and promptly return all requests for scope changes, schedule changes, and pricing requests issued by the Owner’s Representative.

.2 Make no change in Work unless a Change Order has been issued. A Change Order is only valid when signed by the Owner’s Representative, Owner, and Contractor.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 PRE-CONSTRUCTION MEETING

.1 A pre-construction meeting will be arranged by the Owner's Representative after the Contract is awarded.

.2 The pre-construction meeting will be held at a location determined by the Owner's Representative.

1.2 PROGRESS MEETINGS

.1 Progress meetings will be held on a biweekly basis, unless otherwise requested by the Owner's Representative.

.2 The Owner's Representative will schedule the progress meetings.

.3 Accommodations for progress meetings shall be provided by the Contractor at or near the Site.

.4 The Owner's Representative will give advance notice of meeting dates, times, and locations to all parties.

.5 The Contractor shall have in attendance the Contractor's Project Manager, Site Superintendent, and representatives of the major Subcontractors.

.6 The Owner's Representative will be in attendance and will chair the meetings.

.7 Minutes will be taken by the Owner's Representative, and copies will be distributed to attendees.

1.3 COORDINATION OF WORK

.1 General:

.1 The Contractor shall delegate the extent of the Work of various trades and shall coordinate the Work of all trades.

.2 The Owner's Representative will not be an arbitrator to establish the limits of any contracts between the Contractor and its Subcontractors.

.2 Work by Others:

.1 The Contractor shall coordinate the Work of this Contract with the Work of all other Contractors, utility companies, and work forces.

.3 Work of Subcontractors:

.1 The Contractor shall ensure the cooperation of Subcontractors in laying out the Work. The Contractor shall maintain efficient and continuous supervision of Subcontractors.

1.4 FIELD ENGINEERING SERVICES

.1 General:

.1 The Owner's Representative will establish benchmarks and monuments and will be responsible for their accuracy.

.2 The Contractor shall safeguard all survey control markers, statutory iron posts, and lot corner posts and shall re-establish, at their expense, all survey control marks, statutory iron posts, and lot corner posts removed without authorization from the Owner's Representative.

.2 Datum Plane:

.1 Elevations indicated or specified refer to Geodetic datum unless otherwise indicated.

.3 Laying Out of Work:

.1 The Contractor shall remove physical obstructions as necessary for the survey crew's operation and arrange a survey work schedule with the Owner's Representative 48 hours prior to requiring completion of survey work.

.2 The Owner's Representative will establish control points for the Work and may check points, lines, or grades established by the Contractor.

.3 The Contractor shall be responsible for the accuracy of their Work in relation to the Owner's Representative's benchmarks and monuments.

.4 Assistance to the Owner's Representative:

.1 The Owner's Representative may require temporary assistance in performing periodic checks throughout the duration of the Project. The Contractor shall make available, upon request of the Owner's Representative, a temporary assistant at no additional cost.

1.5 WORK SITE BOUNDARY

.1 Confine the Work and the operations of employees to the limits indicated on the Drawings. Do not unreasonably encumber the premises with products.

1.6 CONSTRUCTION PARKING

.1 Consult with the Owner regarding the provision of on-site parking for construction personnel.

.2 Parking will be permitted on-site provided it does not disrupt the performance of the Work.

1.7 PROGRESS PHOTOS

.1 The Contractor shall photograph and document the existing conditions of the site, utilities, concrete, asphalt, driveways, and landscaping prior to mobilization.

.2 Throughout the Work, the Contractor and the Owner's Representative will take photographs to record progress.

.3 When unique, specialized, or difficult conditions arise, photographs of the site, materials, and installation shall be taken. A copy of these photos shall be forwarded to the Owner for review.

.4 Submit progress photos to the Owner's Representative on a monthly basis along with the progress claims.

.5 Photos of people at the Site shall not be taken without the appropriate permissions.

1.8 ADJACENT PROJECTS

.1 The Contractor will reasonably accommodate adjacent construction projects in terms of scheduling, phasing, and maintenance of detours and access points.

1.9 SOLID WASTE COLLECTION

.1 The Contractor shall ensure municipal solid waste collection services can be provided in accordance with the Municipality's schedule. The schedule is available on the Municipality's website.

.2 Where curbside collection cannot reasonably be accommodated, the Contractor will be responsible for collecting all bins, bringing them to an agreed-upon collection point for collection, and returning all bins to the rightful homeowners and/or businesses following collection.

.3 The Contractor shall coordinate with all private waste removal services as required.

.4 In the absence of accommodation of municipal solid waste collection, the Contractor will be responsible for the collection, hauling, and disposal of solid waste from the affected areas, in accordance with applicable legislation.

1.10 CANADA POST

.1 The Contractor will be responsible for notification and coordination with Canada Post for access to public mailboxes.

.2 The Contractor will be responsible for the temporary relocation and reinstatement of any mailboxes required due to construction.

Part 2 Products

.1 Not Used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 SCHEDULES REQUIRED

.1 Submit the following schedules to the Owner's Representative:

.1 Construction Progress Schedule.
.2 Submittal Schedule for Shop Drawings and Product Data.
.3 Submittal Schedule for Mix Designs.

1.2 FORMAT

.1 Prepare schedules in the form of horizontal bar charts.

.2 Provide a separate bar for each trade or operation.

.3 Provide a horizontal time scale identifying the first workday of each week.

.4 Items shall be placed in chronological order based on the start of each item.

.5 Include key milestones established at the pre-construction meeting.

1.3 SUBMISSION

.1 Submit schedules in accordance with Section 1 04 00 – Submittal Procedures.

.2 Submit digital (PDF) copies of the initial schedules within 14 days after award of Contract.

.3 The digital (PDF) copies of the schedules shall be retained by the Owner's Representative.

.4 The Owner's Representative will review the schedules and return a reviewed copy within 10 days of receipt of the schedules.

.5 Resubmit the finalized schedules within 7 days of receiving the reviewed copies.

.6 Submit an updated progress schedule to the Owner's Representative with each progress claim. Distribute copies of the updated progress schedule to:

.1 Job site office;
.2 Subcontractors; and
.3 Other concerned parties.

.7 Instruct recipients to report any problems anticipated by the timetable shown in the schedule to the Contractor within 10 days of receipt.

Part 2 Construction Progress Schedule

.1 Include the complete sequence of construction activities.

.2 Include the start date and completion date of each major element of construction.

.3 Provide the start and completion dates for primary segments of the Work to track progress towards milestones.

.4 Show the projected percentage of completion of each item as of the first day of each month.

.5 Indicate the progress (if any) of each activity as of the date of submission of the schedule.

.6 Show any changes occurring since the previous submission of the schedule, including:

.1 Major changes in Scope of Work.
.2 Activities modified since the previous submission.
.3 Revised projections of progress and completion.
.4 Other identified changes.

.7 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and the impact on the schedule.
.2 Corrective action recommended and its effect.
.3 The effect of changes on the schedules of other Contractors.

2.2 SUBMITTALS SCHEDULE

.1 Include a schedule for the submission of shop drawings, product data, quality control testing, mix designs, operations and maintenance manuals, and record drawings.

.2 Indicate the dates for submission, review time, resubmission time, float time, and the last date for meeting fabrication schedules (if applicable).

2.3 CONSTRUCTION NOTICES

.1 Advance notice to affected Businesses, Residents, the Owner's Representative, and the Municipality shall be provided. All communications must go through the Municipality and must meet the requirements outlined in the Municipality's Construction Communication Administrative Directive (PRC-110-D).

.2 The Contractor shall coordinate with the Municipality to determine the appropriate delivery area and notice type and shall provide hand delivered notices to the public adjacent to the Work according to the following:

.1 Project Introduction Notice: 1 month notice before initiation of the Work.
.2 Construction Notice: 2 weeks notice before initiation of the Work.
.3 Construction Notice and/or other forms of notice as appropriate (e.g., Driveway Interruption Notice, Impacted Stakeholder Notice, etc.): 2 day notice before initiation of the Work.

.3 Responsibility:

.1 All construction notices shall be created using the Municipality's templates and shall be submitted to the Municipality for review. It is the responsibility of the Contractor and the Owner's Representative to understand and follow this process. It is the responsibility of the Municipality to communicate this process and ensure compliance.

.2 Templates for construction notices are available from the Municipality upon request.

.4 Construction Notice Overview:

.1 Project Introduction Notice:

.1 A notification to all affected residents, stakeholders, and business owners with details on what the project is, the anticipated duration of the project, and areas expected to be impacted.

.2 Construction Notice:

.1 Communication to the public on the start, progress, or completion of a project that involves the construction, demolition, or replacement of municipal infrastructure.

.3 Project Completion Notice:

.1 A notification to all affected residents, stakeholders, and business owners with the completion status of a project and details on what the project achieved.

.4 Impacted Stakeholder Notice:

.1 A targeted notice when one or only a few stakeholders may be directly impacted by a project.

.5 Driveway Interruption Notice:

.1 A targeted notice when one or only a few driveways may be blocked or interrupted due to construction activities. It provides advance notice to allow residents to make arrangements for their vehicles during the interruption.

.5 Construction Notice Procedure:

.1 STEP 1 – The Owner's Representative/Contractor shall select the appropriate municipal Construction Notice Template and shall fill in the project specifics at least 2 weeks prior to commencement of the related Work. Draft construction notices are to be submitted in Word format. Consult with the Municipality to confirm the most appropriate template to be used.

.2 STEP 2 – The Owner's Representative/Contractor shall send the construction notice to the Municipality for review.

.3 STEP 3 – The Municipality shall review the construction notice internally and make recommendations for edits. During the review process, the Municipality may request clarifications or revisions prior to final review.

.4 STEP 4 –The Municipality shall return the approved construction notice to the Owner's Representative/Contractor for distribution.

.5 STEP 5 – The Contractor shall deliver the approved construction notice door to door. The Municipality will share the construction notice with Pulse and shall post it to the Municipality's online Construction Map.

2.4 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Follow the procedure for delivering construction notices described in article 1.6. Construction notices shall be distributed 72 hours prior to any service disruption or interruption to access, unless otherwise directed by the Owner's Representative or the Municipality.

.3 Maintain existing sewage flows during construction.

.4 Submit a schedule of expected service disruptions or interruptions to access. Coordinate the service interruptions with the authority(ies) having jurisdiction.

.1 Do not interrupt water service for more than 3 hours and confine this period between the hours of 10:00 and 16:00 local time, unless otherwise directed by the Owner's Representative.

.2 Notify the Municipality and ensure that Emergency Services are notified of any planned or accidental interruption of water supply to hydrants.

.3 Advise the local police department of anticipated interference with the movement of traffic.

Part 3 Products

.1 Not used.

Part 4 Execution

.1 Not used.

Part 5 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS

.1 The Contractor shall engage a qualified Surveyor to carry out the construction survey.

.2 Assume full responsibility for and execute complete layout of the Work to the locations, lines, and elevations indicated, for the purposes of construction and quantity measurement.

.3 Provide devices needed to lay out and survey construction of the Work.

.4 Supply such devices as straight edges and templates required to facilitate the Owner's Representative's inspection of the Work.

.5 Supply stakes and other survey markers required for laying out the Work.

1.2 SURVEY CONTROL POINTS AND LEGAL SURVEY MARKERS

.1 Locate, confirm, and protect control points and legal survey markers prior to starting site Work. Preserve permanent control points during construction.

.2 Delineate all boundaries.

.3 Control points and legal survey markers that will be affected by construction Work or will be not visible during construction are to be relocated after written notice of approval of the new locations has been received from the Owner's Representative.

.4 Make no changes to or relocations of control points and legal survey markers without prior written notice to the Owner's Representative.

.5 Report to the Owner's Representative when a control point or legal survey marker is lost, destroyed, or requires relocation due to construction.

1.3 SURVEY REQUIREMENTS

.1 Establish lines and levels, locate, and lay out the Work by instrumentation.

.2 Locating existing utilities, rights-of-way, structures, and surface features.

.3 Lay out the Work.

.4 Ascertain those premises affected by the Work.

.5 Relocate existing survey monuments which are in locations that will be disturbed during construction before the start of construction. New locations shall be agreed upon with the Owner's Representative prior to relocation of survey monuments.

.6 Monitor the Work for diversion from line and level.

.7 Record all aspects of the Work.

.8 Submit all required records to the Owner's Representative.

.9 Complete as-constructed surveys and maintain records in accordance with articles 1.4 and 1.5.

1.4 CONSTRUCTION RECORDS

.1 Maintain a complete, accurate log of control and survey Work as it progresses.

.2 As-constructed information shall be recorded in separate field books from layout field books.

.3 As-constructed field books shall be on-site, with the Contractor, at all times. The Owner's Representative shall have access to these field books, for reference, at all times.

.4 As-constructed information is required for:

- .1 Pipe inverts at connections to manholes and at termination points.
- .2 Manhole rim elevations.
- .3 Top of watermain elevations at all horizontal and vertical bends and fittings.
- .4 Horizontal tie-ins to legal control points or readily identifiable surface features and inverts for manholes, valves, and hydrants.
- .5 Original ground elevation along pipe centerline.
- .6 Elevation of ground after stripping along pipe centerline.
- .7 Casing pipe inverts and horizontal locations of pipe ends.
- .8 Insulation start, end, thickness and width.
- .9 Asphalt repairs, cold milling and crack repairs, and pavement markings.
- .10 GPS coordinates or as-constructed survey records of all concrete repairs, including curb and gutter, sidewalk driveway accesses, and pedestrian ramps.
- .11 Any deviations from the Contract Documents.

.5 The Contractor shall submit up to date as-constructed information weekly to the Owner's Representative for review. The Contractor shall be responsible for Record Drawings as described in article 1.5.

.6 For any section of pipe backfilled without as-constructed information recorded, the Contractor must, in the presence of the Owner's Representative, excavate and have the as-constructed information recorded at the Contractor's expense.

1.5 RECORD DRAWINGS

.1 In accordance with Section 1 11 00 - Closeout Procedures.

1.6 SUBMITTALS

.1 Submit the name and address of the Surveyor to the Owner's Representative a minimum of 2 weeks prior to commencement of construction.

.2 At the request of the Owner's Representative, submit documentation to verify the accuracy of field engineering work.

.3 Submit a certificate signed by the Surveyor certifying that elevations and locations of completed Work are in conformance, or non-conformance, with the Contract Documents.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 SURVEY

.1 Survey will be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include all costs for carrying out all preliminary and continuing survey work associated with the Contract, including:

.1 Locating existing survey control points and legal survey markers and delineating all boundaries.

.2 Staking property and easement lines adjacent to the construction.

.3 Locating existing utilities, rights-of-way, structures, and surface features.

.4 Laying out the Work.

.5 Ascertaining those premises affected by the Work.

.6 Monitoring the Work for diversion from line and level.

.7 Recording all aspects of the Work.

.8 Submitting all required records.

.9 Relocating existing survey monuments which are in locations that will be disturbed during construction before the start of construction. New locations shall be agreed upon with the Owner's Representative prior to relocation of survey monuments.

END OF SECTION

Part 1 General

1.1 REQUIRED SUBMITTALS

.1 Construction schedules.

.2 Shop drawings and product data.

.3 Emergency response plan.

.4 Dust control plan.

.5 Traffic Accommodation Plan.

.6 Shoring, bracing, and underpinning design, if applicable.

.7 Waste removal plan.

.8 Site health and safety plan, including emergency contact numbers.

.9 Environmental Construction Operations (ECO) Plan.

.10 Quality Control testing results.

.11 Record Drawings, as-constructed survey data, and supporting documentation.

.12 Other submittals as outlined in other specification Sections.

.13 Vibration Monitoring Plan

.14 Erosion and Sedimentation Control (ESC) Plan

.15 Bypass Pumping Plan

.16 Trench Design & Method Plan

1.2 ADMINISTRATION

.1 Provide submittals to the Owner's Representative for review with reasonable promptness and in an orderly sequence so as not to cause delay in the Work. Failure to submit with ample time for review is not considered sufficient reason for an extension of Contract Time and claims for extension by reason of such default will not be allowed.

.2 At the Owner's Representative request, prepare and submit a schedule fixing the dates for submission and return of shop drawings and product data.

.3 Work affected by the submittal shall not proceed until the Owner's Representative's review is complete.

.4 Review submittals prior to submission to the Owner's Representative. This review represents that necessary requirements have been determined and verified, or will be, and

that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals which are not stamped, signed, dated, and identified as to the specific project will be returned without being reviewed and will be considered rejected.

.5 The Contractor's responsibility for errors and omissions in submissions is not relieved by the Owner's Representative's review of submittals.

.6 The Contractor's responsibility for deviations in submissions from the requirements of the Contract Documents is not relieved by the Owner's Representative's review of submittals.

.7 Keep one reviewed copy of each submission at the Site.

1.3 CONSTRUCTION SCHEDULES

.1 In accordance with Section 1 03 10 – Construction Schedule.

1.4 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" shall mean drawings, diagrams, illustrations, schedules, performance charts, brochures, and other data, which are to be provided by the Supplier or Manufacturer to illustrate details of a portion of the Work.

.2 Shop drawings shall use the metric system. Prepare shop drawings to a drafting standard equivalent to the Contract Drawings.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, wiring diagrams, panel layouts with bills of material, explanatory notes, and other information necessary for completion of the Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to Contract Drawings and Specifications.

.4 Adjustments made on shop drawings by the Owner's Representative are not intended to change the Contract Value. If adjustments affect the value of the Work, state such in writing to the Owner's Representative prior to proceeding with the Work.

.5 Make such changes in shop drawings as the Owner's Representative may require, consistent with the Contract Documents. When resubmitting shop drawings, notify the Owner's Representative in writing of any revisions other than those requested.

.6 Submissions shall include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Supplier.
  - .2 Manufacturer.
- .4 Shop drawing stamp, signed by the Supplier's or Manufacturer's authorized representative and the Contractor certifying approval of the submission,

verification of field measurements, and compliance with the Contract Documents.

.5 Details of applicable portions of the Work, such as:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent Work.

.7 Submit one electronic (PDF) copy of product data sheets or brochures for requirements requested in specification Sections, and as the Owner's Representative may reasonably request, where shop drawings will not be prepared due to standardized manufacture of the product.

.8 Submit one electronic (PDF) copy of shop drawings for each requirement requested in specification Sections and as the Owner's Representative may reasonably request.

.9 Submittals will be returned with one or more of the following notations. Take action as noted.

.1 "REVIEWED" - Make and distribute additional copies as required for execution of the Work.

.2 "REVISE & RESUBMIT" - Make the necessary revisions and resubmit revised shop drawings for review. Show the shop drawing number of the first such revised shop drawing and show the latest revision number applicable to the shop drawing by adding a suffix to the drawing number (e.g., "REV. 1", "REV. 2", etc.).

.3 "NOT REVIEWED" - This notation indicates when the Owner's Representative has not reviewed the shop drawing. It may also be used in combination with the notation to revise and resubmit the shop drawing when the Owner's Representative lacks sufficient information to complete their review and requires the Contractor to resubmit the shop drawing for review after revision.

.4 Drawings will be marked "REVIEWED" together with the notation to "REVISE & RESUBMIT" when the Owner's Representative requires the Supplier or Manufacturer to resubmit a revised shop drawing showing corrections made as a result of the Owner's Representative's notations on the shop drawings. This procedure will not relieve the Supplier or Manufacturer of their responsibility for errors or omissions in the shop drawings or of their responsibility for meeting all requirements of the Contract.

.10 Use only those shop drawings on the Work that bear the "REVIEWED" notation.

.11 Do not revise shop drawings marked "REVIEWED" unless resubmitted to the Owner's Representative for further review.

.12 Where more than one type of shop drawing has been specified for one item, e.g., wiring diagrams, layout details, and dimensional drawings, the shop drawings shall be submitted together, to enable the Owner's Representative to review the shop drawings as a complete package.

.13 Catalogue pages or drawings applicable to an entire family or range of equipment will not be accepted as shop drawings unless they are clearly marked to show the pertinent data for the particular materials.

.14 Manufacturers' catalogues, manuals, or price lists will not be accepted as shop drawings. Such materials may be used as supplemental information to the shop drawings.

.15 Indicate the tag number of instruments and valves and clearly show the features and details applicable to the equipment being supplied.

.16 Determine which shop drawings have, in addition to those drawings specifically mentioned in the Contract, design elements requiring Authentication by a Professional Engineer in good standing with APEGA. Such shop drawings shall be Authenticated before they are submitted for review. Submit for review engineering calculations signed by the Professional Engineer responsible for the shop drawing design elements.

.17 If, upon review by the Owner's Representative, no errors or omissions are discovered or if only minor corrections are made, one copy will be returned and fabrication and installation of the Work may proceed. If shop drawings are rejected, a noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, must be performed before fabrication and installation of the Work may proceed.

.18 The Owner may deduct, from payments due to Supplier or Manufacturer, costs of additional Work incurred if correct shop drawings are not submitted after one review by the Owner's Representative.

.19 Review by the Owner's Representative is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that the Owner's Representative approves the detail design inherent in the shop drawings, responsibility for which remains with Supplier or Manufacturer, and such review does not relieve the Supplier or Manufacturer of the responsibility for errors or omissions in the shop drawings or of the responsibility for meeting all requirements of the Contract Documents. The Supplier or Manufacturer is responsible for dimensions to be confirmed and correlated at the job-site, for information that pertains solely to fabrication processes, and to techniques of construction and installation, and for coordination of the Work of all sub-trades.

1.5 EMERGENCY RESPONSE PLAN

.1 In accordance with Section 1 06 00 – Health and Safety Requirements.

1.6 DUST CONTROL PLAN

.1 The Contractor shall submit a dust control plan for the transport of materials to and from the construction Site. The plan shall be submitted prior to the start of construction.

.2 If the Owner's Representative deems the dust control measures to be undertaken are inadequate, they retain the right to request that the Municipality undertake the appropriate dust control measures. The cost of such measures will be billed to the Contractor.

1.7 TRAFFIC ACCOMMODATION PLAN

.1 In accordance with Section 1 05 00 – Traffic Control and the Municipality's *Design Servicing Standards and Development Procedures*.

1.8 SHORING, BRACING, AND UNDERPINNING DESIGN

.1 The Contractor shall submit the design for shoring, bracing, and underpinning to be used, if applicable, in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

1.9 WASTE REMOVAL PLAN

.1 In accordance with Section 3 01 00 – Site Demolition.

1.10 SITE HEALTH AND SAFETY PLAN

.1 In accordance with Section 1 06 00 – Health and Safety Requirements.

1.11 ENVIRONMENTAL CONSTRUCTION OPERATIONS PLAN

.1 In accordance with Section 1 07 10 – Environmental Construction Operations Plan.

1.12 QUALITY CONTROL TESTING RESULTS

.1 Submit Quality Control testing results in accordance with the requirements of the specification Sections.

1.13 RECORD DRAWINGS AND SUPPORTING DATA

.1 Submit Record Drawings, as-constructed survey data, and supporting documentation to the Owner's Representative in accordance with Section 1 11 00 - Closeout Procedures.

1.14 DOCUMENT CONTROL PROCEDURES

.1 All submissions must be sent with a covering Transmittal.

.2 Transmittals will be primarily exchanged via email. The Owner's Representative will provide alternative means to be used for large submissions, when required.

.3 Multiple documents and/or submissions may be sent per Transmittal.

.4 The Owner's Representative will review the Transmittal, ensure it is complete as per the Transmittal list, acknowledge it as received, date it, and the Transmittal page returned via email to the Contractor.

.5 When the Owner's Representative sends Transmittals to the Contractor, they must be acknowledged as received, dated, and the Transmittal page returned via email to the Owner's Representative.

.6 There shall be no revisions made to Transmittals. Necessary revisions to the documents shall be completed and a new Transmittal with new Transmittal number must be started for the revised documents.

.7 The Owner's Representative's Transmittal Numbers may not correspond with the Contractor's Transmittal Numbers.

.8 Schedules must be sent via Transmittal. A covering letter outlining the schedule change(s) must also be included to substantiate the reason for the change(s).

.9 Transmittals from Subcontractors shall not be sent directly to the Owner's Representative. They must be forwarded through the Prime Contractor with a Prime Contractor Transmittal or Request For Information (RFI) Form.

.10 RFIs shall be initiated by the Prime Contractor and sent via email. Transmittals are not required for RFIs. The Owner's Representative's response will also not have a Transmittal; it will be the "Response" to the RFI.

.11 RFIs may have revisions (e.g., RFI_062_R1); however, if there is a revision prior to an RFI "Response", please indicate whether the initial revision is:

a) Superseding the previous RFI.

b) Adding to the previous RFI.

.12 Contract Change Orders (CCOs) and Change Order Price Requests (COPRs) will be initiated by the Owner's Representative and sent via email with a covering letter. Transmittals are not required for CCOs or COPRs. CCO numbering will start at 01 (e.g., CCO#01). Subsequent CCOs shall increase numerically (e.g., CCO#02, CCO#03, etc.).

.13 Filling out COPRs includes filling in:

.1 The unit rate(s).
.2 Th total cost of each line item.
.3 The extension of the number of days.
.4 Signing the COPR.
.5 Dating the COPR.

(This information cannot be sent back in a letter. It must be completed on the COPR form).

.14 Contract Change Requests (CCRs) will be initiated and submitted by the Contractor.

.1 They must have a number (e.g., CCR#01) for tracking purposes.
.2 The number must be referenced in a covering letter accompanying the CCR.
.3 These must be submitted via Transmittal.
.4 If there is a revision, please indicate if the original is being superseded or added to.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 SUBMITTALS

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Traffic control shall be in accordance with:

.1 The Municipality's *Utility Installation and Traffic Control Manual*. This manual is available from the Municipality upon request.

.2 The Transportation Association of Canada's *Manual of Uniform Traffic Control Devices for Canada*.

1.2 PROTECTION OF PUBLIC TRAFFIC

.1 Comply with the requirements of Acts, Regulations, and By-Laws in force for the 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 the travelled way of roadways:

.1 Place equipment in positions to minimize interference and hazards to travelling public.

.2 Keep equipment units as close together as working conditions will permit and preferably on the same side of the travelled way.

.3 Do not leave equipment on the travelled way overnight.

.3 Do not close any alleys or any roadway without the approval of the Municipality. Before re-routing traffic, erect suitable signs and devices in accordance with the Municipality's *Utility Installation and Traffic Control Manual*. Provide sufficient crushed gravel to ensure a smooth riding surface during Work.

.4 Load trucks in a manner that will prevent spillage and tracking of soil or debris on roadways. Clean immediately, to the satisfaction of the Owner's Representative, any spillage or tracking of soil or debris that occurs. Clean haul routes daily or as directed by the Owner's Representative. Failure to clean haul routes may result in municipal crews doing the cleaning without notice to the Contractor and the costs will be deducted from moneys due to the Contractor.

.5 A Traffic Accommodation Plan shall be provided and reviewed by the Owner's Representative for all haul routes, alley closures, and road closures and all Work incidental to traffic control.

1.3 INFORMATIONAL AND WARNING DEVICES

.1 Provide and maintain signs and other devices as required to indicate construction activities or other temporary or 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 the *Manual of Uniform Traffic Control Devices for Canada*.

.3 Place signs and other devices in locations recommended in the *Manual of Uniform Traffic Control Devices for Canada*.

.4 Meet with the Owner's Representative prior to commencement of the Work to prepare a list of signs and other devices required for the project.

.5 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability, and location. Clean, repair, or replace signs as required to ensure clarity and reflectance.

.2 Removing or covering signs which do not apply to conditions existing from day-to-day.

1.4 PROJECT SIGNS

.1 The Contractor shall supply and install project sign(s) at the project boundaries. If the project has definite boundaries, then one sign shall be installed at each end of the project. If the project boundaries are not clearly defined, then one sign shall be installed at a prominent location for each neighbourhood and shall include all affected street names and locations.

.2 Sign printing, erection, safety, maintenance, and removal upon completion will be the responsibility of the Contractor.

.3 The Contactor shall provide posts and/or a bracing arrangement suitable to withstand the weather for the duration of the project.

.4 Project signs shall be erected at locations that will not pose safety issues or obstruct traffic sightlines.

.5 Project Signs shall be formatted as per the image below and shall meet the following specifications:

.1 The completion date shall be formatted in the following manner:

.1 Single Year Project: Month and Year (e.g., October 2019).

.2 2-3 Year Project: Season & Year (e.g., Fall 2019).

.3 3+ Year Project: Year (e.g., 2019).

.2 Size of sign: 2.4 m x 1.2 m.

.3 Structure and Framing:

.1 New construction grade lumber, structurally adequate and suitable for exterior application shall be used. Minimum post size: 89 mm x 89 mm.

.2 Sign Mounting Material: Crezon or approved equivalent.

.3 Thickness: As required to span framing members and to provide an even, smooth surface without waves or buckles, minimum 19 mm.

.4 Hardware: Galvanized steel, of sizes and types to enable sign assemblies to resist wind loads.

.5 Use minimum 13 mm diameter button head carriage bolts to fasten sign panels to supporting structures or #10 x 63.5 mm zinc wood screw spaced at 150 mm on centre. Bolt heads shall be painted to match the sign face.

.4 The Consultant's and Contractor's logos shall be in white reversed, same or smaller in proportion to the Municipality's logo, and placed in the space provided on the template.

.6 The following process for project signs shall be followed.

.1 Step 1 – Submittals:

.1 Submit shop drawings identifying the locations, materials, and the Municipality's Project Signage template (available upon request), in accordance with Section 1 04 00 – Submittal Procedures.

.2 Step 2 – Project Identification:

.1 Provide signs at locations in accordance with article 1.4.1.

.2 Erect the sign(s) on the site at a safe location of high public visibility, adjacent to the main entrance to the Site, as approved by the Municipality.

.3 Step 3 – Installation:

.1 Install project signs within 5 days of commencement of mobilization on the construction Site.

.2 Set, level, and solidly brace signs as required to prevent displacement during the construction period.

.3 Securely install project signs at a height for optimum visibility and in a safe location.

.4 Step 4 – Maintenance:

.1 Maintain signs and supports in a neat, clean condition; promptly repair damages to structure, framing, and sign as required.

.2 Relocate signs as required due to progress of the Work.

.3 Poorly maintained, defaced, damaged, or dirty signs shall be replaced, repaired, or cleaned without delay, and at no additional cost.

.4 Special care shall be taken to ensure that construction materials and dust do not obscure the face(s) of the sign(s).

.5 Signs not in effect shall be covered or removed.

.5 Step 5 – Removal:

.1 Remove signs, framing, supports, and foundations upon completion of the Work.

.2 Leave areas clean and restore as required to remove any traces of temporary signs.

1.5 VARIABLE MESSAGE LED SIGN BOARDS

.1 The Contractor shall supply and keep updated variable message LED sign boards to keep the public informed of upcoming Work and impacts to regular traffic patterns. Variable message LED sign boards shall be located at the limits of construction at all main accesses.

.2 Sign supply, installation, safety, maintenance, and removal upon completion of construction will be the responsibility of the Contractor.

.3 All messages to be displayed on variable message LED sign boards shall be reviewed by the Municipality and the Owner's Representative prior to implementation.

.1 The Contractor shall ensure that variable message LED sign boards are secure and that messages displayed on variable message LED sign boards are not changed without prior approval from the Municipality or the Owner's Representative.

.4 The following are the requirements for mid-size full matrix trailer-mounted portable variable message LED sign boards:

.1 Dimensions:

.1 Length: 3,810 mm minimum.

.2 Width: 2,030 mm footprint.

.2 Display:

.1 Display panel: 1.6 m x 2.5 m.

.2 Full matrix of 30 x 48 pixels.

.3 4 LEDs per pixel.

.4 Up to 3 lines of 8 characters per line.

.5 Display sign rotates 360 degrees for setting.

1.6 TEMPORARY PARKING

.1 When temporary parking is required, each temporary parking location shall have a Municipality Temporary Parking Sign posted (using the Municipality's template, available upon request).

.2 One week prior to closing the temporary parking lot, a Municipality Temporary Parking Closure Sign shall be mounted over top of the initial sign (using the Municipality's template, available upon request).

.3 The Contractor shall be responsible for the coordination of temporary parking and it is to be included in the Contractor's Traffic Accommodation Plan. The costs for a shuttle bus for residents with limited mobility are to be included.

1.7 CONTROL OF PUBLIC TRAFFIC

.1 Ten days prior to undertaking any construction, the Contractor shall submit in writing, to the Owner's Representative, the intended system of routing traffic during construction. The Contractor's system of routing traffic will be reviewed by the Owner's Representative and the Municipality with the Contractor and any modifications requested by the Owner's Representative or the Municipality shall be immediately implemented.

.2 The Contractor shall minimize the disruption to traffic (both public and service vehicles) to the greatest extent possible. Lane closures shall be limited to those sections being actively worked on and shall be re-opened to public traffic as soon as possible.

.3 Provide competent flagpersons, properly equipped as specified in the *Manual of Uniform Traffic Control Devices for Canada*, in the following situations:

.1 When public traffic is required to pass working vehicles or equipment which may block all or part of an active roadway.

.2 When it is necessary to institute a one-way traffic system through a construction area or other blockage where traffic volumes are heavy, approach speeds are high, and a traffic signal system is not in use.

.3 When workers or equipment are employed on the travelled way over the crest 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 out of service.

.4 In situations where complete protection for workers, working equipment, and public traffic is not provided by other traffic control devices, traffic signs shall be erected and maintained to ensure the safety of workers and the public as required in Alberta Transportation's *Traffic Accommodation in Work Zones Manual*. Phasing of construction shall be as shown on the Drawings.

1.8 PUBLIC TRANSPORTATION

.1 The Contractor shall notify Public Transit of any potential disruptions to service prior to construction. The Contractor and Public Transit officials shall coordinate any rerouting required.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 TRAFFIC CONTROL

.1 The provision of traffic control shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

4.2 PROJECT SIGNS

.1 The provision of project signs shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include all costs for preparing, supplying, erecting, maintaining, and removing signs as required for the duration of construction.

4.3 VARIABLE MESSAGE LED SIGN BOARDS

.1 The provision of variable message LED sign boards shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include all costs for supplying, erecting, maintaining, updating, and removing variable message LED sign boards as required for the duration of construction.

4.4 TEMPORARY PARKING

.1 The provision of temporary parking shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include coordinating temporary parking and required signage, shuttles, and communication as required for the duration of construction.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Federal Legislation

.1 Canada Labour Code, Part 2, Occupational Health and Safety

.2 Provincial Legislation

.1 Occupational Health and Safety Legislation (including the Act, Regulation, and Code)

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 1 04 00 - Submittal Procedures.

.2 Submit a site-specific Health and Safety Plan at least 14 days prior to commencement of the Work.

.3 Submit copies of reports or directions issued by federal and provincial health and safety inspectors.

.4 Submit copies of incident, accident, and near miss reports and investigations.

.5 Submit copies of relevant Globally Harmonized System for Classification and Labelling of Chemicals (GHS) Safety Data Sheets (SDS).

.6 The Owner’s Representative will review the Contractor's site-specific Health and Safety Plan and provide comments to the Contractor within 7 business days of receipt of the Health and Safety Plan.

.7 The Owner’s Representative’s review of the Contractor's Health and Safety Plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction health and safety.

.8 Medical Surveillance: where prescribed by legislation, regulation, or safety program, submit certification of medical surveillance for Site personnel prior to commencement of the Work and submit additional certifications for any new Site personnel to the Owner’s Representative as required.

.9 Address standard operating procedures to be implemented during emergency situations in an On-Site Contingency and Emergency Response Plan.

1.3 GENERAL REQUIREMENTS

.1 Develop a written site-specific Health and Safety Plan based on a hazard assessment prior to beginning Work and continue to implement, maintain, keep up-to-date, and enforce the Health and Safety Plan until final demobilization from the Site. The Health and Safety Plan must address project specifications.

.2 The Owner's Representative may respond in writing, where deficiencies or concerns are noted, and may request resubmission of the Health and Safety Plan to correct the noted deficiencies or concerns.

1.4 RESPONSIBILITY

.1 The Contractor is designated the Prime Contractor for the construction Site.

.2 Be responsible for the health and safety of persons on Site, the safety of property on Site, and the protection of persons adjacent to the Site and the environment to extent that they may be affected by the Work.

1.5 COMPLIANCE REQUIREMENTS

.1 Comply with Alberta's Occupational Health and Safety Legislation, including the Occupational Health and Safety Act, Occupational Health and Safety Regulation, and Occupational Health and Safety Code.

1.6 HEALTH AND SAFETY COORDINATOR

.1 Employ and assign to the Work, a competent and authorized representative as Health and Safety Coordinator. The Health and Safety Coordinator shall:

.1 Have site-related working experience specific to the activities associated with the Work.

.2 Have working knowledge of Alberta's Occupational Health and Safety Legislation.

.3 Be responsible for leading the Contractor's Health and Safety Training Sessions and ensuring that personnel that do not successfully complete the required training are not permitted to enter the Site to perform Work.

.4 Be responsible for implementing, enforcing, and monitoring the Contractor's site-specific Health and Safety Plan.

.5 Not be under the direct supervision of the site supervisor.

1.7 POSTING OF DOCUMENTS

.1 Ensure applicable items, articles, notices, and orders are posted in a conspicuous location on Site in accordance with Alberta's Occupational Health and Safety Legislation, and in consultation with the Owner's Representative.

1.8 UNFORESEEN HAZARDS

.1 When unforeseen or unusual safety-related factors, hazards, or conditions occur during performance of the Work, advise the Health and Safety Coordinator and follow the applicable procedures in accordance with Alberta's Occupational Health and Safety Legislation and advise the Owner's Representative verbally and in writing.

1.9 BLASTING

.1 Blasting or other use of explosives is not permitted without prior receipt of written instruction from the Owner's Representative.

1.10 POWDER-ACTUATED TOOLS

.1 Use powder-actuated tools only after receipt of written permission from the Owner's Representative.

1.11 CONSTRUCTION SAFETY MEASURES

.1 Observe construction safety measures of the *National Building Code – Alberta Edition*, the provincial government, Workers' Compensation Board, and the Municipality, provided that in any case of conflict or discrepancy the more stringent requirements shall apply.

1.12 OVERLOADING

.1 Ensure no part of the Work is subjected to loading that will endanger its safety or will cause permanent deformation.

1.13 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1.

1.14 SCAFFOLDING

.1 Design and construct scaffolding in accordance with CSA S269.2

1.15 GHS (GLOBALLY HARMONIZED SYSTEM FOR CLASSIFICATION AND LABELLING OF CHEMICALS)

.1 Comply with the requirements of GHS (formerly WHMIS) regarding the use, handling, storage, and disposal of hazardous materials and regarding the labelling and provision of safety data sheets (SDS), as acceptable to the authority having jurisdiction.

.2 Deliver copies of GHS SDS to the Owner's Representative upon delivery of materials.

.3 Have GHS SDS at the Work Site and ensure all of the Contractors' personnel are aware of the GHS SDS and that recommended precautions are followed.

1.16 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by the authority having jurisdiction or by the Owner's Representative.

.2 Provide the Owner's Representative with a written report of the actions to be taken to correct non-compliance of identified health and safety issues.

.3 The Owner's Representative may issue a Stop Work Order if non-compliance with Alberta's Occupational Health and Safety Legislation is not corrected.

1.17 STOPPAGE OF WORK

.1 Give precedence to the health and safety of the public and Site personnel and the protection of the environment over cost and schedule considerations for the Work.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 FIRES

.1 Fires and the burning of waste on Site is not permitted.

1.2 DISPOSAL OF WASTES

.1 Do not bury waste on Site.

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

.3 Contain and remove Site waste and materials to a specified and designated waste handling facility and comply with all pertinent acts and regulations for the handling and transportation of waste.

.4 Do not dispose of hydrovac waste or concrete truck wash-out on Site. These waste streams shall be disposed of at an approved facility.

.5 Disposal of commercial and industrial waste shall adhere to all municipal bylaws and provincial and federal legislation and regulations.

1.3 DRAINAGE

.1 Provide temporary drainage and pumping measures as necessary to keep excavations and the Site free from water.

.2 Do not pump any water directly into municipal infrastructure. Water may be directed towards municipal infrastructure by overland flow.

.3 Do not pump treated or potable water directly into natural watercourses or water bodies, unless treatment and/or dechlorination plan has been approved by the Municipality.

.4 Control the disposal or runoff of water containing suspended materials or other harmful substances in accordance with legislative requirements.

.5 Prior to the release of water by pumping to the environment or discharging surface and excavation water to municipal infrastructure, the water must be sampled to ensure compliance with the Canadian Council of Ministers of the Environment (CCME) Surface Water Quality Guidelines and municipal bylaw limits.

.6 Maintain existing drainage facilities affected by the Work in good operating condition at all times during construction.

.7 Erosion and sedimentation control (ESC) measures shall be installed at all drainage routes to intercept runoff from the construction Site. ESC measures shall be installed in accordance with the ECO Plan, ESC Plan, Drawings, Specifications, manufacturer’s recommendations, best management practices, and documented requirements from environmental regulators.

1.4 SITE CLEARING AND PLANT PROTECTION

.1 Vegetation removal is not permitted during the Restricted Activity Periods of owls or migratory birds unless preceded by a wildlife sweep. Setbacks must be adhered to as referenced in the Master Schedule of Standards and Conditions unless otherwise approved by the provincial regional Wildlife Biologist. Site clearing shall be completed in accordance with all applicable regulations for Restricted Activity Periods including:

- .1 Migratory birds,
- .2 Nesting owls, and
- .3 Caribou calving.
  - .1 Caribou Plans, where required under the Public Lands Act approval conditions, must be submitted to Alberta Environment before November 30.

.2 Species specific Restricted Activity Period dates and setbacks can be found in the Alberta government's Master Schedule of Standards and Conditions.

.3 Buffer areas, where applicable, shall be established by a qualified Professional Wildlife Biologist at the time of the wildlife sweep and will require protection from clearing until such time as the Owner's Representative's Professional Wildlife Biologist approves the area for clearing.

.4 Resident and property owner engagement must occur before removing any trees.

.5 Protect trees and plants on Site and on adjacent properties where indicated.

.6 Plant material to be preserved on Site shall be of high quality and worthy of preservation. All plant material to be preserved shall be approved by the Municipality.

.7 Temporary protection by way of fencing or flagging is required for all plant material to remain on Site. Protection is required for the trunks, branches, and root systems of all plant material to be saved. Close-cut clearing (hand clearing) shall be used adjacent to areas to be preserved to ensure no damage is done to existing plant materials and root systems. All close-cut and hand clearing shall be inspected by the Municipality.

.8 Protect the roots of designated trees to remain to the dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping, and storage of materials over root zones.

.9 Wrap trees and shrubs adjacent to construction work, storage areas, and trucking lanes in burlap and encase with protective wood framework from grade level to a height of 2 m.

.10 Passage of heavy equipment, stockpiling of gravel, soil, or building materials, and spillage of fuels, oil, solvents, and other chemicals is not allowed in areas to be preserved.

.11 Existing grades around plant material are to be retained. If grades are to be raised or lowered around plant material to be preserved, the Contractor will be responsible for constructing proper soil retention to ensure the health of the plant material.

1.5 POLLUTION CONTROL

.1 Maintain temporary ESC measures installed under this Contract in accordance with the ESC Plan prepared for the project.

.2 Control emissions to the local authority's emission requirements.

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

.4 Provide dust control during all truck transport activities.

.5 Obtain the appropriate permits as required for water for dust control.

1.6 WORK ADJACENT TO WATERWAYS

.1 Construction equipment shall be operated on land only.

.2 Do not occupy or travel over the bed, bank, or shore of water bodies without the approval of Alberta Environment and Fisheries and Oceans Canada.

.3 Work on or near wetlands and waterways shall only be conducted after all applicable regulatory approvals have been obtained. These may include approval from Alberta Environment, Alberta Forestry and Parks, Fisheries and Oceans Canada, and Transport Canada (where applicable). Review and recommendations by a Qualified Aquatic Environment Specialist may also be required.

.4 Work near wetlands and waterways must consider the Municipality's Land Use Bylaw and provincial beneficial management practices for potential setbacks to be implemented, as outlined in *Stepping Back from the Water, a Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region*.

.5 Use waterway beds for borrow material only after written receipt of approval from the Owner's Representative and following receipt of approvals from the applicable regulatory bodies.

.6 Wetlands and waterways shall be kept free of excavated fill, waste material, and debris.

.7 Design and construct temporary crossings to minimize erosion to wetlands and waterways as per regulations and/or applicable regulatory approvals.

.8 Do not skid logs or construction materials across waterways.

.9 Where Work is to occur within the Restricted Activity Period of a water body, the Contractor shall retain a Qualified Aquatic Environment Specialist to monitor instream Work. Avoid spawning beds when constructing temporary crossings of waterways.

.10 Blasting is allowed only above water and 100 m minimum from spawning beds.

1.7 WORK WITHIN KEY WILDLIFE AND BIODIVERSITY ZONES

.1 All work within Key Wildlife and Biodiversity Zones on Crown land will require approval, under the *Public Lands Act*, from Alberta Environment and must comply with the conditions of the approval.

.2 Timing considerations may be applicable as presented under the Master Schedule of Standards and Conditions available on the government of Alberta's website.

.3 When construction is occurring within nesting periods, bird sweeps, conducted by a qualified Environmental Specialist, are required:

.1 At least 7 days prior to commencement of construction.

.2 After Work is to resume after being stopped for a period of at least 10 days.

.4 Wildlife sweeps, conducted by a qualified Environmental Specialist, are required at least 7 days prior to commencement of construction.

1.8 WORK WITHIN CARIBOU HABITAT ZONES

.1 All Work within Caribou Habitat Zones on Crown land will require approval, under the *Public Lands Act*, from Alberta Environment and must comply with the conditions of the approval.

.2 Timing considerations may be applicable as presented under the Master Schedule of Standards and Conditions available on the government of Alberta's website.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

.1 The provision of environmental protection measures shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Regional Municipality of Wood Buffalo (RMWB)

.1 Environmental Construction Operations (ECO) Plan Framework can be found on the RMWB website.

1.2 GENERAL REQUIREMENTS

.1 The Contractor shall prepare an Environmental Construction Operations Plan (ECO Plan) to ensure best management practices and regulatory requirements are incorporated into construction activities to protect the environment and achieve compliance at all stages of the project development.

.2 The ECO Plan shall be project-specific and shall incorporate erosion and sedimentation control (ESC) measures identified on the ESC Plan.

.3 The provisions within the ECO Plan Framework guide the Contractor in the preparation of an ECO plan and risk mitigations that align with regulatory risks, commitments, applications, approvals and regulatory requirements.

.4 The ECO Plan shall address and incorporate continued management within the Contract Limits of the Site, including ESC monitoring and measures, stormwater management systems, protection of groundwater monitoring well infrastructure, care of water plan and the coordination of other separate designated Contract areas as they become active and incorporated into the project.

.5 The ECO Plan will be a core document of the concurrent management of the overall project and shall be kept current and shall be updated to reflect changing conditions and to incorporate existing and future Contract Work as the project develops.

.6 The Contractor may retain a consultant experienced with ECO Plan requirements and preparation of submissions for approval or the Contractor may prepare the documentation with their own forces.

1.3 HAZARD RISK BARRIER MITIGATION (HRBM) TABLE

.1 A Hazard Risk Barrier Mitigation (HRBM) table is a tool for mitigating and monitoring regulatory risks. Completing a HRBM is an ECO Plan Framework requirement.

.2 The HRBM table shall include both risk mitigation and the person responsible to continuously monitor the mitigative measures/controls set in place for the identified risks. Inspections shall be conducted by the Contractor on a regular basis, to assure the functionality of the mitigations and controls, such as restocking spill kits, proper waste segregation practices, and integrity of ESC mitigation, etc.

1.4 SUBMITTALS

.1 ECO Plans and HRBM tables shall be submitted for review and approval a minimum of 2 weeks prior to the start of site activities. Activities cannot be commenced until associated risks are mitigated and risk controls are approved.

.2 Ensure that the Overall Site ECO Plan and HRBM table are reviewed and updated on regular basis and ensure that all required documentation is available at the project site.

1.5 ECO PLAN REVIEW

.1 The review process must include a written summary of actions and procedures based on regular environmental inspections and will be incorporated by the Contractor into ECO Plan updates.

.2 Ensure that project specific ECO Plan submissions by other Contractors are integrated and coordinated with the overall site ECO Plan prepared under the Contract and that all parties are made aware of coordination requirements and risks as they arise.

.3 Activities and risk mitigations tailored to satisfy regulatory requirements shall be tabulated within the ECO plan and the person responsible shall be assigned to complete and/or monitor each of them to closure.

.4 This section does not replace or supersede existing mandated policies, regulations and guides from the Municipal, Provincial and Federal authorities.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 ECO PLAN

.1 The preparation and implementation of a site-specific ECO Plan shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Contract terms and/or Owner’s Representative.

.3 Approval of progress payment applications will be contingent on fulfilling the requirements for ECO Plan reporting.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS

.1 Regulations affecting the Work imposed by Municipal, Provincial and Federal authorities, including:

- .1 Regional Municipality of Wood Buffalo
- .2 Alberta Transportation.
- .3 Alberta Environment.
- .4 Alberta Affordability and Utilities.
- .5 Shallow utility companies.
- .6 Federal Legislation
  - .1 Fisheries and Oceans Canada
  - .2 Transport Canada
  - .3 Environment and Climate Change Canada

.2 Regulatory requirements refer to laws, bylaws, ordinances, rules, regulations, codes, and orders of authorities having jurisdiction, and other legally enforceable requirements applicable to the Work and which are or become in force during the performance of the Work.

1.2 COMPLIANCE WITH REGULATIONS

.1 Ascertain the requirements and regulations of the authorities having jurisdiction, as outlined in article 1.1.1.

.2 Comply with all such requirements and regulations as applicable to the Work.

.3 Requirements set out in this Section are for guidance and information only and are not necessarily complete.

.4 This section does not replace or supersede existing mandated policies, regulations and guides from the Municipal, Provincial and Federal authorities.

.5 Comply with all additional regulatory requirements included in the Contract Documents.

1.3 PERMITS

.1 Obtain all construction permits necessary to perform the Work, including those for access, laydown areas, maintenance, and landscaping/bioengineering.

.2 The Contractor shall apply for, obtain, and pay for all necessary permits to perform/complete the Work.

1.4 WORK IN THE VICINITY OF OVERHEAD POWER LINES

.1 Request that the power company relocate, de-energize, or guard any energized conductor where construction equipment may operate within 3 m of the conductor.

.2 Obtain approval from the power company prior to operating any equipment within 3 m of energized conductors.

.3 Where practical, avoid storage of metallic pipe sections under high voltage overhead power lines.

.4 If pipe sections must be stored under power lines, protect personnel from the effects of induced currents by grounding pipe sections at two locations with AWG #2 copper ground conductors and grounding rods.

1.5 WORK IN WATERCOURSES

.1 Comply with the following requirements for all Work within the high-water mark of the watercourse.

.1 Engage, if necessary, provincial and federal regulators upon project award.

.2 Consultation with the Municipal environmental and regulatory advisors.

.3 Restrict all Work within the wetted perimeter to the minimum necessary to construct the Works and complete all Works outside the Restricted Activity Period of the watercourse.

.4 Undertake all Work in a manner that will prevent the release of sediment into the water in accordance with the Erosion and Sedimentation Control (ESC) Plan for the project.

.5 Rip rap and other materials placed within the high-water mark of the watercourse shall be clean and free of silt, overburden, debris, and other substances which may be deleterious to aquatic life.

.6 Restrict the removal and disturbance of topsoil, forest cover, and vegetation adjacent to the watercourse to the minimum necessary to construct the Works.

.7 Remove all temporary works, including false work, shoring, cofferdams, temporary bridges, access ramps, and protective works from the Site. Reinstate the watercourse to the condition and configuration that existed prior to construction.

.8 Alter or suspend pertinent operations immediately at the request of a provincial or federal regulator. Suspend Work immediately if it is not in compliance with the applicable approvals or regulations.

.9 Following consultation with the Municipal environmental and regulatory advisors, submit regulatory applications for review by Transport Canada, Fisheries and Oceans Canada, Alberta Forestry and Parks, and Alberta Environment, as applicable, prior to any operation within the high-water mark. Agency review timelines are dependent on the type of regulatory application and should be discussed with the Municipality and regulator when developing the project schedule. Applications must include the methods to complete the Work, including methods intended to isolate activities from the watercourse and the means whereby the release of sediment and unacceptable discharges into the watercourse will be controlled.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 ACCESS

.1 Provide and maintain access roads, sidewalk crossings, ramps, and construction runways as may be required for access to the Work.

.2 Maintain existing roads used for Site access for the duration of the Contract and make good any damage resulting from the Contractor's use of these roads.

.3 Clean roadways used by the Contractor's equipment regularly or as directed by the Owner's Representative. Any clean-up work not performed in a timely manner will be completed by the Municipality, at the Owner's expense.

.4 Do not obstruct hydrants, valve or control pit covers, valve boxes, curb stop boxes, fire or police call boxes, or any other utility controls, warning systems, or appurtenances.

.5 Prior to final inspection, obtain and submit, to the Owner's Representative, written signed releases from owners of all roads used for Site access, verifying that roads have been adequately restored and left in a satisfactory condition.

.6 Trim loads of trucks hauling excavated material, cement, sand, stone, gravel, debris, or other loose material before leaving the Site and ensure that no spillage of loads occurs.

1.2 PEDESTRIAN ACCOMMODATION

.1 Provide and maintain pedestrian accommodation within the Site, as shown on the Drawings.

1.3 UTILITY INSTALLATION/REMOVALS

.1 Provide temporary utilities to execute the Work expeditiously. This includes temporary water supply.

.2 Make necessary applications to authorities having jurisdiction, obtain required permits, and pay all fees and related charges.

.3 Remove temporary utilities and related appurtenances from Site after use.

.4 Restore the Site to a clean, tidy condition.

1.4 DUST CONTROL

.1 In accordance with Section 3 03 00 – Dust Control.

1.5 STORAGE SHEDS

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

.2 Maintain storage sheds in a neat, clean condition.

1.6 SANITARY FACILITIES

.1 Provide sanitary facilities for workers in accordance with the governing regulations and ordinances.

.2 Post notices and take such precautions as required by local health authorities. Keep area and premises in a sanitary condition.

.3 Disinfect facilities frequently.

.4 Dispose of sanitary wastes in accordance with applicable regulations and subject to the approval of the Owner’s Representative.

.5 Provide all sanitary supplies required for use by the Contractor's workers and staff of the Owner’s Representative.

.6 Prohibit the committing of nuisance. Promptly discharge any employee violating such provision.

1.7 SITE ENCLOSURES

.1 Provide barricades, fencing, and covered walkways as required by the governing authorities for public rights-of-way.

.2 Provide secure, rigid guard railings and barricades around deep excavations.

.3 All Work areas shall be completely fenced off at all times using temporary fencing. Fencing shall be rigidly supported, steel grade, with a minimum height of 1.8 m. The Contractor shall maintain the fencing for the duration of construction.

1.8 POWER

.1 Arrange, pay for, and maintain temporary electrical power supply as required, in accordance with governing regulations and ordinances.

.2 Install temporary facilities for power, such as poles and underground cables, to the approval of the local power supply authority.

.3 Locate temporary power at the designated location, or at an acceptable location subject to the approval of the Owner’s Representative.

1.9 WATER SUPPLY

.1 In accordance with Section 2 03 00 – Watermains.

1.10 MATERIALS TO BE SALVAGED

.1 Remove, clean, deliver, unload, and neatly stockpile, at the Municipality’s Public Works yard, materials which are specified or designated by the Owner’s Representative to be salvaged.

.2 Repair or replace, at the Contractor's expense, salvaged materials damaged during removal, unloading, or in transit.

1.11 OFFICES

.1 Contractors may provide their own offices as necessary. These offices shall be located in temporary workspace and laydown areas.

1.12 SECURITY

.1 Ensure the security of the Site, and the contents of the Site, after working hours and during holidays.

1.13 LAYDOWN AREAS

.1 The Contractor will be fully responsible to procure laydown areas for the duration of construction. The Contractor, at their expense, shall remediate the laydown area upon construction completion, to the satisfaction of the property owner.

1.14 FIRE ROUTES

.1 Maintain all weather access to operational hydrants and properties, including overhead clearances for use by emergency response vehicles.

1.15 PROTECTION OF OFF-SITE PROPERTY

.1 Protect surrounding private and public property from damage during performance of the Work.

.2 All damage to properties outside the Work area caused by the Contractor shall be restored, at the Contractor's expense, to the satisfaction of the Owner's Representative.

1.16 CONSTRUCTION CLEANING

.1 Maintain the Work in a tidy condition, free from the accumulation of waste products and debris.

.2 Remove waste material and debris from the Site and dispose in an appropriate manner at the end of each working day.

.3 Promptly clean up any spillage that occurs on public roadways, access roads, and other areas where construction vehicles are travelling. If hazardous materials are spilled, call the 24-hour emergency number listed in the Emergency Response Plan.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 TEMPORARY FACILITIES

.1 The provision of temporary facilities shall be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include all costs involved in preparing the Site for performance of the Work and leaving the Site upon completion of the Work. This shall include:

- .1 Mobilization.
- .2 Demobilization.
- .3 Contract administration costs.
- .4 Bonding and insurance required for the project.
- .5 Temporary access.
- .6 Pedestrian accommodation.
- .7 Dust control.
- .8 Sanitary facilities.
- .9 Temporary fencing and barricades.
- .10 Site office and storage sheds.
- .11 Temporary power supply.
- .12 Temporary signs, project signs, and markings to delineate the Site.
- .13 Temporary laydown areas, including restoration upon construction completion.
- .14 Public and Business Notification Program.
- .15 Other Site Works required for the setting up and control of the Work.
- .16 Preparation and submission of all pre-construction submittals as part of Document Controls.
- .17 Record keeping for as-constructed data for all new construction.
- .18 Final cleaning.
- .19 Overhead costs, indirect costs, and profits associated with "Subject to Deletion" items.

END OF SECTION

Part 1 General

1.1 QUALITY CONTROL TESTING

.1 Quality Control testing is the responsibility of the Contractor.

1.2 QUALITY ASSURANCE TESTING

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform the required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents. This does not relieve the Contractor of the responsibility for quality control testing as per article 1.1.1.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 The Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.3 Quality Assurance testing shall be conducted in accordance with the applicable Sections of these Standard Construction Specifications.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

4.1 QUALITY CONTROL AND QUALITY ASSURANCE TESTING

.1 The Owner will not pay for or reimburse the Contractor for any services related to inspection or testing for Quality Control.

.2 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal Work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected Work. No extra payment shall be made for areas that do not meet the project specifications and require reworking.

.3 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.4 The Contractor shall pay costs for uncovering and making good Work that is covered before the required inspection or testing is completed and approved by the Owner's Representative.

.5 No extra payment will be made for areas requiring reworking due to inclement weather.

END OF SECTION

Part 1 General

1.1 SUBSTANTIAL PERFORMANCE

.1 When the Owner and Owner's Representative consider deficiencies and defects have been corrected and it appears the requirements of the Contract have been substantially performed in accordance with the *Prompt Payment and Construction Lien Act*, make an application for a Certificate of Substantial Performance. Acceptance of Substantial Performance will be through the issuance of a Substantial Performance Certificate.

1.2 CONSTRUCTION COMPLETION

.1 Construction Completion Pre-Inspection:

.1 Prior to a construction completion joint municipal inspection, the Contractor, Subcontractors, and the Owner's Representative shall conduct an inspection of the Work and identify deficiencies and defects.

.2 Any deficiencies identified at the pre-inspection are to be noted on a Pre-Inspection Checklist in accordance with the Municipality's *Design Servicing Standards and Development Procedures*.

.3 Major deficiencies (as determined by the Owner's Representative) shall be rectified prior to the construction completion municipal inspection.

.4 Effort is to be made to rectify minor deficiencies (as determined by the Owner's Representative) prior to the construction completion municipal inspection.

.5 Request a construction completion municipal inspection.

.2 Construction Completion Joint Municipal Inspection:

.1 The Owner's Representative, Municipality, and Contractor will perform an inspection of the Work to identify defects and/or deficiencies.

.2 The Contractor shall ensure they have staff available to operate public infrastructure appurtenances (e.g., pull manhole lids, operate valves, etc.).

.3 Construction Completion Certificate (CCC):

.1 When the Owner and Owner's Representative consider that deficiencies and defects have been corrected and it appears the requirements of the Contract have been totally performed, the Owner or Owner's Representative shall apply for a Construction Completion Certificate. The Construction Completion Certificate will state the following:

.1 Work has been completed and inspected for compliance with the Contract Documents.

.2 Defects have been corrected and deficiencies have been rectified.

.3 Equipment and systems have been tested and are fully operational.

.4 Owner's personnel have been trained on the operation of systems as required.

.5 Work is complete and the Warranty Period may commence.

.2 Upon satisfactory completion of the project, a satisfactory construction completion municipal inspection, and after all deficiencies are corrected and submissions received, to the satisfaction of the Municipality, the Municipality

shall issue the Construction Completion Certificate submitted by the Owner or the Owner's Representative, notifying:

.1 Approval of the Work by the Municipality.

.2 The commencement date of the Warranty Period.

1.3 FINAL CLEANING

.1 Final cleaning shall be undertaken prior to construction completion and final acceptance of the project.

.2 Remove debris and surplus materials from Site. This includes tools, construction equipment, and machinery not required for performing the remaining Work.

.3 Inspect valve boxes, manholes, catch basins, catch basin manholes, and hydrants to check for debris and to confirm operation.

.4 Thoroughly clean all surfaces and components as applicable.

.5 Leave the Site free of all foreign and surplus materials, cleaning equipment, obstructions, and hindrances.

1.4 RECORD DRAWINGS

.1 The Owner's Representative will provide a digital (PDF) set of Drawings for record keeping purposes.

.2 Identify the Drawings as "Project Record Copy".

.3 Maintain Record Drawings in a neat, tidy condition.

.4 The Owner's Representative shall prepare the final Record Drawing set, based on the as-constructed data provided by the Contractor, and shall submit the Record Drawings in accordance with the Municipality's *Design Servicing Standards and Development Procedures*.

.5 Record neatly and accurately the locations of all asphalt repairs, cold milling and crack repairs, pavement markings, and any deviations from the Contract Documents. Provide photos and GPS coordinates or as-constructed survey records of all concrete repairs, including curb and gutter, sidewalk, driveway accesses, and pedestrian ramps.

.6 Mark changes to the Drawings in red. The final Record Drawings prepared by the Owner's Representative shall incorporate any redline changes recorded on the Drawings during construction.

.7 Record the following information on one set of Drawings:

.1 Horizontal and vertical location of underground utilities and appurtenances, referenced to permanent surface improvements.

.2 Field changes of dimensions and details.

.3 Changes made by Change Order or field direction.

1.5 WARRANTY PERIOD

.1 Commencement of Warranty Period:

.1 The Construction Completion Certificate issued by the Municipality will indicate the date of commencement of the Warranty Period.

.2 The Warranty Period of items with major deficiencies rectified after the date of commencement of the Warranty Period will begin once the deficiencies are rectified to the satisfaction of the Municipality.

1.6 FINAL PAYMENT

.1 Following completion of the lien period, submit a claim for final payment in accordance with the General Conditions.

1.7 FINAL ACCEPTANCE

.1 Final Acceptance Pre-Inspection:

.1 Prior to a final acceptance joint municipal inspection, the Contractor, Subcontractors, and the Owner's Representative shall conduct an inspection of the Work and identify deficiencies and defects.

.2 Any deficiencies identified at the pre-inspection are to be noted on a Pre-Inspection Checklist in accordance with the Municipality's *Design Servicing Standards and Development Procedures*.

.3 Major deficiencies (as determined by the Owner's Representative) shall be rectified prior to the final acceptance municipal inspection.

.4 Effort is to be made to rectify minor deficiencies (as determined by the Owner's Representative) prior to the final acceptance municipal inspection.

.5 Request a final acceptance municipal inspection.

.2 Final Acceptance Joint Municipal Inspection:

.1 The Owner's Representative, Municipality, and Contractor will perform an inspection of the Work to identify defects and/or deficiencies.

.2 The Contractor shall ensure they have staff available to operate public infrastructure appurtenances installed under this Contract (e.g., pull manhole lids, operate valves, etc.).

.3 Final Acceptance Certificate (FAC):

.1 When the Owner and Owner's Representative consider that deficiencies and defects have been corrected and all requirements of the Contract have been totally performed, the Owner or Owner's Representative shall apply for a Final Acceptance Certificate.

.2 Upon a satisfactory final acceptance municipal inspection, and after all deficiencies are corrected and submissions received, to the satisfaction of the Municipality, the Municipality shall issue the Final Acceptance Certificate submitted by the Owner or the Owner's Representative, notifying:

.1 Approval of the Work and takeover by the Municipality.

.2 Confirmation that the Warranty Period is concluded.

Part 2 Products

.1 Not used.

Part 3 Execution

.1 Not used.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM C117, Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))

.4 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3)

.5 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 DEFINITIONS

.1 Rock Excavation:

.1 Excavation of material from solid masses of rock which, prior to removal, was integral with the parent mass, and boulders or rock fragments having individual volumes in excess of 1 m^3.

.2 Common Excavation:

.1 Excavation of material, which is not included under the definition of Rock Excavation including dense tills, hardpan, frozen materials, and partially cemented materials which can be excavated with heavy construction equipment.

.3 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding or sodding.

.2 Material free from subsoil, clay lumps, brush, weeds and other litter, cobbles, stumps, roots, and other material larger than 25 mm in any dimension.

.4 Waste Material:

.1 Excavated material unsuitable for use in Work or surplus to requirements.

.5 Unsuitable Material:

.1 Weak, chemically unstable, and compressible materials.

.2 Frost susceptible materials:

.1 Fine grained soils with a plasticity index of less than 10 when tested to ASTM D4318 and gradation within limits specified in Table 1 when tested to ASTM C136.

.2 Table 1:

Sieve Designation	% Passing
2 000 µm	100
100 µm	45 - 100
20 µm	10 - 80
5 µm	0 - 45

.3 Coarse grained soils containing more than 20% by mass passing 75 µm sieve.

.6 Native Backfill:

.1 Material excavated from the trench from which all boulders, roots, stumps, and other debris which would prevent consolidation of backfill have been removed.

.7 Granular Backfill:

.1 Imported granular material for backfilling trenches in areas above the Pipe Zone.

.8 Unshrinkable Fill:

.1 Very weak (0.4 MPa at 28 days) mixture of cement, concrete aggregates, and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

.9 Pipe Zone:

.1 That portion of the trench that contains the pipe bedding material.

1.3 PROTECTION OF EXISTING FEATURES

.1 Existing buried utilities and structures:

.1 The size, depth, and location of existing utilities and structures indicated on the Drawings are not guaranteed and this information is provided for guidance only.

.2 Prior to commencing any excavation work, notify applicable owners or authorities having jurisdiction to determine the location and status of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.

.3 Confirm the location of buried utilities by careful test excavations.

.4 Maintain, and protect from damage, water, sewer, gas, electric, telephone and any other utilities and structures encountered. Obtain direction from the Owner's Representative before moving or otherwise disturbing utilities or structures.

.5 Advise affected utility companies or authorities having jurisdiction to remove or relocate existing lines within the area of excavation.

.2 Existing buildings and surface features:

.1 Together with the Owner's Representative, conduct a condition survey of existing buildings, trees and other plant material, lawns, fencing, above ground utility infrastructure, transportation infrastructure, survey benchmarks and monuments, and any other surface features which may be affected by the Work.

.2 Protect existing buildings and surface features which may be affected by the Work from damage while Work is in progress and repair the site to its existing condition, or better, upon completion of the Work.

1.4 SHORING, BRACING, AND UNDERPINNING

.1 Engage the services of a qualified Professional Engineer for the design and inspection of cofferdams, shoring, bracing, and underpinning required to complete the Work.

.2 Submit the design and supporting data at least 2 weeks prior to commencing the Work.

.3 The design and supporting data shall be Authenticated by a Professional Engineer in good standing with APEGA.

.4 The Professional Engineer responsible for the design and inspection of cofferdams, shoring, bracing, and/or underpinning shall submit proof of insurance coverage for professional liability, except where the Professional Engineer is an employee of the Contractor, in which case the Contractor shall submit proof that the work completed by the Professional Engineer is included in Contractor's insurance coverage.

1.5 UTILITY INSTALLATION AND STREET OCCUPATION PERMIT

.1 All construction projects that will occupy or block access to municipal lands are required to apply for and receive an approved Utility Installation and Street Occupation Permit.

.2 Partial road closures require an approved Utility Installation and Street Occupation Permit a minimum of 3 days prior to starting construction.

.3 Full road closures require an approved Utility Installation and Street Occupation Permit a minimum of 5 days prior to starting construction.

.4 In no case shall an approved Utility Installation and Street Occupation Permit be issued more than 2 weeks in advance of the start of construction.

Part 2 Products

2.1 MATERIALS

.1 Pipe Zone Material: to Section 3 04 00 – Aggregate Materials.

.2 Type 1 Fill (washed rock), Type 2 Fill (imported backfill), and Type 3 Fill (Native Backfill): to Section 3 04 00 – Aggregate Materials.

.3 Unshrinkable Fill: Proportioned and mixed to provide:

- .1 Maximum compressive strength of 0.4 MPa at 28 days.
- .2 Minimum cement content of 30 kg/m^3.
- .3 Fly ash replacement: to CSA A3001 pozzolan type F.
- .4 Minimum strength of 0.07 MPa at 24 h.
- .5 Fine aggregate: to CSA A23.1, maximum size of 5 mm.
- .6 Cement: Type GU, to CSA A3001.
- .7 Slump: 100 mm ± 25 mm.
- .8 Entrained air: 6.0% to 8.0% by volume.

.4 Shearmat: Honeycomb type biodegradable cardboard, 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete has cured.

.5 Geotextiles: to Section 3 05 30 – Geotextiles.

Part 3 Execution

3.1 EROSION AND SEDIMENTATION CONTROL

.1 Refer to Section 1 07 10 – Environmental Construction Operations Plan

.2 Provide erosion and sedimentation control measures as per the Municipality's *Design Servicing Standards and Development Procedures*, or the requirements of authorities having jurisdiction, whichever is more stringent.

.3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

3.2 SITE PREPARATION

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

.2 Cut pavement or sidewalk neatly along the limits of excavation so the surface may break cleanly and evenly.

3.3 SITE PROTECTION

.1 Protect existing features in accordance with the Drawings and applicable local regulations.

.2 Keep excavations clean and free of standing water and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the approval of the Owner's Representative.

.4 Protect natural and constructed underground and surface features required to remain undisturbed. Protect existing trees from damage, unless otherwise indicated or located in an area to be occupied by new construction.

3.4 STRIPPING OF TOPSOIL

.1 Refer to Section 4 01 30 – Site Grading.

3.5 STOCKPILING

.1 Stockpile fill materials in areas designated by the Owner's Representative.

.2 Stockpile granular materials in a manner to prevent segregation.

.3 Protect fill materials from contamination.

3.6 COFFERDAMS, SHORING, BRACING, AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods.

.2 Obtain permitting from the authority(ies) having jurisdiction for the diversion of any watercourse.

.3 Construct temporary Works to depths, heights, and locations as indicated on the Drawings or as directed by the Owner's Representative.

.4 During backfill operation:

.1 Unless otherwise indicated or directed by the Owner's Representative, 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 the toe of the sheeting.

.5 When sheeting is required to remain in place, cut off tops at elevations indicated or as directed by the Owner's Representative.

.6 Upon completion of backfilling:

.1 Remove cofferdams, shoring, and bracing.

.2 Remove excess materials from site and restore watercourses to conditions indicated or as directed by the Owner's Representative, to the satisfaction of the authority(ies) having jurisdiction.

3.7 DEWATERING AND HEAVE PREVENTION

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

.2 Submit for Owner's Representative's review, details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut-offs, in accordance with Section 2 01 10 – Dewatering.

.3 Conduct excavation in accordance with the recommendations in the Geotechnical Report.

.4 Protect open excavations against flooding and damage due to surface runoff.

.5 Dispose of water in accordance with Section 1 07 00 – Environmental Procedures and in a manner not detrimental to public or private property, or any portion of the Work either completed or under construction.

3.8 SUPPORTED TRENCHES

.1 Trench Boxes:

.1 The installed pipe and its embedment shall not be disturbed when using movable trench boxes and shields.

.2 Movable supports shall not be used below the top of the Pipe Zone unless an approved method is used to maintain the integrity of the embedment material.

.3 Before moving supports, place and compact embedment to sufficient depths to ensure protection of the pipe. As supports are moved, finish placing and compacting the embedment material.

.2 Sheeting and Shoring:

.1 Where sheeting and shoring or other trench wall supports are used within or below the Pipe Zone, ensure the foundation and embedment materials are not disturbed by removal of the supports.

.2 Fill any voids left by the removal of supports and compact all materials to the required density(ies).

3.9 EXCAVATION

.1 Advise the Owner's Representative in advance of excavation operations.

.2 Any excavation into oilsands materials will require an approved plan from Alberta Environment for the disposal and off-gassing of the material.

.3 Prior to excavation of the trench, establish the location at which the pipe shall be installed by setting stakes at 15 m intervals along a line offset from the centre of the proposed pipe.

.4 Excavate to the lines, grades, elevations, and dimensions indicated on the Drawings or as directed by the Owner's Representative.

.5 Where indicated, remove concrete, pavement, and other surface obstructions encountered during excavation.

.6 Excavation shall not undermine the bottom of any footing.

.7 Do not disturb soil within the dripline of trees and shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with a saw. Seal cuts with approved tree wound dressing.

.8 Caution shall be exercised with respect to structures, piping, or other features that may exist within the working area and due consideration shall be given to the protection and support of such features and structures.

.9 Trenches shall be excavated only as far in advance of the pipe laying operation as safety, traffic, and weather conditions permit.

.10 Trenches shall be progressively backfilled as the next section is excavated such that only a short section of trench is left open at the end of each day. If located under a road, the trench shall be backfilled within 24 hours.

.11 Keep excavated and stockpiled materials a safe distance away from the edge of the trench as directed by the Owner's Representative and in accordance with the Occupational Health and Safety legislation currently in effect.

.12 Restrict vehicle operations directly adjacent to open trenches.

.13 Dispose of surplus and unsuitable excavated material at an approved location off-site.

.14 Do not obstruct the flow of surface drainage or natural watercourses.

.15 The bottoms of excavations shall be undisturbed soil which is level and free from loose, soft, and organic matter.

.16 Notify the Owner's Representative when soil at the bottom of the excavation appears unsuitable and proceed as directed by the Owner's Representative.

.1 Remove Unsuitable Material from the trench bottom to the extent and depth as indicated by the Owner's Representative.

.2 Where required due to unauthorized over-excavation, correct as follows:

.1 Fill with base gravel compacted to a minimum of 98% SPMDD.

.17 Hand trim, make firm, and remove loose material and debris from excavations.

.1 Where material at the bottom of the excavation is disturbed, compact foundation soil to a density at least equal to the undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to the approval of the Owner's Representative.

.18 Obtain the Owner's Representative's approval of the completed excavation.

3.10 TRENCH ALIGNMENT AND DEPTH

.1 The trench shall be excavated so that pipe can be laid to the alignment and depth indicated on the Drawings, with an allowance made for specified trench wall clearances and pipe bedding as required.

3.11 STOCKPILING TRENCH MATERIAL

.1 Stockpiling trench material adjacent to the trench shall be done in accordance with the Occupational Health and Safety legislation currently in effect.

.2 Excavated trench material may be piled alongside the trench provided the near edge of the piled excavated material is a minimum of 1m away from the edge of the trench and does not endanger persons, the Work, or adjacent properties, and that the working space is adequate for this purpose.

.3 Where it is not possible to pile material alongside the trench, it shall be hauled out, stockpiled, and returned for backfill.

.4 Prior to piling excavated trench material outside the working area, the Contractor shall obtain written permission from the Municipality or appropriate landowner(s), as applicable.

3.12 TRENCH WIDTH

.1 The width of the bottom of the trench shall be such as to permit the pipe to be laid, jointed, bedded, and backfilled in accordance with the applicable specifications of this Contract.

.2 Trench walls shall be of sufficient width to permit the placing of timber supports, shoring, bracing, or the handling of special items, as required.

.3 Trench walls shall be vertical from the bottom of the trench to the top of the Pipe Zone where ground conditions allow.

.4 Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 150 mm below and on all sides of pipe and fittings.

3.13 TRENCH BOTTOM CONDITIONS

.1 Trenches shall be maintained such that pipe can be installed without water, mud, silt, gravel, or other foreign material entering the pipe.

.2 Water and any material remaining in the trench bottom upon completion of machine excavating which has been disturbed or softened by workers shall be removed before bedding material is placed. The trench bottom shall be firm and capable of supporting the pipe to be installed, otherwise the bottom shall be stabilized by means of over-excavation or special foundation designed to support the pipe.

.3 When the material in the trench bottom is deemed by the Owner's Representative to be unstable or otherwise unsuitable for pipe support or the support of appurtenances, the trench shall be over-excavated to the level at which stable material is encountered and the excavation backfilled to the level of normal bedding with base gravel material. This material shall be compacted to 95% SPMDD with approved mechanical compactors in lifts having a maximum depth of 300 mm to provide a thoroughly consolidated pipe base.

3.14 PIPE ZONE MATERIAL

.1 Place Pipe Zone material as detailed on the Drawings.

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

.3 Shape transverse depressions as required to receive the pipe bell where bell and spigot pipe is used.

.4 Compact the full width of the bedding zone to 95% SPMDD.

.5 Pipe Zone material shall be placed in accordance with the applicable Standard Detail(s) in the Municipality's *Design Servicing Standards and Development Procedures*.

3.15 PLACING BACKFILL

.1 To prevent damage to the installed pipe, backfill shall be placed in the trench to minimize the disruption of the Pipe Zone material and impact forces on the installed pipe.

.2 Every effort shall be made to plan the backfilling operation such that exposure of backfill material to wet weather is kept to a minimum.

3.16 BACKFILL ABOVE PIPE ZONE AND FOR SITE GRADING

.1 Backfilling procedures above the Pipe Zone shall be carried out in accordance with the following:

.1 Native and imported backfill material shall be placed and compacted using approved equipment. Compaction shall be carried out with soil moisture content such that compaction to 97% of SPMDD is achieved up to the bottom of the prepared subgrade under roadways and 95% of SPMDD is achieved under landscaped areas, unless indicated otherwise.

.2 The upper 300 mm of roadway subgrade shall be compacted to 100% SPMDD.

.3 Material that has undergone extreme changes in moisture content during the period between excavation and backfilling operations shall not be used as backfill until the moisture content has been adjusted to satisfactory limits.

.4 Do not proceed with backfilling operations until the Owner's Representative has inspected and approved utility installations.

.5 Areas to be backfilled and the backfill material shall be free from debris, snow, ice, water, and frozen material.

.6 Place backfill material in uniform layers as per the applicable Standard Detail(s) in the Municipality's *Design Servicing Standards and Development Procedures*. Compact each layer before placing subsequent layers.

.7 Backfilling around installations:

.1 Place bedding material as specified.

.2 Do not backfill around or over cast-in-place concrete within 24 h of placing the concrete.

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

.8 Place Unshrinkable Fill in areas as indicated on the Drawings and in the Contract Specifications.

.1 Consolidate and level Unshrinkable Fill with internal vibrators.

3.17 DISPOSAL OF EXCESS EXCAVATED MATERIAL

.1 Excess excavated material shall be removed from the trench area at the time of backfilling and disposed of off-site at an approved location. Excess material shall not be disposed of on private property without the written permission of the property owner.

.2 Soil testing and consultation with Alberta Environment to confirm compliance with legislation that establishes the level of contamination and the facility/location that can accept the material shall be completed prior to disposing of excess excavated material.

3.18 QUALITY CONTROL AND QUALITY ASSURANCE

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.4 Coordinate field density tests in accordance with Table 2.

Table 2

Test	Minimum Test Frequency
Backfill and Pipe Zone	
Standard Proctor	1 per material type
Field Density – Trench	1 test every 100 m of trench per every 2nd lift Minimum 3 tests for small areas
Field Density – Pipe Zone	1 test every 100 m of trench Minimum 3 tests for small areas
Field Density – Manholes, Catch Basins, Valves, Valve Chambers, and Vaults	Take tests adjacent to all manholes, catch basins, valves, valve chambers, and vaults from Pipe Zone to finished subgrade
Road Base/Subbase/Subgrade	
Standard Proctor/Sieve for Granular	1 per material type
Field Density – Subgrade Preparation	1 test per 1,000 m^2 for roads 1 test per 100 m for sidewalks or curb/gutter Minimum 3 tests for small areas
Field Density – Subbase	1 test per 3,000 m^2 for roads Minimum 3 tests for small areas
Field Density – Base	1 test per 1,000 m^2 for roads 1 test per 100 m for sidewalks or curb/gutter Minimum 3 tests for small areas

Part 4 Measurement and Payment

4.1 TRENCH EXCAVATION AND BACKFILL

.1 Payment for trench excavation and backfill will be made for the pipe size and depth ranges specified, per metre of trench excavated, backfilled, and compacted.

.2 Measurement for each type of installation will be made as follows:

.1 Watermains:

.1 Along the centreline of the main, through valves and fittings.

.2 Sanitary Sewer Mains:

.1 Along the centreline of the main, from centre of manhole to centre of manhole, or from centre of manhole to designated termination point as applicable.

.3 Sanitary and Storm Sewer Forcemains:
  .1 Along the centreline of the main, from centre of manhole to centre of manhole, or from designated start point to designated termination point as applicable.

.4 Storm Sewer Mains:
  .1 Along the centreline of the main, from centre of manhole to centre of manhole, or from centre of manhole to designated termination point as applicable.

.5 Catch Basin Leads:
  .1 Along the centreline of the pipe, from centre of manhole to centre of catch basin, or from centre of catch basin manhole to centre of catch basin as applicable.

.6 Sub-drains:
  .1 Along the centreline of the pipe, from centre of manhole/catch basin to centre of manhole/catch basin, or from centre of manhole/catch basin to designated termination point as applicable.

.7 Culverts:
  .1 Along the centreline of the pipe from inlet to outlet, including beveled end sections.

.8 Concrete Encased and Direct Buried Duct Banks:
  .1 Along the centreline of the duct bank from designated start point to designated termination point, including length through manholes.

.3 Trench depth shall be the vertical distance between the ground surface immediately prior to excavation and the pipe invert, measured at intervals determined by the Owner's Representative. Backfill shall be to the subgrade on roadway Work or to 150 mm below finished grade in areas to be seeded or to 100 mm below finished grade in areas to be sodded.

.4 Unit price to include excavation, loading, hauling, stockpiling, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.2 PIPE ZONE

.1 Measurement and payment for the supply and placement of Pipe Zone material for the pipe sizes specified, will be per metre of Pipe Zone material installed as measured along the centreline of pipe installed.

.2 Unit price to include the supply, placement, and compaction of Pipe Zone material, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 UNSUITABLE PIPE FOUNDATION

.1 Measurement and payment for the supply and placement of base gravel material for unsuitable pipe foundation will be per cubic metre (m^3) of base gravel placed.

.2 Unit price to include the excavation of unsuitable pipe foundation material and the supply, placement, and compaction of base gravel material per Section 3 04 00 – Aggregate Materials, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 ROCK EXCAVATION

.1 Payment for rock excavation will be per cubic metre (m^3) of rock excavated. Payment for overbreak will not be made.

.2 Measurement for rock excavation will be based on the trench width as indicated on the Drawings, the depth of rock from rock surface to the bottom of the Pipe Zone, and the centreline length of pipe installed within the area of rock excavation. Measurement for boulders and rock fragments exceeding 1 m^3 in volume will be determined from three mutually perpendicular dimensions.

.3 Unit price to include excavation, loading, hauling, stockpiling, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.5 PIPE AND UTILITY CROSSINGS

.1 Unless explicitly provided for in the Contract, payment will not be made for the crossing of oil and/or gas pipelines or other utilities. Include costs in related items.

.1 Where provided for in the Contract, pipe and utility crossings will be measured and paid for per each crossing. Unit price to include support of the utility being crossed, fees associated with obtaining utility crossing agreements and utility inspection charges, and labour, equipment, materials, tools, and all other incidentals necessary to perform the work.

.2 Notwithstanding the above statements, payment shall not be made where the pipeline or utility being crossed falls below the pipe being installed or where the pipe being crossed was installed under the same Contract as the pipe being installed.

4.6 SHORING, BRACING, COFFERDAMS, UNDERPINNING AND DEWATERING

.1 Shoring, bracing, cofferdams, underpinning, and typical dewatering (for example due to rainfall or snow melt) of the excavation will not be measured separately for payment. Include costs in related items.

.2 Refer to Section 2 01 10 – Dewatering of Excavations for measurement of and payment for dewatering of excavations that occur below the groundwater table.

4.7 DISPOSAL OF EXCESS EXCAVATED MATERIAL

.1 Measurement and payment for the disposal of excess excavated material for the pipe materials specified, will be per cubic metre (m^3) of excess excavated material disposed.

.2 Unit price to include the loading, hauling, and disposal of materials offsite, disposal fees (if any), and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.8 QUALITY CONTROL AND QUALITY ASSURANCE TESTING

.1 The Owner will not pay for or reimburse the Contractor for any services related to inspection or testing for Quality Control.

.2 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal Work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected Work.

.3 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.4 The Contractor shall pay costs for uncovering and making good work that is covered before the required inspection or testing is completed and approved by the Owner's Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section specifies the requirements for dewatering of excavations that occur below the groundwater table.

.2 This does not include costs for typical surface runoff dewatering such as from rain, snowmelt, etc. The Contactor is responsible to construct and manage the site so that any surface runoff drains away from the work area and no ponding occurs.

1.2 PROTECTION

.1 Prevent damage to trees, landscaping, fencing, natural features, benchmarks, structures, pavement, and surface and underground utility infrastructure which are to remain. Make good any damage.

.2 Adequate control shall be maintained by the Contractor to ensure the stability of excavated slopes is not adversely affected by water, that erosion is controlled, and that flooding of the excavation or damage to structures does not occur. The Contractor is solely responsible for site excavation safety and compliance with the Occupational Health and Safety legislation currently in effect.

.3 Dewatering operations shall be adequate to ensure the integrity of the finished product. The responsibility for conducting dewatering operations in a manner which will protect adjacent structures and facilities rests solely with the Contractor. This includes the potential risk for long-term settlement of adjacent structures due to the dewatering. This risk shall be assessed by the Contractor during the design of the dewatering system.

.4 The Contractor shall bear the sole responsibility for the design, installation, operation, monitoring, removal, and abandonment of the dewatering system to comply with the requirements of this Section and any applicable authorities having jurisdiction.

1.3 SUBMITTALS

.1 Submit a detailed plan of the proposed dewatering system, including an assessment of potential settlement, to the Owner’s Representative at least 4 weeks prior to commencing Work. The submittal shall be Authenticated by a Dewatering Specialist.

.2 Include the following in the detailed plan of the proposed dewatering system:

- .1 Plan layout showing the arrangement and location of wells/well points, methods of installation, and location of headers, discharge lines, points of discharge disposal, and temporary berms.
- .2 Back-up system including contingency measures if part or all of the dewatering system fails.
- .3 Temporary drainage and pumping facilities.
- .4 Dewatering construction staging.

.5 Details of well/well point installation including depth, screen dimension, screen slot size, backfill filter gradation, riser dimensions, pump type and capacity, and header dimensions.

.6 Locations of piezometers and details of installation including depth, backfill, tip type and dimensions, and riser pipe.

.7 Estimate of flow rate and duration of dewatering.

.8 Details of plugging method for any piezometers installed within structure footprint.

.3 Advise the Owner's Representative of any changes to the proposed method of dewatering at least 2 weeks before enacting change.

.4 Upon completion of dewatering installations, submit a detailed plan of the dewatering system as constructed including test data and computations demonstrating that the system is capable of achieving the desired result.

.5 Prior to the completion of the dewatering operations, submit an abandonment plan for any dewatering wells and piezometers.

1.4 POWER SUPPLY

.1 Provide all power and connections as required. Obtain power from the construction power supply as specified in Section 1 09 00 – Temporary Facilities.

.2 If construction power supply as specified in Section 1 09 00 – Temporary Facilities is interruptible. Then provide adequate, continuous back-up power for the dewatering system.

1.5 DESIGN CRITERIA

.1 Design the dewatering scheme to maintain the groundwater level at least 1000 mm below the bottom of the excavation required for all pipelines or structures to be constructed.

.2 Discharge the dewatering system in accordance with Alberta Environment guidelines. Trench dewatering can be discharged to the surface provided it does not flow to raw water ponds, private property, or directly into a natural waterbody. Do not discharge to the sanitary sewer. Ensure adequate erosion protection at discharge points and include sedimentation control measures in the dewatering process. The Contractor will be responsible for restoring any damaged/impacted surface to the original condition.

.3 Discharge piping to be designed to allow for discharge redirection, as directed by Owner's Representative, without affecting the dewatering operations. Route piping to maintain unrestricted access to the site and other construction activities.

.4 Provide a tap at the point of dewatering discharge for sampling purposes.

.5 The Contractor is responsible for obtaining any diversion permits required by government agencies.

Part 2 Products

.1 Not used.

Part 3 Execution

3.1 GENERAL

.1 Prior to commencement, survey and monitor adjacent structures.

.2 The groundwater level beneath the excavation must be measured by the installed piezometers.

3.2 DEWATERING

.1 Control groundwater in a manner that will preserve the strength of the foundation soils, will not cause instability of the excavation slopes, will control erosion, and will prevent flooding of the excavation and damage to structures. An adequate system shall be designed, installed, and maintained to lower and control the groundwater elevations to permit the excavation, construction of infrastructure, and placement of fill materials under dry conditions.

.2 Lower the water table in advance of excavation using wells, well points, or similar methods.

.3 Maintain the water level, as measured in piezometers, a minimum of 1000 mm below the prevailing excavation level for the structure or pipeline under construction, unless otherwise noted.

.4 Dewatering shall be managed to accommodate variations in groundwater levels (resulting from river levels, precipitation, and other influences) to prevent flooding of excavations.

.5 Insulate or otherwise protect dewatering pipes and equipment from freezing.

.6 Keep excavations free of water at all times while Work is in progress. Dewatering shall be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bottom of the excavation.

.7 Protect open excavations against flooding and protect side slopes from damage due to surface runoff and soil piping.

.8 Dispose of water in a manner which is not detrimental to public or private property or any portion of Work completed or under construction.

.9 Operate the dewatering system at all times in such a manner as to detect and guard against the danger caused by the possible discharge and accumulation of methane and other potentially explosive gases which may be present in the groundwater during dewatering operations.

.10 Submit means of flotation prevention for constructed structures to the Owner’s Representative prior to terminating dewatering operations.

.11 Prevent rapid recharge when terminating dewatering operations to prevent loosening of subbase material.

Part 4 Measurement and Payment

.1 Dewatering of excavations during construction per this Section will be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include the design of the dewatering system, fees associated with obtaining necessary permits, the supply, installation, operation, maintenance, and removal of temporary structures to permit workable conditions in all excavations, metering installation and the cost of power supply, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.4 The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

.5 The cost to pump and to dry any wet material caused by ponding due to improper operation and procedures or negligence of the Contractor shall be considered incidental to the Work and separate payment will not be made.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M306, Standard Specification for Drainage, Sewer, Utility, and Related Castings

.2 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM A48/A48M, Standard Specification for Gray Iron Castings

.2 ASTM C139, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes

.3 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)

.4 ASTM C478/C478M, Standard Specification for Circular Precast Reinforced Concrete Manhole Sections

.3 Canadian Standards Association (CSA)

.1 CSA A257.4, Precast Reinforced Circular Concrete Manhole Sections, Catch Basins, and Fittings

.2 CSA A3000, Cementitious Materials Compendium

1.2 SUBMITTALS

.1 At least 4 weeks prior to commencing work, submit manufacturer's product data, shop drawings, and certification that materials meet requirements of this Section.

.2 Product Data:

.1 Submit manufacturer's instructions, product literature, and data sheets for manhole, catch basin manhole, and catch basin structures and include product characteristics, performance criteria, physical size, finish, and limitations.

.3 Shop Drawings:

.1 Submit shop drawings for review and approval by the Owner’s Representative.

.4 Submit a certificate of compliance for the type of precast cement in accordance with Section 1 04 00 – Submittal Procedures.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 Deliver materials to site, labelled with the manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with the manufacturer's recommendations in a clean, dry area.

.2 Store and protect manhole, catch basin manhole, and catch basin structures from damage.

.3 Replace defective or damaged materials with new materials.

Part 2 Products

2.1 MATERIALS

.1 Cast-in-place concrete:

.1 To Section 3 02 30 - Cast-in-Place Concrete.

.2 Cement: to CSA A3001, Type HS.

.2 Concrete reinforcement:

.1 To Section 3 02 20 - Concrete Reinforcement.

.3 Precast manhole and catch basin manhole sections:

.1 To ASTM C478/C478M.

.2 Top sections: eccentric cone or flat slab top type with opening offset for ladder installation.

.4 Precast catch basin sections:

.1 To ASTM C478/C478M.

.5 All joints shall be sealed with rubber gaskets conforming to ASTM C443M.

.6 Manhole bases are to be pre-finished and pre-benched, with pre-formed connection holes to suit the incoming and outgoing pipes. Make all sewer pipe connections watertight using Duraseal or A-Lok joints or approved equivalent.

.7 Ladder rungs shall be standard safety pattern (drop step type), aluminum forged of 6061-T6 alloy having a minimum tensile strength of 260 MPa.

.8 Grade rings:

.1 To ASTM C478/C478M.

.9 Frames, grates, and covers: to dimensions indicated and the following requirements:

.1 Metal grates and covers to bear evenly on frames.

.1 A frame with a grate or cover shall constitute one unit.

.2 Gray iron castings:

.1 To AASHTO M306 and ASTM A48/A48M.

.3 Castings to be coated with two applications of asphalt varnish or sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Manhole frames and covers shall be of the type(s) indicated on the Drawings.

.5 Catch basin manhole frames and grates shall be of the type(s) indicated on the Drawings.

.6 Catch basin frames and grates shall be of the type(s) indicated on the Drawings.

.10 Drop pipes in external and internal drop manholes shall be same diameter and pipe material as incoming sewer pipe.

.11 In areas where the water table is above the bottom of the sanitary manhole, a waterproofing admixture shall be added to the concrete mix design. In addition, the outer surface of the manhole, including under the base, shall be covered by a fully sealed exterior waterproofing membrane (Colphene 3000 c/w Elastocol Stick H_20 or approved equal).

Part 3 Execution

3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Complete field density testing around manholes and catch basins in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.2 CONCRETE WORK

.1 Cast-in-place concrete placement shall be in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete reinforcement shall be in accordance with Section 3 02 20 - Concrete Reinforcement.

3.3 INSTALLATION

.1 Construct manholes, catch basin manholes, and catch basins in accordance with the applicable Standard Details in the Municipality's *Design Servicing Standards and Development Procedures* and in accordance with the approved shop drawings, plumb and true to alignment and grade.

.2 Complete manholes, catch basin manholes, and catch basins as pipe laying progresses.

.3 Set precast concrete base on a 100 mm to 300 mm layer of washed rock.

.4 Make each joint watertight with approved rubber gaskets.

.5 Plug lifting holes with non-shrink grout.

.6 Installing manholes in existing systems:

.1 Where a new manhole is to be installed along an existing pipe, ensure full support of the existing pipe during installation and carefully remove that portion of existing pipe to the dimensions as indicated on the Drawings and install the new manhole as specified.

.2 Make joints between the new manhole and existing pipe watertight.

.7 Place frame and cover on the top section to the elevation indicated on the Drawings.

.1 If adjustment is required, use precast concrete grade ring(s). The grade adjustment shall be between 100 mm and 300 mm.

.8 Manholes, catch basin manholes, and catch basins are not to remain uncovered, even if at incomplete height.

.9 Clean manholes, catch basin manholes, and catch basins of debris and foreign materials.

.10 Prevent debris from entering the existing sewer system.

3.4 QUALITY ASSURANCE

.1 An infiltration or exfiltration test shall be conducted, depending on the elevation of the water table, as per Section 11 Testing Procedures of the Municipality's *Design Servicing Standards and Development Procedures* in the presence of the Owner's Representative.

Part 4 Measurement and Payment

4.1 EXCAVATION AND BACKFILLING

.1 Separate payment will not be made for excavation and backfilling for manhole and catch basin installations. Include costs in related items as per Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.2 MANHOLES

.1 Measurement and payment for the supply and installation of manholes, for the manhole sizes specified, will be per vertical metre of manhole installed, as measured from the top of the frame and cover to the lowest invert elevation.

.2 Unit price to include the supply and installation of the precast manhole base and barrel sections, cast-in-place concrete if required, washed rock, cored openings if required, grouting, gaskets, waterproofing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 02 22 – Adjustment of Manholes, Catch Basins, Hydrants, and Water Valves.

4.3 CATCH BASIN MANHOLES

.1 Measurement and payment for the supply and installation of catch basin manholes, for the catch basin manhole sizes specified, will be per vertical metre of catch basin manhole installed, as measured from the top of the frame and grate to the bottom of the sump.

.2 Unit price to include the supply and installation of precast catch basin manhole base and barrel sections, cast-in-place concrete if required, washed rock, cored openings if required, grouting, gaskets, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 02 22 – Adjustment of Manholes, Catch Basins, Hydrants, and Water Valves.

4.4 CATCH BASINS

.1 Measurement and payment for the supply and installation of catch basins will be per each catch basin installed.

.2 Unit price to include the supply and installation of precast catch basin sections, cast-in-place concrete if required, washed rock, cored openings if required, grouting, gaskets, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 02 22 – Adjustment of Manholes, Catch Basins, Hydrants, and Water Valves.

4.5 MANHOLE FRAMES AND COVERS

.1 Measurement and payment for the supply and installation of manhole frames and covers will be per each frame and cover installed.

.2 Unit price to include the supply and installation of the frame and cover, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.6 CATCH BASIN MANHOLE FRAMES AND GRATES

.1 Measurement and payment for the supply and installation of catch basin manhole frames and grates will be per each frame and grate installed.

.2 Unit price to include the supply and installation of the frame and grate, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.7 CATCH BASIN FRAMES AND GRATES

.1 Measurement and payment for the supply and installation of catch basin frames and grates will be per each frame and grate installed.

.2 Unit price to include the supply and installation of the frame and grate, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

.1 This Section specifies the requirements for supplying and installing catch basin leads.

Part 2 Products

2.1 PLASTIC PIPE

.1 PVC DR35 pipe and fittings to meet CSA B182.2 and ASTM D3034.

.2 Minimum pipe stiffness to be 320 kPa as measured in accordance with ASTM D3034.

.3 Gaskets shall meet the requirements of ASTM F477.

2.2 REINFORCED CONCRETE PIPE

.1 To CSA A257.2 and ASTM C76M.

.2 Class 3 minimum strength classification or as specified.

.3 Concrete to be made with Type HS cement to CSA A3001.

.4 Gaskets shall meet the requirements of CSA A257.3 and ASTM C443M.

Part 3 Execution

3.1 TRENCHING, BEDDING, AND BACKFILL

.1 Trenching, bedding, and backfill to Section 2 01 00 – Excavation, Trenching, and Backfilling.

.2 Complete field density testing in accordance with Section 2 01 00 – Excavation, Trenching, and Backfilling.

3.2 LAYING CATCH BASIN LEADS

.1 Commence laying at manhole (or catch basin manhole, as applicable).

.2 Minimum slope in accordance with the Municipality's *Design Servicing Standards and Development Procedures*.

.3 Lay and join pipe in accordance with the manufacturer's recommendations.

.4 Ensure the bottom of the pipe is in contact with the shaped bedding material along its length.

.5 Do not allow water to flow through pipes during construction except as permitted by the Owner's Representative.

3.3 JOINTS

.1 Install rubber gaskets in accordance with the manufacturer's instructions.

3.4 CONNECTION TO CATCH BASINS, MANHOLES, AND CATCH BASIN MANHOLES

.1 New catch basins, manholes, and catch basin manholes:

.1 Complete pipe connection to pre-formed hole in catch basin, manhole, or catch basin manhole, complete with rubber gasket for a watertight connection.

.2 Ensure catch basin lead does not protrude into catch basin, manhole, or catch basin manhole.

.2 Existing catch basins, manholes, and catch basin manholes:

.1 Core an opening to suit the catch basin lead diameter.

.2 Make the connection to the catch basin, manhole, or catch basin manhole watertight by installing a Kor-N-Seal connection or approved equivalent.

.3 Ensure catch basin lead does not protrude into catch basin, manhole, or catch basin manhole.

Part 4 Measurement and Payment

4.1 CATCH BASIN LEADS

.1 Measurement and payment for the supply and installation of catch basin leads, for the pipe sizes specified, will be per metre of catch basin lead installed, as measured along the centreline of the pipe, from centre of downstream structure to centre of upstream structure.

.2 Unit price to include the supply and installation of the catch basin lead, connections to the upstream and downstream structures, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

END OF SECTION

Part 1 GENERAL

.1 This Section specifies the requirements for:

.1 Adjusting the grade rings of manholes, catch basins, and catch basin manholes to meet finished grade; and

.2 Adjusting hydrants and water valves to meet finished grade.

Part 2 Products

2.1 MATERIALS

.1 Grouting:

.1 To CSA A23.1.

.2 Aggregate: to ASTM C404.

.3 Cement: to CSA A3001, Type HS.

.2 Grade rings:

.1 To ASTM C478/C478M.

.3 Exterior hydrant extension bolts and nuts:

.1 To ASTM A193, stainless steel, Type 304.

Part 3 Execution

3.1 MANHOLES, CATCH BASINS, AND CATCH BASIN MANHOLES

.1 Remove the frame and grate (or frame and cover, as applicable) and store for re-use at a location designated by the Owner's Representative, if required.

.2 Excavate and expose the grade rings of the manhole, catch basin, or manhole catch basin.

.3 Add or remove grade rings as necessary to meet finished grade. Grout additional grade rings in place. Grade rings shall provide a minimum of 100 mm and a maximum of 300 mm of grade adjustment.

.4 Backfill the excavation in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.5 Replace the frame and cover (or frame and grate, as applicable).

.6 Restore the pavement structure which was removed to facilitate the manhole, catch basin, or catch basin manhole adjustment to the required pavement structure indicated on the Drawings.

3.2 HYDRANTS

.1 Excavate and expose the spool piece.

.2 Remove the spool piece and hydrant rod and replace with an appropriate unit to place the breakaway flange of the hydrant 75 mm above finished grade.

3.3 WATER VALVES

.1 Excavate and expose the adjustable portion of the water valve casing.

.2 Adjust the water valve casing based on the finished grade and the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.3 Backfill the excavation in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling and ensure the water valve casing will not settle.

.4 Restore the pavement structure which was removed to facilitate the water valve adjustment to the required pavement structure indicated on the Drawings.

.5 Operate the adjusted valve in the presence of the Owner's Representative to verify that it is operational.

Part 4 Measurement and Payment

4.1 ADJUSTMENT OF MANHOLES

.1 Measurement and payment for the adjustment of manholes will be per each manhole frame and cover adjusted.

.2 Unit price to include saw-cutting, removal of asphalt, removal of granular base and prepared subgrade materials as needed to expose the grade rings, temporary removal of the frame and cover, supply of and grouting in place additional grade rings as required, removal of grade rings as required, replacing the frame and cover, restoration of the pavement structure, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 ADJUSTMENT OF CATCH BASINS AND CATCH BASIN MANHOLES

.1 Measurement and payment for the adjustment of catch basins and catch basin manholes will be per each catch basin and catch basin manhole frame and grate adjusted.

.2 Unit price to include saw-cutting, removal of asphalt, removal of granular base and prepared subgrade materials as needed to expose the grade rings, temporary removal of the frame and grate, supply of and grouting in place additional grade rings as required, removal of grade rings as required, replacing the frame and grate, restoration of the pavement structure, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 ADJUSTMENT OF HYDRANTS

.1 Measurement and payment for the adjustment of hydrants will be per each hydrant adjusted.

.2 Unit price to include excavation as needed to expose the spool piece, temporary removal of the hydrant body, removal of the spool piece and hydrant rod, replacing the hydrant rod and spool piece with an appropriate unit to achieve the required adjustment, replacing the hydrant body, backfilling the excavation, surface restoration, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 ADJUSTMENT OF WATER VALVES

.1 Measurement and payment for the adjustment of water valves will be per each water valve adjusted.

.2 Unit price to include saw-cutting, removal of asphalt, removal of granular base and prepared subgrade materials as needed to expose the adjustable portion of the water valve casing, adjustment of the water valve casing as needed to achieve the required adjustment, restoration of the pavement structure, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

.1 AWWA B300, Hypochlorites

.2 AWWA C104/A21.4, Cement-Mortar Lining for Ductile Iron Pipe and Fittings

.3 AWWA C110, Ductile-Iron and Gray-Iron Fittings

.4 AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

.5 AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast

.6 AWWA C153, Ductile-Iron Compact Fittings

.7 AWWA C200, Steel Water Pipe, 6 in. (150 mm) and Larger

.8 AWWA C206, Field Welding of Steel Water Pipe

.9 AWWA C207, Steel Pipe Flanges for Waterworks Service – Sizes 4 in. Through 144 in. (100 mm Through 3,600 mm)

.10 AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings

.11 AWWA C500, Metal-Seated Gate Valves for Water Supply Service

.12 AWWA C502, Dry-Barrel Fire Hydrants

.13 AWWA C503, Wet-Barrel Fire Hydrants

.14 AWWA C509, Resilient-Seated Gate Valves for Water Supply Service

.15 AWWA C512, Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service

.16 AWWA C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

.17 AWWA C550, Protective Interior Coatings for Valves and Hydrants

.18 AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances

.19 AWWA C604, Installation of Buried Steel Water Pipe – 4 in. (100 mm) and Larger

.20 AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

.21 AWWA C651, Disinfecting Water Mains

.22 AWWA C655, Field Dechlorination

.23 AWWA C800, Underground Service Line Valves and Fittings

.24 AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. through 60 in. (100 mm – 1,500 mm)

.25 AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, ¾ in. (19 mm) Through 3 in. (76 mm), for Water Service

.26 AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in. (100 mm Through 1,650 mm), for Waterworks

.27 AWWA C907, Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 in. through 12 in. (100 mm through 300 mm), for Water, Wastewater, and Reclaimed Water Service

.28 AWWA M11, Steel Pipe: A Guide for Design and Installation

.29 AWWA M17, Fire Hydrants: Installation, Field Testing, and Maintenance
.30 AWWA M23, PVC Pipe – Design and Installation
.31 AWWA M41, Ductile-Iron Pipe and Fittings
.32 AWWA M55, PE Pipe – Design and Installation

.2 Canadian Standards Association (CSA)

.1 CSA A3000, Cementitious Materials Compendium
.2 CSA B137 Series Package, Thermoplastic Pressure Piping Standards Package
.3 CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables
.4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement
.5 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles
.6 CSA Z662, Oil and Gas Pipeline Systems

.3 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM A48/A48M, Standard Specification for Gray Iron Castings
.2 ASTM A105, Standard Specification for Carbon Steel Forgings for Piping Applications
.3 ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
.4 ASTM A536, Standard Specification for Ductile Iron Castings
.5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings
.6 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric)
.7 ASTM B418, Standard Specification for Cast and Wrought Galvanic Zinc Anodes
.8 ASTM B584, Standard Specification for Copper Alloy Sand Castings for General Applications
.9 ASTM B843, Standard Specification for Magnesium Alloy Anodes for Cathodic Protection
.10 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
.11 ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
.12 ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

.4 American Society of Mechanical Engineers (ASME)

.1 ASME B16.1/ASME B16.5, Pipe Flanges and Flanged Fittings Package

1.2 SUBMITTALS

.1 Submittals shall be in accordance with Section 1 04 00 – Submittal Procedures.

.2 At least 4 weeks prior to commencing work, submit manufacturer's product data, shop drawings, and certification that materials meet the requirements of this Section.

.3 Product Data:

.1 Submit manufacturer's instructions, product literature, and data sheets for watermain pipe and associated appurtenances and include product characteristics, performance criteria, physical size, finish, and limitations.

.4 Submit shop drawings for review and approval by the Owner's Representative if required.

.5 Submit manufacturer's MSDS sheets for the type of chlorination and dechlorination agents to be used for the disinfection and dechlorination process.

Part 2 Products

2.1 POTABLE WATER COMPLIANCE

.1 All substances, materials, and compounds (e.g., pipes, coatings, solders, valves, gaskets, lubricants, resins, etc.) that may come into contact with water that is, or will be treated to be, potable shall conform to ANSI/NSF Standard 61 for health effects and the product certified for potable use by an agency accredited by the Standards Council of Canada (e.g., NSF, CSA, UL, etc.).

2.2 PIPE, JOINTS, AND FITTINGS

.1 Pipe to be compatible with specified mechanical joints, fittings, and valves without the use of special adaptors.

.2 Polyvinyl Chloride (PVC) Pipe:

.1 PVC watermain shall have standard nominal diameters as indicated on the Drawings, based on cast iron outside diameters (CIOD), unless otherwise specified.

.2 Pipe materials and fabrication shall conform to AWWA C900. An Affidavit of Compliance to the AWWA C900 standard to be supplied upon request.

.3 PVC watermain shall have a dimension ratio (DR) of 18, unless otherwise specified.

.4 PVC watermain used to convey a potable water supply shall be blue. No other pipe colour may be used. Other utilities, including sewer gravity and forcemains, and non-potable watermains, shall use a different colour of PVC pipe.

.5 Test PVC pipe in accordance with AWWA C900 and CSA B137.3.

.6 Gasket material shall be in accordance with the physical requirements specified in ASTM F477.

.7 Fabricated PVC fittings: to AWWA C900 and CSA B137.3, Class 150. Use push-on type ends complete with one gasket for each bell.

.8 Injection-molded PVC fittings: to AWWA C907 and CSA B137.2, Class 150. Use push-on type ends complete with one gasket for each bell.

.9 Cast Iron Fittings: to AWWA C110, minimum 1,720 kPa working pressure and ASTM A48, Class 30B. Castings to have no cracks, gas holes, or flaws. Surfaces shall be reasonable smooth with no burnt on sand. Casting runners, risers, and fins shall be removed. Castings shall be true to pattern, and within industry

standard dimensional tolerances with no excessive shrinkage or deformity. Use single rubber gasket push-on joints.

.10 All joints and fittings to be compatible with the design, test, and surge pressures of the adjoining pipe.

.11 Use push-on type ends complete with one gasket for each bell.

.3 High Density Polyethylene (HDPE) Pipe:

.1 HDPE pipe shall have standard nominal diameters based on iron pipe size (IPS), unless otherwise specified.

.2 Pipe materials and fabrication shall conform to AWWA C906.

.3 HDPE pipe used to convey a potable water supply shall be marked with a continuous blue stripe.

.4 HDPE pipe shall conform to AWWA C906 for working pressure rating as applicable and shall have a dimension ratio (DR) of 11, unless specified otherwise.

.5 Fittings and joints shall be assembled by electro-fusion or butt-fusion to ASTM F2620. Mechanical connections are not permitted.

.6 Flanged fittings and connections are to be used on the branch side of the pipe at tees, wyes, elbows, etc.

.7 Polyethylene fittings: to AWWA C906 and CSA B137.1, flange end with metal back-up ring.

.8 All joints and fittings to be compatible with the design, test, and surge pressures of the adjoining pipe.

.4 Ductile Iron (DI) Pipe:

.1 The use of ductile iron pipe requires prior approval from the Municipality.

.2 Pipe materials and manufacture shall conform to AWWA C151/A21.51 and ASTM A536.

.3 Class and wall thickness as specified on the Drawings.

.4 Use single rubber gasket push-on joints in accordance with AWWA C111/A21.11.

.5 The use of mechanical joints requires prior approval from the Municipality.

.6 Fittings shall be full body to AWWA C110 or compact to AWWA C153.

.7 Interior pipe coatings shall be cement-mortar lining with asphaltic seal coat to AWWA C104/A21.4.

.8 Exterior pipe coatings shall be an asphaltic seal coat to AWWA C151/A21.51.

.9 All joints and fittings to be compatible with the design, test, and surge pressures of the adjoining pipe.

.5 Steel Pipe:

.1 Steel watermain to conform to AWWA C200.

.2 The minimum yield strength of the steel shall be as specified but shall not be less than 207 MPa.

.3 Pipe materials and fabrication shall conform to AWWA C200. Documentation indicating pipe ASTM/CSA standard used, a mill certificate, and an Affidavit of

Compliance to the AWWA C200 standard to be provided for all steel pipe supplied.

.4 Pipe wall thickness shall be as specified, but shall not be less than 6.35 mm.

.5 Bevel ends of pipe for field butt welding, unless specified otherwise. Bevel ends to an angle of 30º from a line drawn at right angles to the axis of the pipe, with a tolerance of +5º to -0º. The root face for butt welding shall be 1.6 mm ± 0.8 mm.

.6 Use couplings only where designated on the Drawings. Couplings shall be restrained or have poured-in-place concrete thrust blocks as directed by the Owner's Representative. All coupling locations shall be recorded and indicated on the Record Drawings.

.7 Pipe lengths supplied shall have an average length of 8.84 m and a minimum length of 6.1 m. Pipe lengths containing girth welds shall not be permitted without written authorization from the Municipality.

.8 End welding of longitudinal seams shall be done with automatic submerged-arc welding or automatic shielded-arc welding. Manual welding of girth seams on straight pipe sections is not permitted.

.9 All joints and fittings to be compatible with the design, test, and surge pressures of the adjoining pipe.

.10 Fittings to AWWA C200 and AWWA C208, minimum working pressure of 1,035 kPa and minimum 207 MPa yield point strength. Use slip-on flanges of forged steel, in accordance with AWWA C207, Class D, flat faced or weld-neck flanges to ANSI B16.1, Class 125.

.11 Use stainless steel, Type 304 double threaded studs, with 2 nuts, treated to prevent binding.

.12 Use full-faced rubber gaskets for 1,035 kPa working pressure.

.13 Use weldolets and threadolets of forged steel in accordance with ASTM A105.

.14 Welding of shop fabricated fittings to conform to CSA Z662.

.15 Each pipe shall be marked to identify the manufacturer and shipment number.

2.3 BOLTS AND NUTS

.1 Unless otherwise specified, bolts and nuts to be stainless steel, Type 304 to ASTM A193, with threads treated to prevent binding.

2.4 CATHODIC PROTECTION

.1 Magnesium Anodes: high potential, type M1C in accordance with ASTM B843.

.2 Zinc Anodes: Type II in accordance with ASTM B418.

.3 Core: perforated galvanized steel not exceeding 0.15 kg/m. The core length shall be a minimum of 75% of the anode length and shall be centered in the diameter of the anode.

.4 Lead Wire: No. 10 AWG stranded copper conforming to CSA C22.2 No. 38; 3 m long; insulation colour: blue for magnesium, white for zinc.

.5 Lead Wire Connection: the anode lead wire shall be silver-soldered (brazed) to the steel core using a suitable filler material and flux. The joint shall be cleaned before brazing by

removal of zinc from the core and after brazing by removal of all flux. The completed connection shall be sealed using an acceptable electrical potting compound.

.6 Anode Container: water permeable cardboard tube or bag.

.7 Shipping Container: watertight plastic bags complete with label identifying the casting manufacturer, packaging company, anode metal, anode weight, date package, and supplier reference number.

.8 Refer to Section 7 of the Municipality's *Design Servicing Standards and Development Procedures*.

.9 Corrosion protection for welds: Roskote A51 mastic or approved equal.

.10 Conductivity Cables: 8 AWG stranded copper conforming to CSA 22.2 No. 38.

2.5 VALVES AND VALVE BOXES

.1 Gate Valves (100 mm to 300 mm diameter)

.1 To AWWA C509; non-rising stem.

.2 Epoxy-coated (to AWWA C550) iron body, bronze mounted, resilient seated, Type 304 stainless steel stem, single ring gasket, push-on joints to connecting to PVC or ductile iron pipe, opens counterclockwise, O-ring stem seals.

.2 Gate Valves (350 mm diameter and larger)

.1 To AWWA C515; non-rising stem.

.2 Epoxy-coated (to AWWA C550) iron body, bronze mounted, resilient seated, Type 304 stainless steel stem, opens counterclockwise, O-ring stem seals.

.1 350 mm and 400 mm: single ring gasket, push-on joints for connecting to PVC or ductile iron pipe.

.2 450 mm and larger: mechanical joints, single ring gasket.

.3 Bypass valve shall be built into the body of the valve.

.3 Cast Iron Valve Boxes:

.1 Epoxy coated two-piece cast iron sliding type adjustable over a minimum of 450 mm.

.2 50 mm square operating nut with rock guard flange.

.3 Valve operating extension rod shall be square (25 mm x 25 mm), of such length that when set on the valve operating nut, the top of the rod will not be more than 150 mm below the cover.

.4 Top of box to be marked "WATER" with cored handholes.

.4 Air Release and Vacuum Valves:

.1 To AWWA C512.

.2 Cast iron body with threaded or flanged connections as required.

.3 Minimum 1,035 kPa working pressure.

.5 Water Meter Valves (Inlet, outlet & bypass):

.1 To AWWA C800-89.

.2 Brass ball valve with pad-lock wings and opening in a counter clock-wise direction.

.3 Minimum 1,035 kPa working pressure.

2.6 VALVE CHAMBERS

.1 Cast-in-place concrete:

.1 To Section 3 02 30 - Cast-in-Place Concrete.

.2 Cement: to CSA A3001, Type HS.

.2 Concrete reinforcement: to Section 3 02 20 - Concrete Reinforcement.

.3 Precast concrete sections:

.1 To ASTM C478/C478M.

.2 Top sections: eccentric cone or flat slab top type with opening offset for ladder installation.

.4 Frames and covers: to dimensions as indicated and the following requirements:

.1 Metal grates to bear evenly on frames.

.1 A frame with a cover shall constitute one unit.

.2 Gray iron castings: to AASHTO M306 and ASTM A48/A48M.

.3 Castings to be coated with two applications of asphalt varnish or sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Frames and covers shall be of the type(s) indicated on the Drawings.

.5 Cover to be marked "WATER".

.5 In areas where the water table is above the bottom of the valve chamber, a waterproofing admixture shall be added to the concrete mix design, in addition to one of these two methods, as indicated on the Drawings:

.1 The outer surface of the valve chamber, including under the base, shall have two coats of an approved bitumastic coating applied (501 Sealmastic or approved equal), or

.2 The outer surface of the valve chamber, including under the base, shall be covered by a fully sealed exterior waterproofing membrane (Colphene 3000 c/w Elastocol Stick H_20 or approved equal).

.6 All joints shall be sealed with rubber gaskets confirming to ASTM C443M.

.7 Ladder rungs shall be standard safety pattern (drop step type), aluminum forged of 6061-T6 alloy having a minimum tensile strength of 260 MPa.

.8 Grade rings: to ASTM C478/C478M.

2.7 SERVICE CONNECTIONS

.1 Full pressure services: to AWWA C800 or C900 as applicable.

.1 Copper tubing (50 mm diameter and smaller): Type K, annealed, to ASTM B88M, thaw wire (insulated).

.1 Approved products: Wolverine, Cerro, Halstead, or approved equivalent.

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

.2 PVC pipe (100 mm diameter and larger): DR18 unless specified otherwise.

.2 Trickle fill services: to AWWA C906.

.3 Couplings: standard brass, compression type to AWWA C800.

.4 Service saddles:

.1 Stainless steel, Type 304 to ASTM A193 or cast bronze to ASTM B62.

.2 Approved products:

.1 Robar 2706 cast bronze (100 mm to 600 mm).

.2 Robar 2626 stainless steel (100 mm to 450 mm).

.3 Stainless steel service clamps: for PVC pipe service connections. Service clamps to be strap-type, with taper seal cemented in place. Clamps to be tapped with threads to AWWA C800.

.5 Taps:

.1 Threaded without service clamps. Do not use galvanized malleable iron in corrosive soils.

.6 Corporation stops:

.1 Compression type, to AWWA C800.

.2 Red brass to ASTM B62.

.3 Approved products: Mueller, Cambridge Brass, or approved equivalent.

.7 Curb stops:

.1 Brass inverted key-type stop-and-drain, compression type to AWWA C800.

.2 Complete with adjustable epoxy coated cast iron service box with stainless steel stem to suit depth of bury.

.3 Top of cast iron box marked “WATER”.

.4 Approved products: Mueller, Cambridge Brass, or approved equivalent.

.8 All fittings to withstand a test pressure of 1,035 kPa.

2.8 HYDRANTS

.1 To AWWA C502 (dry-barrel hydrants) or AWWA C503 (wet-barrel hydrants) and AWWA C550.

.2 Approved products: as directed by the Municipality.

.3 Hydrants are to be complete with a breakaway flange and a 600 mm (maximum) spool piece.

.4 Drain outlets shall be provided. Plug all drain ports or as directed by the Owner’s Representative.

.5 Hydrants shall have two 63.5 mm hose connections and one 114 mm pumper connection. Threads on hose and pumper connections shall be as required by the Municipality.

.6 Hydrant main spindles shall turn counterclockwise to open.

.7 A gate valve shall be provided on each connection between a hydrant and main, as per the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.8 Municipal hydrants shall be red and private hydrants yellow in colour, painted with alkyd exterior gloss enamel.

2.9 PIPE ZONE MATERIAL

.1 Granular pipe zone material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Concrete pipe bedding and surround material shall be in accordance with Section 3 02 30 – Cast-in-Place Concrete.

2.10 BACKFILL MATERIAL

.1 Backfill material shall be in accordance with Section 3 04 00 – Aggregate Materials.

2.11 THRUST BLOCKS

.1 Concrete for thrust blocks shall be in accordance with Section 3 02 30 – Cast-in-Place Concrete.

2.12 MECHANICAL RESTRAINTS

.1 Restraint devices: high strength ductile iron in accordance with ASTM A536.

.2 Bolts and connecting hardware: high strength, low alloy material in accordance with AWWA C111/A21.11

.3 Ensure tie bolts are compatible with coupling.

2.13 TRACER WIRE

.1 Tracer wire to be 12-gauge copper clad steel, HDPE insulated, rated for direct bury, white in colour.

.2 Tracer wire shall be terminated in a valve casing or in a flush mounted tracer wire access box, with a minimum of 500 mm excess wire inside the box. All termination points must be properly grounded by use of a drive-in magnesium grounding anode rod.

2.14 CORROSION PROTECTION

.1 In addition to cathodic protection per article 2.5, all buried nuts, bolts, transition couplings, restraints, and metal fittings to be wrapped with Denso paste and tape.

2.15 TEMPORARY WATER SUPPLY

.1 Temporary aboveground water connections shall be Series 200 Type III PE-3048 polyethylene pipe meeting the requirements of CSA B137.1.

.2 Materials used for temporary water services shall only be used for that purpose and shall not be used to perform any other function.

.3 Pipe and fittings shall be watertight and capable of withstanding an operating pressure of 620 kPa within the existing water distribution network.

2.16 CHLORINATION AND DECHLORINATION AGENTS

.1 Chlorination: calcium hypochlorite or sodium hypochlorite to AWWA B300.

.2 Dechlorination: ascorbic acid to AWWA C655.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.

.2 Carefully inspect materials for defects to the approval of the Owner's Representative.

.3 Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling.

.2 Allowable tolerances in alignment and grade shall be as follows:

.1 Alignment: ± 50 mm

.2 Grade: ± 20 mm

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Complete concrete Work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete as specified on the Drawings, the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*, or as directed by the Owner's Representative.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weigh pipe down to prevent flotation when concrete is placed.

3.4 PIPE ZONE MATERIAL

.1 Place pipe zone material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.5 PVC PIPE INSTALLATION

.1 Lay and join pipe in accordance with AWWA M23 and AWWA C605.

.2 Bevel or taper ends of pipe to match fittings.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade. Do not lay pipe on frozen bedding.

.5 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment or grade and pipe which shows differential settlement after installation.

.6 Face bell ends in the direction of laying. Where possible, face bell ends up-grade.

.7 Align pipes carefully before jointing.

.8 Do not exceed the permissible deflection at joints as recommended by the pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight plug at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.11 Cut pipes in an approved manner, as recommended by the pipe manufacturer, without damaging the pipe and to leave a smooth end at right angles to axis of pipe.

.12 Install gaskets in accordance with manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

.13 Avoid displacing or contaminating the gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before jointing is attempted again.

.14 Apply sufficient pressure in making joints to ensure that each joint is completed to the manufacturer's recommendations.

.15 Complete each joint before laying the next length of pipe.

.16 Minimize deflection after joint has been made.

.17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck pipe joints assembled aboveground after placing in trench to ensure that no movement of the joint has taken place.

3.6 HDPE PIPE INSTALLATION

.1 Any section of pipe containing gouges or scratches exceeding 50% of the manufacturer's recommended limits will be rejected.

.2 Handle pipes by approved methods.

.3 Pipe shall be checked before jointing to ensure no foreign material or manufacturer's defects exist that might prevent the proper jointing of the pipe or its operation.

.4 Lay and join pipe in accordance with AWWA M55.

.5 Lay pipes on prepared bed, true to line and grade. Do not lay pipe on frozen bedding.

.6 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment or grade and pipe which shows differential settlement after installation.

.7 When possible, the jointing shall be carried out at ground elevation and the jointed pipe subsequently lowered into the trench.

.8 HDPE pipe shall be jointed by electro-fusion or butt-fusion in accordance with ASTM F2620 and in accordance with the pipe manufacturer's recommended procedure for jointing the pipe.

.1 Pipe or fittings jointed by any form of fusion method shall be performed by technicians certified by the pipe manufacturer.

.2 Deflections at joints shall not be accepted unless they form part of a deflection fitting made on-site.

.9 Remove all cuttings from the interior of the pipe before fusing.

.10 Joints between pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 4 mm. The tensile strength of the fused joints shall not be less than that of the pipe.

.11 All joints shall be recorded, with the name of the certified operator, time, date, diameter, wall thickness, heating plate, temperature, fusing time, and cool down time identified.

.12 The operator shall immediately report any joint that fails to the Owner’s Representative.

.13 The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water and other material during periods when pipe is not being installed.

.14 Dispose of all cuttings from the fusion operation.

3.7 DUCTILE IRON PIPE INSTALLATION

.1 Lay and join pipe in accordance with AWWA C600 and the manufacturer's recommendations.

.2 Lay pipes on prepared bed, true to line and grade. Do not lay pipe on frozen bedding.

.3 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment or grade and pipe which shows differential settlement after installation.

.4 Cut pipes where necessary to fit valves and fittings. Make cuts in accordance with the manufacturer's recommendations.

.5 Lower pipe in the trench using proper equipment, tools, and sling to protect pipe's coating.

.6 Face bell ends in the direction of laying. Where possible, face bell ends up-grade.

.7 Align pipes carefully before jointing.

.8 Do not exceed the permissible deflection at joints as recommended by the pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight plug at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.11 Cut pipe as required for fittings, square to centreline, and as recommended by the pipe manufacturer. Do not damage the pipe lining or coating and leave a smooth bevelled edge.

.12 Install gaskets in accordance with manufacturer's recommendations. Use only the lubricant that is supplied by the manufacturer.

.13 Support pipes with hand slings or crane as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

.14 Avoid displacing or contaminating the gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before jointing is attempted again.

.15 Apply sufficient pressure in making joints to ensure that each joint is completed to the manufacturer's recommendations.

.16 Complete each joint before laying the next length of pipe.

.17 Minimize deflection after joint has been made.

.18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.20 Recheck pipe joints assembled aboveground after placing in trench to ensure that no movement of joint has taken place.

.21 Install sacrificial anodes and test leads as designated for cathodic protection where indicated.

.22 Install polyethylene encasement on ductile iron pipe and fittings. Any damage to the polyethylene must be repaired to the satisfaction of the Owner's Representative.

3.8 STEEL PIPE INSTALLATION

.1 Pipe shall be checked before jointing to ensure no foreign material or manufacturer's defects exist that might prevent the proper jointing of the pipe or its operation.

.2 Repair defects in or damages to the protective coating before lowering the pipe into the trench.

.3 If the protective coating is damaged during the lowering-in process, remove the pipe from the trench and repair the coating to the satisfaction of the Owner's Representative.

.4 Lay and join pipe in accordance with AWWA M11, AWWA C604, and the manufacturer's recommendations. Weld pipe in accordance with CSA Z662.

.5 Lay pipes on prepared bed, true to line and grade. Do not lay pipe on frozen bedding.

.6 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment or grade and pipe which shows differential settlement after installation.

.7 Cut pipes where necessary to fit valves and fittings. Make cuts in accordance with the manufacturer's recommendations. Do not damage the pipe lining or coating and leave a smooth bevelled edge.

.8 Lower pipe in the trench using proper equipment, tools, and sling to protect pipe's coating.

.9 Align pipes carefully before jointing.

.10 Complete each joint before laying the next length of pipe.

.11 Position and join pipes with suitable equipment and methods.

.12 Support fittings to reduce loading and/or stress on the adjoining pipe.

.13 Cover the open end of the pipe in the trench to prevent the entrance of trench water or other material during periods when pipe is not being installed.

.14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.15 Install sacrificial anodes and test leads as designated for cathodic protection where indicated.

3.9 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated on the Drawings and in accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.2 Support valves on a concrete seating block on solid ground. Valves shall not be supported by the pipe, except in the case of water meter valves up to 50 mm.

.3 The maximum length of unsupported pipe on each end of the valve shall be 1 m.

3.10 VALVE CHAMBER INSTALLATION

.1 Construct valve chambers in accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures* and in accordance with the approved shop drawings, plumb and true to alignment and grade.

.2 Complete valve chambers as pipe laying progresses.

.3 Set precast concrete base on a 100 mm minimum layer of washed rock.

.4 Make each joint watertight with approved rubber gaskets.

.5 Plug lifting holes with non-shrink grout.

.6 Installing valve chambers in existing systems:

.1 Where a new valve chamber is to be installed along an existing pipe, ensure full support of the existing pipe during installation and install new valve chamber as specified.

.2 Make joints between the new valve chamber and existing pipe watertight.

.7 Place frame and cover on the top section to the elevation indicated on the Drawings.

.1 If adjustment is required, use precast concrete grade ring(s).

.8 Valve chambers are not to remain uncovered, even if at incomplete height.

.9 Clean valve chambers of debris and foreign materials.

.10 Valve chambers shall be made watertight with exterior membrane.

3.11 SERVICE CONNECTION INSTALLATION

.1 Install water services as per the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures* and manufacturer's recommendations.

.2 Construct service connections at right angles to the watermain.

.3 Employ only competent workers equipped with suitable tools to carry out tapping of mains, cutting, and flaring of pipes.

.4 Leave corporation stops fully open.

.5 In order to relieve strain on connections, install service pipe in gooseneck form in a horizontal position.

.6 All services greater than 75 mm require a minimum 19 mm injection point and/or flush point minimum 50 mm for testing.

3.12 WATER METER INSTALLATION

.1 Water meter settings shall be constructed using only approved materials in accordance with these standards and shall meet the following requirements:

.1 In accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.2 Such that the setting is fixed, rigid and properly supported.

.3 With an opening of sufficient length to suit the meter and any appurtenances to be installed.

.4 With threaded fittings to suit the flange or tail pieces, as the case may require.

.5 In a location where the meter will be protected from temperature extremes and accessible for the purpose of reading, inspection and maintenance.

.6 In a horizontal position.

.7 With inlet and outlet control valves within 300 mm of the meter.

.8 Bypasses shall not be constructed in any case unless permission has been granted in writing by the Municipality.

.9 Install grounding wires as per manufacturer's specifications.

3.13 HYDRANT INSTALLATION

.1 Install hydrants at locations as indicated in the Drawings and as per the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.2 Install hydrants in accordance with AWWA M17.

.3 Support hydrant base on a concrete seating block as indicated on the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.4 Provide a minimum of 1.0 m^3 of washed rock to allow unobstructed draining of the hydrant. Washed rock is to be covered with filter fabric to prevent infiltration of backfill materials.

.5 Install hydrant plumb, with breakaway flange horizontal and pumper connection facing roadway. Do not cause the hydrant to move out of plumb or out of position when placing and compacting backfill material.

.6 Place appropriate signage on installed hydrants indicating if they are in service during construction.

.7 Hydrant Flow Testing:

.1 New hydrants and any hydrants that were modified as part of the Work are to be flow tested in accordance with NFPA 291.

.2 Inform the Municipality of the date, time, and location of hydrant flow testing at least 72 h prior to the test time.

.3 The results of the flow testing are to be recorded in a Hydrant Flow Test Report to be submitted to the Owner's Representative and the Municipality.

.4 The bonnets and caps of municipal hydrants shall be painted as per NFPA standards; refer to Section 7 of the Municipality's *Design Servicing Standards and Development Procedures*. Paint shall be of a permanent, reflective type, suitable for the hydrant body material.

.5 Water discharged from hydrants shall be dechlorinated prior to discharge to a storm sewer or the environment.

.6 The Contractor shall pay for water usage based on the measured flow rate and the duration of the test.

.8 Hydrant Static Pressure Testing:

.1 New hydrants and any hydrants that were modified as part of the Work are to be pressure tested in accordance with NFPA 291. The procedure is as follows:

.1 Install a pressure gauge and bleeder valve on one of the 65 mm hydrant ports.

.2 With the bleeder valve open, slowly open the hydrant to drain off air and expose the pressure gauge to system pressure. Close the bleeder valve.

.3 Close the hydrant isolation valve.

.4 Monitor the pressure gauge to ensure there is no loss in pressure over a 5 minute period.

.5 Close the hydrant and re-open the isolation valve.

.6 If the static pressure test fails, the Contractor shall be responsible for completing any repairs as required.

3.14 THRUST BLOCKS AND RESTRAINED JOINTS

.1 Supply and place concrete for thrust blocks in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks at valves, tees, crosses, plugs, caps, bends, reducers, and fittings to undisturbed ground as indicated on the Drawings, the applicable Standard Details in the Municipality's *Design Servicing Standards and Development Procedures*, or as directed by the Owner's Representative.

.3 Keep joints and couplings free of concrete. Keep drain ports on hydrants free of concrete.

.4 Mechanically restrain all connections of pipe, bends, fittings, and valves as indicated on the Drawings and applicable Standard Details in the Municipality's *Design Servicing Standards and Development Procedures*.

3.15 INSULATION

.1 Install insulation in accordance with the manufacturer's recommended installation procedures and as shown on the Drawings and applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

3.16 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Complete field density testing around valves, valve chambers, and vaults in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.17 PRESSURE AND LEAKAGE TESTING

.1 Testing of watermains shall not commence until all mains have been completely installed, including all water services and air relief services, the excavation has been partially or completely backfilled, and thrust blocks have cured. A minimum of 3 days is required in the case of high early strength concrete and a minimum of 7 days is required in the case of normal concrete.

.2 Testing of watermains shall be conducted by competent and experienced personnel using equipment appropriate for the piping being tested.

.3 Do not conduct watermain testing when the ambient air temperature drops below -5°C during the test period. If the temperature drops below -5ºC at any time during the testing, the testing shall be considered invalid and re-testing will be required.

.4 Conduct pressure and leakage testing in the presence of the Owner's Representative.

.5 Conduct pressure and leakage testing for **PVC pipe** in accordance with the following:

- .1 In accordance with AWWA C605 and AWWA M23.
- .2 Ensure corporation stops are open and curb stops are closed.
- .3 Inform the Municipality and the Owner's Representative of the date, time, and location of the pressure and leakage tests at least 72 hours prior to the test time. Failure to notify the Municipality may result in tests being unaccepted.
- .4 Open all main valves in the test section.
- .5 Hydrants isolation valves within the test section shall be closed during testing.
- .6 Inform other construction crews or Contractors of the testing and confirm that no valves are being operated during the test.
- .7 Test duration shall be 2 h.
- .8 Test section shall not exceed 450 m.
- .9 Ensure air is expelled from the section of watermain by exhausting trapped air at high points and dead-ends. Air content can be minimized through the following procedure:
  - .1 Bleed air from the pipe slowly.
  - .2 Fill the watermain at a velocity of less than 0.6 m/s.

.10 The test pressure shall be the greater of 150% of the normal operating pressure at the lowest elevation of the test section, or 125% of the normal operating pressure at the highest elevation in the test section, or 1,035 kPa. Confirm test pressure with the Owner's Representative prior to pressure and leakage testing.

.11 Raise the watermain pressure to the appropriate test pressure using either a hand or motor-powered pump located at a hydrant. Completely open the hydrant valve. The flow rate shall be controlled by the valve at the pump.

.12 Carefully mark the gauge and the level of water in the storage barrel at the beginning of the test.

.13 Maintain the test pressure within 20 kPa of the specified test pressure for the duration of the test.

.14 Pump the test section back to the test pressure at the end of the first 30 minutes. If the allowable leakage is exceeded, air may be trapped. Remove trapped air and repeat the test.

.15 No allowance shall be made for services or in-line valves.

.16 The allowable leakage shall be calculated based on the following formula:

$Q_m = L * D * P^{0.5} / 795{,}000$, where:

Q_m = quantity of make-up water (L/h)

L = length of pipe section being tested (m)

D = nominal diameter of pipe (mm)

P = average test pressure (kPa)

.17 Record the leakage test results.

.18 No installation shall be accepted if the quantity of make-up water is greater than the calculated allowable leakage.

.6 Conduct pressure and leakage testing for **HDPE pipe** in accordance with the following:

.1 In accordance with AWWA M55.

.2 Follow the procedure for pressure and leakage testing for PVC pipe, as per article 3.16.5, with the following adjustments:

.3 The test pressure shall be the greater of 150% of the normal operating pressure at the lowest elevation of the test section, or 125% of the normal operating pressure at the highest elevation in the test section, or 1,035 kPa. Confirm test pressure with the Owner's Representative prior to pressure and leakage testing.

.1 Maintain the hydrostatic test pressure for 4 hours and add water as needed. Do not measure this volume; hydrostatic pressure expands the pipe.

.2 Begin test. Reduce the pressure to 70 kPa below the hydrostatic test pressure.

.3 Monitor the pressure for 1 hour.

.4 The pipe is acceptable if the pressure drop over 1 hour does not exceed 5%.

.5 Record the leakage test results.

.4 Under no circumstances shall the total time for initial pressurization and time at test pressure exceed 8 hours at the hydrostatic test pressure.

.1 If the test is not completed due to leakage, equipment failure, or any other reason within this total time, the test section shall be depressurized

and allowed to “relax” for at least 8 hours before starting the next testing sequence.

.7 Conduct pressure and leakage testing for **Ductile Iron pipe** in accordance with the following:

.1 In accordance with AWWA C600 and AWWA M41.

.2 Follow the procedure for pressure and leakage testing for PVC pipe, as per article 3.16.5.

.8 Conduct pressure and leakage testing for **Steel pipe** in accordance with the following:

.1 In accordance with AWWA C206 and AWWA M11.

.2 Follow the procedure for pressure and leakage testing for PVC pipe, as per article 3.16.5, with the following adjustments:

.1 Fill cement mortar lined pipes with water 24 hours prior to hydrostatic testing.

.2 Test duration shall be 4 hours.

.3 The test pressure shall be the greater of 125% of the normal operating pressure as measured at the highest point in the test section, or 150% of the normal operating pressure as measured at the lowest elevation of the test section, or 1,035 kPa. Confirm test pressure with the Owner’s Representative prior to pressure and leakage testing.

.1 The test pressure must not exceed the rated valve pressure (as per AWWA C500) when resilient-seated gate valves or butterfly valves are at the pressure boundary.

.4 Maintain the test pressure within 34.5 kPa of the specified test pressure for the duration of the test.

.5 Valves within the test section must not be operated for the duration of the pressure and leakage testing.

.6 The allowable leakage shall be 0.93 L/day/mm diameter/km of length.

.7 There is no allowable leakage for the testing of welded steel watermains.

.8 The use of air or other gaseous mediums for pressure testing of steel watermains shall not be permitted under any circumstances.

.9 Coordinate the supply of potable water for watermain testing. The Municipality will pay for the volume of potable water required for up to 3 complete fillings of the pipeline being tested.

.1 The use of hydrants for the supply of water for pressure testing requires prior approval from the Municipality. Hydrants used for this purpose shall include a lock, a water meter, and a reduced pressure backflow preventer.

.10 The Municipality shall have unrestricted access to the site during watermain testing.

.11 The Contractor shall confirm that test sections will maintain pressure prior to the Owner’s Representative being on-site.

3.18 WATERMAIN FLUSHING

.1 Upon completion of pressure and leakage testing, watermains shall be thoroughly flushed to remove all foreign matter.

.2 Flushing of watermains shall not commence until all mains have been completely installed, including all water services and air relief services, and the pressure and leakage testing has been completed.

.3 Flushing of watermains shall be conducted using a uni-directional flushing strategy and shall be completed by competent and experienced personnel using equipment appropriate for the piping being flushed.

.1 The use of hydrants for the supply of water for pressure testing requires prior approval from the Municipality. Hydrants used for this purpose shall include a lock, a water meter, and a reduced pressure backflow preventer.

.4 Conduct watermain flushing in the presence of the Owner's Representative, in accordance with the project's Flushing Strategy/Water Distribution System Disinfection and Flushing Plan, and in accordance with the following:

.1 Flushing runs shall not exceed 450 m in length.

.2 The flushing velocity shall be 1.5 m/s for watermains 300 mm in diameter and smaller, and 0.9 m/s for watermains larger than 300 mm in diameter.

.3 Water shall be exchanged a minimum of 5 times to achieve a completed flush. Water quality sampling reports shall confirm a completed flush.

.4 The source water shall flow from larger pipe to smaller pipe, wherever practical.

.5 The Municipality shall have unrestricted access to the site during watermain flushing.

.6 Swabbing:

.1 When it is not possible to achieve a flushing velocity of 0.9 m/s, the watermain shall be swabbed prior to disinfection.

.2 The Contractor shall supply and install temporary launch/retrieval ports to facilitate swabbing and remove these items following completion of the swabbing.

.3 The Contractor shall provide connections and pumps for swabbing as required.

.4 Each pipe to be swabbed shall be swabbed with a minimum of 4 swabs (pigs): 2 scrubbing swabs and 2 foam swabs.

.5 Each swab shall be launched at a short interval.

.6 Swabs shall be medium density urethane bullet type and shall have a diameter of at least 50 mm larger than the largest pipe nominal diameter.

.7 The pipe shall be filled with water before launching the first swab.

.8 After the first swab has been launched, continue pumping until the swab has travelled at least 30 m or until 5 minutes have passed, then launch the second swab. Continue to launch the third and fourth swabs at the same interval.

.9 Continue to flush the line for 5 minutes after the fourth swab has been retrieved and collect a sample for turbidity testing. Should the turbidity be greater than 0.5 NTU, repeat swabbing.

.7 Flush water shall not be discharged to sanitary or storm sewer systems. Flush water and debris shall be discharged, in accordance with Alberta Environment requirements, to a suitable disposal area approved by the Municipality.

3.19 DISINFECTION

.1 Disinfection of watermains shall not commence until all mains have been completely installed, including all water services and air relief services, and the pressure and leakage testing and flushing have been completed.

.2 Disinfection of watermains shall be conducted by competent and experienced personnel using equipment appropriate for the piping being disinfected.

.3 The Contractor shall submit MSDS sheets for the chlorination and dechlorination agents to be used for the disinfection process to the Owner's Representative prior to conducting watermain disinfection.

.4 Conduct watermain disinfection in the presence of the Owner's Representative and the Municipality. Provide at least 72 hours' notice to the Municipality prior to conducting disinfection.

.5 Watermains and water services shall be disinfected. New valves and hydrants shall be open to ensure they are disinfected.

.6 Disinfection shall be completed using the continuous-feed method in accordance with AWWA C651.

.7 Chlorine for disinfection shall be introduced at the appurtenance used for the initial flushing of the test section.

.8 The discharge rate is subject to approval from the Municipality.

.9 The free chlorine residual of the initial chlorine solution shall be between 25 mg/L and 75 mg/L.

.10 Chlorine gas is not permitted for chlorination.

.11 The procedure shall be as follows:

.1 Open new hydrants and valves on the section of watermain being disinfected.

.2 Supply water for the chlorinator from a hydrant on the active system or from a water tank. Use a pump to inject chlorine solution into pipe if using a water tank.

.3 Continue feeding chlorine solution until the initial free chlorine residual is achieved within the test section.

.4 Isolate the watermain or water service containing the chlorine solution and maintain isolation for 24 hours.

.5 Determine the chlorine residual after the 24 hour retention time in accordance with AWWA C651, in the presence of the Municipality and the Owner's Representative. The acceptable minimum free chlorine residual after 24 hours is 10 mg/L.

.6 Ensure the chlorine residual in the hydrants used for introducing the chlorine solution does not exceed 75 mg/L at the conclusion of chlorination.

.7 Perform final flushing of the pipe with potable water using the appurtenance used for initial flushing once the chlorine residual is acceptable.

.8 Continue flushing until the chlorine residual is less than 2 mg/L.

.9 Test the chlorine residual in the presence of the Municipality and the Owner's Representative.

.12 Chlorinated water flushed from the pipe shall be dechlorinated prior to discharging to a storm sewer or the environment. Ensure the flushing rate of chlorine does not exceed an allowable rate acceptable to the Municipality.

.13 Disinfect watermain repairs and watermains less than 5.5 m long by swabbing or spraying with a maximum 5% solution of chlorine or a 1% hypochlorite solution either before or after installation.

3.20 BACTERIOLOGICAL SAMPLING

.1 Bacteriological sampling of watermains shall not commence until all mains have been completely installed, including all water services and air relief services, and the pressure and leakage testing, flushing, and disinfection have been completed.

.2 Bacteriological sampling shall be carried out by the Owner's Representative, in the presence of the Municipality and the Contractor.

.3 The test results shall be acceptable to the local Health Authority and the Municipality.

.4 The number of samples taken shall be as follows:

.1 Two sets of 2 samples shall be taken, at least 24 hours apart, every 370 m of new main.

.2 One set of 2 samples shall be taken, after at least 24 hours have passed, from the end of the line and at least one from each branch greater than one pipe length.

.5 Samples shall be taken from the discharge pipe used for leakage testing after adequate flushing time to replace water in the discharge pipe.

.6 The Owner's Representative shall submit the samples to an accredited laboratory as soon as possible after obtaining the samples.

.1 Samples that cannot be submitted within 1 hour after collection shall be stored in an iced cooler at 4°C during transport to the laboratory immediately

.7 Disinfection shall be acceptable when bacteriological test results from both sets of samples show:

.1 Total Coliform results are < 1 colony forming unit (cfu) per 100 mL.

.2 Heterotrophic Plate Count (HPC) does not exceed 500 cfu per mL.

.3 Total chlorine residual does not exceed 2 mg/L after flushing.

.8 The Owner's Representative shall document the bacteriological test results once received from the laboratory.

.9 If either sample fails bacteriological testing, flushing shall be repeated, and the Owner's Representative shall take 2 new samples for testing.

.1 If either of the second set of samples taken fail bacteriological testing, disinfection and flushing shall be repeated, and the Owner's Representative shall take 2 new samples for testing.

.2 Repeat this procedure until acceptable results are obtained.

.10 If immediate commissioning of the watermain is not required, the main shall be left fully charged and isolated upon obtaining acceptable bacteriological testing results.

3.21 TIE-INS TO EXISTING WATERMAINS

.1 Ensure that all required equipment, tools, products, plans, procedures, and workers required to make the connection expeditiously are on site before starting.

.2 Shut off boundary valves in the existing water distribution system. Valves shall only be operated by the Municipality.

.3 The Municipality shall be notified 2 weeks in advance of the proposed Work so that municipal staff can identify and operate all mainline valves required to be closed to isolate the proposed work zone.

.4 Connections less than 6 m may be swabbed as per AWWA C651 standards. Connections greater than 6 m shall be in accordance with the disinfection process and AWWA C651.

.5 An air gap or reduced pressure zone backflow preventer shall be provided between the existing and new infrastructure and shall remain in place until after pressure testing, flushing, disinfection, and bacteriological testing is completed and approved.

.6 Pressure testing and super-chlorinating against an existing municipal valve are prohibited.

.7 Tie-ins shall be completed with a spool piece that has been treated with a super-chlorinated solution.

.8 The Municipality shall be present when connecting a newly constructed watermain to the existing water distribution system.

.9 Make the necessary cut to connect.

.10 Use a tapping sleeve and valve where specifically designated to make a connection without taking the existing watermain out of service. Tapping of curved pipe is not permitted.

.11 Tapping shall be in accordance with the instructions of the tapping equipment supplier for the specific pipe material.

.12 Replace the gasket in the existing pipe at the point of connection.

.13 Make electrical connectivity or isolation connections, if required. Install sacrificial anodes and test leads as designated for cathodic protection, if required.

.14 Install joint harness or thrust block as designated on the Drawings.

3.22 TEMPORARY WATER SUPPLY

.1 The Contractor shall obtain the required permitting from the Municipality prior to commencement of the temporary water supply.

.2 The Municipality must inspect the temporary water supply system prior to active watermains being taken offline.

.3 The Contractor shall ensure that the maximum spacing between active hydrants does not exceed 200 m.

.4 Hydrants out of service shall be bagged and clearly marked with a "Hydrant Out of Service" tag.

.5 Temporary water supply shall include hoses and necessary outlets and fittings for each service connection and/or fire line. The bypass connection may be made at the water meter or at a hose bibb where possible.

.6 The Contractor shall provide, install, and maintain the temporary water supply in a safe and operable working condition at all times.

.7 The temporary water supply system shall be installed in a manner to minimize disruption to the public. Vehicular access to driveways, alleys, and parking lots shall be maintained.

.8 Changes to the temporary water supply system require prior approval from the Owner’s Representative and notification to Municipality, including the Fire Department.

.9 When temporary aboveground water connections cross roadways, the asphalt may be required to be cut and the pipe embedded within the road structure, at the discretion of the Municipality.

.1 The disturbed road structure shall be covered by a steel plate or backfilled with granular material or asphalt milling such that the disturbed area is flush with the existing roadway surface.

.10 Each building shall have its own temporary water service connection to the temporary water supply main and a connection to private plumbing via a wye at an outside tap. An approved building connection vacuum breaker shall be supplied on the open ends of all wyes.

.11 Temporary water services shall be connected to a 65 mm hydrant port. All 114 mm hydrant ports shall remain accessible for use by the Fire Department.

.12 The Contractor shall have adequate standby equipment at the construction site ready for immediate use in the event an emergency repair is required.

.13 Shutoff of customer service lines and connections from the bypass line to the customer service lines shall be made by the Municipality, unless otherwise directed by the Municipality.

.14 The Contractor shall meet the Municipality’s requirements for water meter removals.

.15 The Contractor is responsible for coordination and scheduling of water meter removal and reinstatement with both the Municipality and affected residents.

.16 The temporary water supply shall be in service prior to the removal of water meters.

.17 The Contractor shall remove and reinstall water meters as required. The Contractor is responsible for the removed water meters until they are reinstated.

.18 The Contractor is responsible for any damages to residential properties while conducting the removal and reinstallation of water meters.

.19 The existing water services shall be flushed prior to disconnecting from the temporary water supply system and reconnecting them to the permanent network.

.20 After service has been restored to a section of watermain, the Contractor shall remove the temporary bypass and related facilities and shall leave the work site in a neat and orderly condition.

.21 The Contractor is responsible to restore service to affected customers to original or better condition, including disconnection from the temporary water supply system and reconnection to the water distribution network.

.22 Temporary Water Supply System Size:

.1 The bypass pumping system shall be capable of bypassing the flow around the required work area and shall be sized to accommodate the anticipated water demands, including service to private fire protection systems (e.g., sprinklered systems).

.2 Temporary water supply mains (headers) shall be a minimum of 40 mm in diameter.

.3 Single family residential services shall be a minimum of 13 mm in diameter.

.4 Existing 40 mm and 50 mm services will require a minimum of 2 x 13 mm diameter temporary water services.

.5 Existing 100 mm to 200 mm services will require a minimum of 2 x 40 mm diameter temporary water services.

.23 Temporary Water Service Connections:

.1 All temporary water services shall be installed with control valves at the connection to the temporary water supply main with an outlet for the customer to use near the tie-in to the hose bibb.

.2 Provide pressure reducers on temporary water services as indicated in the Drawings or as directed by the Owner’s Representative.

.3 Appropriate back-flow preventers shall be installed on all hydrants being used to supply temporary water.

.24 Temporary Water Supply Disinfection and Storage:

.1 Temporary water supply infrastructure shall be disinfected in accordance with AWWA C651 and article 3.18.

.2 Prior to the installation, the Contractor shall disinfect all temporary water service piping using a sodium or calcium hypochlorite solution. Using the same procedure used to disinfect watermains, the Contractor shall ensure a minimum free chlorine residual of 10 mg/L at the end of a 24 h retention time.

.3 After disinfection, the temporary water service piping shall be adequately flushed.

.4 Flush water shall not be discharged to sanitary or storm sewer systems. Flush water and debris shall be discharged, in accordance with Alberta Environment requirements, to a suitable disposal area approved by the Municipality.

.25 Initial Water Quality Sampling:

.1 Prior to connecting customers to the temporary water supply, water quality samples shall be collected and submitted for testing.

.2 After flushing, the water shall sit in the temporary hoses for a minimum of 16 h before samples are collected.

.3 Water samples shall be collected from the furthest end of the temporary water supply line.

.4 Satisfactory results much be achieved for all samples prior to switching customers over to the temporary water supply.

.26 Interim Water Quality Sampling:

.1 To ensure water quality is being maintained, interim water samples shall be collected every two weeks the temporary water services are in use.

.2 If samples cannot be collected from an existing lateral, samples shall be collected from the inside tap furthest from the temporary water supply point.

Part 4 Measurement and Payment

4.1 WATERMAINS

.1 Measurement and payment for the supply and installation of watermains, for the pipe sizes and materials specified, will be per metre of watermain installed, as measured along the centreline of the main, through valves and fittings.

.2 Unit price to include the supply and installation of the pipe, fittings (tees, crosses, bends, reducers, couplings, etc.), hardware, thrust blocking, mechanical joint restraint if required, tracer wire if required, cathodic protection, crossing of existing utilities where required and identified on the Drawings, disinfection, flushing, and testing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Measurement and payment for tie-ins to existing watermains will be made separately.

.4 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.2 VALVES

.1 Measurement and payment for the supply and installation of water valves, for the types and sizes specified, will be per each water valve installed.

.2 Unit price to include the supply and installation of the valve, valve stem, and valve box, extension to surface, thrust blocking, mechanical joint restraint if required, cathodic protection, concrete block support, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 COMBINATION AIR RELEASE VALVE CHAMBERS

.1 Measurement and payment for the supply and installation of combination air release valve chambers will be per each combination air release valve chamber installed.

.2 Unit price to include the supply and installation of the precast valve chamber base and barrel sections, manhole frame and cover labelled “WATER”, insulated frost cover, spray foam insulation, combination air release/vacuum valve, flanged isolation valve, flanged outlet pipe, telescopic vertical pipe supports, drain pipe, vent pipe c/w insect screen if required, cast-in-place concrete if required, washed rock, cored openings if required, grouting, gaskets, waterproofing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 WATER SERVICES

.1 Measurement and payment for the supply and installation of water services, for the sizes and materials specified, will be per metre of water service installed as measured from the centre of the watermain, through valves and fittings, to the crimped end of the water service (or the plug, as applicable).

.2 Unit price to include excavation, loading, hauling, and stockpiling excavated material, supply and installation of the water service pipe, corporation stop, fittings, hardware, sand bags, supply, placement and compaction of the pipe zone material, thaw wires, curb stop, concrete block support, cathodic protection, thrust blocking if required, mechanical restraints if required, marker stake, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.5 HYDRANTS

.1 Measurement and payment for the supply and installation of hydrants will be per each hydrant installed.

.2 Unit price to include the supply and installation of the hydrant, hydrant valve, fittings, hydrant lead, thrust blocking, mechanical joint restraint if required, cathodic protection, concrete block support, washed rock, geotextile filter fabric, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.6 INSULATION

.1 Measurement and payment for the supply and placement of insulation, for each thickness specified, will be per square metre (m^2) of insulation placed.

.2 Unit price to include the supply and placement of the insulation, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.7 TIE-INS TO EXISTING WATERMAINS

.1 Measurement and payment for tie-ins to existing watermains will be per each tie-in completed.

.2 Unit price to include cleaning and preparation of existing pipe, connection to existing pipe, fittings, hardware, cathodic protection, thrust blocking, mechanical restraints if required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.8 TEMPORARY WATER SUPPLY

.1 Temporary water supply during construction per this Section will be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative based on the tendered price.

.3 Lump sum price to include all costs associated in planning, preparation, set-up, execution, and removal of temporary water supply, flushing, testing, chlorination, disinfection, documentation and submittals, coordination with the Municipality, water shut-down, provision of a licensed plumber on site while connecting and disconnecting temporary water services, and labour, equipment, tools, and all other incidentals necessary to provide continuous potable water supply to any and all affected residents and businesses.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM A252/A252M, Standard Specification for Welded and Seamless Steep Pipe Piles
- .2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
- .3 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
- .4 ASTM D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- .5 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
- .6 ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- .7 ASTM F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- .8 ASTM F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

.2 Canadian Standards Association (CSA)

- .1 CSA A257 Series, Standards for Concrete Pipe and Manhole Sections
- .2 CSA A3000, Cementitious Materials Compendium
- .3 CSA B181.2, Polyvinylchloride (PVC) and Chlorinated Polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings
- .4 CSA B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings
- .5 CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings
- .6 CSA B182.4, Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings
- .7 CSA B182.6, Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications
- .8 CSA B182.11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings
- .9 CSA Z245.1, Steel Pipe

1.2 SUBMITTALS

.1 At least 4 weeks prior to commencing work, submit manufacturer's product data, shop drawings, and certification that materials meet requirements of this Section.

.2 Submit shop drawings for review and approval by the Owner’s Representative in accordance with Section 1 04 00 - Submittal Procedures.

Part 2 Products

2.1 SANITARY SEWER MAINS

.1 Polyvinyl Chloride (PVC) Pipe:

.1 To ASTM D3034, ASTM F679, CSA B182.1, and CSA B182.2.

.2 Standard Dimension Ratio: DR35.

.3 Minimum Pipe Stiffness to be 320 kPa as measured in accordance with ASTM D3034.

.4 Gaskets shall meet the requirements of CSA B182.4 and ASTM F477.

.5 Fabricated PVC fittings: to CSA B182.4 or ASTM F794.

.6 PVC open profile sewer pipe and fittings: to CSA B182.4.

.2 Reinforced Concrete Pipe:

.1 To CSA A257.2 and ASTM C76M.

.2 Class 3 minimum strength classification or as specified.

.3 Concrete to be made with Type HS cement to CSA A3001.

.4 Gaskets shall meet the requirements of CSA A257.3 and ASTM C443M.

.5 Lifting holes:

.1 Pipe 900 mm and smaller in diameter shall have no lifting holes.

.2 Pipe greater than 900 mm in diameter shall not have more than 2 lifting holes per each length of pipe.

.3 Provide pre-fabricated plugs to seal lifting holes watertight after installation of pipe.

.3 Steel Casing Pipe:

.1 To CSA Z245.1 and ASTM A252.

.2 Grade as specified.

2.2 SEWER SERVICE CONNECTIONS

.1 Polyvinyl Chloride (PVC):

.1 To ASTM D3034 and CSA B182.2.

.2 DR28 or DR35 with push-on joints as specified.

2.3 CEMENT

.1 To CSA A3001, Type HS.

2.4 PIPE ZONE MATERIAL

.1 Granular pipe zone material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Concrete pipe bedding and surround material shall be in accordance with Section 3 02 30 - Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

.1 Granular backfill material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Unshrinkable fill shall be in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling.

2.6 SEWER LINE WARNING SIGN

.1 In accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation.

.2 Carefully inspect materials for defects to the approval of the Owner's Representative.

.3 Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Do not allow the contents of any active sewer to flow into the trench.

.3 Allowable tolerances in alignment and grade shall be as follows:

.1 Alignment: ± 50 mm

.2 Grade: no more than 6 mm plus 20 mm per metre of diameter, neither consistently high nor low.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Complete concrete Work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete as specified on the Drawings, the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*, or as directed by the Owner's Representative.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weigh pipe down to prevent flotation when concrete is placed.

3.4 PIPE ZONE MATERIAL

.1 Place pipe zone material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.5 PIPE INSTALLATION

.1 Confirm all inverts prior to commencement of construction.

.2 Lay and join pipes in accordance with CSA B182.2 or CSA A257.2 as specified and the manufacturer's recommendations.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Do not lay pipe on frozen bedding.

.5 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment and grade and pipe which shows differential settlement after installation.

.6 Commence laying at downstream end and proceed in an upstream direction with the bell ends of the pipe facing upgrade.

.7 Align pipes carefully before jointing.

.8 Do not exceed the permissible deflection at joints as recommended by the pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight plug at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.11 Do not allow water to flow through pipe during construction.

.12 Cut pipes in an approved manner, as recommended by the pipe manufacturer, without damaging the pipe and to leave a smooth end at right angles to axis of pipe.

.13 Install gaskets in accordance with manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

.14 Avoid displacing or contaminating the gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before joining is attempted again.

.15 Apply sufficient pressure in making joints to ensure that each joint is completed to the manufacturer's recommendations.

.16 Complete each joint before laying the next length of pipe.

.17 Minimize joint deflection after joint has been made.

.18 At rigid structures, install pipe joints no more than 1.2 m from the side of the structure.

.19 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.20 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.21 Recheck pipe joints assembled aboveground after placing in trench to ensure that no movement of the joint has taken place.

3.6 SERVICE CONNECTION INSTALLATION

.1 Install sanitary services as per the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures* and manufacturer's recommendations.

.2 Sanitary sewer service connections are to be installed as a single connection from the main to 1 m beyond the property line (or shallow utility easement, as applicable) in a common trench with the water and storm services.

.3 The end of the sanitary service shall be adequately capped or plugged to prevent the entry of soil, water, or other deleterious materials into the pipe.

.4 Roof leaders and building foundation drains shall not be connected to the sanitary sewer system.

.5 Always orient sanitary sewer services between the water and storm services.

3.7 CONNECTIONS TO MANHOLES

.1 New manholes:

.1 Complete pipe connection to pre-formed hole in manhole, complete with rubber gasket for a watertight connection.

.2 Ensure pipe does not protrude into manhole.

.2 Existing manholes:

.1 Core an opening to suit the sewer main diameter.

.2 Make the connection to the manhole watertight by installing a Kor-N-Seal connection or approved equivalent.

.3 Ensure pipe does not protrude into the manhole.

3.8 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Complete field density testing around valves, valve chambers, and vaults in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.9 QUALITY ASSURANCE

.1 Testing of sanitary sewer mains shall depend on the elevation of the groundwater table and shall consist of the following, at the discretion of the Owner's Representative.

.1 An infiltration or exfiltration test.

.2 A video inspection test.

.3 A deflection test.

.2 Testing of sanitary sewer mains shall be conducted in the presence of the Owner's Representative.

.3 An **infiltration test** shall be performed where the groundwater table is at least 1.0 m above the pipe crown at the upstream manhole. The procedure shall be as follows:

.1 Install a watertight plug at the upstream end of the pipeline test section.

.2 Discontinue dewatering operations for at least 3 days before test measurements are to commence.

.3 Prevent damage to pipe and bedding material due to flotation and erosion.

.4 Place a 90° V-notch weir, or another measuring device acceptable to the Municipality, in the invert of each outlet sewer at each manhole.

.5 Measure the rate of flow over a minimum of 1 hour, with recorded flows for each 5 min interval.

.6 The allowable infiltration for PVC pipe shall be 4.6 L/day/mm diameter/km of length.

.7 Repair and retest the sanitary sewers as required until the test results are within the specified limit.

.8 Repair visible leaks regardless of test results.

.4 An **exfiltration test** shall be performed where the groundwater table is below the sanitary sewer. The procedure shall be as follows:

.1 Install a watertight plug at the downstream end of the pipeline test section.

.2 Fill the test section with water, allowing for displacement of air in the line, and let stand for 24 hours.

.3 Prior to the test, add enough water to ensure a head of 1.0 m over the pipe crown in the upstream manhole. Pressures in excess of 7.6 m water head at the lowest point are not recommended.

.4 The test duration shall be 2 hours.

.5 Measure the water level at the beginning and end of the test in order to calculate the exfiltration.

.6 The allowable leakage for PVC pipe shall be 4.6 L/day/mm diameter/km of length.

.7 Repair and retest the sanitary sewers as required until the test results are within the specified limit.

.8 Repair visual leaks regardless of test results.

.5 **CCTV inspections** of the sanitary sewer system shall be carried out at construction completion and at the end of the Warranty Period.

.1 A digital copy in colour format, and of acceptable clarity, quality, and colour, along with inspection reports and summaries of the CCTV inspection, shall be supplied to the Owner's Representative.

.2 The National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) pipe rating system shall be used for all CCTV inspections.

.3 The CCTV report shall include the location of all service connections together with a statement of opinion as to whether the service connections are leaking.

.4 Any deficiencies found during this test shall be promptly remedied.

.1 Repair all defects which will impair the structural integrity or the performance of the sewer system, including:

.1 Improper joints.

.2 Cracked, sheared, or excessively deflected pipe.

.3 Sags and rises which pond water in excess of twice the allowable deviation from grade as per article 3.9.5.5.

.4 Protruding service connections.

.5 Visible infiltration or exfiltration.

.2 Prior to undertaking any repairs, a meeting with the Municipality and the Owner's Representative is required to review the proposed construction method.

.5 The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of diameter and should not be consistently high nor low.

.6 Flushing shall be performed prior to the CCTV inspection such that the water movement caused by the flushing activities is not immediately present in the CCTV inspection. This is to ensure the observed inspection conditions are not affected by the flushing activities.

.6 Where CCTV inspections show evidence of excessive or non-symmetrical deflection, formal **deflection tests** shall be conducted.

.1 A mandrel shall be pulled through the pipe in such a manner so as to ensure that excessive force is not used to advance the device through any deflected portion of the pipe.

.2 Deflection testing shall be performed in conjunction with a CCTV inspection.

.1 The mandrel shall be located in front, and in clear view, of the CCTV camera. An appropriate distance is typically between 1.5 and 2.5 pipe diameters.

.3 The mandrel shall be cylindrical in shape and constructed with 9 evenly spaced arms.

.4 Mandrels larger than 450 mm in diameter shall be constructed of special breakdown devices to facilitate entry through access manholes.

.5 The barrel section of the mandrel shall have a contact length of at least 75% of the base inside diameter of the pipe.

.6 The outside diameter of the mandrel shall not be less than 95% of the inside diameter of the sewer.

.7 The mandrel material shall be steel.

.8 If the mandrel is unable to pass through the pipe, the Contractor shall measure the exact inside diameter of the pipe with a deflectometer.

.9 If the pipe deflections exceed 5% at final acceptance, the pipe is to be replaced.

.7 Remove foreign material from sewers and related appurtenances by flushing with water. Contractor to supply and dispose of all water required for testing.

Part 4 Measurement and Payment

4.1 SANITARY SEWER MAINS

.1 Measurement and payment for the supply and installation of sanitary sewer mains, for the pipe sizes and materials specified, will be per metre of sanitary sewer main installed, as measured along the centreline of the main, from centre of manhole to centre of manhole or from centre of manhole to designated termination point as applicable.

.2 Unit price to include the supply and installation of the pipe, fittings, hardware, crossing of utilities where required and identified on the Drawings, infiltration or exfiltration testing as specified, deflection testing where required, CCTV inspections, connections at manholes, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.2 SANITARY SERVICES

.1 Measurement and payment for the supply and installation of sanitary services, for the sizes and materials specified, will be per metre of sanitary service installed as measured from the centre of the sanitary sewer main to the plugged end of the sanitary service.

.2 Unit price to include excavation, loading, hauling, and stockpiling excavated material, supply and installation of the sanitary service pipe, fittings, hardware, sand bags, supply, placement, and compaction of the pipe zone material, marker stake, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 TIE-INS TO EXISTING MANHOLES

.1 Measurement and payment for tie-ins to existing manholes will be per each tie-in completed.

.2 Unit price to include coring an opening in the existing manhole, supply and installation of a Kor-N-Seal connection or approved equivalent, connection of the sanitary sewer, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 CCTV INSPECTIONS

.1 Measurement and payment for CCTV inspections will be per metre of sanitary sewer main inspected.

.2 Unit price to include labour, equipment, tools, and all other incidentals necessary to conduct the CCTV inspections.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Water Works Association (AWWA)

- .1 AWWA C110, Ductile-Iron and Gray-Iron Fittings
- .2 AWWA C200, Steel Water Pipe, 6 in. (150 mm) and Larger
- .3 AWWA C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipes
- .4 AWWA C206, Field Welding of Steel Water Pipe
- .5 AWWA C207, Steel Pipe Flanges for Waterworks Service - Sizes 4 in. Through 144 in. (100 mm Through 3,600 mm)
- .6 AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings
- .7 AWWA C210, Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings
- .8 AWWA C213, Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
- .9 AWWA C214, Machine-Applied Polyolefin Tape Coatings for Steel Water Pipe
- .10 AWWA C507, Ball Valves, 6 in. Through 60 in. (150 mm Through 1,500 mm)
- .11 AWWA C512, Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
- .12 AWWA C517, Resilient-Seated Cast-Iron Eccentric Plug Valves
- .13 AWWA C600, Installation of Ductile-Iron Mains and Their Appurtenances
- .14 AWWA C604, Installation of Buried Steel Water Pipe – 4 in. (100 mm) and Larger
- .15 AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, ¾ in. (19 mm) Through 3 in. (76 mm), for Water Service
- .16 AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 in. Through 65 in. (100 mm Through 1,650 mm), for Waterworks
- .17 AWWA M55, PE Pipe – Design and Installation

.2 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- .2 ASTM A252/A252M, Standard Specification for Welded and Seamless Steel Pipe Piles
- .3 ASTM D450/D450M, Standard Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing

.3 Canadian Standards Association (CSA)

- .1 CSA A3000, Cementitious Materials Compendium
- .2 CSA B137 Series Package, Thermoplastic Pressure Piping Standards Package
- .3 CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables
- .4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement
- .5 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles

.6 CSA Z245.1, Steel Pipe

.7 CSA Z245.21, Plant-Applied External Polyethylene Coating for Steel Pipe

.8 CSA Z662, Oil and Gas Pipeline Systems

1.2 SUBMITTALS

.1 Submittals shall be in accordance with Section 1 04 00 – Submittal Procedures.

.2 At least 4 weeks prior to commencing work, submit manufacturer's product data, shop drawings, and certification that materials meet the requirements of this Section.

.3 Product Data:

.1 Submit manufacturer's instructions, product literature, and data sheets for manhole structures and include product characteristics, performance criteria, physical size, finish, and limitations.

.4 Submit shop drawings for review and approval by the Owner’s Representative if required.

Part 2 Products

2.1 SANITARY FORCEMAINS

.1 High Density Polyethylene (HDPE) Pipe:

.1 May be used for low pressure sewer mains and sanitary forcemains.

.2 HDPE pipe shall have standard nominal diameters based on IPS, unless otherwise specified.

.3 Pipe materials and fabrication shall conform to AWWA C906.

.4 HDPE pipe shall conform to AWWA C906 for working pressure rating as applicable and shall have a dimension ratio (DR) of 11, unless specified otherwise.

.5 Fittings and joints shall be assembled by electro-fusion or butt-fusion to ASTM F2620. Mechanical connections are not permitted.

.6 Flanged fittings and connections are to be used on the branch side of the pipe at tees, wyes, elbows, etc.

.7 Polyethylene fittings: to AWWA C906 and CSA B137.1, flange end with metal back-up ring.

.8 All joints and fittings to be compatible with the design, test, and surge pressures of the adjoining pipe.

.2 Steel Pipe:

.1 Steel forcemains to conform to AWWA C200 and ASTM A252/A252M, grade as specified.

.2 Pipe wall thickness shall be as specified.

.3 All joints and fittings to be compatible with the design, test, and surge pressures of the adjoining pipe.

.4 Steel pipe shall be exterior coated with polyethylene tape wrapping to AWWA C214 or Yellow Jacket, total minimum thickness of 1.27 mm.

.5 Steel pipe interior shall be epoxy lined to AWWA C210 or fusion bonded epoxy lined to AWWA C213.

.6 Flanges to AWWA C207.

.7 Fittings to AWWA C208 and exterior protected to AWWA C203.

.8 Use stainless steel, Type 304 double threaded studs, with 2 nuts, treated to prevent binding.

.9 Welding of shop fabricated fittings to conform to CSA Z662.

.10 Each pipe shall be marked to identify the manufacturer and shipment number.

2.2 LOW PRESSURE SEWER SERVICES

.1 High Density Polyethylene (HDPE):

.1 To AWWA C206.

.2 DR11 or as specified.

2.3 BOLTS AND NUTS

.1 Unless otherwise specified, bolts and nuts to be stainless steel, Type 304 to ASTM A193, with threads treated to prevent binding.

2.4 CEMENT

.1 To CSA A3001, Type HS.

2.5 PIPE ZONE MATERIAL

.1 Granular pipe zone material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Concrete pipe bedding and surround material shall be in accordance with Section 3 02 30 - Cast-in-Place Concrete.

2.6 BACKFILL MATERIAL

.1 Granular backfill material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Unshrinkable fill shall be in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling.

2.7 TRACER WIRE

.1 Tracer wire to be 12-gauge copper clad steel, HDPE insulated, rated for direct bury, white in colour.

.2 Tracer wire shall be terminated in a valve casing or in a flush mounted tracer wire access box, with a minimum of 500 mm excess wire inside the box. All termination points must be properly grounded by use of a drive-in magnesium grounding anode rod.

2.8 VALVES AND VALVE BOXES

.1 Plug Valves:

.1 All plug valves shall be installed such that the direction of flow through the valve is in accordance with AWWA C517 and the manufacturer's recommendations.

.2 Valves shall be of the non-lubricating, resilient-seated, eccentric type and shall be furnished with end connections as shown on the Drawings.

.3 Valve bodies shall be cast iron to ASTM A126, Class B with welded-in overlay of at least 95% nickel alloy content on all surfaces contacting the face of the plug.

.4 Valves shall be furnished with permanently lubricated sleeve type bearings conforming to AWWA C517.

.5 Plug valves shall be tested in accordance with AWWA C517.

.2 Cast Iron Valve Boxes:

.1 Epoxy coated two-piece cast iron sliding type adjustable over a minimum of 450 mm.

.2 50 mm square operating nut with rock guard flange.

.3 Valve operating extension rod shall be square (25 mm x 25 mm), of such length that when set on the valve operating nut, the top of the rod will not be more than 150 mm below the cover.

.4 Top of box to be marked "SEWER" with cored handholes.

.3 Air Release and Vacuum Valves:

.1 To AWWA C512.

.2 Type 304 or 316 stainless steel body with threaded or flanged connections as required.

.3 Minimum 1,035 kPa working pressure.

2.9 VALVE CHAMBERS

.1 Cast-in-place concrete:

.1 To Section 3 02 30 - Cast-in-Place Concrete.

.2 Cement: to CSA A3001, Type HS.

.2 Concrete reinforcement: to Section 3 02 20 - Concrete Reinforcement.

.3 Precast concrete sections:

.1 To ASTM C478/C478M.

.2 Top sections: eccentric cone or flat slab top type with opening offset for ladder installation.

.4 Frames and covers: to dimensions as indicated and the following requirements:

.1 Metal grates to bear evenly on frames.

.1 A frame with a cover shall constitute one unit.

.2 Gray iron castings: to AASHTO M306 and ASTM A48/A48M.

.3 Castings to be coated with two applications of asphalt varnish or sand blasted or cleaned and ground to eliminate surface imperfections.

.4 Frames and covers shall be of the type(s) indicated on the Drawings.

.5 Cover to be marked "SEWER".

.5 In areas where the water table is above the bottom of the valve chamber, a waterproofing admixture shall be added to the concrete mix design. In addition, the outer surface of the valve chamber, including under the base, shall be covered by a fully sealed exterior waterproofing membrane (Colphene 3000 c/w Elastocol Stick H_20 or approved equal).

.6 All joints shall be sealed with rubber gaskets confirming to ASTM C443M.

.7 Ladder rungs shall be standard safety pattern (drop step type), aluminum forged of 6061-T6 alloy having a minimum tensile strength of 260 MPa.

.8 Grade rings: to ASTM C478/C478M.

2.10 CATHODIC PROTECTION

.1 Magnesium Anodes: high potential, type M1C in accordance with ASTM B843.

.2 Zinc Anodes: Type II in accordance with ASTM B418.

.3 Core: perforated galvanized steel not exceeding 0.15 kg/m. The core length shall be a minimum of 75% of the anode length and shall be centered in the diameter of the anode.

.4 Lead Wire: No. 10 AWG stranded copper conforming to CSA C22.2 No. 38; 3 m long; insulation colour: blue for magnesium, white for zinc.

.5 Lead Wire Connection: the anode lead wire shall be silver-soldered (brazed) to the steel core using a suitable filler material and flux. The joint shall be cleaned before brazing by removal of zinc from the core and after brazing by removal of all flux. The completed connection shall be sealed using an acceptable electrical potting compound.

.6 Anode Container: water permeable cardboard tube or bag.

.7 Shipping Container: watertight plastic bags complete with label identifying the casting manufacturer, packaging company, anode metal, anode weight, date package, and supplier reference number.

.8 Refer to Section 7 of the Municipality's *Design Servicing Standards and Development Procedures*.

.9 Corrosion protection for welds: Roskote A51 mastic or approved equal.

.10 Conductivity Cables: 8 AWG stranded copper conforming to CSA 22.2 No. 38.

2.11 CORROSION PROTECTION

.1 In addition to cathodic protection per article 2.9, all buried nuts, bolts, transition couplings, restraints, and metal fittings to be wrapped with Denso paste and tape.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.

.2 Carefully inspect materials for defects to the approval of the Owner's Representative.

.3 Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling.

.2 Allowable tolerances in alignment and grade shall be as follows:

.1 Alignment: ± 50 mm

.2 Grade: ± 20 mm

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Complete concrete Work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete as specified on the Drawings, the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*, or as directed by the Owner's Representative.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weigh pipe down to prevent flotation when concrete is placed.

3.4 PIPE ZONE MATERIAL

.1 Place pipe zone material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.5 HDPE PIPE INSTALLATION

.1 Any section of pipe containing gouges or scratches exceeding 50% of the manufacturer's recommended limits will be rejected.

.2 Handle pipes by approved methods.

.3 Pipe shall be checked before jointing to ensure no foreign material or manufacturer's defects exist that might prevent the proper jointing of the pipe or its operation.

.4 Lay and join pipe in accordance with AWWA M55.

.5 Lay pipes on prepared bed, true to line and grade. Do not lay pipe on frozen bedding.

.6 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment or grade and pipe which shows differential settlement after installation.

.7 When possible, the jointing shall be carried out at ground elevation and the jointed pipe subsequently lowered into the trench.

.8 HDPE pipe shall be jointed by electro-fusion or butt-fusion in accordance with ASTM F2620 and in accordance with the pipe manufacturer's recommended procedure for jointing the pipe.

.1 Pipe or fittings jointed by any form of fusion method shall be performed by technicians certified by the pipe manufacturer.

.2 Deflections at joints shall not be accepted unless they form part of a deflection fitting made on-site.

.9 Remove all cuttings from the interior of the pipe before fusing.

.10 Joints between pipe sections shall be smooth on the inside and internal projection beads shall not be greater than 4 mm. The tensile strength of the fused joints shall not be less than that of the pipe.

.11 All joints shall be recorded, with the name of the certified operator, time, date, diameter, wall thickness, heating plate, temperature, fusing time, and cool down time identified.

.12 The operator shall immediately report any joint that fails to the Owner’s Representative.

.13 The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water and other material during periods when pipe is not being installed.

.14 Dispose of all cuttings from the fusion operation.

3.6 STEEL PIPE INSTALLATION

.1 Pipe shall be checked before jointing to ensure no foreign material or manufacturer's defects exist that might prevent the proper jointing of the pipe or its operation.

.2 Repair defects in or damages to the protective coating before lowering the pipe into the trench.

.3 If the protective coating is damaged during the lowering-in process, remove the pipe from the trench and repair the coating to the satisfaction of the Owner’s Representative.

.4 Lay and join pipe in accordance with AWWA M11, AWWA C604, and the manufacturer’s recommendations. Weld pipe in accordance with CSA Z662.

.5 Lay pipes on prepared bed, true to line and grade. Do not lay pipe on frozen bedding.

.6 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment or grade and pipe which shows differential settlement after installation.

.7 Cut pipes where necessary to fit valves and fittings. Make cuts in accordance with the manufacturer's recommendations. Do not damage the pipe lining or coating and leave a smooth bevelled edge.

.8 Lower pipe in the trench using proper equipment, tools, and sling to protect pipe's coating.

.9 Align pipes carefully before jointing.

.10 Complete each joint before laying the next length of pipe.

.11 Position and join pipes with suitable equipment and methods.

.12 Support fittings to reduce loading and/or stress on the adjoining pipe.

.13 Cover the open end of the pipe in the trench to prevent the entrance of trench water or other material during periods when pipe is not being installed.

.14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.15 Install sacrificial anodes and test leads as designated for cathodic protection where indicated.

3.7 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated on the Drawings.

.2 Support valves on a concrete seating block on solid ground. Valves shall not be supported by the pipe.

.3 The maximum length of pipe on each end of the valve shall be 1 m.

3.8 VALVE CHAMBER INSTALLATION

.1 Construct valve chambers in accordance with the approved shop drawings, plumb and true to alignment and grade.

.2 Complete valve chambers as pipe laying progresses.

.3 Set precast concrete base on a 100 mm minimum layer of washed rock.

.4 Make each joint watertight with approved rubber gaskets.

.5 Plug lifting holes with non-shrink grout.

.6 Installing valve chambers in existing systems:

.1 Where a new valve chamber is to be installed along an existing pipe, ensure full support of the existing pipe during installation and install new valve chamber as specified.

.2 Make joints between the new valve chamber and existing pipe watertight.

.7 Place frame and cover on the top section to the elevation indicated on the Drawings.

.1 If adjustment is required, use precast concrete grade ring(s).

.8 Valve chambers are not to remain uncovered, even if at incomplete height.

.9 Clean valve chambers of debris and foreign materials.

3.9 LOW PRESSURE SEWER SERVICE CONNECTION INSTALLATION

.1 Install low pressure sewer services in accordance with manufacturer's recommendations.

.2 Construct service connections at right angles to the low pressure sewer main.

3.10 THRUST BLOCKS

.1 Supply and place concrete for thrust blocks at locations indicated on the Drawings and in accordance with Section 3 02 30 - Cast-in-Place Concrete.

3.11 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Complete field density testing around valves, valve chambers, and vaults in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.12 PRESSURE AND LEAKAGE TESTING

.1 Testing of forcemains and low pressure sewers shall not commence until all mains have been completely installed, including all low pressure sewer services and air relief services, the excavation has been partially or completely backfilled, and thrust blocks have cured. A minimum of 3 days is required in the case of high early strength concrete and a minimum of 7 days is required in the case of normal concrete.

.2 Testing of forcemains and low pressure sewers shall be conducted by competent and experienced personnel using equipment appropriate for the piping being tested.

.3 Do not conduct forcemain or low pressure sewer testing when the ambient air temperature drops below -5°C during the test period. If the temperature drops below -5ºC at any time during the testing, the testing shall be considered invalid and re-testing will be required.

.4 Conduct pressure and leakage testing in the presence of the Owner's Representative.

.5 Conduct pressure and leakage testing for **HDPE pipe** in accordance with the following:

.1 In accordance with AWWA M55.

.2 Ensure corporation stops are open and curb stops are closed.

.3 Inform the Municipality and the Owner's Representative of the date, time, and location of the pressure and leakage tests at least 72 hours prior to the test time. Failure to notify the Municipality may result in tests being unaccepted.

.4 Open all main valves in the test section.

.5 Inform other construction crews or Contractors of the testing and confirm that no valves are being operated during the test.

.6 Test section shall not exceed 450 m.

.7 Ensure air is expelled from the section of pipeline being tested by exhausting trapped air at high points and dead-ends. Air content can be minimized through the following procedure:

.1 Bleed air from the pipe slowly.

.2 Fill the pipeline being tested at a velocity of less than 0.6 m/s.

.8 The maximum test pressure for pressure-rated polyethylene piping is not to exceed 1.5 × the system design pressure where lower pressure-rated components or devices are not present or have been removed or isolated from the test section. Confirm test pressure with the Owner's Representative prior to pressure and leakage testing.

.9 Maintain the hydrostatic test pressure for 4 hours and add water as needed. Do not measure this volume; hydrostatic pressure expands the pipe.

.10 Begin test. Reduce the pressure to 70 kPa below the hydrostatic test pressure.

.11 Monitor the pressure for 1 hour.

.12 The pipe is acceptable if the pressure drop over 1 hour does not exceed 5%.

.13 Record the leakage test results.

.14 Under no circumstances shall the total time for initial pressurization and time at test pressure exceed 8 hours at the hydrostatic test pressure.

.1 If the test is not completed due to leakage, equipment failure, or any other reason within this total time, the test section shall be depressurized and allowed to "relax" for at least 8 hours before starting the next testing sequence.

.6 Conduct pressure and leakage testing for **Steel pipe** in accordance with the following:

.1 In accordance with AWWA C206 and AWWA M11.

.2 Inform the Municipality and the Owner's Representative of the date, time, and location of the pressure and leakage tests at least 72 hours prior to the test time. Failure to notify the Municipality may result in tests being unaccepted.

.3 Open all main valves in the test section.

.4 Inform other construction crews or Contractors of the testing and confirm that no valves are being operated during the test.

.5 Valves within the test section must not be operated for the duration of the pressure and leakage testing.

.6 Test section shall not exceed 450 m.

.7 Ensure air is expelled from the section of pipeline being tested by exhausting trapped air at high points and dead-ends. Air content can be minimized through the following procedure:

.1 Bleed air from the pipe slowly.

.2 Fill the pipeline being tested at a velocity of less than 0.6 m/s.

.8 Fill cement mortar lined pipes with water 24 hours prior to hydrostatic testing.

.9 The use of air or other gaseous mediums for pressure testing of steel watermains shall not be permitted under any circumstances.

.10 Test duration shall be 4 hours.

.11 The test pressure shall be the greater of 125% of the normal operating pressure as measured at the highest point in the test section, or 150% of the normal operating pressure as measured at the lowest elevation of the test section, or 1,035 kPa. Confirm test pressure with the Owner's Representative prior to pressure and leakage testing.

.12 Raise the watermain pressure to the appropriate test pressure using either a hand or motor-powered pump located at the test port. The flow rate shall be controlled by the valve at the pump.

.13 Carefully mark the gauge and the level of water in the storage barrel at the beginning of the test.

.14 Maintain the test pressure within 34.5 kPa of the specified test pressure for the duration of the test.

.15 Pump the test section back to the test pressure at the end of the first 30 minutes. If the allowable leakage is exceeded, air may be trapped. Remove trapped air and repeat the test.

.16 No allowance shall be made for in-line valves.

.17 Record the leakage test results.

.18 The allowable leakage shall be 0.93 L/day/mm diameter/km of length.

.19 No installation shall be accepted if the quantity of make-up water is greater than the calculated allowable leakage.

.20 There is no allowable leakage for the testing of welded steel watermains.

.7 Coordinate the supply of water for forcemain and low pressure sewer testing. The Municipality will pay for the volume of water required for up to 3 complete fillings of the pipeline being tested.

.8 The Municipality shall have unrestricted access to the site during forcemain and low pressure sewer testing.

.9 The Contractor shall confirm that test sections will maintain pressure prior to the Owner's Representative being on-site.

3.13 FLUSHING

.1 Upon completion of pressure and leakage testing, low pressure sewers and forcemains shall be thoroughly flushed to remove all foreign matter.

.2 Flushing of forcemains and low pressure sewers shall not commence until all mains have been completely installed, including all low pressure sewer services and air relief services, and the pressure and leakage testing has been completed.

.3 Flushing of forcemains and low pressure sewers shall be conducted using a uni-directional flushing strategy and shall be completed by competent and experienced personnel using equipment appropriate for the piping being flushed.

.4 Conduct forcemain and low pressure sewer flushing in the presence of the Owner's Representative and in accordance with the following:

.1 Flushing runs shall not exceed 450 m in length.

.2 The flushing velocity shall be 1.5 m/s for pipes 300 mm in diameter and smaller, and 0.9 m/s for pipes larger than 300 mm in diameter.

.3 Water shall be exchanged a minimum of 5 times to achieve a completed flush.

.4 The source water shall flow from larger pipe to smaller pipe, wherever practical.

.5 The Municipality shall have unrestricted access to the site during forcemain and low pressure sewer flushing.

.6 When it is not possible to achieve a flushing velocity of 0.9 m/s, the forcemain or low pressure sewer shall be swabbed prior to disinfection.

.1 The Contractor shall supply and install temporary launch/retrieval ports to facilitate swabbing and remove these items following completion of swabbing.

.2 The Contractor shall provide connections and pumps for swabbing as required.

.3 Each pipe to be swabbed shall be swabbed with a minimum of 4 swabs (pigs): 2 scrubbing swabs and 2 foam swabs.

.4 Each swab shall be launched at a short interval.

.5 Swabs shall be medium density urethane bullet type and shall have a diameter of at least 50 mm larger than the largest pipe nominal diameter.

.6 The pipe shall be filled with water before launching the first swab.

.7 After the first swab has been launched, continue pumping until the swab has travelled at least 30 m or until 5 minutes have passed, then launch the second swab. Continue to launch the third and fourth swabs at the same interval.

.8 Continue to flush the line for 5 minutes after the fourth swab has been retrieved.

.7 Flush water shall not be discharged to sanitary or storm sewer systems. Flush water and debris shall be discharged, in accordance with Alberta Environment requirements, to a suitable disposal area approved by the Municipality.

Part 4 Measurement and Payment

4.1 FORCEMAINS

.1 Measurement and payment for sanitary sewer forcemains, for the pipe sizes and materials specified, will be per metre of forcemain installed, as measured along the centreline of the main, from centre of manhole to centre of manhole or from designated start point to designated termination point as applicable.

.2 Unit price to include the supply and installation of the pipe, fittings (tees, crosses, bends, reducers, couplings, etc.), hardware, thrust blocking, cathodic protection, crossing of existing utilities were required and identified on the Drawings, flushing, testing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Measurement and payment for tie-ins to existing manholes will be made separately.

.4 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.2 LOW PRESSURE SEWER MAINS

.1 Measurement and payment for low pressure sewer mains, for the pipe sizes and materials specified, will be per metre of low pressure sewer main installed.

.2 Unit price to include the supply and installation of the pipe, fittings (tees, crosses, bends, reducers, couplings, etc.), hardware, thrust blocking if required, cathodic protection if required, crossing of existing utilities where required and identified on the Drawings, flushing, testing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Measurement and payment for tie-ins to existing manholes will be made separately.

.4 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.3 VALVES

.1 Measurement and payment for the supply and installation of sewer valves, for the types and sizes specified, will be per each sewer valve installed.

.2 Unit price to include the supply and installation of the valve, valve stem, and valve box, extension to surface, thrust blocking, mechanical joint restraint if required, cathodic protection, concrete block support, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 COMBINATION AIR RELEASE VALVE CHAMBERS

.1 Measurement and payment for the supply and installation of combination air release valve chambers will be per each combination air release valve chamber installed.

.2 Unit price to include the supply and installation of the precast valve chamber base and barrel sections, manhole frame and cover labelled “SEWER”, insulated frost cover, spray foam insulation, combination air release/vacuum valve, isolation ball valve, flanged outlet pipe, concrete pipe supports, vent pipe c/w insect screen if required, cast-in-place concrete if required, washed rock, cored openings if required, grouting, gaskets, waterproofing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.5 LOW PRESSURE SEWER SERVICES

.1 Measurement and payment for the supply and installation of low pressure sewer services, for the sizes and materials specified, will be per metre of low pressure sewer service installed as measured from the centre of the low pressure sewer main, through valves and fittings, to the plug.

.2 Unit price to include excavation, loading, hauling, and stockpiling excavated material, supply and installation of the low pressure sewer service pipe, fittings, hardware, supply, placement and compaction of the pipe zone material, curb stop, concrete block support, cathodic protection, thrust blocking if required, mechanical restraints if required, marker stake, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.6 TIE-INS TO EXISTING MANHOLES

.1 Measurement and payment for tie-ins to existing manholes will be per each tie-in completed.

.2 Unit price to include coring an opening in the existing manhole, supply and installation of a Kor-N-Seal connection or approved equivalent, connection of the sanitary sewer, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
- .2 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)
- .3 ASTM D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- .4 ASTM F667, Standard Specification for 3 Through 24 in. Corrugated Polyethylene Pipe and Fittings
- .5 ASTM F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
- .6 ASTM F794, Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

.2 Canadian Standards Association (CSA)

- .1 CSA A257 Series, Standards for Concrete Pipe and Manhole Sections
- .2 CSA A3000, Cementitious Materials Compendium
- .3 CSA B182.1, Plastic Drain and Sewer Pipe and Pipe Fittings
- .4 CSA B182.2, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings
- .5 CSA B182.4, Profile Polyvinylchloride (PVC) Sewer Pipe and Fittings
- .6 CSA B182.8, Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings

1.2 SUBMITTALS

.1 At least 4 weeks prior to commencing work, submit manufacturer's product data, shop drawings, and certification that materials meet requirements of this Section.

.2 Submit shop drawings for review and approval by the Owner’s Representative in accordance with Section 1 04 00 - Submittal Procedures.

Part 2 Products

2.1 STORM SEWER MAINS

.1 Reinforced Concrete Pipe:

- .1 To CSA A257.2 and ASTM C76M.
- .2 Class 3 minimum strength classification or as specified.
- .3 Concrete to be made with Type HS cement to CSA A3001.
- .4 Gaskets shall meet the requirements of CSA A257.3 and ASTM C443M.
- .5 Lifting holes:
  - .1 Pipe 900 mm and smaller in diameter shall have no lifting holes.
  - .2 Pipe greater than 900 mm in diameter shall not have more than 2 lifting holes per each length of pipe.

.3 Provide pre-fabricated plugs to seal lifting holes watertight after installation of pipe.

.2 Polyvinyl Chloride (PVC) Pipe:

.1 To ASTM D3034, ASTM F679, CSA B182.1, and CSA B182.2.

.2 Standard Dimension Ratio: DR35.

.3 Minimum Pipe Stiffness to be 320 kPa as measured in accordance with ASTM D3034.

.4 Gaskets shall meet the requirements of CSA B182.4 and ASTM F477.

.5 Fabricated PVC fittings: to CSA B182.4 or ASTM F794.

.6 PVC open profile sewer pipe and fittings: to CSA B182.4.

.3 High Density Polyethylene (HDPE) Pipe:

.1 Open wall (corrugated) polyethylene pipe to CSA B182.8.

2.2 STORM SERVICE CONNECTIONS

.1 Polyvinyl Chloride (PVC):

.1 To ASTM D3034 and CSA B182.2.

.2 DR28 or DR35 with push-on joints as specified.

2.3 CEMENT

.1 To CSA A3001, Type HS.

2.4 PIPE ZONE MATERIAL

.1 Granular pipe zone material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Concrete pipe bedding and surround material shall be in accordance with Section 3 02 30 - Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

.1 Granular backfill material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Unshrinkable fill shall be in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling.

2.6 CATCH BASIN LEADS

.1 Refer to Section 2 02 11 – Catch Basin Leads.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation.

.2 Carefully inspect materials for defects to the approval of the Owner's Representative.

.3 Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Do not allow the contents of any active sewer to flow into the trench.

.3 Allowable tolerances in alignment and grade shall be as follows:

.1 Alignment: ± 50 mm.

.2 Grade: no more than 6 mm plus 20 mm per metre of diameter, neither consistently high nor low.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Complete concrete Work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete as specified on the Drawings, the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*, or as directed by the Owner's Representative.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weigh pipe down to prevent flotation when concrete is placed.

3.4 PIPE ZONE MATERIAL

.1 Place pipe zone material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.5 PIPE INSTALLATION

.1 Confirm all inverts prior to commencement of construction.

.2 Lay and join pipes in accordance with CSA B182.2, CSA A257.2, or ASTM F667 as specified and the manufacturer's recommendations.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Do not lay pipe on frozen bedding.

.5 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment and grade and pipe which shows differential settlement after installation.

.6 Commence laying at downstream end and proceed in an upstream direction with the bell ends of the pipe facing upgrade.

.7 Align pipes carefully before jointing.

.8 Do not exceed the permissible deflection at joints as recommended by the pipe manufacturer.

.9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight plug at open end of last pipe laid to prevent entry of foreign materials.

.10 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.11 Do not allow water to flow through pipe during construction.

.12 Cut pipes in an approved manner, as recommended by the pipe manufacturer, without damaging the pipe and to leave a smooth end at right angles to axis of pipe.

.13 Install gaskets in accordance with manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

.14 Avoid displacing or contaminating the gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before joining is attempted again.

.15 Apply sufficient pressure in making joints to ensure that each joint is completed to the manufacturer's recommendations.

.16 Complete each joint before laying the next length of pipe.

.17 Minimize joint deflection after joint has been made.

.18 At rigid structures, install pipe joints no more than 1.2 m from the side of the structure.

.19 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.20 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.21 Recheck pipe joints assembled aboveground after placing in trench to ensure that no movement of the joint has taken place.

.22 Plug lifting holes in concrete pipe with prefabricated plugs set in non-shrink grout.

3.6 SERVICE CONNECTION INSTALLATION

.1 Install storm services as per the applicable Standard Detail in the Municipality’s *Design Servicing Standards and Development Procedures* and manufacturer's recommendations.

.2 Storm service connections are to be installed as a single connection from the main to 1 m beyond the property line (or shallow utility easement, as applicable) in a common trench with the water and sanitary services.

.3 The end of the storm service shall be adequately capped or plugged to prevent the entry of soil, water, or other deleterious materials into the pipe.

3.7 CONNECTIONS TO MANHOLES

.1 New manholes:

.1 Complete pipe connection to pre-formed hole in manhole, complete with rubber gasket for a watertight connection.

.2 Ensure pipe does not protrude into manhole.

.2 Existing manholes:

.1 Core an opening to suit the storm sewer main diameter.

.2 Make the connection to the manhole watertight by installing a Kor-N-Seal connection or approved equivalent.

.3 Ensure pipe does not protrude into the manhole.

3.8 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Complete field density testing around valves, valve chambers, and vaults in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.9 QUALITY ASSURANCE

.1 Testing of storm sewer mains shall depend on the elevation of the groundwater table and shall consist of the following, at the discretion of the Owner's Representative.

.1 A video inspection test.

.2 A deflection test.

.2 Testing of storm sewer mains shall be conducted in the presence of the Owner's Representative.

.3 **CCTV inspections** of the storm sewer system, including catch basin leads, shall be carried out at construction completion and at the end of the Warranty Period.

.1 A digital copy in colour format, and of acceptable clarity, quality, and colour, along with inspection reports and summaries of the CCTV inspection, shall be supplied to the Owner's Representative.

.2 The National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) pipe rating system shall be used for all CCTV inspections.

.3 The CCTV report shall include the location of all service connections together with a statement of opinion as to whether the service connections are leaking.

.4 Any deficiencies found during this test shall be promptly remedied.

.1 Repair all defects which will impair the structural integrity or the performance of the sewer system, including:

.1 Improper joints.

.2 Cracked, sheared, or excessively deflected pipe.

.3 Sags and rises which pond water in excess of twice the allowable deviation from grade as per article 3.9.5.5.

.4 Protruding service connections.

.5 Visible infiltration or exfiltration.

.2 Prior to undertaking any repairs, a meeting with the Municipality and the Owner's Representative is required to review the proposed construction method.

.5 The invert of the pipe shall not deviate from the design grade by more than 6 mm plus 20 mm per metre of diameter and should not be consistently high nor low.

.6 Flushing shall be performed prior to the CCTV inspection such that the water movement caused by the flushing activities is not immediately present in the CCTV inspection. This is to ensure the observed inspection conditions are not affected by the flushing activities.

.4 Where CCTV inspections show evidence of excessive or non-symmetrical deflection, formal **deflection tests** shall be conducted.

.1 A mandrel shall be pulled through the pipe in such a manner so as to ensure that excessive force is not used to advance the device through any deflected portion of the pipe.

.2 Deflection testing shall be performed in conjunction with a CCTV inspection.

.1 The mandrel shall be located in front, and in clear view, of the CCTV camera. An appropriate distance is typically between 1.5 and 2.5 pipe diameters.

.3 The mandrel shall be cylindrical in shape and constructed with 9 evenly spaced arms.

.4 Mandrels larger than 450 mm in diameter shall be constructed of special breakdown devices to facilitate entry through access manholes.

.5 The barrel section of the mandrel shall have a contact length of at least 75% of the base inside diameter of the pipe.

.6 The outside diameter of the mandrel shall not be less than 95% of the inside diameter of the sewer.

.7 The mandrel material shall be steel.

.8 If the mandrel is unable to pass through the pipe, the Contractor shall measure the exact inside diameter of the pipe with a deflectometer.

.9 If the pipe deflections exceed 5% at final acceptance, the pipe is to be replaced.

.5 Remove foreign material from storm sewers and related appurtenances by flushing with water. Contractor to supply and dispose of all water required for testing.

Part 4 Measurement and Payment

4.1 STORM SEWER MAINS

.1 Measurement and payment for the supply and installation of storm sewer mains, for the pipe sizes and materials specified, will be per metre of storm sewer main installed, as measured along the centreline of the main, from centre of manhole to centre of manhole or from centre of manhole to designated termination point as applicable.

.2 Unit price to include the supply and installation of the pipe, fittings, hardware, crossing of utilities where required and identified on the Drawings, infiltration or exfiltration testing as specified, deflection testing where required, CCTV inspections, connections at manholes, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.2 STORM SERVICES

.1 Measurement and payment for the supply and installation of storm services, for the sizes and materials specified, will be per metre of storm service installed as measured from the centre of the storm sewer main to the plugged end of the storm service.

.2 Unit price to include excavation, loading, hauling, and stockpiling excavated material, supply and installation of the storm service pipe, fittings, hardware, supply, placement, and compaction of the pipe zone material, marker stake, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 TIE-INS TO EXISTING MANHOLES

.1 Measurement and payment for tie-ins to existing manholes will be per each tie-in completed.

.2 Unit price to include coring an opening in the existing manhole, supply and installation of a Kor-N-Seal connection or approved equivalent, connection of the storm sewer, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 CCTV INSPECTIONS

.1 Measurement and payment for CCTV inspections will be per metre of storm sewer main and catch basin lead inspected.

.2 Unit price to include labour, equipment, tools, and all other incidentals necessary to conduct the CCTV inspections.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
- .2 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric)

.2 Canadian Standards Association (CSA)

- .1 CSA A257 Series, Standards for Concrete Pipe and Manhole Sections
- .2 CSA A3000, Cementitious Materials Compendium
- .3 CSA G401, Corrugated Steel Pipe Products

.3 American Association of State Highway and Transportation Officials (AASHTO)

- .1 AASHTO M306, Standard Specification for Drainage, Sewer, Utility, and Related Castings

1.2 SUBMITTALS

.1 At least 4 weeks prior to commencing work, submit manufacturer's product data, and certification that materials meet requirements of this Section.

Part 2 Products

2.1 PIPE CULVERTS

.1 Corrugated Steel Pipe (CSP):

- .1 To CSA G401; stiffness as per AASHTO M306.
- .2 Galvanized.
- .3 Minimum wall thickness of 1.6 mm or as specified.
- .4 Watertight cut-off collars: as indicated.
- .5 Prefabricated end sections: as indicated.

.2 Reinforced Concrete Pipe:

- .1 To CSA A257.2 and ASTM C76M.
- .2 Class 3 minimum strength classification or as specified.
- .3 Concrete to be made with Type HS cement to CSA A3001.
- .4 Gaskets shall meet the requirements of CSA A257.3 and ASTM C443M.
- .5 Lifting holes:
  - .1 Pipe 900 mm and smaller in diameter shall have no lifting holes.
  - .2 Pipe greater than 900 mm in diameter shall not have more than 2 lifting holes per each length of pipe.

.3 Provide pre-fabricated plugs to seal lifting holes watertight after installation of pipe.

2.2 CEMENT

.1 To CSA A3001, Type HS.

2.3 PIPE ZONE MATERIAL

.1 Granular pipe zone material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Concrete pipe bedding and surround material shall be in accordance with Section 3 02 30 - Cast-in-Place Concrete.

2.4 RIP RAP

.1 Rip rap shall be in accordance with Section 3 15 00 – Rip Rap.

2.5 GEOTEXTILE FILTER FABRIC

.1 Non-woven geotextile filter fabric shall be in accordance with Section 03 05 30 – Geotextiles.

2.6 BACKFILL MATERIAL

.1 Granular backfill material shall be in accordance with Section 3 04 00 – Aggregate Materials.

.2 Unshrinkable fill shall be in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation.

.2 Carefully inspect materials for defects to the approval of the Owner's Representative.

.3 Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Allowable tolerances in alignment and grade shall be as follows:

.1 Alignment: ± 50 mm

.2 Grade: no more than 6 mm plus 20 mm per metre of diameter, neither consistently high nor low.

3.3 CONCRETE BEDDING AND ENCASEMENT

.1 Complete concrete Work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.2 Place concrete as specified on the Drawings, the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*, or as directed by the Owner's Representative.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weigh pipe down to prevent flotation when concrete is placed.

3.4 PIPE ZONE MATERIAL

.1 Place pipe zone material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.5 CORRUGATED STEEL PIPE CULVERT INSTALLATION

.1 Confirm inverts prior to commencement of construction.

.2 Lay and join pipes in accordance with CSA G401 and the manufacturer's recommendations.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Do not lay pipe on frozen bedding.

.5 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment and grade and pipe which shows differential settlement after installation.

.6 Commence laying at downstream end and proceed in an upstream direction with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.7 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.8 Do not allow water to flow through pipe during construction.

.9 Cut pipes in an approved manner, as recommended by the pipe manufacturer, without damaging the pipe and to leave a smooth end at right angles to axis of pipe.

.10 Align pipes carefully before jointing.

.11 Match corrugations or indentations of coupling with pipe sections before tightening.

.12 Tap couplings firmly as they are being tightened to take up slack and ensure a snug fit. Insert and tighten bolts.

.13 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich epoxy paint.

.14 Complete each joint before laying the next length of pipe.

.15 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.16 Install end treatment as specified on the Drawings, in accordance with the manufacturer's recommendations.

3.6 CONCRETE PIPE CULVERT INSTALLATION

.1 Confirm inverts prior to commencement of construction.

.2 Lay and join pipes in accordance with CSA A257.2 and the manufacturer's recommendations.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Do not lay pipe on frozen bedding.

.5 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment and grade and pipe which shows differential settlement after installation.

.6 Commence laying at downstream end and proceed in an upstream direction with the bell ends of the pipe facing upgrade.

.7 Align pipes carefully before jointing.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight plug at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.10 Do not allow water to flow through pipe during construction.

.11 Cut pipes in an approved manner, as recommended by the pipe manufacturer, without damaging the pipe and to leave a smooth end at right angles to axis of pipe.

.12 Install gaskets in accordance with manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

.13 Avoid displacing or contaminating the gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before joining is attempted again.

.14 Apply sufficient pressure in making joints to ensure that each joint is completed to the manufacturer's recommendations.

.15 Complete each joint before laying the next length of pipe.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.17 Plug lifting holes in with prefabricated plugs set in non-shrink grout.

.18 Install end treatment as specified on the Drawings, in accordance with the manufacturer’s recommendations.

3.7 RIP RAP PLACEMENT

.1 Place rip rap in accordance with Section 3 15 00 – Rip Rap.

3.8 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Complete field density testing in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.9 CLEANING

.1 Remove foreign material from pipe culverts by flushing with water. Contractor to supply and dispose of all water required for testing.

Part 4 Measurement and Payment

4.1 PIPE CULVERTS

.1 Measurement and payment for the supply and installation of pipe culverts, for the pipe sizes and materials specified, will be per metre of pipe culvert installed, as measured along the centreline of the pipe from inlet to outlet, including beveled end sections.

.2 Unit price to include the supply and installation of the pipe, fittings, hardware, crossing of utilities where required and identified on the Drawings, end treatment, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

.4 Refer to Section 3 15 00 – Rip Rap.

END OF SECTION

Part 1 General

.1 This Section specifies the requirements for supplying and installing sub-drain systems for roadways and other specified applications.

Part 2 Products

2.1 SUB-DRAINAGE PIPING

.1 Perforated Polyvinyl Chloride (PVC) Pipe:

.1 To ASTM D3034 and CSA B182.2, perforated.

.2 Standard Dimension Ratio: DR35.

.3 Minimum Pipe Stiffness to be 320 kPa as measured in accordance with ASTM D3034.

.4 Gaskets shall meet the requirements of CSA B182.4 and ASTM F477.

.5 Perforations shall consist of two rows of 14 mm holes positioned at 120º radially and spaced to provide a minimum total cross sectional hole area of 3,000 mm^2 per metre of length.

2.2 GRANULAR FILTER MATERIAL

.1 Washed rock in accordance with Section 3 04 00 – Aggregate Materials.

2.3 GEOTEXTILE FABRIC

.1 Geotextile filter fabric shall be in accordance with Section 3 05 30 – Geotextiles.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes and fittings of debris and water before installation.

.2 Carefully inspect materials for defects to the approval of the Owner's Representative.

.3 Remove defective materials from site.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.3 SUB-DRAIN INSTALLATION

.1 Place geotextile filter fabric in trench as indicated on the Drawings.

.2 Place washed rock in bottom of trench to a minimum thickness of 75 mm.

.3 Confirm all inverts prior to commencement of construction.

.4 Lay and join pipes in accordance with CSA B182.2 and the manufacturer's recommendations.

.5 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.6 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Do not lay pipe on frozen bedding.

.7 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not true to alignment and grade and pipe which shows differential settlement after installation.

.8 Commence laying at downstream end and proceed in an upstream direction with the bell ends of the pipe facing upgrade.

.9 Wrap pipe with geotextile filter fabric or insert pipe into geotextile filter fabric sleeve.

.10 Lay perforated pipes with perforations facing downwards and align pipes carefully before jointing.

.11 Do not exceed the permissible deflection at joints as recommended by the pipe manufacturer.

.12 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight plug at open end of last pipe laid to prevent entry of foreign materials.

.13 Position and join pipes with suitable equipment and methods. Do not use excavating equipment to force pipe sections together.

.14 Do not allow water to flow through pipe during construction.

.15 Cut pipes in an approved manner, as recommended by the pipe manufacturer, without damaging the pipe and to leave a smooth end at right angles to axis of pipe.

.16 Install gaskets in accordance with manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned.

.17 Avoid displacing or contaminating the gasket with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated, and replaced before joining is attempted again.

.18 Apply sufficient pressure in making joints to ensure that each joint is completed to the manufacturer's recommendations.

.19 Complete each joint before laying the next length of pipe.

.20 Minimize joint deflection after joint has been made.

.21 At rigid structures, install pipe joints no more than 1.2 m from the side of the structure.

.22 Ensure completed joints are restrained by compacting washed rock alongside and over installed pipes in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.23 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.24 Recheck pipe joints assembled aboveground after placing in trench to ensure that no movement of the joint has taken place.

.25 Wrap geotextile filter fabric around the top of the washed rock. Ensure the ends overlap a minimum of 300 mm.

3.4 CONNECTIONS TO MANHOLES AND CATCH BASINS

.1 New manholes and catch basins:

.1 Complete pipe connection to pre-formed hole in manhole or catch basin, complete with rubber gasket for a watertight connection.

.2 Ensure pipe does not protrude into manhole or catch basin.

.2 Existing manholes and catch basins:

.1 Core an opening to suit the sub-drainage piping diameter.

.2 Make the connection to the manhole or catch basin watertight by installing a Kor-N-Seal connection or approved equivalent.

.3 Ensure pipe does not protrude into the manhole or catch basin.

3.5 BACKFILL

.1 Place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

Part 4 Measurement and Payment

.1 Measurement and payment for the supply and installation of sub-drainage piping, for the pipe sizes specified, will be per metre of sub-drainage piping installed, as measured along the centreline of the pipe, from centre of manhole/catch basin to centre of manhole/catch basin or from centre of manhole/catch basin to designated termination point as applicable.

.2 Unit price to include the supply and installation of the pipe, fittings, crossing of utilities where required and identified on the Drawings, connections at manholes and catch basins, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM A252/A252M, Standard Specification for Welded and Seamless Steel Pipe Piles

.2 ASTM A536, Standard Specification for Ductile Iron Castings

.3 ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

.2 Canadian Standards Association (CSA)

.1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete

.2 CSA A3000, Cementitious Materials Compendium

.3 CSA W47.1, Certification of Companies for Fusion Welding of Steel

.4 CSA W59, Welded Steel Construction

1.2 SUBMITTALS

.1 In accordance with Section 1 04 00 – Submittal Procedures.

.2 Trenchless Work Plan:

.1 The Contractor shall submit a detailed work plan outlining their planned trenchless construction methodology at least 20 working days prior to the scheduled mobilization for each crossing.

.2 The methodology and equipment selected by the Contractor shall be suitable for the anticipated ground and groundwater conditions of the crossing. The Contractor is solely responsible to evaluate the ground and groundwater conditions and to ensure that the appropriate equipment and installation procedures are employed during the Work.

.3 The Trenchless Work Plan shall include:

.1 Detailed description of the proposed trenchless construction methodology.

.2 Trenchless installation equipment specifications, and capabilities.

.3 Description of alignment control and steering systems, including manufacturer’s literature.

.4 Description of thrusting or ramming systems and estimate of jacking or ramming forces to complete the crossing.

.5 Description of the excavation system including: cutterhead details, tooling, location of the cutterhead relative to the leading edge of the casing, casing banding, shoe, and/or leading-edge reinforcement details, soil plug length (if required, or as otherwise specified on the Drawings), timing of casing clean-out relative to forward advance, and radial overcut dimensions.

.6 Lubrication system details (if used) including the water source, lubricant mix design and proposed additives, rheological properties and planned

testing, additive safety data sheets (SDS), injection system details, and injection pressures.

.7 Site layout plan including the locations and dimensions of all trenchless working pits.

.8 Working pit excavation shop drawings and specifications, Authenticated by a Professional Engineer in good standing with APEGA in accordance with Alberta's Occupational Health and Safety Legislation.

.9 Groundwater management plan for working pit excavations.

.10 Casing pipe jointing procedure, including welding procedure data sheets (WPDS) and/or welding procedure specifications (WPS) to CSA W47.1.

.11 Welder qualifications.

.12 Carrier pipe insertion plan, including carrier pipe jointing procedures and mitigation strategies to limit carrier pipe joint damage and over-insertion/over-belling (where applicable).

.13 Contact grout mix design and grouting plan (if casing is large enough to permit internal access) including injection port (locations, type, frequency/spacing, and closure details), and injection pressures.

.14 Backfill grout mix design and grouting plan (if backfill grout is specified on the Drawings) including bulkhead details, injection and venting port details, lift heights and volumes, and demonstration of low heat of hydration such as calculations or adiabatic temperature-rise tests.

.15 Settlement monitoring plan (if required).

.16 Contingency procedures to address the following:

.1 Inadvertent utility strikes including power, natural gas, water, sewer, or telecommunication lines.

.2 Obstruction, inability to advance, or damaged tooling/equipment.

.3 Unexpected ground conditions.

.4 Excessive deviation from the design line and grade.

.5 Excessive ground movement.

.17 Schedule of the Work including the sequence of working pit excavations, casing pipe installation, carrier pipe insertion, contact grouting (where applicable), backfill grouting (if specified), and working pit backfill.

.3 Product Data:

.1 Submit mill test certificates/mill test reports for the casing pipe steel.

.2 Submit manufacturer's instructions, printed product literature, and data sheets for carrier pipes, casing spacers, casing end seals, joint restraint systems, and working pit backfill materials.

.4 Record Drawings:

.1 Submit final surveyed information noting the casing end locations with northing, easting, and invert elevations.

.2 The Contractor shall indicate any horizontal or vertical deviations between the design line and grade and the actual installation. Note changes in red.

.5 Field Notes:

.1 A daily logbook must be kept for all installations and submitted upon crossing completion. The daily logbook shall include, at a minimum:

.1 The position of the casing pipe in relation to the design line and grade.

.2 The date, starting time, and finish time for each casing pipe segment installed.

.3 Advance rates.

.4 Jacking forces or hammer strokes per minute.

.5 Quantity and type of lubrication, if used.

.6 Quantity of spoil excavated.

.7 Quantity of contact grout, if used, per port, and locations of ports.

.8 Quantity of backfill grout, if used.

.9 Settlement monitoring survey results (if required).

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with the manufacturer's written instructions.

.2 Deliver materials to Site in original factory packaging, labelled with the manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with Section 1 09 00 – Temporary Facilities and the manufacturer's recommendations.

.2 Store and protect materials from damage.

.3 Replace defective or damaged materials with new.

Part 2 Products

2.1 STEEL CASING PIPE

.1 Seamless or welded steel pipe: to ASTM A252/A252M, Grade 2 or better (as indicated in the Contract Documents).

.2 Wall thickness: as shown on the Drawings. The Contractor is responsible to independently assess the need to increase the wall thickness based on their estimated installation loads.

.3 End finish: beveled to an angle of 30° to 35°.

.4 Pipe joints: to be complete joint penetration (CJP) groove weld butt joints to CSA W59.

.1 Joints welded from one side without backing are not prequalified CJP groove welds under CSA W59 and require qualification in accordance with CSA W47.1.

2.2 CARRIER PIPE

.1 Carrier pipe materials: in accordance with related Sections.

.2 Polyvinyl Chloride (PVC) pressure pipe joints: to be push-on style (bell and spigot ends) with bell harness restraint or integral restraint.

.3 Type PSM PVC pipe joints: to be locked-in gasket and integral bell system.

.4 High Density Polyethylene (HDPE) pipe joints: to be thermal butt fusion joined to ASTM F2620.

2.3 BELL HARNESS RESTRAINTS

.1 Bell harness restraints shall consist of two split restraint rings with internal serrations, one installed on the spigot connected to one installed on the pipe barrel behind the bell.

.2 Restraint rings: ductile iron to ASTM A536.

.3 Restraining rods: Type 304 stainless steel.

.4 The Contractor is responsible to ensure that bell harness restraints will fit properly within the casing pipe and are compatible with the casing spacers.

2.4 CASING SPACERS

.1 Shell/band: 14-gauge steel, Type 304 stainless or carbon with shop coat.

.2 Risers: 10-gauge steel, Type 304 stainless or carbon with shop coat, MIG (metal inert gas) welded to shell/band when runner height extension is required.

.3 Runners: glass reinforced polymer plastic.

.4 Fasteners: Type 304 stainless steel.

.5 Configuration:

.1 Centered if no backfill grout is specified on the Drawings.

.2 Centered and restrained if backfill grout is specified on the Drawings.

.6 The Contractor is responsible to ensure that casing spacers will fit properly within the casing pipe prior to ordering.

2.5 SELF-RESTRAINING CASING SPACERS

.1 The Contractor may elect to use self-restraining casing spacers as an alternative to bell harness restraints or integral joint restraints and casing spacers.

.2 The Contractor is responsible to upsize the casing pipe, if required, based on the spacer manufacturer’s recommendations for minimum casing inside diameter. If the casing pipe is upsized, the Contractor is responsible to independently assess the upsized casing pipe wall thickness. The costs of upsizing the casing pipe will be borne by the Contractor.

2.6 END SEALS

.1 Manufactured end seals: synthetic rubber with Type 304 stainless steel banding straps.

2.7 CONTACT AND BACKFILL GROUTS

.1 Compressive Strength: minimum 2 MPa at 28 days unless specified otherwise.

.2 Portland cement: to CSA A3000, Type HS, low heat of hydration.

.3 Water: to CSA A23.1.

.4 Aggregates: to CSA A23.1, normal-density fine aggregates.

.5 Admixtures: subject to the approval of the Owner's Representative.

2.8 PIPE ZONE MATERIAL

.1 In accordance with Section 3 04 00 – Aggregate Materials.

2.9 BACKFILL MATERIAL

.1 In accordance with Section 3 04 00 – Aggregate Materials.

2.10 CROSSING WARNING SIGNS

.1 All materials and fabrication of warning signs shall be in accordance with the requirements of the authority having jurisdiction and related Sections in these Standard Construction Specifications.

Part 3 Execution

3.1 PRE-COMMENCEMENT

.1 All underground utilities within 25 m of the proposed alignment must be identified and their location marked on the surface in accordance with Section 1 01 00 – Work Restrictions.

.2 All utility crossings shall be carefully exposed to confirm depth in accordance with the relevant crossing agreements.

3.2 WORKING PIT EXCAVATIONS

.1 Do excavation Work in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling and Alberta's Occupational Health and Safety Legislation.

.2 Working pit dimensions and means of wall stabilization/support shall be determined by the Contractor based on the site conditions and constraints, anticipated ground and groundwater conditions, and the proposed trenchless installation equipment.

.3 Working pit dimensions shall conform to constraints specified on the Drawings.

.4 Temporary protective structures/shoring/support systems shall be installed from the top of the excavation downwards, installing supports in descending order, and shall be removed from the bottom of the excavation upwards, removing supports in ascending order.

.1 Temporary protective structures/shoring/support systems may be abandoned in place if deemed unsafe to remove due to deteriorating ground conditions. There will be no compensation for lost materials.

.2 Temporary protective structures/shoring/support systems shall be designed and Authenticated by a Professional Engineer in good standing with APEGA, in accordance with Alberta's Occupational Health and Safety Legislation.

.5 The Contractor shall manage the inflow of groundwater and surface water as required to keep working pits free of water during performance of the Work.

3.3 TRENCHLESS INSTALLATION

.1 The Owner's Representative shall be notified 48 hours in advance of starting Work. Trenchless crossings shall not begin until the Owner's Representative is present at the Site and agrees that proper preparations for the operation have been made. The Owner's Representative's approval for beginning the installation shall in no way relieve the Contractor of the responsibility for the satisfactory completion of the Work as authorized under the Contract.

.2 Steel casings may be installed by auger boring, pilot tube guided boring, pipe ramming, guided pipe ramming, down the hole hammer boring, or by any combination of these methods, unless specified otherwise on the Drawings.

.3 Trenchless installations shall be executed such that settlement and/or heave is minimized, the in-place steel casing has full bearing against earth, and no voids are left in any portion of the Work.

.4 The Contractor shall monitor spoil material, quantity, and consistency, and make suitable changes to the trenchless installation method to control ground movements and minimize over-excavation as required.

.5 The Contractor shall monitor jacking or ramming forces and ensure that installation forces remain below the axial capacity of the casing pipe and welded pipe joints.

.6 Install casing pipe as required to satisfy the line and grade of the carrier pipe as shown on the Drawings.

.1 For carrier pipes conveying contents under pressure, the tolerance for line shall be ± 100 mm horizontal deviation and the tolerance for grade shall be ± 100 mm vertical deviation.

.2 For carrier pipes conveying contents by gravity, or where installation by pilot tube guided boring is specified on the Drawings, the tolerance for line shall be ± 100 mm horizontal deviation and the tolerance for grade shall be ± 25 mm vertical deviation.

.7 Lubrication to reduce skin friction may be used at the Contractor's discretion. If lubrication is used, pressures must be kept below the confining pressure of the overlying ground, which shall be estimated as the vertical earth pressure to the casing crown (total

stress model) unless otherwise estimated by the Contractor using an industry recognized model (e.g., Delft Equation, Queen's Method, etc.).

.8 The Contractor is responsible to establish and use benchmarks to furnish and maintain all reference lines and grades for any guidance systems used and is fully responsible for the accuracy of the Work and any corrections. Guidance systems shall be mounted independently from the thrust block and jacking frame.

.9 Spoil material from the trenchless operations shall be disposed of off-site by the Contractor at an appropriate facility.

.10 Spoil material demonstrating unexpected ground conditions must be stored on Site for review by the Owner's Representative.

.11 The Contractor is responsible for the inspection of all welds. Support the pipe segments in the working pit and tack weld as required to ensure a straight joint before full circumferential welding. Complete welding in accordance with the submitted WPS and/or WPDS.

.12 On completion of trenchless crossings, complete contact grouting of the annular space between the casing pipe and the ground and any voids outside the casing pipe.

.13 If the casing pipe installation does not meet the specified tolerances for line and grade, the Contractor shall correct the installation including any necessary redesign of the pipeline or structures and acquisition of necessary Easements. Corrective Work shall be completed at no additional cost to the Owner and is subject to the approval of the Owner's Representative.

.14 If excessive voids are created or if it is necessary to abandon a crossing, the casing and any external voids shall be filled with grout. Equipment that is not internally retrievable in locations where surface intervention/rescue is not permitted shall be abandoned in place.

3.4 CARRIER PIPE INSERTION

.1 Handle and joint carrier pipes in accordance with related Sections.

.2 Use an approved blocking method to guide the carrier pipe into the casing in true alignment.

.3 Place casing spacers near carrier pipe joints as follows:

- .1 Within 0.6 m on either side of integrally restrained PVC pressure pipe joints.
- .2 Immediately outside of bell harness restraints for external mechanically restrained PVC pressure pipe joints.
- .3 In line with the insertion mark of the spigot and within 0.3 m of the bell of Type PSM PVC pipe joints.

.4 Spacers for the remaining pipe barrel shall not exceed a separation of 1.8 m, or less, based on the manufacturer's recommendations for carrier pipe support.

.5 Clearance between casing spacer risers and the casing pipe shall be a maximum of 25 mm when the carrier pipe is in position in a centered and restrained spacer configuration.

.6 Join carrier pipes one length at a time outside of the casing. Push or pull the carrier pipe into position.

.1 Prevent over-insertion/over-belling of the carrier pipe joints if the pipe is pushed into position.

.2 Prevent joint separation if the pipe is pulled into position.

.7 Place end seals on each end of the casing.

.8 Manufacturer's recommendations for installation shall be followed where applicable.

3.5 BACKFILL GROUTING

.1 The Contractor shall backfill the annular space between the casing and carrier pipes with grout when specified on the Drawings. The annular space shall be filled according to the Contractor's submitted grouting plan and backfill grouting shall meet the following:

.1 The Contractor shall consider the potential for carrier pipe flotation due to grout and pipe densities as well as the potential for hydrostatic collapse/buckling of the carrier pipe due to grouting pressures and pipe softening due to heat of hydration.

.2 The Contractor shall completely fill the annular space with grout and shall displace all water and air from the annular space.

.3 The Contractor may complete the grouting in multiple lifts, if required, to prevent carrier pipe flotation and hydrostatic collapse.

.4 Samples of grout shall be obtained from the grout mixer discharge in accordance with CSA Test Method A23.2-1B. The temperature of the grout shall be measured upon sampling in accordance with CSA Test Method A23.2-17C.

.5 Test cubes shall be prepared and stored in accordance with CSA Test Method A23.2-1B.

.6 Not less than one compressive strength test shall be made from samples from each 50 m^3 of grout placed, and in no case shall there be less than one test from each day's pour.

.7 Each compressive strength test shall consist of three cubes tested at 28 days.

.8 The compressive strength of test cubes shall be in accordance with CSA Test Method A23.2-1B and shall be the average of the strengths of the test cubes.

.9 The compressive strength of the grout shall be considered satisfactory if the average of the three strength tests are equal to or exceed the specified compressive strength.

3.6 WORKING PIT BACKFILL

.1 Upon completion of the trenchless installation, insertion of the carrier pipe, and installation of the end seals, surround and cover the pipe ends in the working pits as indicated.

.2 Backfill working pits from the base of the pit to the bottom of the pipe zone with fillcrete in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling or Type 1 fill (washed rock) in accordance with Section 3 04 00 – Aggregate Materials.

.3 Backfill the pipe zone with fillcrete in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling or pipe zone material in accordance with Section 3 04 00 – Aggregate Materials. Compact pipe zone material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.4 If fillcrete is used for the pipe zone material, measures shall be taken to prevent floatation of the carrier pipe within the working pit; measures may include placement of fillcrete in small lifts, ballasting/weighting of the carrier pipe, and/or anchoring/blocking of the carrier pipe.

.5 Backfill working pits from the top of pipe zone to subgrade with fillcrete in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling or Type 3 fill (native fill) in accordance with Section 3 04 00 – Aggregate Materials. Compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.7 SURFACE RESTORATION

.1 After backfilling working pits, restore the surface to pre-construction condition or as indicated on the Drawings.

3.8 CLEANING

.1 In accordance with Section 1 11 00 – Closeout Procedures.

Part 4 Measurement and Payment

4.1 TRENCHLESS INSTALLATION OF STEEL CASINGS

.1 Measurement and payment for the trenchless installation of steel casings, for the types and sizes specified, will be per metre of steel casing installed, as measured along the centreline of the casing pipe.

.2 Unit price to include surface preparation, excavation of the entry and exit pits, wall stabilization of the entry and exit pits and/or temporary protective structures, groundwater management of the entry and exit pit excavations, design and construction of temporary working pit bases, design and construction of temporary thrust reaction systems, supply and installation of the casing and carrier pipe materials, casing spacers, joint restraints, contact and backfill grouts, and end seals, casing pipe welding, management and disposal of excess material and trenchless spoil, disposal fees if any, pipe bedding in working pits, backfill and compaction of the entry and exit pits, surface restoration of the entry and exit pits to pre-construction condition or as indicated, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

.1 This Section specifies the requirements for direct burial of underground cable ducts under roadways and boulevards.

Part 2 Products

2.1 PVC DUCTS AND FITTINGS

.1 PVC Duct and Fittings:

- .1 Type DB2.
- .2 6.1 m lengths.
- .3 One end belled.
- .4 Conforming to CSA C22.2 No. 211.1.

.2 PVC Primer:

- .1 Approved for cleaning PVC DB2 electrical duct surfaces in preparation of duct interface.

.3 PVC Cement:

- .1 Approved for solvent welding for PVC DB2 components.

.4 Pull String:

- .1 90 kg polypropylene twine, 1 ply.

2.2 CONCRETE

.1 25 MPa concrete to Section 3 02 00 – Basic Concrete Materials and Test Methods.

.2 Concrete reinforcing to Section 3 02 20 – Concrete Reinforcement.

2.3 BEDDING AND SURROUND MATERIAL

.1 Sand in accordance with Section 3 04 00 – Aggregate Materials.

Part 3 Execution

3.1 PREPARATION

.1 Duct and fittings to be clean and dry before installation.

.2 Prior to installation, obtain approval of duct and fittings from Owner’s Representative.

3.2 TRENCHING

.1 Complete trenching Work in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Trench width to be determined by the number of ducts placed horizontally in trench with 50 mm to 75 mm separation between ducts or width of compaction equipment, whichever is greater.

.3 Trench depth to be as follows (if depths other than those listed are required, obtain approval from the Owner's Representative):

.1 Road crossings: 1.2 m below the top of the pavement.

.2 Under concrete or paving stone sidewalks: 0.75 m.

.3 Landscaped areas: 0.9 m.

3.3 BEDDING AND SURROUND MATERIAL

.1 Place bedding and surround material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.4 DUCT INSTALLATION

.1 Lay and join duct in accordance with manufacturer's instructions.

.2 Lay duct on prepared bed true to line and grade, with duct invert smooth and free of sags or high points. Ensure duct is in contact with bed throughout its full length.

.3 Place parallel lengths of duct in a horizontal layer across bottom of trench with 50 mm minimum spacing. Vertical stacking of duct will not be permitted.

.4 Prepare joints in accordance with manufacturer's recommendations. Remove all sharp edges and burrs from inside the conduit.

.5 Clean all joints with approved pipe cleaner.

.6 Apply solvent cement in accordance with manufacturer's recommendations and complete joint. Do not disturb joint for 24 hours to allow for proper curing of joint solvent.

.7 Install end caps or plugs on the ends of all ducts.

.8 Pull string to be pulled out the side of the end of the duct, not the top or bottom.

3.5 DUCT CROSSINGS

.1 When required to cross existing ducts, place sufficient bedding material to provide a minimum separation of 150 mm between the duct banks.

3.6 CONCRETE ENCASEMENT

.1 Place concrete encasement to a minimum thickness of 150 mm at all bends of 45º or greater.

3.7 DUCT TERMINATION

.1 For road crossings, end duct installation 2.0 m clear of paved road surface or back of curb, 1.0 m clear of sidewalk, or as directed by the Owner's Representative.

3.8 MARKER POSTS

.1 Install a 38 mm x 89 mm marker post from the invert of the duct to 1.0 m above ground at each end of the duct installation.

.2 Install a 1200 mm x 15 mm diameter steel marker pin at the end of the duct. Set top of pin flush with existing surface after final backfill.

.3 Marker posts for streetlighting/traffic/low voltage (600 V or lower) ducts shall be orange. Marker posts for high voltage (greater than 600 V) ducts shall be red.

3.9 BACKFILL

.1 Upon completion of duct laying and after the Owner's Representative has inspected the duct joints, place and compact backfill material in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

Part 4 Measurement and Payment

.1 Measurement and payment for the supply and installation of underground cable ducts will be per metre of underground cable duct installed, as measured along the centreline of the duct bank from designated start point to designated termination point, including length through manholes.

.2 Measurement and payment for the supply and installation of connections from the main duct to streetlight bases, secondary voltage service vaults, and other connections shown on the Drawings will be per each connection installed.

.3 Unit price to include the supply and installation of the ducts, bends, couplings, glue, pull string, primer, concrete, marker posts, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.4 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

END OF SECTION

Part 1 General

1.1 PROTECTION OF EXISTING FEATURES

.1 Protect existing features designated to remain or identified for salvage in accordance with Section 2 01 00 - Excavating, Trenching, and Backfilling, Section 3 01 10 – Asphalt Pavement Removal, and Section 4 01 30 – Site Grading. In the event of damage to such items, the Contractor shall make necessary repairs to the approval of the Owner's Representative, at the Contractor's expense.

.2 Implement erosion and sedimentation control as specified on the Drawings and in accordance with Section 1 07 00 – Environmental Procedures.

.3 Do not dispose of waste or volatile materials into watercourses, the environment, or municipal storm or sanitary sewer systems. Waste shall be disposed of at an approved facility. Ensure proper disposal procedures are followed throughout the project.

1.2 EXISTING CONDITIONS

.1 Prior to the start of any demolition Work, remove and dispose contaminated and/or hazardous materials from site in accordance with the *Transportation of Dangerous Goods Act* and all other applicable regulatory requirements.

1.3 SUBMITTALS

.1 Prior to commencement of Work on site, submit a Waste Removal Plan identifying:

- .1 Location and type of waste containment on site,
- .2 Types and quantities of materials to be salvaged, reused, recycled, and disposed,
- .3 Schedule of demolition and anticipated frequency of hauling materials for disposal,
- .4 Planned haul route and type of vehicle(s) to be used, and
- .5 Arrangements for hazardous waste disposal.

.2 Provide confirmation in writing and proof of proper disposal following any hazardous waste disposal at an approved waste collection facility.

Part 2 Products

.1 Not used.

Part 3 Execution

3.1 PREPARATION

.1 Inspect the site with the Owner's Representative and verify the extents and locations of items designated for removal, disposal, recycling, salvage, and items to remain.

.2 Locate and protect utilities. Preserve active utilities in operating condition.

.3 Notify and obtain approval from affected utility companies before commencing demolition Work.

3.2 SEQUENCE OF OPERATIONS

.1 Removing Material:

.1 Remove items as indicated.

.2 Do not disturb items designated to remain in place.

.3 In removal of pavement, curb, and gutter:

.1 Square up adjacent surfaces to remain in place by saw-cutting or other method approved by the Owner's Representative.

.2 Protect adjacent joints and load transfer devices.

.3 Protect underlying and adjacent granular materials.

.4 Prevent contamination with base course aggregates when removing asphalt pavement designated for future reuse in Recycled Asphalt Pavement.

.5 Remove pipes, manholes, and associated appurtenances as specified. Seal pipe ends and walls of manholes, catch basins, and catch basin manholes as specified. Ensure a watertight seal.

.6 When removing pipes, excavate at least 150 mm below pipe invert.

.2 Salvaging Material:

.1 Carefully dismantle items containing materials to be salvaged.

.3 Stockpiling Salvaged Material:

.1 Stockpile salvaged material in an approved location and prevent stockpiled materials from cross-contamination/mixing.

.2 Stockpile topsoil for final grading and landscaping. Provide erosion control and seeding in accordance with the Erosion and Sedimentation Control Plan.

.4 Disposal of Removed Material:

.1 Dispose of materials not designated for salvage or reuse to an approved disposal facility off-site, as per the Waste Removal Plan. Deviations from the Waste Removal Plan must be approved in writing by the Owner's Representative.

.5 Backfill:

.1 Backfill in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.3 SURFACE RESTORATION

.1 Restore disturbed areas beyond the limits of demolition to conditions that existed prior to commencement of Work.

3.4 CLEAN-UP

.1 Upon completion of the Work, and immediately prior to inspection, remove surplus materials, tools, construction machinery, and equipment not required for the performance of the remaining Work from the site and thoroughly clean all surfaces and components.

.2 Use only cleaning solutions and procedures which are not harmful to the public or the environment.

Part 4 Measurement and Payment

4.1 CONCRETE REMOVAL

.1 Measurement and payment for the removal and disposal of concrete sidewalks, trails, curb ramps, driveway crossings, alley crossings, and slabs-on-grade will be per square metre (m^2) removed.

.2 Measurement and payment for the removal and disposal of concrete curb, gutter, and swales will be per metre removed.

.3 Measurement and payment for the removal and disposal of miscellaneous concrete will be per cubic metre (m^3) removed.

.4 Unit price to include saw-cutting, breaking, removal, separation of materials if required, loading, hauling, and stockpiling salvageable materials at designated locations, hauling and disposal of surplus or waste materials at an approved facility, disposal fees if any, dust control, maintenance, and clean-up of haul routes as required, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.2 ASPHALT REMOVAL

.1 Refer to Section 3 01 10 – Asphalt Pavement Removal.

4.3 HYDRANT REMOVAL

.1 Measurement and payment for the removal and disposal of hydrants will be per each hydrant removed and disposed.

.2 Unit price to include saw-cutting, removal and disposal of the hydrant, hydrant lead, hydrant valve, tee, fittings, hardware, concrete thrust block, mechanical joint restraints, valve seating block, washed rock, geotextile filter fabric, cathodic protection, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.4 VALVE REMOVAL

.1 Measurement and payment for the removal and disposal of valves will be per each valve removed and disposed.

.2 Unit price to include saw-cutting, removal and disposal of valve, valve stem, valve box, fittings, hardware, concrete thrust block, valve seating block, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.5 WATERMAIN REMOVAL

.1 Measurement and payment for the removal and disposal of watermains, for the pipe sizes and materials specified, will be per metre of watermain removed and disposed, as measured along the centreline of the main, through valves and fittings.

.2 Unit price to include saw-cutting, removal and disposal of the watermain, fittings, hardware, concrete thrust blocks, mechanical joint restraints, cathodic protection, tracer wire if required, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.6 WATER SERVICE REMOVAL

.1 Measurement and payment for the removal and disposal of water services, for the service sizes and materials specified, will be per metre of water service removed and disposed, as measured along the centreline of the service, from the centre of the main to the property line.

.2 Unit price to include saw-cutting, removal and disposal of the water service pipe, sand bags, cathodic protection, curb stop, valve seating block, thaw wires, fittings, and hardware, closing the corporation stop, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.7 COMBINATION AIR RELEASE VALVE CHAMBER REMOVAL

.1 Removal and disposal of combination air release valve chambers will be measured as a lump sum item.

.2 Payment will be made on a percent complete basis as determined by the Owner's Representative.

.3 Lump sum price to include saw-cutting, removal and disposal of the precast concrete chamber base and barrel sections, manhole frame and cover, insulated frost cover, spray foam insulation, combination air release/vacuum valve, flanged isolation valve, flanged outlet pipe, telescopic vertical pipe supports, drain pipe, vent pipe if required, washed rock, fittings, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.8 SANITARY SEWER MAIN REMOVAL

.1 Measurement and payment for the removal and disposal of sanitary sewer mains, for the pipe sizes and materials specified, will be per metre of sanitary sewer main removed and disposed, as measured along the centreline of the main, from centre of manhole to centre of manhole (or from centre of manhole to identified termination point, as specified).

.2 Unit price to include saw-cutting, removal and disposal of the sanitary sewer main, fittings, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.9 SANITARY SERVICE REMOVAL

.1 Measurement and payment for the removal and disposal of sanitary services, for the service sizes and materials specified, will be per metre of sanitary service removed and disposed, as measured along the centreline of the service, from the centre of the main to the property line.

.2 Unit price to include saw-cutting, removal and disposal of the sanitary service pipe, fittings, hardware, sand bags, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.10 STORM SEWER MAIN REMOVAL

.1 Measurement and payment for the removal and disposal of storm sewer mains, for the pipe sizes and materials specified, will be per metre of storm sewer main removed and disposed, as measured along the centreline of the main, from centre of manhole to centre of manhole (or from centre of manhole to identified termination point, as specified).

.2 Unit price to include saw-cutting, removal and disposal of the storm sewer main, fittings, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.11 CATCH BASIN LEAD REMOVAL

.1 Measurement and payment for the removal and disposal of catch basin leads, for the pipe sizes and materials specified, will be per metre of catch basin lead removed and disposed, as measured along the centreline of the lead, from centre of manhole/catch basin manhole to centre of catch basin/catch basin manhole as applicable.

.2 Unit price to include saw-cutting, removal and disposal of the catch basin lead, fittings, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.12 STORM SERVICE REMOVAL

.1 Measurement and payment for the removal and disposal of storm services, for the service sizes and materials specified, will be per metre of storm service removed and disposed, as measured along the centreline of the service, from the centre of the main to the property line.

.2 Unit price to include saw-cutting, removal and disposal of the storm service pipe, fittings, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.13 PIPE CULVERT REMOVAL

.1 Measurement and payment for the removal and disposal of pipe culverts, for the sizes and materials specified, will be per metre of pipe culvert removed and disposed, as measured along the centreline of the culvert, from inlet to outlet.

.2 Unit price to include the removal and disposal of the pipe, end treatment, headwalls if required, rip rap, geotextile filter fabric, fittings, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.14 MANHOLE REMOVAL

.1 Measurement and payment for the removal and disposal of manholes, for the sizes specified, will be per each manhole removed and disposed.

.2 Unit price to include removal and disposal of the precast concrete base and barrel sections, grade rings, frame and cover, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.15 CATCH BASIN REMOVAL

.1 Measurement and payment for the removal and disposal of catch basins will be per each catch basin removed and disposed.

.2 Unit price to include removal and disposal of the precast concrete base and barrel sections, grade rings, frame and grate, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.16 CATCH BASIN MANHOLE REMOVAL

.1 Measurement and payment for the removal and disposal of catch basin manholes will be per each catch basin manhole removed and disposed.

.2 Unit price to include removal and disposal of the precast concrete base and barrel sections, grade rings, frame and grate, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.17 SIGN REMOVAL

.1 Measurement and payment for the removal and disposal of signs will be per each sign removed and disposed.

.2 Unit price to include removal and disposal of the sign, sign post, sign support, hardware, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Not used.

1.2 SUBMITTALS

.1 At least 2 weeks prior to commencing Work, submit a Traffic Accommodation Plan in accordance with Section 1 05 00 – Traffic Control and the Municipality's *Design Servicing Standards and Development Procedures*.

1.3 PROTECTION OF EXISTING FEATURES

.1 Protect existing features designated to remain or identified for salvage in accordance with Section 3 01 00 – Site Demolition. In the event of damage to such items, the Contractor shall make necessary repairs to the approval of the Owner's Representative, at the Contractor's expense.

.2 Implement erosion and sedimentation control as specified on the Drawings and in accordance with Section 1 07 00 – Environmental Procedures.

.3 Do not dispose of waste or volatile materials into watercourses, the environment, or municipal storm or sanitary sewer systems. Waste shall be disposed of at an approved facility. Ensure proper disposal procedures are followed throughout the project.

Part 2 Products

.1 Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Inspect the site with the Owner's Representative and verify the extents and locations of pavement designated for removal, disposal, recycling, salvage, and to remain.

.2 In areas designated to be cold milled, remove dirt and debris prior to commencing milling.

3.2 TRAFFIC SAFETY

.1 Provide advance warning signage in areas opened to traffic before paving, as follows:

Bump – at all transverse edges and edges at exposed utility structures.

Uneven Pavement – at all longitudinal edges, and at edges within crosswalks.

.2 Install a taper over a minimum length of 1 m at the vertical edges at the limits of pavement removal. Taper to have a minimum slope of 10H:1V. Taper to remain in place until immediately before repaving operations. Remove taper via cold milling.

.3 Install a wedge over a minimum width of 1 m at the vertical edges at lip of gutter. Wedge to have a minimum slope of 10H:1V. Wedge to remain in place until immediately before repaving operations. Remove wedge via cold milling.

3.3 PAVEMENT REMOVAL

.1 Excavation:

.1 Saw-cut and remove existing asphalt pavement to lines and depths specified on the Drawings or as directed by the Owner's Representative.

.2 Use equipment and methods of removal and hauling which do not damage or disturb adjacent and/or underlying pavement.

.3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel, or other materials.

.4 Provide dust control in accordance with Section 3 03 00 – Dust Control.

.2 Cold Milling:

.1 Mill to lines and depths specified on the Drawings or as directed by the Owner's Representative.

.2 Mill pavement to expose the vertical surface of the gutter face, manhole frames, water valves, survey monuments, utility vaults, and any other structures within the area to be milled.

Part 4 Measurement and Payment

4.1 ASPHALT PAVEMENT REMOVAL

.1 Measurement and payment for the removal and disposal of asphalt pavement, for the depths specified, will be per square metres (m^2) of pavement removed.

.2 Unit price to include saw-cutting, breaking, removal, separation of materials if required, loading, hauling, and stockpiling salvageable materials at designated locations, hauling and disposal of surplus or waste materials at an approved facility, disposal fees if any, dust control, maintenance, and clean-up of haul routes as required, sweeping of remaining pavement surface, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

4.2 COLD MILLING

.1 Measurement and payment for cold milling, for the depths specified, will be per square metre (m^2) of asphalt milled.

.2 Unit price to include cold milling, loading, hauling, and disposal of surplus or waste materials at an approved facility, disposal fees if any, dust control, maintenance, and clean-up of haul routes as required, sweeping of remaining pavement surface, and labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

.1 Not used.

Part 2 Products

2.1 MATERIALS

.1 Use only approved abrasives and solvents for the removal of paint, oil, grease, and rubber deposits.

Part 3 Execution

3.1 PAVEMENT CLEANING

.1 Remove and dispose of excess sealing compound as directed by the Owner's Representative.

.2 Remove dust, contaminants, loose and foreign materials, oil, and grease in areas designated.

3.2 PAVEMENT MARKING REMOVAL

.1 Remove paint markings where indicated on the Drawings.

.2 Exercise care to avoid dislodging coarse aggregate particles, removal of fines, damage to bituminous binder, and damage to joint and crack sealants.

.3 Do not heat pavement surfaces above 120°C when using heater planing equipment.

Part 4 Measurement and Payment

4.1 PAVEMENT CLEANING

.1 Separate payment will not be made for the cleaning of pavement surfaces. Include costs in related items.

4.2 PAVEMENT MARKING REMOVAL

.1 Measurement and payment for the removal of dashed and solid lines, for the types specified, will be per metre of pavement marking removed.

.2 Measurement and payment for the removal of stop bars, zebra bars, single arrows, double arrows, and symbols will be per each pavement marking removed.

.3 Extra payment will not be made for varying widths.

.4 Unit price to include labour, equipment, materials, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete
- .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete
- .4 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
- .5 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- .6 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
- .7 ASTM D1752, Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34, Polyethylene Sheet for Use in Building Construction – Material Specification

.3 Canadian Standards Association (CSA)

- .1 CSA A23.1/CSA A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .2 CSA A283, Qualification Code for Concrete Testing Laboratories
- .3 CSA A3000, Cementitious Materials Compendium

1.2 ABBREVIATIONS AND ACRONYMS

.1 Portland Cement:
The following types of cement are presented in this order: hydraulic cement, blended hydraulic cement, and Portland-limestone cement.

- .1 Type GU, GUb, and GUL - General use cement.
- .2 Type MS, MSb, and MSe - Moderate sulphate-resistant cement.
- .3 Type MH, MHb, and MHL - Moderate heat of hydration cement.
- .4 Type HE, HEb, and HEL - High early-strength cement.
- .5 Type LH, LHb, and LHL - Low heat of hydration cement.
- .6 Type HS, HSb, and HSe - High sulphate-resistant cement.

.2 Fly ash:

.1 Type F - with calcium oxide (CaO) content less than 15%.

.2 Type CI - with CaO content ranging from 15% to 20%.

.3 Type CH - with CaO greater than 20%.

1.3 SUBMITTALS

.1 Provide an Authenticated letter, from a qualified Professional Engineer in good standing with APEGA, certifying that the proposed concrete mix design is suitable for the intended application.

.2 Provide documentation verifying that the concrete supplier meets industry certification requirements, or:

.1 Satisfy the requirements of CSA A23.2-24C, Standard Practice for Sampling, Testing, and Inspection of Concrete for Qualification Purposes. The minimum documentation shall include:

.1 Provide certification that the plant, equipment, and materials to be used in concrete comply with the requirements of CSA A23.1.

.2 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.

.3 Submit mix designs, cement, aggregate, and admixture material test reports, data sheets, and/or certifications as applicable.

.4 Submit current test results for the proposed mix design, or a demonstrably similar mix design prior to starting concrete Work.

.5 Provide a summary of the preventative measures for alkali-reactivity in accordance with CSA A23.2-27A for all concrete mix designs.

.3 Where combinations of supplementary cementitious materials and hydraulic cement or a blended cement are to be used in the concrete mix design, they shall be designated as MSe (MS equivalent) or HSe (HS equivalent) and documentation shall be provided demonstrating equivalent performance against sulphate exposure as specified in CSA A23.1.

.4 Submit proposed quality control procedures. Identify procedures that will prevent non-compliant concrete from entering the final Work.

.5 Submit drawings showing proposed construction joint locations and pour sequence for review prior to starting concrete Work.

.6 Submit concrete test results taken during concrete pour. Material samples shall be taken directly from truck chute.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: to CSA A3000.

.2 Supplementary cementing materials: to CSA A3000.

.3 Water: to CSA A23.1/CSA A23.2.

.4 Aggregates: to CSA A23.2-30A.

.5 Air entraining admixture: to ASTM C260/C260M.

.6 Chemical admixtures: to ASTM C494/494M.

.1 The use of accelerating or set retarding admixtures, when required during cold and hot weather placing, must be approved in writing by the Owner's Representative.

.7 Use of calcium chloride or admixtures containing calcium chloride is not permitted.

.8 Pressure injected epoxy grout: to be reviewed by the Owner's Representative.

2.2 CONCRETE MIXES

.1 In accordance with Section 3 02 30 – Cast-in-Place Concrete.

Part 3 Execution

3.1 GENERAL

.1 Do cast-in-place concrete work in accordance with CSA A23.1.

.2 Allow for a minimum of 3 days to elapse between adjacent wall or slab pours.

.3 All phases of construction, materials, and workmanship are to proceed with full regard to providing a watertight structure upon completion.

.4 Temperature of the concrete during discharge into the forms shall comply with CSA A23.1. The temperature of the mix is to be maintained below 25°C unless otherwise approved in writing by the Owner's Representative. Typical methods of reducing mix temperature include evaporative cooling of aggregate stockpiles, using chilled batch water or the inclusion of ice into the mix at the plant. Any measures implemented to reduce the mix temperature shall maintain the design water/cementitious materials ratio. Obtain the approval of the Owner's Representative for the proposed method of temperature control.

3.2 WORKMANSHIP

.1 Obtain the Owner’s Representative's approval before placing concrete. Provide 48 hours notice prior to the placing of concrete.

.2 Pumping of concrete is permitted.

.3 Concrete shall be delivered to the site and discharged into the Work within 2 hours after introduction of the mixing water to the cement and aggregate.

.4 Ensure reinforcement and inserts are not disturbed during concrete placement.

.5 Prior to the placing of concrete, obtain the Owner’s Representative's approval of the proposed method for protection of the concrete during placing and curing.

.6 Do not place concrete against any surfaces such as rebar, concrete, or formwork that have a surface temperature of less than 5°C.

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

.8 Consolidate concrete using internal vibrators. Use pencil vibrators where larger sizes are unsuitable.

.9 Do not place load upon new concrete until specified cure times have been met.

3.3 INSERTS

.1 Set sleeves, ties, pipe hangers, and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 mm x 100 mm not indicated on the Drawings must be approved by the Owner’s Representative.

.2 No sleeves, ducts, pipes, or other openings shall pass through beams, except where expressly detailed on the Drawings or approved by the Owner’s Representative.

.3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from the Owner’s Representative before the placing of concrete.

.4 Anchor bolts:

- .1 Place anchor bolts to templates under supervision of trade supplying anchors prior to placing concrete.
- .2 With the Owner’s Representative's approval, grout anchor bolts in pre-formed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be a minimum of 25 mm larger in diameter than the bolts used.
- .3 Protect anchor bolt holes from water accumulation.
- .4 Set bolts and fill holes with shrinkage compensating grout.

3.4 CONSTRUCTION JOINTS

.1 Provide construction joints as shown on the Drawings. Submit pour sequence for review by the Owner's Representative as specified in Section 3 02 10 - Concrete Formwork.

.2 Surfaces shall be clean, free of all laitance and unsound concrete, and roughened to CSP8 (Concrete Surface Profile 8; scabbled) in accordance with (International Concrete Repair Institute) guidelines; sandblast, green cut, or hydro blast as required.

3.5 FINISHING

.1 Finish concrete in accordance with CSA A23.1 and as shown on the Drawings. Concrete tolerance - use straight edge method, Class A.

.2 Protect surfaces from excessive drying before and during finishing operations.

.3 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.4 All tie recesses are to be grouted with waterproof grout.

3.6 CRACK REPAIR

.1 Use the best possible care and construction techniques to minimize cracking of concrete.

.2 Cracks which do appear shall be routed out on each face and repaired with cementitious waterproof grout in accordance with manufacturer's recommendations. Cracks which are more than 2 mm in width or are deemed by the Owner's Representative to be structurally detrimental or subject to movement shall be grouted with pressure injected epoxy resin.

.3 Obtain approval from the Owner's Representative of pressure grouting techniques and epoxy materials to be used prior to proceeding with the Work.

.4 Depth of epoxy grouting shall be sufficient to restore structural integrity and/or watertightness, as required, but shall not be less than 100 mm.

.5 Cure crack repairs to manufacturer's instructions.

3.7 CURING

.1 Curing shall be in accordance with CSA A23.1.

.2 Provide wet curing for a minimum of 7 consecutive days in all cases, at not less than 10°C.

.3 Acceptable curing methods:

.1 Absorptive mat or fabric kept continuously wet.

.2 Other moisture retaining method approved by the Owner's Representative.

3.8 COLD WEATHER CONCRETING

.1 Protection shall be provided when there is a probability of the air temperature falling below 5°C within 24 hours of placing (as forecast by the nearest official meteorological office). All materials and equipment needed for adequate protection and curing shall be on hand and ready for use prior to concrete placement.

.2 Cold weather placement, protection, and preparation shall comply with CSA A23.1.

.3 Concrete placed between April 16 and September 30 shall attain the minimum allowable compressive strength in 28 days. For concrete placed between October 1 and April 15, the minimum allowable compressive strength shall be attained in 7 days.

.4 Designation C-HE concrete may be required before September 30 based on forecasted weather conditions.

.5 After placement, the concrete surface temperatures are to remain at or above 10°C for a minimum of 3 days and continued until the concrete has attained at least 85% of the specified compressive strength.

.6 When the air temperature is at or below 5°C or is likely to drop below 5°C within 24 hours of placing the concrete, the temperature of the concrete immediately after being placed in the forms shall not be less than 10°C.

.7 Concrete shall not be placed on subgrade if the ground temperature is less than 5°C.

.8 If a temperature of 10°C cannot be maintained for 3 days after placing the concrete, concrete placing shall cease.

3.9 HOT WEATHER CONCRETING

.1 When the ambient air temperature is at or above 27°C, or when there is a probability of the temperature rising above 27°C during the placement period (as forecast by the nearest official meteorological office), facilities shall be provided for the protection of the concrete in place from the effects of hot and/or drying weather conditions.

.2 During hot weather, begin the curing process immediately after finishing.

.3 Hot weather placement, protection, and preparation shall comply with CSA A23.1.

3.10 MASS CONCRETE

.1 When a concrete element is designated to be mass concrete, a Thermal Control Plan shall be prepared. Mass concrete placements shall not be performed prior to approval of the Thermal Control Plan by the Owner’s Representative.

.2 The Thermal Control Plan shall include recommended practices to control and monitor concrete temperatures.

3.11 QUALITY ASSURANCE

.1 The Owner shall engage the services of a qualified independent testing laboratory or agency to perform the required Quality Assurance testing, in accordance with CSA A23.1, to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.4 Coordinate the collection of concrete samples for testing in accordance with CSA A23.2-1C:

.1 One strength test shall consist of test cylinders for each 50 m^3 of concrete placed in any one day, each concrete mix design placed in any one day, or each separate type of concrete element placed in any one day.

.2 For concrete with a specified 56 day compressive strength, each strength test shall consist of a minimum 4 test cylinders. Test one cylinder at 7 days, one cylinder at 28 days, and two cylinders at 56 days.

.3 For concrete with a specified 28 day compressive strength, each strength test shall consist of a minimum of 3 test cylinders. Test one cylinder at 7 days and two cylinders at 28 days.

.4 For concrete with a specified 7 day compressive strength, each strength test shall consist of a minimum of 4 test cylinders. Test two cylinders at 7 days and two cylinders at 28 days.

.5 The Owner's Representative will request additional strength test cylinders and test ages during cold weather concreting.

.1 After September 30 or if the ambient air temperature is below 0°C or is likely to fall below 0°C within 72 hours after placement, two additional cylinders shall be made for each strength test. These two cylinders will be field cured and shall have the same protection from the elements on all surfaces as is given to the portions of the structure they represent.

.6 To facilitate testing, the Contractor shall provide and maintain, for the sole use of the testing laboratory or agency, adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the initial curing period. Adequate facilities shall include a protected and temperature-controlled designated area in accordance with CSA A23.2-3C.

.7 Compressive Strength Tests:

.1 Test cylinders shall be in accordance with CSA A23.2-9C, Compressive Strength of Cylindrical Concrete Specimens and shall be the average of the strengths of the test cylinders tested at the same age.

.2 The strength level of the concrete shall be considered satisfactory if the averages of three consecutive strength tests for each designation of concrete are equal to, or exceed, the specified strength and no individual strength test is more than 5 MPa below the specified compressive strength.

.8 Air Content:

.1 Air content determinations shall be made in accordance with CSA A23.2-4C, Air Content of Plastic Concrete by the Pressure Method or CSA A23.2-7C, Air Content of Plastic Concrete by the Volumetric Method.

.2 During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the strength test cylinders will be sufficient once satisfactory control has been established.

.3 Whenever a test falls outside the specified limits, the testing frequency shall revert to one test per load or batch until such time as satisfactory control is re-established.

.9 Slump:

.1 Slump tests shall be completed in accordance with CSA A23.2-5C.

.2 Slump of concrete shall be reported in conjunction with each strength test.

.10 Non-destructive Methods for Testing Concrete shall be in accordance with CSA A23.2, Test Methods and Standard Practices for Concrete. Make good concrete surfaces after completion of tests.

3.12 FAILURE TO MEET TEST REQUIREMENTS

.1 Strength:

.1 If the concrete tested in accordance with these specifications fails to meet the strength requirements, the Owner's Representative shall have the right to require any one, any combination of, or all of the following at no additional expense to the Owner.

.1 Change the concrete mix proportions for the remainder of the Work.

.2 Core the portions of the Work in question and test in accordance with CSA A23.2-14C, Obtaining and Testing Drilled Cores for Compressive Strength Testing.

.3 Replace the concrete represented by the tests with concrete which meets these specifications.

.2 Air Content:

.1 If the measured air content falls outside the limits specified, a check test shall be made immediately on another portion of the same sample. In the event of a second failure, the load of concrete shall not be used for construction.

.2 Where deemed necessary, the Owner's Representative will require testing of hardened concrete for air content and spacing factor by the linear traverse method, ASTM C457/C457M. For Designation A, C, and C-HE concrete, the air-void system shall meet the following requirements:

.1 The average spacing factor determined on samples of the same mix design shall not exceed 230 µm, with no single value greater than 260 µm; and

.2 Air content shall be greater than or equal to 3.0% in the hardened concrete.

.3 The cost of linear traverse testing will be borne by the Contractor if the concrete is proven defective.

.3 Slump:

.1 If the measured slump falls outside the limits specified, a check test shall be made immediately on another portion of the same batch. In the event of a second failure, the Owner's Representative may refuse to permit the use of the batch.

Part 4 Measurement and Payment

.1 Separate payment will not be made for work specified in this Section. Include costs in related items.

.2 The Owner will not pay for or reimburse the Contractor for any services related to inspection or testing for Quality Control.

.3 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected work.

.4 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.5 The Contractor shall pay costs for uncovering and making good work that is covered before the required inspection or testing is completed and approved by the Owner's Representative.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA):

.1 CSA A23.1, Concrete Materials and Methods of Concrete Construction

.2 CSA O86.1, Engineering Design in Wood

.3 CSA S269.1, Falsework and Formwork

1.2 SUBMITTALS

.1 Comply with CSA S269.1 for falsework drawings and formwork.

.2 Indicate sequence and location of proposed construction joints. Locate construction joints as shown and maximum 11 m in any direction, unless noted otherwise.

.3 On shop drawings, indicate method and schedule of construction, rate of pour, materials, arrangement of joints, ties, shores, waterstops, and locations of temporary embedded parts.

.4 Submit a sample of the form tie proposed.

.5 Where failure of the form would be hazardous, the shop drawings shall be Authenticated by a qualified Professional Engineer in good standing with APEGA.

Part 2 Products

2.1 MATERIALS

.1 Formwork lumber: plywood and wood formwork materials to CSA O86.1 and CSA S269.1.

.2 Falsework materials: to CSA S269.1.

.3 Form ties: removable ends or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm in diameter in concrete surface, and leaving no metal within 25 mm of concrete surface when forms have been removed. Use tapered plastic cones on faces of concrete to facilitate grouting and use a purpose made waterstop flange at the mid-length of the tie.

.4 Form release agent: non-staining type, containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms. Agent to be compatible with subsequent surface finishes.

Part 3 Execution

3.1 ERECTION

.1 Verify lines and levels before proceeding with formwork and ensure dimensions agree with Drawings.

.2 Construct falsework in accordance with CSA S269.1.

.3 Construct forms to produce finished concrete conforming to shape, dimensions, locations, and levels indicated, within the tolerances required by CSA A23.1.

.4 Align form joints and make watertight. Keep form joints to a minimum.

.5 Use 20 mm chamfer strips on external corners.

.6 Form expansion and control joints as indicated.

.7 Clean formwork in accordance with CSA A23.1 before placing concrete.

.8 Leave formwork in place after placing concrete and strip formwork only after concrete has hardened adequately, at the discretion of the Owner's Representative.

.9 Re-use of formwork and falsework is subject to the requirements of CSA A23.1.

Part 4 Measurement and Payment

.1 Separate payment will not be made for work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCES AND REFERENCE STANDARDS

.1 Reinforcing Steel Institute of Canada (RSIC), Manual of Standard Practice

.2 MNL-66, ACI (American Concrete Institute) Detailing Manual

.3 Canadian Standards Association (CSA)

- .1 CSA A23.1/CSA A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .2 CSA A23.3, Design of Concrete Structures
- .3 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement
- .4 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel
- .5 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction

1.2 SOURCE QUALITY CONTROL

.1 Upon request, inform the Owner's Representative of the proposed source of material to be supplied.

.2 Upon request, provide the Owner's Representative with a certified copy of the mill test report for reinforcing steel, showing physical and chemical analysis.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 1 04 00 – Submittal Procedures.

.2 Indicate bar bending details, lists, and quantities of reinforcement on shop drawings.

.3 On placing drawings, clearly indicate sizes, spacing, locations and quantities of reinforcement and mechanical splices, with identifying code marks to permit correct placement without reference to the Drawings. Indicate sizes, spacing, and locations of chairs, spacers, and hangers. Prepare reinforcement drawings in accordance with the RSIC Manual of Standard Practice.

.4 Detail lap lengths and bar development lengths to CSA A23.3. Provide Class B tension lap splices, unless otherwise indicated.

1.4 SUBSTITUTES

.1 Substitution of different size bars shall be permitted only upon written approval from the Owner's Representative.

Part 2 Products

2.1 MATERIALS

.1 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA G30.18, unless indicated otherwise.

.2 Chairs, bolsters, bar supports, spacers: to CSA A23.1.

.3 Mechanical splices: subject to the approval of the Owner’s Representative.

2.2 FABRICATION

.1 Fabricate reinforcing steel in accordance with CSA A23.1.

.2 Obtain the Owner’s Representative's approval for locations of reinforcement splices other than those shown on the placing drawings.

.3 Coordinate splices and lap locations with location of pour breaks and construction joints.

.4 Upon approval of the Owner’s Representative, weld reinforcement in accordance with CSA W186.

.5 Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend reinforcement except where indicated or authorized by the Owner’s Representative.

.2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

.3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA A23.1.

.2 Place, support, and space reinforcing in alignment to position indicated and as follows:

.1 Provide additional bars necessary to support dowels, stirrups, or straight bars.

.2 Supports are to be purpose made and maintain integrity and watertightness of concrete construction.

.3 Provide tiers and spacers for reinforcing to prevent movement or displacement during concrete pour and to maintain specified reinforcing cover as shown on the Drawings.

.4 All reinforcing steel shall be cleaned to the satisfaction of the Owner's Representative, and free of any rust, scale, mortar, paint, oil, mud, ice, and other foreign substances which will reduce bond, prior to the placement of concrete.

Part 4 Measurement and Payment

.1 Separate payment will not be made for work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C109/C109M, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm (2 in.) Cube Specimens)
- .2 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete
- .3 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- .4 ASTM C332, Standard Specification for Lightweight Aggregates for Insulating Concrete
- .5 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete
- .6 ASTM C827/C827M, Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures
- .7 ASTM C939/C939M, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
- .8 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
- .9 ASTM D1752, Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

.2 Canadian Standards Association (CSA)

- .1 CSA A23.1/CSA A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .2 CSA A283, Qualification Code for Concrete Testing Laboratories
- .3 CSA A3000, Cementitious Materials Compendium

1.2 SUBMITTALS

.1 At least 4 weeks prior to starting concrete Work, submit to the Owner's Representative proposed quality control procedures in accordance with Section 1 04 00 – Submittal Procedures for the following items:

- .1 Formwork erection.
- .2 Hot weather concrete.
- .3 Cold weather concrete.
- .4 Curing.
- .5 Finishes.
- .6 Formwork removal.
- .7 Joints.

.2 At least 4 weeks prior to starting concrete Work, submit to the Owner's Representative, in accordance with Section 1 04 00 – Submittal Procedures, manufacturer's test data and certification by a qualified independent inspection and testing laboratory that the following materials will meet the specified requirements:

.1 Portland cement.
.2 Blended hydraulic cement.
.3 Supplementary cementing materials.
.4 Grout.
.5 Admixtures.
.6 Aggregates.
.7 Water.
.8 Joint filler.

.3 Provide certification that the mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA A23.1/CSA A23.2.

.4 Provide certification that the plant, equipment, and materials to be used in the production of concrete comply with the requirements of CSA A23.1/CSA A23.2.

.5 Submit mix design in accordance with Section 1 04 00 – Submittal Procedures at least 7 days prior to delivery of any concrete to site.

Part 2 Products

2.1 MATERIALS

.1 Portland cement: to CSA A3000.

.2 Supplementary cementing materials: to CSA A3000.

.3 Water: to CSA A23.1/CSA A23.2.

.4 Aggregates: to CSA A23.1/CSA A23.2. Coarse aggregates to be normal density.

.5 Air entraining admixture: to ASTM C260/C260M.

.6 Chemical admixtures: to ASTM C494/C494M.

.1 The use of accelerating or set retarding admixtures, when required during cold and hot weather placing, must be approved in writing by the Owner's Representative.

.7 Shrinkage compensating grout: pre-mixed compound consisting of non-metallic aggregate, Portland or Portland Limestone Cement, and water reducing and plasticizing agents.

.1 Minimum compressive strength: 30 MPa in 28 days.

.8 Curing compound: to ASTM C309 Type 1-D with fugitive dye.

.9 Concrete reinforcement: to Section 3 02 20 – Concrete Reinforcement.

2.2 MIXES

.1 Except where specified otherwise, provide concrete mixes to satisfy the performance requirements of Table 1.

.2 All concrete shall be proportioned to avoid deleterious expansion due to alkali-reactivity for the design service life of each element/structure in accordance with CSA A23.2-27A.

.3 Proportion concrete mix designs to minimize the potential for creep and shrinkage.

.4 Proportion concrete mix designs to maximize watertightness.

.5 Do not change any accepted concrete mix without prior approval from the Owner's Representative. Should a change in material source be proposed, a new mix design shall be approved by the Owner's Representative.

.6 Table 1 – Concrete Mixes:

Designation	**A**	**B**	**C**	**C-HE**
Application	Foundations and Foundation Walls and Slabs	Mud Slabs	Exterior Slab on Grade	Exterior Slab on Grade after September 30
Structural Requirements				
CSA Exposure Class	S-1	N	C-2	C-2
Minimum Specified Compressive Strength (MPa)	35	10	32	32
Age (days) for Specified Strength	56	28	28	7
Minimum Cement Content (kg/m^3)	N	N	315	315
Maximum W/CM Ratio	0.40	N	0.45	0.40
Maximum Aggregate Size (mm)	20	20	14 - 20	14 – 20
Durability Requirements				
Use Sulphate Resistant Cement or Cementitious Blend (Y/N)	Y	N	N	N
Aggressive Chemical/Waste/Chlorides/ Other (Y/N)	N	N	Y	Y
Air Content Category (per CSA A23.1)	1	2	1	1
Materials				
Fly Ash Usage (Y/N)	Y	Y	Y	Y
HVSCM 1 or HVSCM 2	1 or 2	1 or 2	N	N

Designation	A	B	C	C-HE
Application	Foundations and Foundation Walls and Slabs	Mud Slabs	Exterior Slab on Grade	Exterior Slab on Grade after September 30
Fly Ash Class	F or Cl	F or Cl	F or Cl	F or Cl

Part 3 Execution

3.1 PREPARATION

.1 Obtain the Owner's Representative's approval before placing concrete. Provide 24 hours notice prior to placing of concrete.

.2 Pumping of concrete is permitted only after the Owner's Representative's approval of the equipment and mix.

.3 Ensure reinforcement and inserts are not disturbed during concrete placement.

.4 Prior to placing of concrete, obtain the Owner's Representative's approval of the 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 In locations where new concrete is dowelled to existing work:

.1 Drill holes in existing concrete.

.2 Place steel dowels of deformed steel reinforcing bars and pack solidly with shrinkage compensating grout to anchor and hold dowels in position.

.7 Do not place load upon new concrete until authorized by the Owner's Representative.

3.2 DELIVERY OF CONCRETE

.1 Deliver concrete to the job site in accordance with CSA A23.1.

3.3 CONSTRUCTION

.1 General cast-in-place concrete placing, finishing, and curing practices shall conform to CSA A23.1.

.2 Finishing:

.1 General concrete finishing practices shall conform to CSA A23.1.

.2 Use procedures acceptable to the Owner's Representative or those noted in CSA A23.1 to remove excess bleed water. Ensure concrete surface is not damaged during the removal of bleed water.

.3 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.

.4 Do not apply water to concrete surface to facilitate finishing under any circumstances.

.5 Protect the Work from rain to avoid excessive moisture on the unfinished surface and to prevent pitting to the finished surface if still plastic.

.3 Joint fillers:

.1 Locate and form isolation joints as indicated. Install joint filler in accordance with ASTM D1751.

3.4 QUALITY ASSURANCE

.1 As per Section 03 02 00 – Basic Concrete Materials and Test Methods.

3.5 FAILURE TO MEET REQUIREMENTS

.1 As per Section 03 02 00 – Basic Concrete Materials and Test Methods.

3.6 REPAIR

.1 Repair defective areas while concrete is still plastic, otherwise wait until curing is complete.

.2 Where directed by the Owner's Representative, remove defective work and replace with new concrete.

.3 Where directed by the Owner's Representative, grind off high surface irregularities.

3.7 COLD WEATHER REQUIREMENTS

.1 As per Section 03 02 00 – Basic Concrete Materials and Test Methods.

3.8 HOT WEATHER REQUIREMENTS

.1 As per Section 03 02 00 – Basic Concrete Materials and Test Methods.

Part 4 Measurement and Payment

.1 Separate payment will not be made for work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM C117, Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

.2 ASTM C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3))

.4 ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

.2 Canadian Standards Association (CSA)

.1 CSA A23.1/CSA A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete

1.2 SUBMITTALS

.1 In accordance with Section 3 02 30 - Cast-in-Place Concrete and Section 1 04 00 – Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 Concrete mixes and materials: to Section 3 02 00 – Basic Concrete Materials and Test Methods and Section 3 02 30 – Cast-in-Place Concrete.

.2 Curing compound: to Section 3 02 30 – Cast-in-Place Concrete.

.3 Joint sealing compound:

.1 To be used in the joint between two separately poured concrete structures.

.2 To be an elastic type sealant conforming to ASTM D6690.

.4 Sealing solutions: 50% boiled linseed oil and 50% kerosene or other sealant approved by the Owner’s Representative.

.5 Form release agent: to Section 3 02 10 – Concrete Formwork.

Part 3 Execution

3.1 SUBGRADE PREPARATION

.1 Subgrade preparation: in accordance with Section 3 07 00 – Roadway Embankment and Compaction.

.2 Cement-stabilized subgrade preparation: in accordance with Section 3 05 10 – Portland Cement-Stabilized Subgrade.

.3 When constructing embankments, provide a minimum 0.5 m shoulder outside of neat lines of concrete.

3.2 GRANULAR BASE

.1 In accordance with Section 3 07 30 – Granular Base.

3.3 CONSTRUCTION WITH FORMS

.1 Forms:

.1 Forms shall be wood and shall produce a true line without irregularities in the alignment. Flexible forms shall be used for all structures having a radius of less than 40 m.

.2 All forms shall be cleaned of hardened concrete or other foreign matter.

.3 Sufficient forms shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well stayed and braced or otherwise held rigidly to the established line and grade. Any form which has lost its shape or has become dented and rough shall not be used.

.2 Use of Template:

.1 After the forms have been set to the lines and grades indicated, a template, supplied by the Contractor, shall be used to check that there is the specified clearance from the top of the forms to the base. This inspection shall be carried out by the Contractor in the presence of the Owner's Representative.

.3 Placing of Concrete:

.1 Concrete shall be placed only after the forms have been inspected and approved by the Owner's Representative.

.2 Concrete shall only be placed on a base which is sufficiently moist to prevent absorption of water from the freshly placed concrete. Where necessary, the base shall be sprinkled with water to raise the moisture content to the desired level.

.3 All forms shall be thoroughly moistened or oiled. Chemicals shall not be used to remove ice or hardened concrete from the forms.

.4 Concrete shall be handled from the mixer to the place of use as rapidly as possible by methods which will prevent the separation or loss of the ingredients. Concrete shall be deposited in the forms as close as possible to its ultimate location to reduce rehandling or flowing. Under no circumstances shall concrete that has partially hardened be used. Once a pour has started it shall be carried on as a continuous operation until the section is completed.

.5 A mechanical vibrator shall be used during the concrete placing operations as required to eliminate air pockets and honeycombing. To secure uniform dense surfaces, vibration shall be supplemented by hand spading.

.6 Concrete shall not be poured in the rain and freshly poured concrete surfaces shall be protected from rain, frost, dust and other physical damage, until it has obtained sufficient strength to resist marking.

.7 All pours shall start and stop at a contraction joint and surplus material shall be wasted.

.4 Stripping of Forms:

.1 The face of curb form shall be removed within 2 hours after the initial set to permit proper finishing of the concrete.

.2 Adequate care shall be taken to avoid damage to the concrete surface when removing the forms.

.3 Any patching that is necessary shall be done immediately after the forms have been removed.

3.4 SLIP FORMING

.1 Use only self-powered extruders with automatic line and grade control capable of placing, consolidating, screeding, and float finishing in one pass.

.2 Operate concrete extruder continuously until section or scheduled pour is completed. Empty hopper of concrete and construct a joint containing two 1.2 m 10M deformed steel bars when operations are delayed by more than 30 minutes.

.3 Stringline to be inspected by the Owner's Representative prior to commencing operations. Adjust stringline as directed by the Owner's Representative. All stringlines to be extended 15 m beyond the limit of the section to be poured.

.4 Vibrate concrete to obtain a dense, smooth, finished mass.

.5 Finishing handwork to be minimized. Concrete requiring excessive hand finishing will be rejected.

.6 Construct a joint containing two 1.2 m 10M deformed steel bars at the end of each section of extruded concrete.

.7 Areas of concrete to be formed and placed by hand to be completed within 7 days of completion of adjacent extruded section.

.8 Hand forming shall be used for curves where extruding cannot provide a smooth arc of the specified radius.

3.5 CONCRETE PLACEMENT

.1 Obtain Owner's Representative's approval of granular base and reinforcing steel prior to placing concrete.

.2 Do concrete Work in accordance with Section 3 02 30 - Cast-in-Place Concrete.

.3 Finish exposed surfaces to a smooth, uniform finish free of open texturing and exposed aggregate. Do not work more mortar to surface than required. Do not use neat cement as a drier to facilitate finishing.

.4 Broom finish surface to provide a non-skid texture.

.5 Round edges, including the edges of joints, with a 5 mm radius edging tool.

.6 Finish surfaces to within 6 mm in 3 m from line, level, or grade as measured with a straight edge placed on the surface.

3.6 COLD WEATHER REQUIREMENTS

.1 As per Section 03 02 30 – Cast-in-Place Concrete.

3.7 HOT WEATHER REQUIREMENTS

.1 As per Section 03 02 30 – Cast-in-Place Concrete.

3.8 REINFORCING STEEL

.1 Reinforcing steel shall be incorporated into the Work as shown on drawings and in accordance with Section 3 02 20 – Concrete Reinforcement.

3.9 EXPANSION AND CONTRACTION JOINTS

.1 Install expansion and contraction joints in accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.2 When sidewalk is adjacent to curb, the joints of each shall coincide.

.3 Install isolation joints in concrete around manholes, catch basins, poles, hydrants, etc. and along the length of concrete adjacent to existing sidewalks, catch basins, buildings, or permanent structures.

.4 Construct longitudinal construction joints using 10M deformed steel bars at 1 m spacing and extend at least 300 mm into both sides of the joint.

.5 Vary transverse construction joint spacing near the end of a pour as follows:

.1 If the end of the pour falls within 300 mm of a required joint location, the spacing of the last two joints shall be averaged.

.2 If the end of pour falls within 800 mm of a required joint location, the spacing of the last three joints shall be averaged.

.6 Construct transverse construction joints using 10M deformed steel bars at 500 mm spacing and extending at least 300 mm into both sides of the joint.

3.10 JOINT SEALING

.1 A cut or pre-formed joint, 25 mm in depth and a maximum of 12 mm wide, shall be provided at the top of all separately poured, abutting concrete structures. A hot poured elastic type sealant shall be placed in this joint, in accordance with the manufacturer's recommendations.

3.11 FINISH TOLERANCE

.1 Concrete placement procedures and equipment shall be carefully regulated to maintain the finished Work within the following tolerances:

.1 The finished surface of concrete shall be within 10 mm of the designated vertical alignment.

.2 The maximum allowable irregularity in the finished surface of concrete shall be 5 mm measured from a 3 m straight edge.

.3 Edges of sidewalks shall be within 15 mm of the designated horizontal alignment.

.4 The maximum ponding depth shall be 5 mm.

.5 The maximum length of ponding shall be 2 m for each occurrence.

3.12 MARKINGS

.1 The Contractor shall mark the concrete structure with a marking tool showing the initials of the Contractor and the year of construction. These marks shall be made at the ends of each block and at the termination points if the construction is terminated within the middle of a block.

.2 The letters and numerals of the marking tools shall be approximately 40 mm high.

3.13 BACKFILL

.1 Allow concrete to cure for 7 days prior to backfilling.

.2 Backfill in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.3 Placing of backfill shall be done promptly after formwork removal to avoid damage to the concrete structure.

3.14 QUALITY ASSURANCE

.1 As per Section 3 02 00 – Basic Concrete Materials and Test Methods.

3.15 ACCEPTANCE CRITERIA

.1 Acceptance criteria shall be in accordance with the Municipality's *Design Servicing Standards and Development Procedures*.

Part 4 Measurement and Payment

4.1 CURB AND GUTTER

.1 Measurement and payment for the installation of concrete curb and gutter, for the types specified, will be per metre of curb and gutter installed, as measured along the face of curb.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing if required, jointing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 MONOLITHIC SIDEWALK

.1 Measurement and payment for the installation of concrete monolithic sidewalk, for the widths and curb types specified, will be per metre of monolithic sidewalk installed, as measured along the face of curb.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing if required, jointing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 SEPARATE SIDEWALK

.1 Measurement and payment for the installation of concrete separate sidewalk, for the widths specified, will be per metre of separate sidewalk installed, as measured along the centreline of the sidewalk.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing if required, jointing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 RESIDENTIAL DRIVEWAY CROSSINGS – MONOLITHIC SIDEWALK

.1 Measurement and payment for the installation of concrete residential driveway crossings of monolithic sidewalk, for the curb types specified, will be per metre, as measured along the face of curb, inclusive of the drop curbs for straight face curb.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.5 RESIDENTIAL DRIVEWAY CROSSINGS – SEPARATE SIDEWALK

.1 Measurement and payment for the installation of concrete residential driveway crossings of separate sidewalk, for the curb types specified, will be per square metre (m^2), as measured based on the finished surface area.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.6 MULTI-FAMILY/COMMERCIAL CROSSINGS – MONOLITHIC SIDEWALK

.1 Measurement and payment for the installation of concrete multi-family and commercial crossings of monolithic sidewalk, for the curb types specified, will be per metre, as measured along the face of curb, inclusive of the drop curbs for straight face curb.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.7 MULTI-FAMILY/COMMERCIAL CROSSINGS – SEPARATE SIDEWALK

.1 Measurement and payment for the installation of concrete multi-family and commercial crossings of separate sidewalk, for the curb types specified, will be per square metre (m^2), as measured based on the finished surface area.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.8 ALLEY CROSSINGS – MONOLITHIC SIDEWALK

.1 Measurement and payment for the installation of concrete alley crossings of monolithic sidewalk, for the curb types specified, will be per metre, as measured along the face of curb, inclusive of the drop curbs for straight face curb.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.9 ALLEY CROSSINGS – SEPARATE SIDEWALK

.1 Measurement and payment for the installation of concrete alley crossings of separate sidewalk, for the curb types specified, will be per square metre (m^2), as measured based on the finished surface area.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.10 CONCRETE SWALES

.1 Measurement and payment for the installation of concrete swales, for the widths specified, will be per metre of concrete swale installed, as measured along the centreline of the swale.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required,

supply and placement of concrete, formwork if required, reinforcing, jointing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.11 CURB RAMPS

.1 Measurement and payment for the installation of concrete curb ramps will be per square metre (m^2), as measured based on the finished surface area, inclusive of the monolithic curb and gutter.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing, tooled grooves, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.12 CONCRETE MEDIANS

.1 Measurement and payment for the installation of concrete medians will be per square metre (m^2), as measured based on the finished surface area.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, jointing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.13 MISCELLANEOUS CONCRETE

.1 Measurement and payment for the installation of miscellaneous concrete will be per square metre (m^2), as measured based on the finished surface area.

.2 Unit price to include excavation to the proposed subgrade elevation, preparation of the subgrade to the required density and depth, supply, placement, and compaction of granular base material to the required density and depth, sand levelling course if required, supply and placement of concrete, formwork if required, reinforcing if required, jointing, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Canadian Standards Association (CSA)

- .1 CSA A23.1/CSA A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .2 CSA A23.4, Precast Concrete - Materials and Construction
- .3 CSA A3000, Cementitious Materials Compendium
- .4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement

.2 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete

Part 2 Products

2.1 MATERIALS

.1 Cement: to CSA A3000, Type GU.

.2 Water: to CSA A23.1/CSA A23.2.

.3 Aggregates: to CSA A23.1/CSA A23.2.

.4 Air entraining admixture: to ASTM C260/C260M.

.5 Reinforcing steel: billet steel, grade 400R, deformed bars to CSA G30.18, unless indicated otherwise.

.6 Concrete: to CSA A23.1/CSA A23.2, minimum 30 MPa compressive strength at 28 days.

.7 Curb anchors: steel dowels or pins to CSA G30.18, minimum 15 mm diameter x 600 mm length.

2.2 FABRICATION

.1 Fabricate precast concrete parking curbs and Jersey barriers to CSA A23.4.

.2 Fabricate to size and dimensions as shown on Drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install precast curbs and/or barriers at the locations indicated on the Drawings.

.2 Secure curbs in position by driving steel dowels through precast holes until flush with top of curb.

.3 Rejected, damaged, or defective units shall be removed from site and replaced with sound units.

Part 4 Measurement and Payment

4.1 PRECAST CONCRETE PARKING CURBS

.1 Measurement and payment for the supply and installation of precast concrete parking curbs will be per each unit installed.

.2 Unit price to include the supply and installation of the precast parking curbs and steel dowels, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 PRECAST BARRIERS

.1 Measurement and payment for the supply and installation of precast concrete Jersey barriers will be per each unit installed.

.2 Unit price to include the supply and installation of the precast concrete Jersey barriers, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

- .1 CSA A23.1/CSA A23.2, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete
- .2 CSA A23.4, Precast Concrete - Materials and Construction
- .3 CSA A3000, Cementitious Materials Compendium

.2 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C67/C67M, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
- .2 ASTM C936/C936M, Standard Specification for Solid Concrete Interlocking Paving Units

Part 2 Products

2.1 MATERIALS

.1 Granular base course: in accordance with Section 3 04 00 – Aggregate Materials.

.2 Sand for levelling course: in accordance with Section 3 04 00 – Aggregate Materials.

.3 Precast concrete paving stones:

- .1 To ASTM C936/C936M.
- .2 Thickness: as specified.
- .3 Colour: as specified.
- .4 Compressive strength: average of a minimum of 55 MPa with no individual unit less than 50 MPa.
- .5 Absorption: average of a maximum of 5% with no individual unit greater than 7%.
- .6 Permissible variation in dimensions:
  - .1 Length or width: 1.5 mm.
  - .2 Thickness: 3 mm.

.4 Edge Restraint:

- .1 Pressure treated lumber, concrete, or PVC edging as specified.

Part 3 Execution

3.1 SUBGRADE PREPARATION

.1 In accordance with Section 3 07 00 – Roadway Embankment and Compaction.

3.2 GRANULAR BASE COURSE

.1 In accordance with Section 3 07 30 – Granular Base.

3.3 EDGE RESTRAINT

.1 In areas not restrained by existing concrete work, place specified edge restraint material as shown on the Drawings.

3.4 SAND LEVELLING COURSE

.1 Place and screed a 25 mm compacted thickness of sand levelling course over the granular base course.

.2 Once screeded and levelled, do not disturb the sand levelling course.

3.5 PRECAST CONCRETE PAVING STONE INSTALLATION

.1 Paving stones shall be laid in the approved pattern.

.2 Joints between paving stones shall not exceed 3 mm.

.3 Gaps at the edge of the paved surface shall be filled with standard edge pieces or with stones cut to fit. Paving stones shall be cut to a straight, even surface without cracks or chips.

.4 Paving stones shall be vibrated to their final level by at least two passes of a vibrating plate compactor.

.5 After vibration, sand containing at least 30% - 3 mm particles shall be brushed over the surface and vibrated into the joints with additional passes of a plate vibrator to completely fill the joints.

.6 Surplus material shall be swept from the surface and disposed of in an approved method/location. Prevent surplus material from entering the storm drainage system.

3.6 FINISH TOLERANCE

.1 The finished surface shall be true to grade and shall not vary by more than 8 mm when tested with a 3 m straight edge.

Part 4 Measurement and Payment

4.1 PRECAST CONCRETE PAVING STONES

.1 Measurement and payment for the supply and installation of precast concrete paving stones, for the types specified, will be per square metre (m^2) of paving stones installed.

.2 Unit price to include the supply and installation of the precast concrete paving stones, sand, compaction, cleaning, edge restraint if required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Refer to Section 3 07 00 – Roadway Embankment and Compaction for measurement and payment for subgrade preparation.

.4 Refer to Section 3 07 30 – Granular Base for measurement and payment for granular base course.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 The rate of application shall be provided by the Contractor in accordance with all applicable regulatory requirements.

Part 2 Products

.1 Supply calcium chloride as a 35% aqueous solution.

Part 3 Execution

3.1 APPLICATION

.1 Maintain dust control on the worksite, haul routes, and other working areas by means of watering, sweeping, or any other means necessary to control dust due to construction operations.

.2 Contractor to perform the Work in a manner that will minimize the production of dust.

.3 Dust shall be monitored at all times by the Contractor and water and/or additional dust control measures shall be applied to assist with dust control.

.4 Water supply for dust control is the responsibility of the Contractor.

.5 The Contractor shall provide a daily dust control log to the Owner's Representative. The log shall identify the date, time, location, and type of dust control measure used, with supporting pictures.

Part 4 Measurement and Payment

.1 Separate payment will not be made for dust control. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM C117, Standard Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

.2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))

.4 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

.5 ASTM E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

.2 International Organization for Standardization (ISO)

.1 ISO 3310-1, Test Sieves – Technical Requirements and Testing – Part 1 Test Sieves of Metal Wire Cloth

1.2 APPROVAL OF MATERIALS

.1 The materials to be incorporated into the Work require approval from the Owner's Representative.

.2 Provide the sieve results for each type of granular material to be incorporated into the Work for review by the Owner's Representative at least 4 weeks prior to delivery to site.

.3 If, in opinion of the Owner's Representative, the proposed materials do not meet, or cannot reasonably be processed to meet specified requirements, locate an alternative source, or demonstrate that material from the source in question can be processed to meet the specified requirements.

.4 Should a change of material source be proposed during the Work, provide the sieve results for the new material to the Owner's Representative at least 1 week in advance of delivery to site.

.5 Acceptance of a material at the source does not preclude future rejection if it is subsequently found to lack uniformity, it fails to conform to the specified requirements, or its field performance is found to be unsatisfactory.

1.3 PRODUCTION SAMPLING

.1 Upon request, provide additional sieve results to the Owner's Representative.

.2 The Contractor shall bear the cost of sampling and testing of aggregates which fail to meet the specified requirements.

.3 Sieve analyses shall be performed by a qualified materials testing laboratory.

1.4 METRIC SIEVES

.1 ISO 3310-1 sieve sizes shall replace ASTM E11 sieves as follows:

ISO 3310-1 Sieves (µm)	ASTM E11 (mm)
125 000	125.0
80 000	75.0
63 000	63.0
50 000	50.0
40 000	37.5
25 000	25.0
20 000	19.0
16 000	16.0
12 500	12.5
10 000	9.5
5 000	4.75
2 500	2.36
2 000	2.00
1 600	1.70
1 250	1.18
800	0.850
630	0.600
400	0.425
315	0.300
160	0.150
80	0.075
45	0.045

Part 2 Products

2.1 TYPE 1 FILL (WASHED ROCK)

.1 Clean, hard, durable gravel or stone free from clay lumps, cementation, shale, organic material, frozen material, and other deleterious materials.

.2 Gradation shall be within the following limits when tested to ASTM C136 and ASTM C117 and shall have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
80 000	100
50 000	95 – 100
25 000	20 – 100
20 000	0 – 80
10 000	0 – 10
5 000	0 – 5

2.2 TYPE 2 FILL (IMPORTED BACKFILL)

.1 Crushed or screened stone, gravel, or sand consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material, and other deleterious materials.

.2 Gradation shall be within the following limits when tested to ASTM C136 and ASTM C117 and shall have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
50 000	100
25 000	55 – 90
5 000	25 – 60
630	2 – 10

2.3 NATIVE BACKFILL

.1 Selected material from the excavation or other approved sources.

.2 Unfrozen and free from rocks larger than 75 mm, cinders, ashes, sod, organics, refuse, and other deleterious materials.

2.4 PIPE ZONE MATERIAL

.1 Crushed or screened stone, gravel, or sand consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material, and other deleterious materials.

.2 Graduation shall be within the following limits when tested to ASTM C136 and ASTM C117 and shall have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
10 000	100
5 000	95 – 100
2 500	80 – 100
1 250	50 – 85
630	30 – 65
315	10 – 30
160	2 – 10

2.5 CRUSHED AGGREGATE

.1 Sound, hard, durable particles of sand, gravel, and rock free from elongated or laminated particles, detrimental amounts of flaky particles, soft shales, coal ironstone, clay lumps, organic material, and other deleterious materials.

.2 Flat and elongated particles are those whose greatest dimension exceeds five times their least dimension.

.3 Fine aggregates satisfying the requirements of the applicable section shall be one or a blend of the following:

.1 Natural sand.

.2 Manufactured sand.

.3 Screenings produced in the crushing of quarried rock, boulders, gravel, or slag.

.4 Coarse aggregates satisfying the requirements of the applicable section shall be one of following:

.1 Crushed rock or slag.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

2.6 GRANULAR BASE

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

.2 Gradation shall be within the following limits when tested to ASTM C136 and ASTM C117 and shall have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
20 000	100
10 000	65 – 86
5 000	45 – 68
1 250	26 – 45
630	19 – 38
315	14 – 30
160	5 – 20
80	2 – 10

.3 The aggregate shall have a minimum California Bearing Ratio (CBR) of 60.

.4 The coarse fraction of the aggregate shall have an abrasion loss by the Los Angeles abrasion test of not more than 50%.

.5 The material passing the 400 µm sieve shall have a plasticity index of 6 or less.

.6 The material retained on the 5 000 µm sieve shall have a minimum of 60% with at least two fractured faces, based on dry mass.

2.7 GRANULAR SUB-BASE

.1 Clean, hard, durable gravel free from clay, loam, and other deleterious materials.

.2 Gradation shall be within the following limits when tested to ASTM C136 and ASTM C117 and shall have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
63 000	100
5 000	25 – 50
80	0 – 10

.3 The aggregate shall have a minimum CBR of 30.

.4 The coarse fraction of the aggregate shall have an abrasion loss by the Los Angeles abrasion test of not more than 50%.

.5 The material passing the 400 µm sieve shall have a plasticity index of 6 or less.

.6 The material retained on the 5 000 µm sieve shall have a minimum of 30% with at least two fractured faces, based on dry mass.

2.8 GRAVEL SURFACING

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

.2 Gradation shall be within the following limits when tested to ASTM C136 and ASTM C117 and shall have a smooth curve without sharp breaks when plotted on semi-log charts.

Sieve Designation (µm)	% Passing
20 000	100
10 000	35 – 77
5 000	15 – 55
1 250	0 – 30
80	0 – 12

.3 The material passing the 400 µm sieve shall have a plasticity index of 8 or less.

.4 The material retained on the 5 000 µm sieve shall have a minimum 40% with at least two fractured faces, based on dry mass.

2.9 CRUSHED CONCRETE

.1 Crushed concrete that meets the requirements of the following materials is approved for use as an alternative for these materials:

.1 Imported Granular Backfill

.2 Granular Base

.3 Granular Sub-base

2.10 SAND LEVELLING COURSE

.1 Sand to be used as a levelling course shall be in accordance with article 2.4.

Part 3 Execution

3.1 HANDLING

.1 Handle and transport aggregates using methods that prevent contamination, segregation, and degradation.

3.2 STOCKPILING

.1 Stockpile aggregates on site in designated locations.

.2 Do not stockpile material on completed pavement surfaces.

.3 Stockpile aggregate in sufficient quantities to meet project schedules.

.4 Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support the stockpiled materials and handling equipment.

.5 Stockpile aggregates on the ground but do not incorporate the bottom 300 mm of the pile into the Work.

.6 Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

.7 Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed by the Owner’s Representative within 48 hours of rejection.

.8 Stockpile materials in uniform layers of 750 mm maximum thickness.

.9 Complete each layer over the entire stockpile area before beginning the next layer.

.10 Coning of piles or spilling of material over the edges of a pile will not be permitted.

3.3 STOCKPILE CLEAN-UP

.1 Leave the stockpile site in a tidy, well drained condition, free of standing surface water.

.2 Remove any unused aggregates from the site after the Work has been completed.

.3 Restore the stockpile site to existing condition or better.

Part 4 Measurement and Payment

.1 Separate payment will not be made for work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))

.2 ASTM D4718/D4718M, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles

.2 Canadian Standards Association (CSA)

.1 CSA A3000, Cementitious Materials Compendium

Part 2 Products

2.1 PORTLAND CEMENT

.1 To CSA A3000, Type GU.

Part 3 Execution

3.1 SUBGRADE CEMENT STABILIZATION

.1 Pre-grade and shape the soil to the specified grade and cross section prior to beginning the cement stabilization of the subgrade.

.2 Loosen the soil to a 300 mm depth below the subgrade elevation. Work the soil with cultivating and mixing equipment until soil is pulverized into no larger than 25 mm pieces, exclusive of stones.

.3 Provide dust control to contain cement dust within the site area. Do not spread cement during or when high winds or rain are forecast.

.4 Spread and blend the cement into the soil at a rate of 16 to 30 kg per square metre of 300 mm compacted depth as specified.

.5 Add water to the blended soil and cement to bring the mixture within 2% of the optimum moisture content. Mix to a homogeneous mixture.

.6 Spread the mixture uniformly in lifts as required to achieve the required density throughout the entire 300 mm depth.

.7 Shape and compact the entire roadbed to within 15 mm of the design grade, but not uniformly low or high.

.8 Complete compaction and finishing on the same day as mixing.

.9 Water may be lightly sprayed with a pressurized distributor for surface finishing.

.10 Leave the surface of the compacted subgrade slightly higher than the required elevation, then trim to indicated crown and grade. Leave the finished surface even and free of depressions, humps, and loose material.

.11 Maximum Density: the dry unit mass of a sample at the optimum moisture content, as determined in the laboratory according to ASTM D698. Maximum density testing shall be completed on the treated and mixed material.

.12 Required Density: minimum of 100% of the corrected maximum density according to ASTM D4718/D4718M.

.13 Do not permit vehicular traffic over the stabilized subgrade.

.14 If the subgrade floods, drain immediately.

.15 Adjust cement mixing rate according to the required depth if differs from 300 mm.

3.2 QUALITY CONTROL AND QUALITY ASSURANCE

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

Part 4 Measurement and Payment

4.1 CEMENT-STABILIZED SUBGRADE

.1 Measurement and payment for the supply and placement of cement-stabilized subgrade, for the depths indicated, will be per square metre (m^2).

.2 Unit rate to include scarifying the subgrade to the appropriate depths, supply and addition of cement at the rate specified, addition of water, mixing, compacting the subgrade to the required densities and depths, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal Work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected Work. Payment will not be made for reworking and compaction of areas that do not meet the compaction requirements.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
- .2 ASTM D4101, Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
- .3 ASTM D4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
- .4 ASTM D5262, Standard Test Method for Determining the Unconfined Tension Creep and Creep Rupture Behaviour of Planar Geosynthetics Used for Reinforcement Purposes
- .5 ASTM D6637/D6637M, Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
- .6 ASTM D4354, Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

1.2 SUBMITTALS

.1 Submit copies of mill test data and certificates 4 weeks prior to the start of Work.

.2 The specifications on the Mill or Manufacturer's Certificate shall be provided in the same units as specified in these Specifications.

1.3 DELIVERY AND STORAGE

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, water, mud, soil, dust, debris, and rodents.

Part 2 Products

2.1 MATERIAL

.1 Open grid polymer geosynthetic having biaxial or triaxial orientation, free of striations, roughness, pinholes, blisters, undispersed raw materials, and any sign of contamination by foreign matter.

.2 The geosynthetic must be manufactured with fibers consisting of long-chain synthetic polymers composed of at least 95% by weight of polyolefins or polyesters. They must form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

2.2 APPROVED MATERIALS

.1 Stratagrid 200 by Strata Systems Inc.

.2 Tensar UX1500HS by Tensar International Corporation.

.3 Tencate Miragrid 5XT by Tencate Geosynthetics North America.

.4 Fortrac by HUESKER Inc.

.5 Tensar TriaAx by Tensar International Corporation.

.6 Products listed on the Alberta Transportation Products List.

2.3 QUALITY CONTROL

.1 Manufacturing Quality Control: Testing must be performed at a laboratory accredited by GAI-LAP (Geosynthetic Accreditation Institute-Laboratory Acceptance Program) for tests required for the geosynthetic, at frequency meeting or exceeding ASTM D4354.

.2 Ultraviolet stability must be verified by an independent laboratory on the geosynthetic or a geosynthetic of similar construction and yarn type.

Part 3 Execution

3.1 INSPECTION

.1 Verify that the condition of the substrate is acceptable for soil stabilization installation in accordance with the manufacturer's written instructions.

.1 Visually inspect the substrate in the presence of the Owner’s Representative.

.2 Inform the Owner’s Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with the installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the requirements of the authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize any areas that were disturbed during the removal process.

3.3 INSTALLATION

.1 Place geogrid material by unrolling onto the graded surface in the manner and locations indicated and retain in position in accordance with manufacturer's written recommendations.

.2 Place geogrid on sloping surfaces in one continuous length from the toe of slope to the upper extent of the geogrid.

.3 Overlap each successive strip of geogrid 600 mm over previously laid strip.

.4 Join successive strips of geogrid as recommended by the manufacturer.

.5 Protect geogrid from displacement, damage, or deterioration before and during placement of overlaid aggregate, geotextiles, and soil layers.

.6 After installation, cover with an overlay layer.

.7 Replace damaged or deteriorated geogrid to the approval of the Owner’s Representative.

.8 Place and compact soil layers in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.4 CLEANING

.1 Progress Cleaning: leave the Work area clean at the end of each day.

.2 Final Cleaning: upon completion, remove surplus materials, rubbish, tools, and equipment.

.3 Waste Management: remove waste and recycling containers and bins from the site and dispose of the materials at an appropriate facility.

3.5 PROTECTION

.1 Do not permit the passage of any vehicular traffic directly on the geogrid.

.2 Do not overload the soil or aggregate covering the geogrid.

Part 4 Measurement and Payment

4.1 GEOGRID SOIL REINFORCEMENT

.1 Measurement and payment for the supply and installation of geogrid soil reinforcement will be per metre (m^2) of geogrid soil reinforcement installed.

.2 Unit price to include the supply, storage, handling, and installation of the geogrid, including overlapping and joining, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- .2 ASTM D4491/D4491M, Standard Test Methods for Water Permeability of Geotextiles by Permittivity
- .3 ASTM D4595/D4595M, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Method
- .4 ASTM D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- .5 ASTM D4716/D4716M, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
- .6 ASTM D4751, Standard Test Methods for Determining Apparent Opening Size of a Geotextile
- .7 ASTM D4833/D4833M, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
- .8 ASTM D6241, Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geosynthetic-Related Products Using a 50 mm Probe

.2 Canadian Standards Association (CSA)

- .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

1.2 SUBMITTALS

.1 Submit copies of mill test data and certificates 4 weeks prior to the start of Work.

.2 The specifications on the Mill or Manufacturer's Certificate shall be provided in the same units as specified in these Specifications.

1.3 DELIVERY AND STORAGE

.1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, water, mud, soil, dust, debris, and rodents.

Part 2 Products

2.1 GEOTEXTILE MATERIAL

.1 Non-woven synthetic fibre fabric, supplied in rolls:

- .1 Width: 3.80 m minimum.
- .2 Length: 109 m minimum.
- .3 Seams: lapped in accordance with the manufacturer’s recommendations.

.4 Tensile strength and elongation (in any principal direction): to ASTM D4632/D4632M.

.1 Tensile strength: minimum 912 N, wet condition.

.2 Elongation at break: maximum 50%.

.3 Static CBR Puncture (ASTM D6241): 2,336 N.

.2 Woven synthetic fibre fabric, supplied in rolls:

.1 Width: 5.49 m minimum.

.2 Length: 76.2 m minimum.

.3 Seams: Lapped in accordance with the manufacturer's recommendations.

.4 Tensile strength and elongation (in any principal direction): to ASTM D4632/D4632M.

.1 Tensile strength: minimum 4,702 N.

.2 Grab Elongation: 12% minimum.

.3 Static CBR Puncture (ASTM D4833/D4833M): 4,005 N.

.3 Acceptable products are listed on the Alberta Transportation Products List.

Part 3 Execution

3.1 INSTALLATION

.1 Place geotextile material, of the type indicated on the Drawings, as per the manufacturer's instructions.

.2 Place geotextile material smooth and free of tension stress, folds, wrinkles, and creases.

.3 Place geotextile material on sloping surfaces in one continuous length from the toe of slope to the upper extent of the geotextile.

.4 Join successive strips of geotextile by sewing longitudinal joints with a 200 mm overlap (if required) at the place of manufacture or, by overlapping (400 mm) and pinning joints perpendicular to the roadway centreline in accordance with the manufacturer's recommendations.

.5 Protect installed geotextile material from displacement, damage, or deterioration before, during, and after placement of the material layers.

.6 After installation, cover with an overlay layer within 4 h of placement.

.7 Replace damaged or deteriorated geotextile to the approval of the Owner's Representative.

3.2 PROTECTION

.1 Do not permit the passage of any vehicular traffic directly on the geotextile.

.2 Do not overload the soil or aggregate covering on the geotextile.

Part 4 Measurement and Payment

4.1 GEOTEXTILE

.1 Measurement and payment for the supply and installation of geotextiles will be per square metre (m^2) of geotextile installed.

.2 Unit price to include the supply, storage, handling, and installation of the geotextile, including overlapping and pinning, and labour, equipment, tools and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 DELIVERY AND STORAGE

.1 During delivery and storage, protect insulation from direct sunlight, physical damage, and incompatible chemicals (solvents, petroleum products, etc.). On the job site, cover temporarily stored insulation with a light-coloured tarpaulin. Insulation must not be exposed to excessive heat, flame, or other ignition source.

Part 2 Products

2.1 STYROFOAM INSULATION

.1 Styrofoam H1-40 as manufactured by Dow Chemical Canada Inc. or approved equivalent.

.2 Thickness: as indicated on the Drawings.

Part 3 Execution

3.1 UTILITY MAIN INSULATION

.1 Install soil insulation in accordance with the applicable Standard Detail in the Municipality's *Engineering Servicing Standards and Development Procedures* and the manufacturer's instructions.

.2 Backfill and compact trench in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.2 ROADWAY INSULATION

.1 Place soil insulation as shown on the Drawings. To prevent wind blow-off, pin in place with wooden skewers or weigh down with granular material.

.2 Place and compact first lift of granular material carefully to prevent damage or displacement.

.3 Place subsequent lifts of granular material and asphalt as required to complete the Work.

3.3 PROTECTION

.1 Do not permit the passage of any vehicular traffic directly on the soil insulation.

3.4 QUALITY ASSURANCE

.1 The Owner's Representative must review the placement of soil insulation before covering the insulation with granular material.

Part 4 Measurement and Payment

4.1 SOIL INSULATION

.1 Measurement and payment for the supply and installation of soil insulation, for the thicknesses specified, will be per square metre (m^2) of soil insulation installed.

.2 Unit rate to include the supply and installation of the soil insulation, and labour, equipment, tools and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))

1.2 SUBMITTALS

.1 Notify the Owner's Representative of the location of the borrow source for embankment material at least 4 weeks in advance of commencing construction.

1.3 DEFINITIONS

.1 Rock Excavation: as per Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Common Excavation: as per Section 2 01 00 – Excavating, Trenching, and Backfilling.

.3 Stripping: excavation of organic material covering the original ground.

.4 Embankment: material derived from usable excavated material and placed above the original ground or stripped surface up to the subgrade elevation.

.5 Waste Material: as per Section 2 01 00 – Excavating, Trenching, and Backfilling.

.6 Borrow Material: material obtained from areas outside the project limits and required for construction of embankments or for other portions of the Work.

.7 Topsoil: as per Section 2 01 00 – Excavating, Trenching, and Backfilling.

1.4 REGULATORY REQUIREMENTS

.1 Adhere to the regulations of the authority having jurisdiction if blasting is required.

.2 Adhere to Provincial and Federal environmental requirements.

1.5 BURIED SERVICES

.1 Check with utility companies and use Utility Safety Partners (formerly Alberta One Call) services to locate or advise regarding buried pipes, cables, ducts, or services. Make good and pay for repair to services damaged during excavation.

Part 2 Products

2.1 MATERIALS

.1 Embankment materials require the approval of the Owner's Representative.

.2 Material shall contain less than 10%, by volume, of stone and rock fragments larger than 100 mm.

.3 Material used for embankment shall be free of organic matter, frozen lumps, weeds, sod, roots, stumps, and any other deleterious materials.

Part 3 Execution

3.1 EQUIPMENT

.1 Compaction equipment must be capable of obtaining the required densities for the materials to be incorporated into the Work.

3.2 WATER DISTRIBUTORS

.1 Apply water with equipment capable of uniform distribution.

3.3 EXCAVATION

.1 General:

.1 Provide the Owner's Representative with sufficient advance notice of excavation operations to allow for initial cross sections to be taken.

.2 Maintain crowns and cross slopes to provide positive surface drainage.

.3 Where subgrade transitions from excavation to embankment, treat ground slopes at grade points as directed by the Owner's Representative.

.4 Dispose of waste material at an approved disposal site.

.2 Unsuitable materials:

.1 Notify the Owner's Representative whenever unsuitable materials are encountered in cut sections. Remove materials unsuitable for embankment to lateral limits and depths as directed by the Owner's Representative.

.2 Dispose of excavated unsuitable materials at an approved disposal site.

.3 Borrow materials:

.1 Completely use suitable materials removed from excavations before taking material from borrow areas.

.2 Provide additional suitable embankment material as required to complete the Work.

.4 Rock excavation:

.1 If, during excavation, material appearing to conform to the definition of rock is encountered, notify the Owner's Representative.

.2 Submit a plan for review by the Owner's Representative indicating the methods proposed for the removal of rock.

.3 Undertake methods that reduce overbreak, increase the stability of all rock faces, and control blasting to minimize flying particles.

3.4 EMBANKMENT

.1 Where indicated or directed by the Owner's Representative, scarify or bench existing slopes to ensure a proper bond between new materials and existing surfaces. Obtain approval of the method to be used from the Owner's Representative.

.2 Do not place material which is frozen nor place material on frozen surfaces.

.3 Maintain a crowned surface during construction to ensure positive drainage is achieved. Standing water is not permitted.

.4 Place and compact material to full width in uniform layers not exceeding 200 mm compacted thickness.

.5 Compact material to a minimum of 97% of the Standard Proctor Maximum Dry Density in accordance with ASTM D698.

.6 Bring the moisture content of the material to within 2% of the optimum moisture content. Add water or aerate as required.

3.5 SUBGRADE PREPARATION

.1 The subgrade shall be scarified to the depth indicated.

.2 The subgrade material shall then be brought to within 2% of the optimum moisture content, shaped to line and grade, and compacted to a minimum of 100% of the Standard Proctor Maximum Dry Density in accordance with ASTM D698.

.3 Subgrade to be finished as per the road profile elevations as detailed on the Drawings.

3.6 SUBGRADE CEMENT STABILIZATION

.1 In accordance with Section 3 05 10 – Portland Cement-Stabilized Subgrade.

3.7 FINISHING

.1 Remove soft and unstable material that will not compact properly and fill the resulting depressions with material approved by the Owner's Representative.

.2 Shape and compact the entire roadbed to within 15 mm of design elevations but not uniformly high or low.

.3 Scarify, blade, and compact as necessary to provide a thoroughly compacted roadbed shaped to grades and cross sections as indicated on the Drawings.

.4 Finish back and side slopes to a neat condition, suitable for seeding or sodding, true to line and grade.

.1 Remove boulders encountered in cut slopes and fill the resulting cavities.

.2 Hand finish slopes that cannot be finished satisfactorily by machine.

3.8 PROOFROLLING

.1 Proofroll in accordance with Section 3 07 20 – Granular Subbase and Section 3 07 30 – Granular Base as applicable.

3.9 MAINTENANCE

.1 Maintain finished surfaces in a condition conforming to this Section until acceptance.

3.10 QUALITY CONTROL AND QUALITY ASSURANCE

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.4 Coordinate field density testing such that a minimum of one field density test is taken for each 1,000 m^2 of compacted subgrade lift.

.1 The testing frequency shall increase to reflect any changes in subgrade material.

.2 Areas smaller than 1,000 m^2 require a minimum of 3 tests.

.5 A proofroll of the finished subgrade is required to confirm adequate bearing capacity of the subgrade soils. The proofroll shall be conducted in the presence of the Owner's Representative and a representative from the independent testing laboratory.

Part 4 Measurement and Payment

4.1 COMMON EXCAVATION

.1 Measurement and payment for common excavation will be per cubic metre (m^3), as measured using survey cross sections for the material compacted in place.

.2 Unit rate to include excavation, loading, hauling, stockpiling, placement, compaction, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 BORROW

.1 Measurement and payment for the supply and placement of borrow material will be per cubic metre (m^3), as measured using survey cross sections for the material compacted in place.

.2 Unit rate to include excavation, loading, hauling, stockpiling, placement, compaction, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 SUBGRADE PREPARATION

.1 Measurement and payment for subgrade preparation, for the depths specified, will be per square metre (m^2).

.2 Unit rate to include scarifying the subgrade to the appropriate depths, addition of water, mixing, compacting the subgrade to the required densities and depths, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.4 ROCK EXCAVATION

.1 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.5 DISPOSAL OF EXCESS EXCAVATED MATERIAL

.1 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

4.6 DISPOSAL OF CONTAMINATED MATERIAL

.1 Measurement and payment for the disposal of contaminated material will be per cubic metre (m^3), as measured by field survey.

.2 Unit price to include the loading, hauling, and disposal of contaminated materials at an approved landfill, disposal fees (if any), and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Payment will not be made for excavation beyond the limits identified by the Owner's Representative.

4.7 QUALITY CONTROL AND QUALITY ASSURANCE TESTING

.1 The Owner will not pay for or reimburse the Contractor for any services related to inspection or testing for Quality Control.

.2 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal Work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected Work. No extra payment shall be made for areas that do not meet the project specifications and require reworking.

.3 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.4 The Contractor shall pay costs for uncovering and making good work that is covered before the required inspection or testing is completed and approved by the Owner's Representative.

.5 No extra payment will be made for areas requiring reworking due to inclement weather.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C131/C131M, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- .2 ASTM C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .3 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))
- .4 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Part 2 Products

2.1 MATERIALS

.1 Granular subbase material: to Section 3 04 00 – Aggregate Materials.

Part 3 Execution

3.1 SEQUENCE OF OPERATIONS

.1 Scarifying and reshaping:

- .1 Trim roadbed and remove contaminated materials to depth indicated. Dispose of excess material.
- .2 Scarify roadbed to width and depth indicated.
- .3 Blade and trim roadbed material to elevation and cross section dimensions indicated.
- .4 Where deficiency of material exists, add and blend in new granular subbase material as directed by the Owner's representative. Do not use frozen material.

.2 Compacting:

- .1 Compaction equipment shall be capable of obtaining the required material densities.
- .2 Compact material to a minimum of 100% of the Standard Proctor Maximum Dry Density in accordance with ASTM D698.
- .3 Shape and compact the material to obtain a smooth, even, and uniformly compacted subbase.
- .4 Apply water as necessary during compaction to obtain the specified density.
- .5 In areas which are inaccessible to rolling equipment, compact to the specified density with mechanical tampers capable of obtaining the required densities.

.3 Repair of soft areas:

.1 Correct soft areas by removing defective material to the depth and extents as directed by the Owner's Representative. Replace with material acceptable to the Owner's Representative and compact to the specified density.

3.2 FINISH TOLERANCES

.1 Reshaped compacted surfaces shall be within 10 mm of the elevation indicated on the Drawings but shall not be uniformly high or low.

Part 4 Measurement and Payment

4.1 RESHAPE GRANULAR SUBBASE

.1 Measurement and payment for the reshaping of the existing granular subbase will be per square metre (m^2).

.2 Unit price to include trimming, scarifying, blading, compaction, addition of water as required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Payment will not be made for areas that require rework due to failed densities.

4.2 SUPPLY ADDITIONAL GRANULAR SUBBASE MATERIAL

.1 Measurement and payment for the supply of additional granular subbase material will be per cubic metre (m^3) of material, placed and compacted.

.2 Unit price to include loading, hauling, and stockpiling of granular subbase material on-site, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Subbase: depth of granular material constructed immediately on the prepared subgrade, prior to construction of the granular base material.

1.2 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM C117, Standard Test Method for Materials Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing

.2 ASTM C131/C131M, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.3 ASTM C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))

.5 ASTM D1883, Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils

.6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

.7 ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

.2 International Organization for Standardization (ISO):

.1 ISO 3310-1, Test Sieves – Technical Requirements and Testing – Part 1 Test Sieves of Metal Wire Cloth

Part 2 Products

2.1 MATERIALS

.1 Granular subbase: in accordance with Section 3 04 00 – Aggregate Materials.

Part 3 Execution

3.1 INSPECTION OF SUBGRADE

.1 Do not place granular subbase course until the finished subgrade surface has been inspected and approved by the Owner's Representative.

3.2 PLACING

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

.2 Place material using methods which do not lead to segregation or degradation of the aggregate.

.3 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Owner's Representative may authorize thicker lifts if the specified compaction can be achieved.

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

.5 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 COMPACTING

.1 Bring material to within 2% of the optimum moisture content and compact to a minimum of 100% of the Standard Proctor Maximum Dry Density in accordance with ASTM D698, in uniform layers not exceeding 150 mm compacted thickness.

.2 Shape and roll alternately to obtain a smooth, even, and uniformly compacted subbase.

.3 Apply water as necessary during compacting to obtain the specified density. If material is excessively moist, aerate by scarifying with suitable equipment until the moisture content is corrected.

.4 In areas that are inaccessible to rolling equipment, compact to the specified density with mechanical tampers capable of obtaining the required densities.

.5 The top of the finished subbase course shall exhibit a smooth, continuously dense surface.

3.4 FINISH TOLERANCES

.1 The finished subbase surface shall be within 10 mm of the elevation indicated on the Drawings but shall not be uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until the surface is within the specified tolerance.

3.5 QUALITY CONTROL AND QUALITY ASSURANCE

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.4 Coordinate field density testing in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.1 The testing frequency shall increase to reflect any changes in subbase material.

.5 A proofroll of the finished subbase is required to confirm adequate bearing capacity of the subbase. The proofroll shall be conducted in the presence of the Owner's Representative and a representative from the independent testing laboratory.

.6 For proofrolling, use a loaded tandem axle, dual wheel dump truck, with axle loads equivalent to the maximum legal highway limit. The tire pressure of the vehicle should be inflated to a minimum of 90% of the manufacturer's recommended inflation pressure.

.1 The Owner's Representative may authorize the use of other acceptable proofrolling equipment, such as a water truck or a motor grader with equivalent axle loads.

.7 Proofroll the top of the subbase upon completion of fine grading and compaction. The proofrolling test procedure is to be performed in a pattern to load all areas of the granular subbase course. It requires a minimum of two complete passes in one direction.

.1 In the case of parking lot pavement areas, a second series of at least two complete passes is required, perpendicular to the first series.

.8 The vehicle is to travel at the approximate speed of a comfortable walking pace. Qualified personnel are required to walk behind or beside the rear axles of the equipment while the passes are being made, to monitor for failures.

.1 Any areas that appear soft, display rutting, are displaced, or show deflections that are visually apparent are to be delineated and considered to be failed areas.

.9 Rework any failed areas. Once remedial work has been performed to correct the failed areas, a final proofroll test must be performed on the repaired and recompacted areas.

3.6 MAINTENANCE

.1 Maintain the finished subbase in a condition conforming to this Section until the succeeding material is applied.

Part 4 Measurement and Payment

4.1 GRANULAR SUBBASE

.1 Measurement and payment for the supply and placement of granular subbase material, for the depths specified, will be per square metre (m^2).

.2 Unit price to include supply, placement, and compaction of the granular subbase material to the appropriate densities and depths, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 SUPPLY ADDITIONAL GRANULAR SUBBASE MATERIAL

.1 Measurement and payment for the supply of additional granular subbase material to replace unsuitable material will be per cubic metre (m^3) of material, placed and compacted.

.2 Unit price to include removal and disposal of the unsuitable material, supply, placement, and compaction of additional granular subbase material to the appropriate densities and depths, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 QUALITY CONTROL AND QUALITY ASSURANCE TESTING

.1 The Owner will not pay for or reimburse the Contractor for any services related to inspection or testing for Quality Control.

.2 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal Work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected Work. No extra payment shall be made for areas that do not meet the project specifications and require reworking.

.3 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.4 The Contractor shall pay costs for uncovering and making good Work that is covered before the required inspection or testing is completed and approved by the Owner’s Representative.

.5 No extra payment will be made for areas requiring reworking due to inclement weather.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM C117, Standard Test Method for Material Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
- .2 ASTM C131/C131M, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- .3 ASTM C136/C136M, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ft^3) (600 kN-m/m^3))
- .5 ASTM D1883, Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
- .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- .7 ASTM D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

.2 International Organization for Standardization (ISO):

- .1 ISO 3310-1, Test Sieves – Technical Requirements and Testing – Part 1 Test Sieves of Metal Wire Cloth

Part 2 Products

2.1 MATERIALS

.1 Granular base: in accordance with Section 3 04 00 – Aggregate Materials.

Part 3 Execution

3.1 INSPECTION OF SUBBASE OR SUBGRADE

.1 Do not place granular base course until the finished subgrade or subbase surface has been inspected and approved by the Owner's Representative.

3.2 PLACING

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

.2 Place material using methods which do not lead to segregation or degradation of the aggregate.

.3 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Owner's Representative may authorize thicker lifts if the specified compaction can be achieved.

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

.5 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 COMPACTING

.1 Bring material to within 2% of the optimum moisture content and compact to a minimum of 100% of the Standard Proctor Maximum Dry Density in accordance with ASTM D698, in uniform layers not exceeding 150 mm compacted thickness.

.2 Shape and roll alternately to obtain a smooth, even, and uniformly compacted base course.

.3 Apply water as necessary during compacting to obtain the specified density. If material is excessively moist, aerate by scarifying with suitable equipment until the moisture content is corrected.

.4 In areas that are inaccessible to rolling equipment, compact to the specified density with mechanical tampers capable of obtaining the required densities.

.5 The top of the finished base course shall exhibit a smooth, continuously dense surface.

3.4 FINISH TOLERANCES

.1 The finished base surface shall be within 10 mm of the elevation indicated on the Drawings but shall not be uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until the surface is within the specified tolerance.

3.5 QUALITY CONTROL AND QUALITY ASSURANCE

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.4 Coordinate field density testing in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.1 The testing frequency shall increase to reflect any changes in base material.

.5 A proofroll of the finished base is required to confirm adequate bearing capacity of the base. The proofroll shall be conducted in the presence of the Owner's Representative and a representative from the independent testing laboratory.

.6 For proofrolling, use a loaded tandem axle, dual wheel dump truck, with axle loads equivalent to the maximum legal highway limit. The tire pressure of the vehicle should be inflated to a minimum of 90% of the manufacturer's recommended inflation pressure.

.1 The Owner's Representative may authorize the use of other acceptable proofrolling equipment, such as a water truck or a motor grader with equivalent axle loads.

.7 Proofroll the top of the base upon completion of fine grading and compaction. The proofrolling test procedure is to be performed in a pattern to load all areas of the granular base course. It requires a minimum of two complete passes in one direction.

.1 In the case of parking lot pavement areas, a second series of at least two complete passes is required, perpendicular to the first series.

.8 The vehicle is to travel at the approximate speed of a comfortable walking pace. Qualified personnel are required to walk behind or beside the rear axles of the equipment while the passes are being made, to monitor for failures.

.1 Any areas that appear soft, display rutting, are displaced, or show deflections that are visually apparent are to be delineated and considered to be failed areas.

.9 Rework any failed areas. Once remedial work has been performed to correct the failed areas, a final proofroll test must be performed on the repaired and recompacted areas.

3.6 MAINTENANCE

.1 Maintain the finished base in a condition conforming to this Section until the succeeding material is applied.

Part 4 Measurement and Payment

4.1 GRANULAR BASE

.1 Measurement and payment for the supply and placement of granular base material, for the depths specified, will be per square metre (m^2).

.2 Unit price to include supply, placement, and compaction of the granular base material to the appropriate densities and depths, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 SUPPLY ADDITIONAL GRANULAR BASE MATERIAL

.1 Measurement and payment for the supply of additional granular base material to replace unsuitable material will be per cubic metre (m^3) of material, placed and compacted.

.2 Unit price to include removal and disposal of the unsuitable material, supply, placement, and compaction of the additional granular base material to the appropriate densities and depths, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.3 QUALITY CONTROL AND QUALITY ASSURANCE TESTING

.1 The Owner will not pay for or reimburse the Contractor for any services related to inspection or testing for Quality Control.

.2 Where tests or inspections conducted by the designated Quality Assurance testing laboratory reveal Work not in accordance with Contract requirements, the Contractor shall pay the costs associated with additional testing or inspections to verify the acceptability of the corrected Work. No extra payment shall be made for areas that do not meet the project specifications and require reworking.

.3 Where tests or inspections are called prematurely or the testing laboratory is delayed by the Contractor, the Contractor shall pay all additional costs incurred.

.4 The Contractor shall pay costs for uncovering and making good Work that is covered before the required inspection or testing is completed and approved by the Owner’s Representative.

.5 No extra payment will be made for areas requiring reworking due to inclement weather.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM C88/C88M, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

.2 ASTM C128, Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate

.3 ASTM C131/C131M, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

.4 ASTM D2041/D2041M, Standard Test Method for Theoretical Maximum Specific Gravity and Density of Asphalt Mixtures

.5 ASTM D2172/D2172M, Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures

.6 ASTM D2419, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

.7 ASTM D2726/D2726M, Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures

.8 ASTM D3203, Standard Test Method for Percent Air Voids in Compacted Asphalt Mixtures

.9 ASTM D6307, Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method

.10 ASTM D6926, Standard Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus

.11 ASTM D6927, Standard Test Method for Marshall Stability and Flow of Asphalt Mixtures

.2 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M230, Standard Specification for Performance-Graded Asphalt Binder

.2 AASHTO M323, Standard Specification for Superpave Volumetric Mix Design

.3 AASHTO T283, Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage

.4 AASHTO T327, Standard Method of Test for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

.5 AASHTO T350, Standard Method of Test for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

.3 Alberta Transportation, Transportation Laboratory Tests (TLTs)

.1 TLT-107, Determination of Detrimental Matter Content in Coarse Aggregate (Abbreviated Petrographic Analysis)

1.2 SUBMITTALS

.1 Submit the asphalt concrete mix design and trial mix test results to the Owner's Representative for approval at least 4 weeks prior to commencing Work, in accordance with Section 1 04 00 – Submittal Procedures.

.2 The Contractor shall engage the services of a qualified testing laboratory to prepare the mix design. Refer to article 2.5 for more information.

Part 2 Products

2.1 ASPHALT CEMENT

.1 The Contractor shall supply the types and grades of asphalt specified in the Contract.

.2 Asphalt cements that are acceptable for use are listed on the Alberta Transportation Products List.

.3 The asphalt cement shall be uniform in character, free of water, and shall not foam when heated to 175ºC.

.4 Asphalt binders shall be prepared from petroleum oils and shall be free from impurities.

.5 Re-refined Engine Oil Bottoms (REOB), also known as Vacuum Tower Asphalt Extenders (VTAE), shall not be added in any proportion to performance grade asphalt cement. The Owner's Representative may coordinate the performance of a chemical composition analysis to determine if REOB has been used.

.6 The Contractor shall ensure the asphalt supplied meets all requirements for the types and grades specified. Any change in asphalt type or grade must be approved by the Owner's Representative. The Contractor shall notify the Owner's Representative of any changes in asphalt material suppliers.

.7 Performance grade asphalt cements (PGAC) shall meet the requirements of AASHTO M320 as outlined in this Section, with modifications for certain grades.

- .1 PGAC used for local roadways, alleys, trails, and parking lots shall meet the requirements for PG 52-34.
- .2 PGAC used for collector roadways shall meet the requirements for PG 58-34.
- .3 PGAC used for arterial roadways shall meet the requirements for PG 64-34P.
  - .1 Percent Recovery Requirements for PG 64-34P:
    - .1 Asphalt cements which have been enhanced to meet the specifications of AASHTO M320 through the use of polymer additives or other chemical means shall be referred to as modified asphalts and include the P designation following the grade.
    - .2 Modified asphalt cements shall be tested in accordance with the requirements of AASHTO T350. The testing temperature shall be 58ºC to determine the average percent recovery at 3.2 kPa ($R_{3.2}$). The minimum $R_{3.2@58ºC}$ value for PG 64-34P shall be 40%.

.8 Asphalt Prime Coat:

.1 In accordance with Section 3 08 20 – Asphalt Prime Coat.

.9 Asphalt Tack Coat:

.1 In accordance with Section 3 08 21 – Asphalt Tack Coat.

2.2 ANTI-STRIPPING ADDITIVE

.1 Asphalt mixes shall be treated with a liquid anti-strip additive regardless of test results reported for evaluation of moisture susceptibility. Liquid anti-strip additive products are subject to the approval of the Owner's Representative.

.2 The dosage rate by weight of virgin asphalt binder shall be based upon the supplier's recommendation. Dosage rates greater than 0.5% by weight of virgin binder are subject to the approval of the Owner's Representative.

.3 In lieu of using a liquid anti-strip additive, the Contractor may use hydrated lime at an additive rate of 1.4% by weight of dry aggregate, at the discretion of the Owner's Representative. Hydrated lime shall meet the requirements of AASHTO M303.

.1 If approved for use, the Contractor shall include details of the proposed procedure for uniformly incorporating hydrated lime into the asphalt mix as part of the mix design submission.

.4 The Contractor shall supply the Owner's Representative with copies of all invoices or bills of lading for asphalt cement treated by the supplier, or for quantities of anti-strip additive or hydrated lime added by the Contractor.

.5 Costs associated with the supply and incorporation of liquid anti-strip additive or hydrated lime into the asphalt concrete pavement mix, regardless of whether the additives are incorporated by the asphalt supplier or the Contractor, shall be included in the unit price bid for Hot Mix Asphalt Concrete. Separate payment will not be made.

2.3 AGGREGATE MATERIAL

.1 All aggregate particles shall be clean and durable and shall not contain clay particles or other deleterious materials.

.2 The aggregate shall be crushed gravel and 60% of the material retained on the 5 000 µm sieve, based on dry mass, shall have at least two crushed faces.

.3 When tested by means of laboratory sieves, the mixed aggregate shall meet the following gradation limits:

Sieve Designation (µm)	% Passing
12 500	100
10 000	83 – 92
5 000	55 – 70
1 250	26 – 45
630	18 – 38
315	12 – 30
160	8 – 20
80	4 – 10
% Fractures by dry mass (+5 mm, 2 faces)	60 min.
LA Abrasion (% loss, coarse aggregate, grading 'C')	40 max.
% Manufactured Fines (-5 mm material)	50 min.

.4 A maximum of 2% oversize shall be allowed on the largest sieve size.

.5 Coarse aggregate:

.1 Coarse aggregate is all material retained on 5 000 µm sieve.

.2 This aggregate shall consist of sound crushed stone, crushed gravel, or a combination of these materials.

.3 Coarse aggregate shall be free from coatings of clay, silt, or other deleterious materials.

.4 The percentage of wear of coarse aggregate used in surface course mixes shall not be greater than 40% when tested for 'C' grading by ASTM C131/C131M.

.5 The percentage of wear of coarse aggregate used in surface course mixes shall not be greater than 17% when tested for 'Table 3' grading by AASHTO T327.

.6 Coarse aggregate shall be tested for soundness by ASTM C88/C88M or shall have been satisfactorily proven sound through adequate record of service. When tested for soundness, the number of cycles shall be 5, the solution shall be sodium sulphate, and the maximum loss shall be 12%. Aggregates having known polishing characteristics shall not be used in mixes for the surface course.

.7 Coarse aggregate used for surface course mixes shall not contain more than 3% detrimental matter based on the total mass of the combined aggregates in the final product, when tested in accordance with TLT-107.

.8 When coarse aggregate grading is such that the material will tend to segregate in stockpiling or handling, such aggregate shall be supplied in two or more sizes. Each size of coarse aggregate required to produce the combined gradation specified above shall be placed in individual stockpiles to the satisfaction of the Owner's Representative. When it is necessary to blend two or more coarse aggregates before placing them in the cold bins, the blending shall be done through separate bins at the cold elevator feeders and not in the stockpile.

.6 Fine aggregate:

.1 Fine aggregate is all material passing the 5 000 µm sieve.

.2 This aggregate shall consist of natural sand and/or manufactured material derived by crushing of stone, slag, or gravel.

.3 Fine aggregate shall be clean, tough, durable, moderately sharp, and free from coatings of clay, silt, or other deleterious materials and shall contain no clay balls or other aggregations of fine material.

.4 Fine aggregate shall be tested for soundness in accordance with ASTM C88/C88M or shall have been satisfactorily proven sound through adequate record of service. When tested for soundness, the number of cycles shall be 5, the solution shall be sodium sulphate, and the maximum loss shall be 16%.

.5 When it is necessary to blend fine aggregates from two or more sources to produce the combined gradation specified, each source or size of fine aggregates shall be placed in individual stockpiles to the satisfaction of the Owner's Representative. The blending shall be done through separate bins at the cold elevator feeders and not in the stockpile.

.7 The combined aggregate shall have a minimum sand equivalent of 45 and shall be Non-Plastic.

.8 If the Contractor elects to use an approved drier-drum asphalt mixing process, the designated aggregates shall be split on the 5 000 µm sieve size and each material shall be stockpiled separately such that intermixing of each size and type does not occur.

.9 The coarse aggregate stockpile shall contain no more than 20% passing the 5 000 µm sieve size and the fine aggregate stockpile shall contain no more than 20% retained on the 5 000 µm sieve size. At least 2,000 tonnes of aggregate shall be placed in each stockpile prior to the start of mixing operations.

.10 The Contractor, during the crushing and splitting process, shall provide a convenient means for accurately and representatively:

.1 Sampling the individual coarse and fine aggregate streams, and the combined aggregate stream in its proper proportion, or

.2 Sampling the individual coarse and fine aggregate streams and weighing the total amounts of both coarse and fine materials being produced.

2.4 MINERAL FILLER

.1 Finely ground particles of limestone, hydrated lime, Portland cement, or other approved non-plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet the job mix aggregate gradation or as directed to improve mix properties.

.3 Mineral filler shall be dry and free flowing when added to the aggregate.

.4 When tested by means of laboratory sieves, the mineral filler shall have zero plasticity index and shall meet the following gradation limits:

Sieve Designation (µm)	% Passing by Weight
400	100
160	90 minimum
80	70 minimum
45	62 minimum

2.5 MIX DESIGN

.1 Mix Design and Job Mix Formula:

.1 A qualified testing laboratory, licensed to practice Professional Engineering in the Province of Alberta, engaged and paid for by the Contractor shall be employed to prepare a mix design and job mix formula for aggregate on which the Bid is based. If the Contractor proposes to use a material which does not conform to the specified aggregate gradation limitations, a preliminary mix design shall accompany the Bid submission.

.2 The mix design and job mix formula require the approval of the Owner's Representative prior to paving.

.2 Design of mix: by the Marshall method, to the following requirements.

.1 Mix Properties:

Max. size of aggregate (mm)	12.5
No. of blows (each end of specimen)	75 (arterials/collectors) 50 (locals/alleys/trails/parking lots)
Stability (kN)	11.5 minimum (arterials/collectors) 6 minimum (locals)
Flow (mm)	2 – 3.5
% air voids in total mix	3.5 – 4.0
% voids in mineral aggregate	13.5 – 14.0 minimum (in relation to air voids)
% retained stability	70
Film thickness (mm)	7.0 minimum

.2 Moisture Susceptibility Testing:

.1 Asphalt mixes shall be evaluated for moisture susceptibility, in accordance with the requirements of AASHTO T283, using either gyratory or Marshall compacted specimens. All specimens shall be formed using the same procedure.

.2 Mix design submissions shall include the test results as outlined in the AASHTO T283 test procedure, including the visual estimate of the degree of moisture damage.

.3 The minimum value for Tensile Strength Ratio (TSR) shall be 80%. If the TSR value for the treated mix is less than 80%, the mix will be considered unsuitable and shall not be used for mix production.

.4 The Contractor shall include the following information with the mix design submission:

.1 Full details on the type of liquid anti-strip additive proposed for use, including product name, manufacturer, and supplier.

.2 Dosage rate.

.3 TSR values for the treated mix.

.4 The proposed method for incorporating the additive into the plant produced mix.

.5 When the liquid anti-strip is not added by the asphalt supplier, the Contractor shall provide documentation from the asphalt binder supplier that confirms the proposed anti-strip additive is

compatible with the asphalt crude source and grade contained in the mix design when added within the dosage range recommended by the additive supplier.

.3 Reclaimed Asphalt Pavement (RAP):

.1 If approval is received from the Owner's Representative, the Contractor may elect to use suitable RAP in the hot mix asphalt mix design to a maximum RAP to virgin aggregate ratio of 10/90 for the surface course and 30/70 for any non-surface course.

.2 Suitable RAP shall not contain any other additives including sulphur, crumb rubber, asphalt rubber, asbestos, produced sand, paving fabrics, and reinforcement grids.

.3 The proper handling, stockpiling, storage, and hauling of all RAP shall be the responsibility of the Contractor, such that contamination and consolidation of the material is prevented.

.4 Rheological testing of the RAP is not required for mixtures using a maximum RAP to virgin aggregate ratio of 10/90.

.5 For RAP to virgin aggregate ratios greater than 10/90, the Contractor shall undertake rheology testing of the RAP and the virgin grade shall be selected according to the rheology blending procedures outlined in the Appendix of AASHTO M323.

.6 Mix design submissions using RAP shall include the RAP source name and location, type of RAP (millings or cores), all RAP asphalt content and gradation test results, the bulk specific gravity of the RAP aggregate, the percentage by weight of RAP to be used in the mixture, and, when required, all RAP rheological test results, the design rheology, and all blending charts used.

.4 Measure the physical requirements as follows:

.1 Marshall load and flow value: to ASTM D6927.

.2 Compute void properties on the basis of bulk specific gravity of the aggregate (to ASTM C128). Make an allowance for the volume of asphalt absorbed into the pores of the aggregate.

.3 Air voids: calculated to ASTM D3203.

.4 Marshall specimens prepared to ASTM D6926, and Bulk Relative Density (BRD) to ASTM D2726/D2726M.

.3 Do not change the job mix without the prior written approval of the Owner's Representative. Should a change in material source be proposed, a new job mix formula shall be approved by the Owner's Representative in writing.

.4 The job mix formula shall be posted in a conspicuous place within sight of the plant operator. Any subsequent changes must be approved by the Owner's Representative in writing.

.5 The job mix formula shall list the following information:

.1 Batch Plants:

.1 The sieve analysis of the combined aggregate in the mix.

.2 The aggregate size range in each bin to be used.

.3 The weight of the material to be used from each bin for one batch of mix.

.4 The weight of the asphalt to be used in each batch.

.5 The mixing temperature of the asphalt mix as determined from the temperature-viscosity relationship for the asphalt.

.2 Continuous Plant:

.1 Proportions for a continuous feed mixing plant shall be determined on the basis of a field trial which shall be carried out at least 48 hours prior to placing the mix on the job site.

.2 The volumetric settings of the aggregate and asphalt shall be determined by the Contractor and approved by the Owner's Representative. These settings shall be interlocked, so that a change in the volume of aggregate automatically results in a corresponding change in the volume of asphalt.

.3 The following data shall be displayed at the plant:

.1 The weight of asphalt per tonne of mix.

.2 The mixing temperature of the asphalt mix as determined from the temperature-viscosity relationship for the asphalt.

.3 The settings of the feed systems.

Part 3 Execution

3.1 CONTROL OF THE MIX

.1 Mix Property Tolerances:

.1 Permissible variation in aggregate gradation from the job mix formula:

	Percent of Total Mass
5 000 µm sieve and larger	± 5.0
2 000 µm sieve	± 4.0
630 µm sieve	± 3.0
80 µm sieve	± 2.0

.2 Permissible variation of asphalt cement (AC) content from the job mix formula: ± 0.30%.

.2 Sampling and Testing: the Quality Assurance testing laboratory will:

.1 Determine the AC content and gradation of representative core samples at a minimum frequency of one sample for every 250 tonnes of hot mix or a day's production, whichever is less, up to a maximum of 4 samples per day's production.

.1 AC content and gradation shall be determined in accordance with ASTM D6307 or ASTM D2172/D2172M.

.2 Determine the Marshall density and void properties of laboratory compacted loose mix asphalt samples at a minimum frequency of one test for every 1,000 tonnes of hot mix, or a day's production, and/or one per street, whichever is less.

.1 Hot mix samples shall be formed into Marshall specimens according to ASTM D6926.

.2 The density of the laboratory prepared Marshall specimens shall be determined in accordance with ASTM D2726/D2726M.

.3 The MTD of hot mix samples shall be determined in accordance with ASTM D2041/D2041M.

.4 Marshall void properties shall be determined in accordance with ASTM D3203.

.3 Basis of Acceptance: AC content and gradation will be accepted on the basis of deviation from the approved job mix formula, according to the tolerances outlined in article 3.1.1. Void properties will be accepted based on the limits outlined in article 2.5.2.

.1 Deficient AC content:

.1 If the average AC content of the core samples from a day's production is outside the tolerances outlined in article 3.1.1, the represented area of mat may be accepted subject to a pay factor to be applied to the price of the quantity of hot mix in that mat area. Pay factors will be assessed as per the "AC Content Penalty" table in article 4.1.

.2 Deficient gradation or void properties:

.1 If the average gradation of the core samples from a day's production is outside the tolerances outlined in article 3.1.1, or if the average void properties of the laboratory compacted Marshall specimens from a day's production are outside the limits outlined in article 2.5.2, the Owner's Representative may order the suspension of mix production until the Contractor has demonstrated corrective measures, to the satisfaction of the Owner's Representative, to produce mix meeting the specified mix tolerances and properties.

.3 Permissible variation of mix temperature at discharge from the plant: 9°C.

.4 In no case shall the mixing temperature exceed the maximum temperature indicated from the asphalt temperature - viscosity curve data.

3.2 HOT MIX PLANT

.1 The paving plant shall be of a type capable of consistently meeting or exceeding all of the requirements of this Section.

.2 The plant shall be equipped with devices to allow samples of asphalt cement and aggregates to be taken and shall indicate the temperature of the aggregate, asphalt cement, and mixtures.

3.3 PREPARATION AND MIXING

.1 Preparation of Mineral Aggregate:

.1 For Pugmill Type Mixers:

.1 The aggregate may be blended either through a cold feed proportioning unit or by other means, but in any case, shall be screened into bins in accordance with the aggregate sizes called for in the job mix formula.

.2 The mineral aggregate shall be dried to a maximum moisture content of 0.5%. The temperature of the aggregate, when delivered to the mixing unit, shall be at a temperature which is consistent with proper mixing and laying and in no case shall be above 150°C.

.2 For Dryer-Drum Type Mixers:

.1 Each aggregate size shall be fed through a separate feeder which has a positive feed, and which can be easily and accurately calibrated. Each feeder shall be quick adjusting and shall maintain a uniform, constant flow throughout the range of its calibration.

.2 The plant shall be equipped with an aggregate cold feed control, such as a belt scale or other device, which automatically and instantly regulates the feed gates, and which has an automatic, positive coupling with the bitumen flow to maintain the required asphalt content.

.3 The mineral aggregate shall be dried to a maximum moisture content of 0.5%. The temperature of the aggregate, when delivered to the mixing unit, shall be at a temperature which is consistent with proper mixing and laying and in no case shall be above 150°C.

.4 Removal or addition of any size of aggregate, to attain gradation requirements, shall be done at the initial crushing and stockpiling stage.

.5 The cold feed control and bitumen flow shall be calibrated to the job mix formula.

.2 Preparation of Binder:

.1 The asphaltic binder shall be heated to a temperature between 120°C and 150°C by approved means designed to obtain uniform heating of the entire contents of the storage tank.

.2 The temperature differential between the aggregate and asphalt binder shall be no more than 15°C.

.3 Mixing:

.1 For Pugmill Type Mixers:

.1 The mineral aggregate and asphaltic binder shall be mixed to produce a homogeneous mixture in which all particles of the mineral aggregate are uniformly coated and in the proportions called for in the approved job mix formula.

.2 The volume of mineral aggregate and asphalt cement shall not be so great as to extend above the tips of the mixer blades when the blades are in a vertical position.

.3 After the hot aggregate and mineral filler have been charged into the mixer and thoroughly mixed for a period of not less than 15 seconds, the asphaltic binder shall be added, and the mixing continued for a period of at least 20 seconds and not more than 45 seconds.

.2 For Dryer-Drum Type Mixers:

.1 The dryer-drum mixer mixing process shall produce a uniform mixture in which all aggregate particles are thoroughly coated with asphalt.

.2 The plant shall be equipped with an automatic, positive coupling which instantly regulates the aggregate cold feed gates with the bitumen flow to maintain the required asphalt content.

.4 Prior to laying mix, clean surfaces of loose and foreign material.

.5 Prior to laying mix, adjust manhole, catch basin manhole, and catch basin frames, valves, valve boxes, and other street hardware to finished/design elevations.

3.4 TRANSPORTATION OF MIX

.1 Transport the mix to the job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with light oil, limewater, soap, or a detergent solution at least once a day or as required. Elevate the truck bed and thoroughly drain. Excess solution remaining in the truck bed will not be permitted.

.3 Schedule the delivery of material for placement in daylight unless the Owner's Representative has approved the use of artificial light.

.4 Deliver material to the paver at a uniform rate and in an amount within the capacity of the paving and compacting equipment.

.5 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at a temperature not lower than 120°C nor more than 140°C.

3.5 BASE PREPARATION

.1 The hot asphaltic mixture shall be laid upon a dry, firm base, true to grade and cross section, and free from all screenings, loose, and foreign material. No hot mix shall be spread when the base is wet or when other conditions prevent proper spreading, finishing, or compaction.

.2 If undercutting and subsequent backfill with hot asphaltic concrete is done, the backfill operation shall be performed sufficiently far ahead of the paving operation to allow the asphaltic concrete sufficient time to cool down to support equipment.

.3 Apply diluted emulsion (prime coat) in accordance with Section 3 08 20 – Asphalt Prime Coat.

.4 Where the asphaltic surface course is placed in two lifts, the surface of the first lift shall first be thoroughly cleaned of dirt or other deleterious materials by sweeping with a power broom supplemented by hand brooming and scraping where necessary. A tack coat shall then be applied, where required, by means of an approved pressure distributor. No levelling course or surface course mixtures shall be placed until the tack coat is thoroughly set.

3.6 PLACEMENT

.1 Spreading the Mixture:

.1 The mixture shall be laid at a temperature not lower than 120°C nor more than 140°C. The atmospheric air temperature shall be not less than 5°C and rising and the road surface shall be dry.

.2 The mixture shall be spread by means of a mechanical self-propelled paver or approved mechanical spreader capable of spreading the mixture true to the line, grade, and crown as indicated on the Drawings.

.3 Unless operating on fixed side forms, the paver shall employ mechanical devices such as equalizing runners, straight-edge runners, evener arms, or other compensating devices to adjust the depth and confine the edges of the mixture to true lines without the use of stationary side forms. The paver shall be capable of spreading the mixture without segregation to a minimum depth of 40 mm and to adjustable widths.

.4 The paver shall be equipped with an adjustable strike off screed of such design that drag marks will be eliminated and with built-in tamping bars for compaction during spreading. The paver shall carry an approved 3 m straight edge for checking the finished surface.

.5 Immediately after any course is screeded and before compaction is started, the surface shall be checked, and any irregularities adjusted. Irregularities in alignment and grade along the outside edge shall also be corrected by the addition or removal of mixture before the edge is rolled.

.6 The Contractor shall provide a competent worker who can perform the Work incidental to the correction of all pavement irregularities. Special attention shall be given by the worker to the straight edge checking of each course immediately following the initial rolling.

.7 Where the asphaltic surface course is to be placed in two lifts, the first lift shall be placed, finished, and compacted for the full width, as shown on the Drawings, prior to commencing the second lift.

.8 In placing the second lift, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in each layer will not coincide.

.9 In narrow areas, deep or irregular sections, intersections, turnouts, and driveways, where it is impractical to spread with a paver, the Contractor may use machine or hand methods as directed by the Owner's Representative.

.10 Machine placed asphalt shall include asphalt placed with any mechanical equipment other than a paver.

.11 Hand placed asphalt shall include asphalt placed by hand labour without the use of any mechanical equipment other than equipment used for transporting the mix.

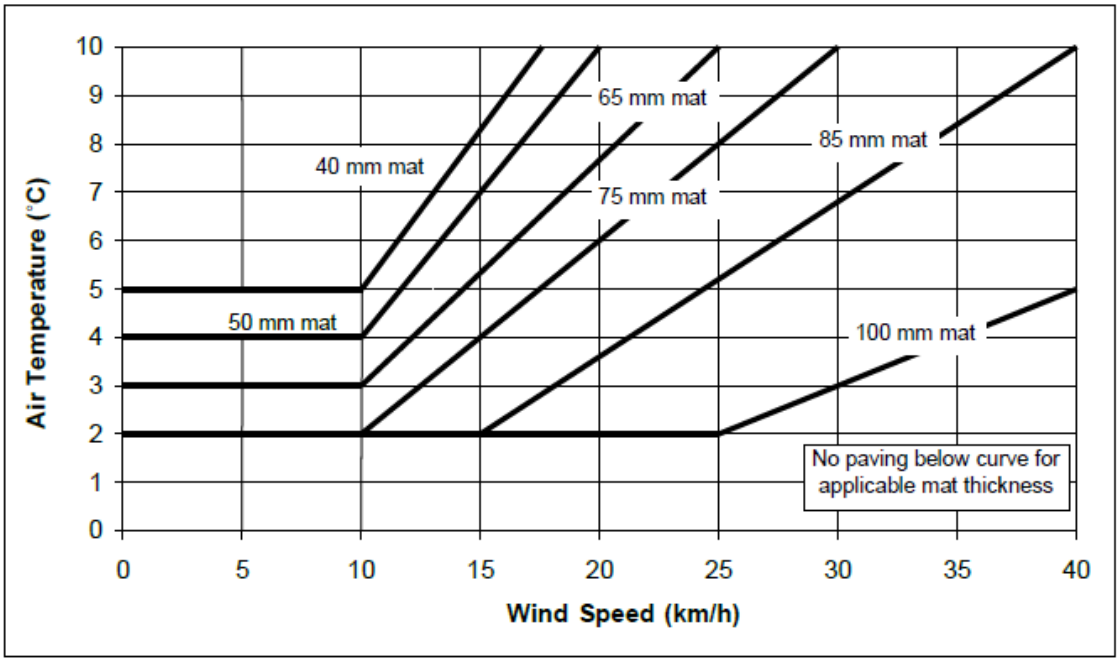
.12 Hauling over new pavement will not be permitted until the mixture has been thoroughly compacted in the manner specified and has cooled to atmospheric temperature.

.2 Cold Weather Paving:

.1 Paving is not permitted when rain or snow is imminent, or when the surface or base to be paved is wet, icy, snow-covered, or frozen.

.2 Paving is not permitted when the air temperature and wind speed conditions are below the applicable mat curve in the following chart.

.3 Paving is not permitted unless the temperature of the surface on which the asphalt will be placed is above 2ºC.



Note: City of Edmonton chart; modified.

3.7 COMPACTION

.1 After the asphaltic mixture has been spread to the uniform thickness indicated, it shall be compacted to a minimum Marshall Density as specified in Section 4 Roadways in the Municipality's *Design Servicing Standards and Development Procedures*. The Contractor shall be responsible for the selection of the type and number of units of compaction equipment. Compaction to the specified density shall be completed before the asphaltic mixture has dropped in temperature to 65°C.

.2 If the asphaltic concrete surface course is to be placed on a previously constructed soil cement base course, vibratory compaction equipment shall be discontinued after one complete pass of the vibratory roller.

.3 The Contractor shall provide a sidewalk roller, hand tampers, and other compaction equipment as required for compaction in areas inaccessible to the roller.

.4 The speed of compaction equipment shall not exceed 5 km/h and shall always be slow enough to avoid displacement of the hot mix. Any displacements shall at once be corrected. Rolling shall proceed continuously until all roller marks are eliminated and no further compression is possible. To prevent adhesion of the mix to the roller, the wheels shall be kept moistened with water; however, excess water is not permitted. Fuel oil, lubricating oil, and kerosene are not permitted.

.5 Along curbs and in areas around manholes and other structure which are inaccessible to the roller, the mix shall be compacted thoroughly by means of hot tampers. The joints between these structures and the mix shall be sealed.

3.8 JOINTS

.1 Longitudinal and transverse joints shall be made in such a manner as to provide proper bonding between the two mats for the full depth of the joint.

.2 Transverse joints shall be made by cutting into the previously spread and rolled course to expose its full depth and to remove the taper. When spreading of the course is resumed, the exposed edge of the joint shall be painted with a thin layer of tack coat and the freshly laid mixture shall be raked against the joint, tamped with hot tampers, and rolled.

.3 The mixture shall be spread and laid so that all longitudinal joints are made while the asphalt mat which was laid first is still hot.

.4 A narrow strip along the edge of a mat which is to be joined with another asphalt mat shall be left without rolling until the adjoining mat has been placed against it. The joint which is formed shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

.5 Care must be taken during the forming of the joints such that there will be a coincidence of surface planes devoid of ridges or depressions at the joints.

.6 Transverse joints in succeeding courses shall be offset at least 0.6 m. Longitudinal joints shall be offset at least 0.2 m.

.7 All concrete or metal surfaces such as curbs, manholes, etc., that are to come in contact with plant-mix material shall be painted with a thin layer of tack coat. Where mechanical placing methods do not produce proper joints at gutters, curbs, or other structures, hand methods will be required.

3.9 FINISH TOLERANCES

.1 Smoothness: the maximum variation under a 3 m straight edge shall be as follows:

- .1 Longitudinal (in the direction of travel): 3 mm.
- .2 Transverse to the direction of travel: 6 mm.

.2 Grade: + 6 mm maximum variation from the design grade elevations.

.3 Texture: the finished surface shall have a tight knit texture free of visible signs of poor workmanship such as:

- .1 Segregation.
- .2 Areas exhibiting excess or insufficient asphalt.
- .3 Improper offset of longitudinal and transverse joints.
- .4 Roller marks, cracking, or tearing.

.4 If surface and grade tolerances are exceeded, or if the surface texture is not met, grind down and resurface defective areas as directed by the Owner’s Representative.

.5 Segregation:

- .1 The finished surface shall have a uniform texture and shall be free of segregated areas. A segregated area is defined as an area of the pavement where the texture differs visually from the texture of the surrounding pavement.
- .2 All segregation shall be evaluated by the Owner’s Representative to determine repair requirements.
- .3 The severity of the segregation shall be rated as follows:

.1 **Slight** – The matrix of asphalt cement and fine aggregate is in place between the coarse aggregate particles; however, there is more stone in comparison to the surrounding acceptable mix.

.2 **Moderate** – There is significantly more stone than the surrounding mix and it exhibits a lack of surrounding matrix.

.3 **Severe** – Appears as an area of very stony mix, stone against stone, with very little or no matrix.

.4 **Centre-of-Paver Streak** – Appears as a continuous or semi-continuous longitudinal "streak" typically located in the middle of the paver "mat".

.4 Segregated areas shall be repaired by the Contractor as directed by the Owner's Representative based on the following methods of repair:

.1 **Slight** – Squeegee the asphalt to completely fill the surface voids.

.2 **Moderate** – Slurry seal for the full mat width.

.3 **Severe** – Remove and replace or overlay.

.4 **Centre-of-Paver Streak** – Only moderate and severely segregated centre-of-paver streaks on the surface lift of pavement will require repair as described above.

.5 All repairs shall be regular in shape and finished using good workmanship practices to provide an appearance acceptable to the Owner's Representative.

.6 Any other methods of repair proposed by the Contractor will be subject to the approval of the Owner's Representative.

.7 Repairs shall be carried out by the Contractor at their expense.

3.10 THICKNESS TOLERANCES

.1 Representative Cores: At the Owner's Representative's request, the Quality Assurance laboratory will take one or more sets of cores from asphalt pavement suspected to be deficient in total thickness, each set comprising 3 cores whose average thickness represents not more than 1,000 m^2 of asphalt pavement.

.2 Deficient Thickness: If the average core thickness is deficient, that area of asphalt pavement will be assessed a pay factor as per the "Asphalt Thickness Penalty" table in article 4.1.

.3 Excess Thickness: Asphalt pavement with excess thickness may be accepted with no extra payment if the surface and grade tolerances and texture are met.

3.11 DENSITY TOLERANCES

.1 Sampling and Testing: The Quality Assurance laboratory will:

.1 Determine the density of laboratory compacted Marshall specimens at a minimum frequency of one Marshall density for every 1,000 tonnes of hot mix, or a day's production and/or one per street, whichever is less.

.2 Drill cores from the compacted mat placed from the same load of hot mix from which the Marshall specimens were taken, or from suspected compacted mat, and test for density.

.2 Basis of Acceptance: Pavement compaction will be accepted on the basis of the ratio (in percent of the core density to the density of the Marshall specimen). If cores were drilled

from mat where no Marshall specimen was taken, acceptance will be based on the ratio of core density to the average density of all Marshall specimens to date.

.3 Representative Cores: A single core is initially taken representing the quantity of hot mix in not more than 1,000 m^2 of mat, with a minimum of one core taken from a day's production. If the initial core density is below specified, that initial density is discarded, and 3 new cores will be taken from the same area with a minimum separation of 10 m between cores. The average density of the 3 new cores will represent that area.

.4 Deficient Density: If the average core density is below specified, the represented area of mat may be accepted subject to a pay factor to be applied to the price of the quantity of hot mix in that mat area. Pay factors will be assessed as per the "Asphalt Density Penalty" table in article 4.1.

3.12 CLEAN-UP AND TRAFFIC CONTROL

.1 Clean up the project site at the end of each construction day, including removal of all construction refuse from boulevards, ditches, roadways, and driveways to the satisfaction of the Owner's Representative.

.2 Do not permit traffic on the finished pavement until it has cooled to atmospheric temperature. The Contractor shall be responsible for traffic control during construction and shall maintain traffic to the satisfaction of the Owner's Representative.

.3 Within 24 hours following the placement of asphalt, visually inspect all manholes, catch basins, catch basin manholes, and valve boxes. Verify that structures have not been paved over, and that covers are removable and vent holes have not been sealed with asphalt. Remove all accumulated asphalt or other debris that may have fallen to the bottom of these structures to the satisfaction of the Owner's Representative.

3.13 QUALITY CONTROL AND QUALITY ASSURANCE

.1 The Owner shall engage the services of an independent testing laboratory or agency to perform required Quality Assurance testing to confirm the compliance of the Work within the Contract Documents.

.1 The Contractor shall provide access to the independent testing laboratory or agency for the purposes of obtaining samples for Quality Assurance testing.

.2 Quality Control testing is the responsibility of the Contractor. Copies of results for any Quality Control testing carried out by the Contractor shall be forwarded directly to the Owner's Representative in a timely manner.

.3 Contractor's responsibilities include providing labour and facilities to:

.1 Access the Work being inspected and tested.

.2 Facilitate inspections and testing.

.3 Make good Work that is disturbed by inspection and testing.

.4 Coordinate testing of the hot mix in accordance with articles 3.1, 3.10, and 3.11.

.5 The Quality Assurance laboratory will undertake testing of the asphaltic concrete binder.

.1 The Contractor shall deliver all Quality Assurance samples of the asphalt cement to the Owner's Representative on the day they were sampled. The Owner's Representative will forward the samples to the designated Quality Assurance testing laboratory for testing and will accept or reject asphalt material based on the test results.

.2 The minimum frequency of asphalt cement sampling and Quality Assurance testing will be once per week of production.

.3 Basis of Acceptance: asphalt cement will be accepted in accordance with the limits outlined in article 2.1.1.

.6 Tests will be coordinated by the Owner's Representative at their discretion at no expense to the Contractor to check compliance with the specifications and to determine acceptability of the end product.

.7 Copies of Quality Assurance test results will be made available to the Contractor.

3.14 MANHOLE, CATCH BASIN MANHOLE, CATCH BASIN, AND VALVE ADJUSTMENTS

.1 Prior to commencing asphalt overlay operations, the Contractor shall locate all manholes, catch basin manholes, catch basins, and valves which may interfere with operations.

.2 Prior to placing the surface course, the Contractor shall raise the manholes, catch basins, catch basin manholes, and valves to the design finished pavement surface elevation. The manhole frames and covers and catch basin and catch basin manhole frames and grates shall be set to conform to the established cross slopes and grades of the pavement surface.

.3 Adjustments to manholes, catch basins, catch basin manholes, and valves shall be made using the types of materials and workmanship used in constructing the original structures and shall be in accordance with Section 2 02 22 – Adjustment of Manholes, Catch Basins, Hydrants, and Water Valves.

Part 4 Measurement and Payment

4.1 HOT MIX ASPHALT CONCRETE PAVING

.1 Measurement and payment for the supply and placement of hot mix asphalt concrete pavement, for the thicknesses specified, will be per square metre (m^2), based on field area measurements of compacted-in-place material.

.2 Unit price to include preparation of the mix design and job mix formula, the supply and placement of the hot mix asphalt concrete, asphalt prime coat if required, asphalt tack coat, compaction, clean-up of all aggregate/asphalt materials that may fall off delivery trucks/equipment along haul routes, the removal of any tack coat that has been tracked onto concrete structures or roadway pavement markings, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.1 Haul routes shall be inspected prior to commencement of Work and again following completion of Work to determine cleaning requirements. Any clean-up Work not performed in a timely manner will be completed by the Owner with all related costs deducted from final payments.

.3 Payment reductions shall apply to those areas found to be deficient in asphalt cement (AC) content, thickness, and density unless other corrective actions taken by the Contractor are approved by the Owner's Representative. Each day's production will be considered as a single Lot, based on the average results for that day, and payment reductions shall be applied to the entire Lot.

.1 Payment reductions for deficient thickness shall be applied in accordance with the "Asphalt Thickness Penalty" table in article 4.1 and the following conditions:

.1 There will be no payment reduction for areas deficient in thickness by 6 mm or less.

.2 Payment will not be made for areas of pavement found deficient in thickness by more than 15 mm.

.3 Areas of pavement found to be deficient in thickness by 7 mm or more, but less than 15 mm, shall be paid for at an adjusted unit price as per the "Asphalt Thickness Penalty" table.

.4 The Contractor shall arrange and pay for testing involved in determining the extent of pavement having insufficient thickness.

.2 Payment reductions for deficient densities shall be applied in accordance with the "Asphalt Density Penalty" table in article 4.1. The Contractor shall arrange and pay for testing involved in determining the extent of pavement having deficient densities.

.3 Payment reductions for deficient AC content shall be applied in accordance with the "AC Content Penalty" table in article 4.1. The Contractor shall arrange and pay for testing involved in determining the extent of pavement having deficient AC content.

.4 Appeal of Acceptance Test Results:

.1 The Contractor may appeal the results of acceptance testing for AC content, thickness, or density for any rejected or penalized results only once. Appeals will only be considered if cause can be shown.

.2 Quality Control test results that are provided to the Owner's Representative subsequent to the Contractor's receipt of the Quality Assurance test results for that day's production will not be considered when evaluating cause for an appeal.

.3 The appeal shall be for all tests within the Lot representing that day's production, and there will be no appeal allowed for single tests within a Lot.

.4 The following procedures shall be followed when making an appeal:

.1 The Contractor shall serve notice of appeal to the Owner's Representative, in writing, within 48 hours of receipt of the test results.

.2 The Owner's Representative will arrange for an independent testing laboratory, certified to operate in the Province of Alberta, to perform appeal testing. The personnel employed or testing laboratory retained by the Contractor for Quality Control testing on the project shall not be used for appeal testing.

.3 The Owner's Representative will determine the number and location of the new tests for each segment. The Contractor shall sample the pavement at such locations and provide the samples to the Owner's Representative.

.4 The single high and low test results from the old Lot will be rejected and the remaining test results will be added to the results of the new tests. A new Lot Mean for the test results will be determined and used for acceptance and unit price adjustment.

.5 The new values, thus determined, in all cases, will be binding on the Contractor and the Owner.

Asphalt Thickness Penalty	
Thickness Deficiency (mm)	Payment Reduction (%)
6.0	0.0
7.0	3.0
8.0	6.3
9.0	10.0
10.0	14.5
11.0	19.5
12.0	25.0
13.0	32.0
14.0	40.0
15.0	50.0
Over 15.0	Grind and resurface.

Asphalt Density Penalty			
98% Minimum Density Requirement		97% Minimum Density Requirement	
Actual Density (%)	Payment Reduction (%)	Actual Density (%)	Payment Reduction (%)
98.0 and greater	0.0	97.0 and greater	0.0
97.9	0.1	96.9	0.1
97.8	0.2	96.8	0.3
97.7	0.4	96.7	0.6
97.6	0.6	96.6	0.9
97.5	0.9	96.5	1.3
97.4	1.3	96.4	1.8
97.3	1.7	96.3	2.3
97.2	2.2	96.2	2.9
97.1	2.8	96.1	3.7
97.0	3.5	96.0	4.5
96.9	4.2	95.9	5.4
96.8	5.0	95.8	6.4
96.7	5.8	95.7	7.5
96.6	6.7	95.6	8.7
96.5	7.7	95.5	10.1
96.4	8.9	95.4	11.6
96.3	10.2	95.3	13.3
96.2	11.5	95.2	15.2
96.1	12.9	95.1	17.3
96.0	14.5	95.0	19.7
95.9	16.7	94.9	22.4
95.8	18.0	94.8	25.7
95.7	20.0	94.7	29.4
95.6	22.3	94.6	34.0
95.5	24.6	94.5	40.0
95.4	27.0	Under 94.5	Remove and replace.
95.3	29.7		
95.2	32.8		
95.1	36.3		
95.0	40.0		
Under 95.0	Remove and replace.		

Actual Density = average % of Marshall Densities for the 3 representative cores.
Pay Factor = % of unit price.

AC Content Penalty				
Deviation of the Actual Asphalt Content from the Approved Job Mix Formula (%)	Payment Reduction (%)			
	Surface Lift		Lower Lifts	
	Below	Above	Below	Above
From 0.00 to 0.30	0.0	0.0	0.0	0.0
From 0.31 to 0.35	5.0	2.5	5.0	2.5
From 0.36 to 0.40	10.0	5.0	10.0	5.0
From 0.41 to 0.45	15.0	7.5	15.0	7.5
From 0.46 to 0.50	25.0	12.5	25.0	12.5
From 0.51 to 0.55	-	-	30.0	15.0
From 0.56 to 0.60	-	-	40.0	20.0
From 0.61 to 0.65	-	-	50.0	25.0

Notes:

1. For surface lift deviations of more than 0.50%, the Municipality will determine whether to overlay or remove and replace the previously placed mix.
2. For lower lift deviations of more than 0.65%, the Municipality will determine whether removal and replacement is necessary. For material that is allowed to stay in place, payment will be at 50% of the unit price bid.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D5/D5M, Standard Test Method for Penetration of Bituminous Materials

.2 ASTM D88/D88M, Standard Test Method for Saybolt Viscosity

.3 ASTM D140/D140M, Standard Practice for Sampling Asphalt Materials

.4 ASTM D244, Standard Test Methods and Practices for Emulsified Asphalts

1.2 SUBMITTALS

.1 Submit manufacturer's test data and certification that the asphalt prime material meets the requirements of this Section in accordance with Section 1 04 00 - Submittal Procedures.

Part 2 Products

2.1 MATERIAL

.1 The prime coat shall be a liquid asphalt Type MS-1 placed at an application rate of 1.5 L/m^2 (± 0.5) with a concentration of 100%.

2.2 MATERIAL SPECIFICATIONS

.1 Asphalt prime coat shall meet the following material specifications.

Viscosity at 25°C	Min. 20; Max. 100
Residue by distillation (% by mass)	Min. 55
Settlement in 5 days (% difference by mass)	Max. 5
Storage Stability Test, 24 h (% by mass)	Max. 1.5
Retained on the 1 000 µm sieve (% by mass)	Max. 0.10
Cement Mixing Test (% by mass)	Max. 2.0
Penetration at 25°C, 100 g, 5 s dmm	Min. 100; Max. 200
Ductility at 25°C and 5 cm/min, cm	-
Solubility in trichloroethylene (% by mass)	-
Delivery temperature (°C)	Min. 40; Max. 70

.2 Testing: to ASTM D5/D5M, ASTM D88/D88M, and ASTM D244.

Part 3 Execution

3.1 EQUIPMENT

.1 The pressure distributor shall be:

.1 Designed, equipped, maintained, and operated so that asphalt material can be:

.1 Maintained at an even temperature.

.2 Applied uniformly on variable widths of surface of up to 4 m.

.3 Applied at a controlled rate of 1.5 L/m^2 with uniform pressure.

.4 Distributed in a uniform spray without atomization at the temperature specified.

.2 Equipped with a meter registering the metres of travel per minute, visibly located to enable the truck driver to maintain the constant speed required for application at the specified rate.

.3 Equipped with a pump having a flow meter graduated in units of 5 L or fewer per minute passing through nozzles and readily visible to the operator. The pump power unit shall be independent of the truck power unit.

.4 Equipped with an easily read, accurate, and sensitive device which registers the temperature of the liquid in the reservoir.

.5 Equipped with an accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of the same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with a nozzle spray bar, with operational height adjustment.

.8 Cleaned if previously used with incompatible asphalt material.

3.2 APPLICATION

.1 Obtain the Owner Representative’s approval of the granular base course surface before applying the asphalt prime coat.

.2 Protect adjoining curbs, gutters, walks, slabs, and any other surface not intended for coating. Remove any splatter on those surfaces.

.3 Do not apply liquid asphalt when the weather is foggy, rainy, windy, or when the air temperature is below 2°C.

.4 Spray liquid asphalt in a uniform coat. Do not spray excessively to create ponding. Hand spray areas missed by or inaccessible to the distributor.

.5 Do not allow traffic on the prime coat within 6 hours after application or until the prime coat has cured.

.6 Permit the prime coat to cure before placing asphalt pavement.

3.3 USE OF SAND BLOTTER

.1 If the asphalt prime coat fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.

.2 Allow sufficient time for excess prime coat to be absorbed as directed by the Owner's Representative.

.3 Apply a second application of sand blotter as required.

.4 Sweep and remove excess blotter material and dispose in an approved manner.

3.4 QUALITY CONTROL

.1 A qualified testing laboratory shall be engaged and paid for by the Contractor for all liquid asphalt testing.

.2 The Owner's Representative may request samples of liquid asphalt for Quality Assurance testing by a qualified materials testing lab.

Part 4 Measurement and Payment

.1 Separate payment will not be made for items in this Section. Include costs in the line item for Hot Mix Asphalt Concrete Paving, in accordance with article 4.1 of Section 3 08 00 – Hot Mix Asphalt Concrete Paving.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D5/D5M, Standard Test Method for Penetration of Bituminous Materials

.2 ASTM D88/D88M, Standard Test Method for Saybolt Viscosity

.3 ASTM D113/D113M, Standard Test Method for Ductility of Asphalt Materials

.4 ASTM D140/D140M, Standard Practice for Sampling Asphalt Materials

.5 ASTM D244, Standard Test Methods and Practices for Emulsified Asphalts

.6 ASTM D2042, Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene or Toluene

1.2 SUBMITTALS

.1 Submit manufacturer's test data and certification that asphalt tack material meets the requirements of this Section in accordance with Section 1 04 00 - Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 The tack coat shall be a liquid asphalt Type SS-1, MS-1 placed at an application rate of 0.5 L/m^2 (± 0.2) with a concentration of 100%.

2.2 MATERIAL SPECIFICATIONS

.1 Asphalt tack coat shall meet the following material specifications.

Asphalt Grade Requirements	**SS-1**		**MS-1**	
	Min.	**Max.**	**Min.**	**Max.**
Viscosity at 25°C	20	60	20	100
Residue by distillation (% by mass)	55	-	55	-
Settlement in 5 days (% difference by mass)	-	5	-	5
Storage Stability Test, 24 h (% by mass)	-	1	-	1.5
Retained on the 1 000 µm sieve (% by mass)	-	0.10	-	0.10
Cement Mixing Test (% by mass)	-	2.0	-	2.0
Penetration at 25°C , 100 g, 5 s dmm	100	200	100	200
Ductility at 25°C and 5 cm/min, cm	60	-	40	-
Solubility in trichloroethylene (% by mass)	97.5	-	97.5	-
Delivery Temperature (°C)	40	70	40	70

.2 Testing: to ASTM D5/D5M, ASTM D88/D88M, ASTM D113, ASTM D244, and ASTM D2042.

Part 3 Execution

3.1 EQUIPMENT

.1 The pressure distributor shall be:

.1 Designed, equipped, maintained and operated so that asphalt material can be:

.1 Maintained at an even temperature.

.2 Applied uniformly on variable widths of surface of up to 4 m.

.3 Applied at a controlled rate of 0.50 L/m^2 with uniform pressure.

.4 Distributed in a uniform spray without atomization at the temperature specified.

.2 Equipped with a meter registering the metres of travel per minute, visibly located to enable the truck driver to maintain the constant speed required for application at the specified rate.

.3 Equipped with a pump having a flow meter graduated in units of 5 L or fewer per minute passing through nozzles and readily visible to operator. The pump power unit shall be independent of the truck power unit.

.4 Equipped with an easily read, accurate, and sensitive device which registers the temperature of the liquid in the reservoir.

.5 Equipped with an accurate volume measuring device or calibrated tank.

.6 Equipped with nozzles of the same make and dimensions, adjustable for fan width and orientation.

.7 Equipped with a nozzle spray bar, with operational height adjustment.

.8 Cleaned if previously used with incompatible asphalt material.

3.2 APPLICATION

.1 Apply the asphalt tack coat on a clean and dry surface. Obtain the Owner Representative's approval of the surface before applying the asphalt tack coat.

.2 Dilute the asphalt emulsion with water at a 1:1 ratio for the application. Mix thoroughly by pumping or other method approved by the Owner's Representative.

.3 Apply the asphalt tack coat evenly to the pavement surface at the rate specified.

.4 Paint contact surfaces of curbs, gutters, headers, manholes, and like structures with a thin, uniform layer of asphalt tack coat material.

.5 Do not apply the asphalt tack coat when the air temperature is less than 2ºC or when rain is forecast within 2 hours of the application.

.6 Apply the asphalt tack coat only to surfaces that are expected to be overlayed on the same day.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by the Owner's Representative.

.8 Where traffic is to be maintained, treat no more than one half of the width of the surface in one application.

.9 Keep traffic off tacked areas until the asphalt tack coat has set.

.10 Re-tack contaminated or disturbed areas as directed by the Owner's Representative.

.11 Permit the asphalt tack coat to set before placing asphalt pavement.

3.3 QUALITY CONTROL

.1 A qualified testing laboratory shall be engaged and paid for by the Contractor for all liquid asphalt testing.

.2 The Owner's Representative may request samples of liquid asphalt for Quality Assurance testing by a qualified materials testing lab.

Part 4 Measurement and Payment

.1 Separate payment will not be made for items in this Section. Include costs in the line item for Hot Mix Asphalt Concrete Paving, in accordance with article 4.1 of Section 3 08 00 – Hot Mix Asphalt Concrete Paving.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit manufacturer's test data and certification that the asphalt binder meets the requirements of this Section in accordance with Section 1 04 00 - Submittal Procedures.

Part 2 Products

2.1 MATERIAL

.1 Asphalt Binder: emulsified asphalt cement with properties in accordance with the Alberta Transportation *Standard Specifications for Highway Construction*, of the type indicated on the Drawings.

.1 Prime: MC-30, SEP-1, SEP-2, SS-1.

.2 Anionic bituminous binder: RS-1, RS-2, MS-1.

.3 Cationic bituminous binder: CRS-2, CRS-2P.

.4 Fog spray: MC-30, SS-1.

.2 Aggregate:

.1 Aggregate for chip seal shall be washed, crushed gravel with a gradation within the following limits:

Percent Passing Metric Sieve	12 500	100
	10 000	55 – 75
	5 000	0 – 15
	1 250	0 – 3
	80	0 – 0.03
% Fracture by Weight (2 Faces)	All +5000	75+ (100% 1 Face)
Plasticity Index	-	
LA Abrasion Loss (% Max.)	35	
Flakiness Index	Max. 15	

.2 Refer to Section 3 04 00 – Aggregate Materials.

Part 3 Execution

3.1 EQUIPMENT

.1 The Contractor shall provide a self-powered asphalt distributor, self-propelled aggregate spreader, self-propelled pneumatic rollers, and power sweepers suitable for completing the Work.

3.2 PREPARATION

.1 Notice shall be given to the Owner's Representative 48 hours in advance of chip sealing operations.

.2 Sweep the pavement surface and patch and correct depressions and other irregularities to the approval of the Owner's Representative.

.3 The bitumen binder distributor shall be tested before each spray lot for uniformity, to ensure there are no clogs in the spray nozzles and the sprayers uniformly overlap to spray the binder evenly over the full area.

.4 If the chip seal is to be applied on top of a granular base, the following shall apply:

.1 The granular base shall be swept and shall be free from loose granular material.

.2 A bituminous prime shall be applied in accordance with Section 3 08 20 – Asphalt Prime Coat.

.5 Receive approval of the surface from the Owner's Representative before the chip seal is applied.

.6 A trial section shall be constructed before the full chip seal operations commence. The trial section shall be at least 100 m long and may form part of the permanent works. During the trial, the spread rates for the prime, bituminous binder, and chips shall be confirmed. Repair work to the trial section may be required as directed by the Owner's Representative.

3.3 APPLICATION

.1 The Work shall be carried out when the ambient temperature is at least 5°C. Chip sealing operations shall halt if inclement weather is imminent.

.2 The Work shall take place during daylight hours only.

.3 Apply asphalt binder as indicated on the Drawings or as directed by the Owner's Representative.

.4 Prevent asphalt binder from entering storm sewers.

.5 Distribute material uniformly. Do not broadcast material.

.6 Drip sheets consisting of reinforced paper (or approved equivalent) shall be placed at the beginning and end of each section to be paved to combat over-spraying. Once the paving operation is complete, the sheets shall be removed and disposed of in an approved manner.

.7 Once the chip seal has been swept and is free from loose chips, a fog spray shall be applied at the spray rate confirmed for the trial section.

.8 Do not permit traffic on the binder nor freshly chip sealed surface until the chip sealing operation is complete and the fog spray has cured.

3.4 CLEANING AND MAINTENANCE

.1 Sweep the application areas to remove any loose chips after rolling and initial set of the binder.

.2 Continue to sweep chip seal areas and adjacent areas for a period of up to two weeks or as directed by the Owner's Representative.

.3 Prevent sweepings from entering storm sewers. The Contractor shall use a pick-up broom for all brooming where loose chips could enter ditches or storm sewers.

.4 Sweepings shall be disposed of at an approved location off-site.

3.5 PAVEMENT MARKINGS

.1 Place temporary reflectorized centerline and lane lines as required until permanent pavement markings are installed.

.2 Apply permanent pavement markings in accordance with Section 3 10 00 – Pavement Marking.

.3 Pavement markings removed or damaged during the sweeping process shall be replaced.

.4 Permanent pavement markings to be installed a maximum of 3 days after the chip sealing operation is complete.

3.6 FINISH TOLERANCES

.1 A minimum of 99% chip seal coverage shall be obtained with no single bare area greater than 0.01 m^2 in any one square metre.

.2 There shall be no streaking or ravelling.

.3 The finished surface shall be uniform and of even texture.

.4 No over rich or bleeding areas shall be evident.

.5 All pavement markings shall be in good condition.

Part 4 Measurement and Payment

4.1 CHIP SEALING

.1 Measurement and payment for chip sealing will be per square metre (m^2) of completed surface area.

.2 Unit price to include supply and application of the asphalt binder, prime coat if required, trial section, chip seal, drip sheets, sweeping, clean-up, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Microsurfacing is a type of slurry seal application which is placed on roadways. The microsurfacing treatment is intended to fill the existing wheel path ruts as well as to provide a durable, skid-resistant surface.

.2 The Microsurfacing mixture shall consist of cationic polymer modified asphalt, mineral aggregate, mineral filler, field control additive, and water.

1.2 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M316, Standard Specification for Polymer-Modified Emulsified Asphalt

.2 AASHTO T59, Standard Method of Test for Emulsified Asphalts

.2 International Slurry Surfacing Association (ISSA)

.1 ISSA A143, Recommended Performance Guideline for Micro Surfacing

1.3 TRAFFIC CONTROL

.1 In accordance with Section 1 05 00 – Traffic Control.

Part 2 Products

2.1 MIX DESIGN

.1 The Contractor shall supply the mix design and all components of the mix. The Contractor shall submit a mix design, Authenticated by a Professional Engineer in good standing with APEGA, to the Owner's Representative a minimum of 5 working days prior to the placement of any microsurfacing material.

.2 The mix design shall be prepared by a qualified testing laboratory that has experience in the design of microsurfacing mixes using ISSA test methods and design procedures. No microsurfacing material shall be placed prior to the Owner's Representative reviewing and accepting the submitted mix design.

.3 Compatibility of the aggregate, polymer-modified emulsion, mineral filler, and other additives shall be verified by the mix design. All component materials used in the mix design shall be representative of the materials proposed by the Contractor for incorporation into the Work. The mix design shall list the characteristics and proportions of all materials to be used in the microsurfacing formulation.

.4 The microsurfacing material shall meet the following mix design requirements:

ISSA TEST NO.	DESCRIPTION	SPECIFICATION
ISSA TB-139	Wet Cohesion @ 30 min minimum (set) @ 60 min minimum (traffic)	 12 kg-cm minimum 20 kg-cm minimum or near spin
ISSA TB-109	Excess asphalt by LWT sand adhesion	538 g/m^2
ISSA TB-114	Wet Stripping	Pass (90% minimum)
ISSA TB-100	Wet-Track Abrasion Loss One-hour soak Six-day soak	 538 g/m^2 maximum 807 g/m^2 maximum
ISSA TB-147	Lateral Displacement Specific Gravity after 1,000 cycles of 11.34 kg	5% maximum 2.10 maximum
ISSA TB-144	Classification Compatibility	11 grade points minimum (AAA, BAA)
ISSA TB-113	Mix time @ 25°C	Controllable to 120 s minimum

.5 The mix design proportions shall be within the following limits.

.1 Residual asphalt: 6% to 11.5% by dry weight of aggregate.

.2 Mineral filler: 0% to 3.0% by dry weight of aggregate.

.3 Polymer Content: Minimum of 3% solids based on bitumen weight content.

.6 The microsurfacing material shall be designed to accommodate traffic without damage within one hour of placement.

2.2 ASPHALT MATERIALS

.1 The emulsified asphalt shall be a quick-traffic polymer modified asphalt emulsion conforming to the requirements of AASHTO M316 for CQS-1hP with the following changes:

.1 The cement mixing test shall be waived for this emulsion.

.2 The residue after distillation shall be tested in accordance with AASHTO T59, except that the distillation temperature shall be held at 177°C ± 5°C for 20 minutes.

.3 The residue after distillation shall be a minimum of 62%.

.2 The residue after distillation shall meet the following requirements:

TEST METHOD	TESTS ON RESIDUE	SPECIFICATION
ASTM D36/D36M	Softening Point	57°C minimum
ASTM D5/D5M	Penetration at 25°C	40 - 90 dmm *
ASTM D2171/D2171M	Kinematic Viscosity @ 135°C	50 cSt/s minimum
ASTM D6930	Settlement and Storage Stability	1% maximum

*Subject to specific project requirements

.3 The polymer material shall be milled or blended into the asphalt or emulsifier solution prior to the emulsification process.

.4 The addition rate of polymer modifier shall be a minimum of 3% polymer solids by mass of asphalt residue.

.5 Each load of emulsified asphalt shall be accompanied with a Certificate of Analysis/Compliance indicating that all asphalt requirements are met.

2.3 AGGREGATE

.1 The ISSA Type II aggregate gradation shall be used. All aggregate shall be 100% manufactured material that meets the following Specifications and is evaluated as being fully compatible with the specified emulsion.

.2 The aggregate gradation, including mineral filler, shall be within the following limits:

Sieve Size (µm)	% Passing (Type I)	% Passing (Type II)	Stockpile Tolerance
10 000	100	100	-
5 000	100	90 - 100	± 5%
2 500	90 - 100	65 - 90	± 5%
1 250	65 - 90	45 - 70	± 5%
630	40 - 65	30 - 50	± 5%
315	25 - 42	18 - 30	± 4%
160	15 - 30	10 - 21	± 3%
80	10 - 20	5 - 15	± 2%

.3 Screening by the Contractor, at the discretion of the Owner's Representative, may be required at the stockpile prior to delivery to the paving machine if there are any problems created by having oversized or excessive fines in the mix.

2.4 WATER

.1 The Contractor shall arrange for and supply the water used for the mixing of the microsurfacing material and pre-wetting of the existing pavement. The water shall be potable and free of harmful soluble salts.

2.5 MINERAL FILLER

.1 The Contractor shall supply the mineral filler which shall be introduced into the mineral aggregate. Mineral filler may be any recognized brand of non air-entrained Portland cement, hydrated lime, or any other approved mineral filler that is free of lumps.

.2 The amount and type of mineral filler needed will be determined by the laboratory mix design and will be considered as part of the material gradation requirement. An increase or decrease of less than 1% may be permitted in the field for improving the mix consistency or set times.

2.6 FIELD CONTROL ADDITIVE

.1 The Contractor shall supply the specified field control additive and apply it as required to maintain the quick-set characteristics of the mix.

2.7 MICROSURFACING MIX STABILITY AND FIELD CONTROL ADDITIVE

.1 The microsurfacing mixture shall be homogeneous during and following mixing and spreading.

.2 The micro-surfacing mix shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. To maintain mixture stability, a liquid field control additive may be introduced to provide effective control of the required quick-set properties.

Part 3 Execution

3.1 EQUIPMENT

.1 General:

.1 The Contractor shall provide all equipment, tools, machines, and incidentals necessary to complete the Work. Equipment shall be maintained in a clean and satisfactory working condition to ensure a high-quality product.

.2 The Contractor shall provide a self-propelled microsurfacing mixing machine specifically designed and manufactured to lay microsurfacing. The equipment shall be able to accurately deliver and proportion the aggregate, emulsified asphalt, mineral filler, field control additive, and water to a revolving multi-blade twin shafted mixer and discharge the mixed product on a continuous flow basis. The machine shall be equipped to allow the operator to have full control of the forward and reverse speed during application of the microsurfacing material.

.2 Proportioning Device:

.1 The Contractor shall provide proportioning devices that are properly marked for the individual volume or weight proportioning of each raw material to be added to the mix. These proportioning devices can be revolution counters or similar devices and shall be used in the material calibration for determining the mix design dial and gate settings and calculating the materials output at any time.

.3 Spreading Equipment:

.1 The mechanical spreader box attached to the paver shall be equipped with rotating paddle shafts to agitate and spread the material throughout the box and be capable of uniformly spreading the microsurfacing mixture. A front seal shall be provided to ensure no loss of the mixture at the road contact point. The rear seal shall act as the final strike off and shall be adjustable.

.2 The spreading equipment shall be capable of spreading the mixture to fill cracks and minor surface irregularities and leave a uniform friction resistant application of material on the surface. The spreader box and rear strike off shall be so designed and operated that a free flow of material to the rear strike off is achieved.

.3 The spreader box shall have suitable means provided to side shift the box to compensate for any change in longitudinal alignment.

.4 Auxiliary Equipment:

.1 Surface cleaning equipment, hand tools, and any support equipment shall be provided by the Contractor as necessary to perform the Work.

.5 Sampling Requirements:

.1 The Contractor shall arrange to have suitable sampling facilities for the Owner's Representative to obtain representative field samples of the microsurfacing mixture and each of the component materials.

.6 Machine Calibration:

.1 Each mixing unit to be used in the performance of the Work shall be calibrated in the presence of the Owner's Representative prior to construction. The calibration shall be documented and shall include the individual calibrations of the aggregate, mineral filler, and emulsified asphalt at various settings, which can be related to the machine proportioning devices to verify the application rate and mix design compliance.

3.2 SEASONAL AND WEATHER LIMITATIONS

.1 The placement of microsurfacing shall be limited to the period from June 1 to September 15. Microsurfacing shall not be placed when, in the opinion of the Owner's Representative, damage to the finished product may occur.

.2 The microsurfacing shall be placed only when the atmospheric temperature is at least 10°C and rising and the weather is free of fog or precipitation and there is no forecasted temperatures below 0°C within 24 hours from the time of application.

3.3 SURFACE PREPARATION

.1 The area to be surfaced shall be thoroughly cleaned of loose aggregate and soil and soil that is bound to the surface.

.2 Thermoplastic markings, storms sewer, and appurtenances shall be covered.

3.4 APPLICATION

.1 The surface shall be pre-wetted by fogging with water ahead of the spreader box, when required by local conditions, or sprayed with tack coat if required. The rate of application of the fog spray shall be adjusted during the day to suit temperatures, surface texture, humidity, and dryness of the pavement.

.2 The microsurfacing mixture shall be of the desired consistency when exiting the mixer and no additional materials shall be added. A sufficient amount of material shall be carried in all parts of the spreader box at all times so that complete coverage is obtained. Overloading of the spreader box is not permitted. No lumping, balling, or unmixed aggregate will be permitted. The material shall not have segregation of the emulsion and aggregate fines from the coarser aggregate.

.3 No streaks, such as those caused by oversized aggregate shall be left in the finished surface. If excessive streaking or drag develops, the operation will be stopped until the Contractor proves to the Owner's Representative that the situation has been corrected.

.4 The suggested application rate (based on dry aggregate) for the surface pass shall be 12 to 16 kg/m^2, or as directed by the Owner's Representative, and shall use exclusively Type II aggregate as outlined in article 2.3.

.5 No excessive build-up, uncovered areas, or unsightly appearances will be permitted.

3.5 HAND WORK

.1 Small areas of non-uniform application shall be spot repaired using hand squeegees to provide completed and uniform coverage. Care shall be exercised to prevent an unsightly appearance from the handwork. The same type of finish as applied by the spreader box is required.

3.6 JOINTS

.1 No excess build-up, uncovered areas, or unsightly appearance shall be permitted on longitudinal or transverse joints. The Contractor shall provide suitable width spreading equipment to produce a minimum number of longitudinal joints. When possible, longitudinal joints shall be placed on lane lines. Partial width passes are only to be used when necessary and shall not be the last pass of any paved area. A maximum of 76.2 mm shall be allowed for the overlap of longitudinal joints.

.2 The joint shall have no more than a 6.4 mm difference in elevation when measured by placing a 3 m straight edge over the joint and measuring the elevation difference.

3.7 MIXTURE

.1 The microsurfacing mixture shall possess sufficient stability so that premature breaking of the material in the spreader box does not occur. The mixture shall be homogeneous during and following mixing and spreading. It shall be free of excess liquids that create segregation of the aggregate. Spraying of additional water into the spreader box is not permitted.

3.8 LINES

.1 Care shall be taken to ensure straight lines along curbs and shoulders. No runoff on these areas will be permitted. Lines at intersections will be kept straight.

3.9 CLEAN-UP

.1 All areas, such as gutters, and intersections, shall have the microsurfacing mix removed as directed by the Owner's Representative. The Contractor shall remove any debris associated with the performance of the Work on a daily basis.

3.10 TRAFFIC READINESS

.1 The modified emulsified asphalt will be formulated so that the material will cure sufficiently so that rolling traffic can be allowed on the surface within one hour of

placing with no damage to the surface. Areas with rut fills deeper than 25 mm and fills in areas where hard, sharp turning or braking occur may require up to one additional hour of cure time as directed by the Owner's Representative.

3.11 ACCEPTANCE CRITERIA

.1 Requirements for the acceptance of the completed microsurfacing include the following:

.1 Materials shall meet all specified requirements.

.2 The finished microsurfacing shall have a uniform texture free from excessive scratch marks, tears, or other surface irregularities. Tear marks in any 12 m^2 area per lane are considered excessive if there are:

.1 Four or more marks ≥ 12 mm wide and ≥ 100 mm long.

.2 Any marks ≥ 25 mm wide and ≥ 25 mm long.

.3 There shall be no longitudinal ripples, raking, wash-boarding, chatter, or other irregularities that will affect the ride quality.

.4 The edges of the microsurfacing shall be finished uniformly, with a neat appearance along the roadway centreline, lane lines, shoulder, pavement edge, and curb lines.

.5 The finished surface shall have a uniform, even texture.

.6 No over-rich or bleeding areas shall be evident.

.7 No loose chips shall be evident.

.8 All existing pavement markings have been preserved or replaced in accordance with Section 3 10 10 - Painted Traffic Lines and Markings and Section 3 10 20 – Thermoplastic Pavement Markings as applicable.

.9 Work that does not meet these requirements shall be repaired or reconstructed to the satisfaction of the Owner's Representative.

Part 4 Measurement and Payment

4.1 MICROSURFACING

.1 Measurement and payment for microsurfacing will be per square metre (m^2).

.2 Unit price to include mix design, surface preparation, supply, and placement of the microsurfacing mixture, clean-up, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Payment for preparing trial batches of microsurfacing for evaluating the proper proportions of the various ingredients is considered incidental and shall be included in the unit price bid for Microsurfacing.

.1 If the trial batch is acceptable as applied, it will be measured and paid for at the bid unit price.

.2 If it is unacceptable and covered by a second application, payment will not be made for the trial batch applied.

.4 If a second layer of microsurfacing is required due to failure of the first layer, payment will not be made for the first layer.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D244, Standard Test Methods and Practices for Emulsified Asphalts

.2 ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

.3 ASTM D7116, Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete Pavements

1.2 SUBMITTALS

.1 Submit the following in accordance with Section 1 04 00 – Submittal Procedures.

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature, and data sheets for pavement sealants and include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Tests and Evaluation Reports:

.1 Submit manufacturer's test data and certification that sealant materials meet the requirements of this Section at least 2 weeks prior to beginning Work.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with the manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with the manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Cold applied sealant: rubberized asphalt emulsion.

.1 Shall consist of suitable penetration grade asphalts, rubber latex, emulsifiers, stabilizers, and suitable modifiers, uniformly dispersed in water to form a homogeneous, stable emulsion.

.2 Uniformity: emulsion, when left standing undisturbed for a minimum of 24 hours after delivery, shall show no separation of water, no coagulation, and no separation of base solids.

.3 Viscosity: emulsion shall have Saybolt Furol viscosity of 20 to 100 seconds at 25ºC when tested to ASTM D244.

.4 Solids content: residue of solids shall not be less than 59% when tested to ASTM D244, procedure A.

.5 Ash: mineral residue after ignition shall not exceed 2.0%.

.6 Pooling loss at 25ºC: percent of emulsion which will flow out from a channel of 12 mm x 12 mm x 450 mm in 15 minutes shall not exceed 30%.

.7 Tack-free time: 1.6 mm thick film of material to become tack-free in less than 6 hours.

.8 Resistance to water immersion: specimens of sealant 6 mm thick, after curing for 72 hours, when immersed in water for 24 hours, shall not re-emulsify or impart any cloudiness to the water after lightly rubbing its specimen surface at the end of the immersion period. Specimens shall remain firm during the immersion period and show no blistering, significant swelling, or other evidence which would reduce the serviceability of the material.

.9 Rate of curing: specimen of sealant 6 mm thick shall lose at least 65% of water content during 24 hours of curing and 85% of water content during 6 days of curing at 25ºC (± 1ºC) and 50% relative humidity.

.10 Flow at 50ºC: specimens of sealant cured on asbestos-cement panels shall withstand a temperature of 50ºC for 2.5 hours without exceeding a flow of 40 mm.

.11 Low temperature flexibility: specimens of sealant cured on absorbent paper shall not crack or break at -5ºC when bent 180º around a 12 mm diameter mandrel in 30 seconds.

.12 Elastic recovery: a cured specimen stretched to eight times its original length shall recover at least 40% of the amount stretched in 15 minutes.

.13 Re-sealability by flame: a standard joint cut open shall reseal in 40 seconds without charring or igniting when tested with propane flame.

.14 Sealing compound on delivery shall have a smooth, uniform consistency with no evidence of coagulation or separation.

.15 Deliver in non-metallic or polyethylene lined metal drums.

.2 Hot poured sealant: to ASTM D6690.

.3 The gradation of the aggregate used for spray patching shall be within the following limits:

Sieve Designation (µm)	% Passing
12 500	100
10 000	90 – 100
5 000	20 – 100
2 500	5 – 30
1 250	0 – 10

.4 The Contractor shall supply an emulsified asphalt binder that is appropriate for the aggregate materials used.

2.2 EQUIPMENT

.1 Heating equipment for melting the sealant:

- .1 Insulated double shell, oil jacketed kettle.
- .2 Motor-driven agitator.
- .3 Totally automatic temperature control system controlling both heat transfer oil temperature and sealing compound temperature.

.2 The pressure applicator shall be capable of applying sealant at 100 kPa by means of a hose and wand fitted with a size of tip suitable for the cracks.

- .1 Capable of maintaining the temperature of the sealant as per the manufacturer's recommendations during application.

.3 Mechanical rotary routers shall be specifically designed for following random irregular cracks without tearing, chipping, or spalling the edge of the cracks and shall be capable of producing clean, vertical side walls. Open "V" type grooves are not permitted.

.4 Mixer: in accordance with the manufacturer's recommendations.

.5 Spray patch: the required equipment includes the following:

- .1 An air compressor with a minimum rated capacity of 5.2 m^3/min (185 CFM), capable of blowing the crack clean of all dirt, sand, rock, and other deleterious materials.
- .2 A proprietary or prototype machine capable of spraying the asphalt into the crack, and then combining crushed aggregate and asphalt and spraying the mixture into the crack.
- .3 Appropriate compaction equipment.

Part 3 Execution

3.1 INSPECTION

.1 Verify that the condition of the substrate is acceptable for pavement sealant application in accordance with the manufacturer's written instructions.

- .1 Visually inspect the substrate in the presence of the Owner’s Representative.
- .2 Inform the Owner’s Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with the installation only after any unacceptable conditions have been remedied.

3.2 PREPARATION

.1 Use joint plows or high-pressure water to remove old sealant material from designated joints or cracks.

.2 Rout cracks to a width approved by the Owner’s Representative.

.3 The centre of the rout shall not deviate by more than ± 8 mm from the centreline of the crack.

.4 Dispose of material removed from cracks as directed by the Owner's Representative.

.5 Clean and dry routed cracks using a lance with oil-free, hot compressed air, applied at a minimum pressure of 600 kPa.

.6 Where the crack extends into the base or subgrade, fill the crack with a sand-asphalt emulsion mixture.

.7 Obtain the Owner's Representative's approval of the preparation of cracks before application of the sealant.

.8 Spray patch:

.1 Cracks with a width of less than 5 mm do not require repair, unless directed otherwise by the Owner's Representative. Potholes and other surface defects that are contiguous with cracks are considered to be 'crack related' and shall be repaired by spray patching.

.2 Work shall not be performed when the atmospheric temperature is below 5ºC.

.3 Deleterious materials shall be removed from the open crack and surrounding area by blowing with high pressure air streams.

3.3 APPLICATION OF SEALANT

.1 Do not use frozen sealant material.

.2 Ensure cracks are clean and dry immediately before applying the sealant.

.3 Heat the joint sealant to the application temperature slowly, in accordance with the manufacturer's recommendations.

.4 Mix two-component sealants in accordance with the manufacturer's recommendations.

.5 Fill the crack with sealant immediately after cleaning. Maintain the tip of the cone or wand close to the bottom of the routed groove during filling.

.6 Fill cracks only when the atmospheric temperature is above 10ºC, the daily low temperature does not fall below 5ºC, and no rain is forecast.

.7 Pour the sealant in the crack such that the cooled sealant fills the crack from the bottom up to a level 3 mm to 5 mm below the pavement surface.

.8 Sprinkle the sealed cracks with Portland cement before opening the pavement to traffic.

.9 Spray patch:

.1 Cleaned cracks shall be sprayed with the emulsified asphalt, and then sprayed with the combined asphalt and crushed aggregate mixture.

.2 Over-spraying of the crack will be required to ensure a smooth transition between the repaired crack and the adjacent undisturbed pavement surface.

.3 The repaired area shall be compacted to ensure adequate embedment of the asphalt aggregate mixture into and over the crack.

.4 Loose aggregate and debris shall be swept or removed from the pavement and disposed of.

Part 4 Measurement and Payment

4.1 CRACK ROUTING AND SEALING

.1 Measurement and payment for crack routing and sealing will be per metre.

.2 Unit price to include cleaning the cracks, disposing of removed debris, routing, cleaning, and drying routed cracks, application of the sealant, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 CRACK REPAIR – SPRAY PATCH

.1 Measurement and payment for spray patch crack repair will be per metre.

.2 Unit price to include cleaning the cracks, disposing of debris, tacking, supplying the crushed aggregate and asphalt binder, producing, hauling, placing, and compacting the mix, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

.1 Not used.

Part 2 Products

2.1 PAVEMENT MARKINGS

.1 Painted traffic lines and markings: in accordance with Section 3 10 10 – Painted Pavement Markings.

.2 Thermoplastic pavement markings: in accordance with Section 3 10 20 – Thermoplastic Pavement Markings.

.3 Cold plastic pavement markings: in accordance with Section 3 10 30 – Cold Plastic Pavement Markings.

Part 3 Execution

3.1 DRAWING REVIEW

.1 Arrange a site meeting with the Owner's Representative to review the pavement marking Drawings prior to commencement of pre-marking.

3.2 GENERAL

.1 Pavement markings shall be as indicated on the Drawings and in accordance with the Transportation Association of Canada's *Manual of Uniform Traffic Control Devices for Canada*.

.2 The Contractor shall use an accurate dashing mechanism capable of being easily adjusted to retrace existing dashed markings or to apply new materials at the correct spacing.

.3 New dashed lines that are to be applied over plainly visible existing dashed lines shall begin within 150 mm of the beginning of the existing dash, unless otherwise directed by the Owner's Representative.

.4 Lines and symbols shall be sharp, well defined, and uniformly reflective.

.5 Methods and equipment used for pavement preparation, marking, and marking removal shall be subject to the approval of the Owner's Representative.

.6 The Contractor shall submit copies of the manufacturer's instructions and recommendations for the application of any marking material, including primer, activator, catalyst and/or adhesive to the Owner's Representative.

.7 Other construction Work such as shoulder paving, seeding, and/or mulching shall be scheduled and performed in a manner to avoid damage to applied pavement markings.

3.3 SITE PREPARATION

.1 Provide adequate signage and traffic control measures in accordance with Section 1 05 00 – Traffic Control, or as directed by the Owner's Representative.

.2 Clean and dry the pavement surface.

.3 If required, remove existing pavement markings and repair the pavement surface in accordance with Section 3 01 20 - Pavement Cleaning and Marking Removal.

.4 Pre-mark all intended lines and symbols.

.1 Lines shall be pre-marked at a minimum offset of 150 mm.

.2 Symbols shall be pre-marked by an outline.

.3 All markings shall be within 12 mm of the location as specified on the Drawings.

.4 The Owner's Representative must inspect and approve the pre-markings prior to commencing pavement marking operations.

3.4 INSTALLATION

.1 Painted traffic lines and markings: in accordance with Section 3 10 10 - Painted Pavement Markings.

.2 Thermoplastic pavement markings: in accordance with Section 3 10 20 - Thermoplastic Pavement Markings.

.3 Cold plastic pavement markings: in accordance with Section 3 10 30 – Cold Plastic Pavement Markings.

3.5 TYPES OF MARKINGS

.1 Centre Line:

.1 Shall be 100 mm wide, yellow in colour, solid or broken, and may be a single line or two parallel lines separated by a distance of 100 mm.

.2 When broken, the directional dividing line shall consist of a line 3 m long with a 6 m skip distance between lines in a consecutive pattern.

.2 Lane Line:

.1 Shall be a single line, 100 mm wide, white in colour, and may be broken or solid.

.2 When broken, the lane shall consist of a line 3 m long with a 6 m skip distance between lines in a consecutive pattern.

.3 Channelization Line:

.1 Shall be a single line, 200 mm wide, white in colour, and may be broken or solid.

.2 When broken, the continuity line shall consist of a line 3 m long with a 3 m skip distance between lines in a consecutive pattern.

.4 Stop Bar:

.1 Shall be a single solid line, 400 mm wide, and white in colour.

.5 Crosswalk Lines:

.1 Standard intersection crosswalks shall be two parallel solid lines, 200 mm wide, and white in colour.

.2 Standard mid-block crosswalk lines shall be 600 mm wide, white in colour, a minimum of 3.0 m long, arrayed across the street, with 600 mm spacing between lines.

.6 Arrows:

.1 Shall be white and designed in accordance with the Transportation Association of Canada *Manual of Uniform Traffic Control Devices for Canada*.

Part 4 Measurement and Payment

.1 Separate payment will not be made for items in this Section. Include costs in accordance with Section 3 10 10 – Painted Pavement Markings, Section 3 10 20 – Thermoplastic Pavement Markings, or Section 3 10 30 – Cold Plastic Pavement Markings as applicable.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

- .1 ASTM D713, Standard Practice for Conducting Road Service Tests on Fluid Traffic Marking Materials
- .2 ASTM D868, Standard Practice for Determination of Degree of Bleeding of Traffic Paint
- .3 ASTM D913, Standard Practice for Evaluating Degree of Pavement Marking Line Wear
- .4 ASTM D1155, Standard Test Method for Roundness of Glass Spheres
- .5 ASTM D1214, Standard Test Method for Sieve Analysis of Glass Spheres
- .6 ASTM D1394, Standard Test Methods for Chemical Analysis of White Titanium Pigments
- .7 ASTM E11, Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
- .8 ASTM E1347, Standard Test Method for Colour and Colour-Difference Measurement by Tristimulus Colourimetry

.2 SOR/2009-264, Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations

- .1 Schedule: Architectural Coatings and their VOC Concentration Limits

.3 Master Painters Institute (MPI) guidelines

1.2 SUBMITTALS

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish, and limitations, in accordance with Section 1 04 00 – Submittal Procedures.

Part 2 Products

2.1 MATERIALS

.1 Paint:

- .1 Hot applied, white (513-301 in accordance with former CGSB 1-GP-12.1C) or yellow (505-308 in accordance with former CGSB 1-GP-12.1C); applicable on asphalt and concrete pavement surfaces shall be homogenous and shall be well ground to a uniform smooth consistency and properly dispersed in the vehicle.
- .2 Free from dirt and foreign particles; settled pigment shall be easily redispersed with minimum resistance to form a smooth uniform product of proper consistency and shall be capable of being sprayed at the temperature intended for the paint.
- .3 Traffic paint shall flow evenly and smoothly and cover solidly when applied to pavements.

.4 The materials used in the manufacture of the traffic paint shall be of high quality and consistency such that the appearance will not change in service to impair the colour or visibility of the delineation.

.5 Traffic paint shall be flat in finish and white and yellow markings shall be visible under daylight and artificial light.

.6 Traffic Marking Coatings: maximum VOC limit of 450 g/L to SOR/2009-264, Schedule: Architectural Coatings and their VOC Concentration Limits.

.7 Upon request, the Owner's Representative will supply an approved product list of paints applicable to the Work.

.2 Glass beads:

.1 To ASTM D1155 and ASTM E11.

2.2 EQUIPMENT REQUIREMENTS

.1 Paint applicator: pressure type with positive shut-off distributor, capable of applying paint in single, double, and dashed lines and capable of applying marking components uniformly, at the rate specified, and to the required dimensions.

.2 The Owner's Representative shall approve the paint applicator prior to its use.

Part 3 Execution

3.1 PREPARATION

.1 Verify the condition of the surfaces to receive pavement markings are acceptable for product installation prior to commencing with pavement marking installation.

.2 Ensure the pavement surface is dry and free of water, frost, ice, dust, oil, grease, and other deleterious materials.

.3 Proceed with the Work only after any unacceptable conditions have been rectified.

3.2 APPLICATION

.1 Apply paint only when the air temperature is above 10ºC, wind speed is less than 60 km/h, and no rain is forecast within 4 hours after application. Do not apply paint when the wind conditions would result in overspray.

.2 Apply paint evenly, at rate of 0.33 L/m^2.

.3 Do not thin paint unless approved by the Owner's Representative.

.4 Symbols and letters shall be as indicated on the Drawings and in accordance with the Transportation Association of Canada's *Manual of Uniform Traffic Control Devices for Canada*.

.5 Paint lines shall be uniform in colour and density, with sharp edges.

.6 Thoroughly clean the distributor tank before refilling with paint of a different colour.

.7 Glass beads shall be applied immediately following paint application at a uniform application rate of at least 600 g/L of paint.

3.3 FINISH TOLERANCE

.1 Paint markings shall be within ± 12 mm of the required dimensions.

.2 Remove incorrect markings in accordance with Section 3 01 20 - Pavement Cleaning and Marking Removal.

3.4 PROTECTION

.1 Protect painted pavement markings until they are dry.

.2 Repair damage to adjacent materials caused by pavement marking application.

Part 4 Measurement and Payment

4.1 PAINTED PAVEMENT MARKINGS

.1 Measurement and payment for painted line markings, of the types and colours indicated, will be per metre.

.2 Measurement and payment for painted arrows, symbols, and letters, of the types and colours specified, will be per each arrow, symbol, and letter painted.

.3 Unit price to include surface preparation, supply and application of the paint and glass beads, protection as required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

.2 ASTM D570, Standard Test Method for Water Absorption of Plastics

.3 ASTM D1214, Standard Test Method for Sieve Analysis of Glass Spheres

.4 ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness

.5 ASTM E28, Standard Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus

.2 Transportation Association of Canada (TAC):

.1 Manual of Uniform Traffic Control Devices for Canada

1.2 SUBMITTALS

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish, and limitations, in accordance with Section 1 04 00 – Submittal Procedures.

Part 2 Products

2.1 THERMOPLASTIC PAVEMENT MARKINGS

.1 The materials shall be manufactured to be applied by extrusion onto the pavement in molten form with glass spheres (also referred to as glass beads) mixed in. Glass spheres can also be dropped onto the material immediately after application.

.2 The compound shall not deteriorate by contact with the asphaltic cement in asphalt concrete pavement, sodium chloride, calcium chloride, or other chemicals used against the formation of ice on roadways, oil content of pavement materials, or from oil droppings from traffic.

.3 In the plastic state, the materials shall not give off fumes which are toxic or otherwise injurious to persons or property. The material shall not break down or deteriorate if held at the plastic temperature for a period of 4 hours or 4 reheatings to the plastic temperature.

.4 The temperature versus viscosity characteristics of the plastic material shall remain constant through up to 4 reheatings and shall be the same from batch to batch. There shall be no obvious change in colour of the material as a result of up to 4 reheatings or from batch to batch.

.5 To ensure the best possible adhesion, the compound, as specified, shall be installed in a melted state at a minimum temperature of 190°C and the material shall not scorch or discolour if kept at this temperature for up to 4 hours.

.6 There shall be no discolouration from sunlight ultraviolet exposure and no bond failure for the warranted life of the material.

.7 During manufacturing, reflectorizing glass spheres shall be mixed into the material to the extent of not less than 20% nor more than 50% by weight of the material. Glass spheres shall also be automatically applied to the surface of the material at a uniform rate of approximately 150 g of glass spheres to every 10 m^2 of line. These glass spheres shall be dropped onto the thermoplastic material while it is in a molten state immediately after it has been extruded onto the pavement.

.8 The drying time shall not exceed a characteristic straight line curve, the lower limits of which are 2 minutes at 10°C, the upper limits of which are 15 minutes at 32°C, both temperatures measured at a maximum relative humidity of 70%. Do not permit traffic over applied markings until they have adequately hardened.

.9 Physical Requirements:

.1 Colour:

.1 Marking shall be brilliant white or yellow.

.2 Brightness is the value obtained with the Gardner Multi-Purpose Reflectometer when measuring 0 - 45 daylight luminous directional reflectance with the green filter.

.3 The rating so obtained shall not be less than 70% for white or 55% for yellow.

.2 Water Absorption:

.1 Materials shall have no more than 0.5% by weight of retained water when tested by ASTM D570, Procedure (A) (24-hour Immersion).

.3 Softening Point:

.1 Materials shall have a softening point of not less than 90°C as determined by ASTM E28.

.4 Specific Gravity:

.1 The specific gravity of the thermoplastic compound at 25°C shall be from 1.9 to 2.5.

.5 Impact Resistance:

.1 Shall not be less than 1.13 N-m at 25°C after the material has been heated for 4 hours at 204°C and cast into bars of 25 mm cross sectional area, 75 mm long and placed with 25 mm extending above the vice in a cantilever beam (Izod type) tester using the 2.82 N-m scale. This instrument is described in ASTM D256 Method C.

.6 Abrasion Resistance:

.1 Materials shall have a maximum weight loss of 0.6 g when subjected to 200 revolutions on a Taber Abrader at 25°C using H-22 Calibrade wheels weighted to 500 g. The test samples shall be prepared by forming representative lots of materials at a thickness of 3 mm ± 0.1 mm on a 100 mm square plate. The test surface shall be kept wet during the test.

.7 Indentation Resistance:

.1 The reading of the Shore Durometer, Type A2, as described in ASTM D2240, after 15 seconds and using a 0.907 kg weight, shall not be less

than the amounts specified below when the material is tested after heating for temperatures.

Temperature	Reading
45°C	65 ± 2
25°C	95 ± 2

.8 Chemical Resistance to anti-freeze, brake fluid, motor oil, diesel fuel, gasoline, calcium chloride, sodium chloride, and transmission fluid:

.1 5 cm x 5 cm test sections should show no signs of degradation after exposure to:

.1 5% NaCl (24-hour Immersion)

.2 5% CaCl (24-hour Immersion)

.9 Reheating:

.1 The thermoplastic compound shall maintain proper performance properties when heated 4 times to the application temperatures. After heating to 200°C for 6 hours while continually stirring at 50 RPM to 100 RPM, the Brookfield viscosity shall not exceed 16,000 cps at 12 RPM.

.10 General Requirements - Glass Beads:

.1 Imperfections:

.1 The surface of the spheres shall be smooth and free from film, scratches, and pits. At least 90% shall be of true spherical shape and free from milkiness, dark or air inclusions, and other defects.

.2 Index of Refraction:

.1 The liquid immersion method of 25°C may be used to determine the refractive index of glass spheres. A refractive index of 1.50 to 1.60 is required.

.3 Gradation:

.1 The spheres shall meet the following gradation requirements when tested in accordance with ASTM D1214.

.1 Spheres included in the manufacture of the thermoplastic material:

US Standard Sieve	Percent Passing
#270 µm	80 – 100
#100 µm	0 – 10

.2 Spheres for application on molten thermoplastic material:

US Standard Sieve	Percent Passing
#900 µm	90 – 100
#300 µm	20 – 50
#200 µm	0 – 10

Part 3 Execution

3.1 GENERAL

.1 The thermoplastic material shall be installed in a groove ground into the pavement surface. The material shall completely fill the groove and extend not less than 2.0 mm above the pavement surface.

3.2 EXISTING PAVEMENT MARKINGS

.1 Where the location of the new thermoplastic markings conflict with existing pavement markings, the new marking shall be installed in the same line as the existing marking, ensuring that the routed groove completely removes the previous marking material.

3.3 APPLICATION

.1 The thermoplastic markings shall not be installed over a longitudinal joint or seam, except transverse markings such as stop bars and crosswalk lines.

.2 All work must be done on a clean, dry road surface. All grooves must be clean and dry before the material is installed.

.3 To ensure the best possible adhesion, the material shall be applied in a melted state at a minimum temperature of 190°C for white markings and 175°C for yellow markings.

3.4 TRAFFIC CONTROL AND WORK AREA

.1 The Contractor shall keep traffic congestion to a minimum. The Work shall be undertaken from one lane and all workers, materials, and equipment shall be contained as much as possible in that lane. The Work shall be carried out as quickly as possible to prevent excessive delay and inconvenience to traffic.

.2 All equipment, including the grinder, vacuum machine or sweeper, material applicator, and cone truck shall operate within 100 m at one time.

.3 No grooving of the roadway will be permitted beyond what can be cleaned and inlaid with thermoplastic material in that day.

3.5 PRE-MARKINGS

.1 The Contractor is responsible for pre-marking all Work. Pre-marking must be done on a clean, dry road surface. All pre-marking shall be done with pre-marking paint approved by the Owner’s Representative.

.2 All pre-marking shall be approved by the Owner’s Representative prior to the installation of the thermoplastic markings. Changes in the alignment of markings that do not correspond to the Drawings may be made in the field by the Owner’s Representative. Any changes made in the field must be recorded by the Contractor on Drawings issued by the Owner and returned to the Owner within 7 working days after completion of the Work.

.3 Any pre-marking lines remaining after a period of 6 weeks must be removed or blacked out by the Contractor at their expense.

.4 Final markings shall be installed as soon as possible but no later than 7 calendar days after pre-marking.

3.6 ADHESION TO PAVEMENT

.1 The Contractor shall make all tests and take all samples necessary to assure adequate adhesion between the thermoplastic material and the pavement.

3.7 WORKMANSHIP

.1 Faulty markings such as insufficient or wrong filling of grooves, crooked lines, too much overflow, and non-uniform lengths shall be re-done within 5 working days.

3.8 MARKING THICKNESS

.1 The depth of directional dividing line, lane line, and continuity line markings shall be 7 mm (5mm below and 2 mm above the pavement surface), unless otherwise specified.

.2 The depth of stop bar, mid-block crosswalk line, arrow, and crosswalk line markings shall be 12 mm (10mm below and 2 mm above the pavement surface), unless otherwise specified.

Part 4 Measurement and Payment

4.1 THERMOPLASTIC PAVEMENT MARKINGS

.1 Measurement and payment for thermoplastic line markings, of the types and colours indicated, will be per metre.

.2 Measurement and payment for thermoplastic arrows, symbols, and letters, of the types and colours specified, will be per each arrow, symbol, and letter applied.

.3 Unit price to include surface preparation, pre-marking, grinding grooves in the pavement, supply and installation of the thermoplastic material and glass beads, protection as required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

.2 ASTM D570, Standard Test Method for Water Absorption of Plastics

.3 ASTM D1214, Standard Test Method for Sieve Analysis of Glass Spheres

.4 ASTM D2240, Standard Test Method for Rubber Property – Durometer Hardness

.5 ASTM E28, Standard Test Methods for Softening Point of Resins Derived from Pine Chemicals and Hydrocarbons, by Ring-and-Ball Apparatus

.2 Transportation Association of Canada (TAC):

.1 Manual of Uniform Traffic Control Devices for Canada

1.2 SUBMITTALS

.1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish, and limitations, in accordance with Section 1 04 00 – Submittal Procedures.

Part 2 Products

2.1 COLD PLASTIC PAVEMENT MARKINGS

.1 Physical Requirements:

.1 Two-component, cold-extruded, and cold-curing, having a minimum specific gravity of 1.9 at 25°C.

.2 Colour:

.1 Marking shall be brilliant white or yellow.

.2 Brightness is the value obtained with the Gardner Multi-Purpose Reflectometer when measuring 0 - 45 daylight luminous directional reflectance with the green filter.

.3 The rating so obtained shall not be less the 70% for white or 55% for yellow.

.3 Water Absorption:

.1 Materials shall have no more than 0.5% by weight of retained water when tested by ASTM D570, Procedure (A) (24-hour Immersion).

.4 Softening Point:

.1 Materials shall have a softening point of not less than 90°C as determined by ASTM E28.

.5 Impact Resistance:

.1 Shall not be less than 1.13 N-m at 25°C after the material has been heated for 4 hours at 204°C and cast into bars of 25 mm cross sectional area, 75mm long and placed with 25 mm extending above the vice in a cantilever beam (Izod type) tester using the 2.82 N-m scale. This instrument is described in ASTM D256 Method C.

.6 Abrasion Resistance:

.1 Materials shall have a maximum weight loss of 0.6 g when subjected to 200 revolutions on a Taber Abrader at 25°C using H-22 Calibrade wheels weighted to 500 g. The test samples shall be prepared by forming representative lots of materials at a thickness of 3 mm ± 0.1 mm on a 100 mm square plate. The test surface shall be kept wet during the test.

.7 Indentation Resistance:

.1 The reading of the Shore Durometer, Type A2, as described in ASTM D2240, after 15 seconds and using a 0.907 kg weight, shall not be less than the amounts specified below when the material is tested after heating for temperatures.

Temperature	Reading
45°C	65 ± 2
25°C	95 ± 2

.8 Chemical Resistance to anti-freeze, brake fluid, motor oil, diesel fuel, gasoline, calcium chloride, sodium chloride, and transmission fluid:

.1 5 cm x 5 cm test sections should show no signs of degradation after exposure to:

.1 5% NaCl (24-hour Immersion)

.2 5% CaCl (24-hour Immersion)

.9 General Requirements - Glass Beads:

.1 Imperfections:

.1 The surface of the spheres shall be smooth and free from film, scratches, and pits. At least 90% shall be of true spherical shape and free from milkiness, dark or air inclusions, and other defects.

.2 Index of Refraction:

.1 The liquid immersion method of 25°C may be used to determine the refractive index of glass spheres. A refractive index of 1.50 to 1.60 is required.

.3 Gradation:

.1 The spheres shall meet the following gradation requirements when tested in accordance with ASTM D1214.

.1 Spheres included in the manufacture of the thermoplastic material:

US Standard Sieve	Percent Passing
#270 µm	80 – 100
#100 µm	0 – 10

.2 Spheres for application on molten thermoplastic material:

US Standard Sieve	Percent Passing
#900 µm	90 – 100
#300 µm	20 – 50
#200 µm	0 – 10

Part 3 Execution

3.1 EXISTING PAVEMENT MARKINGS

.1 Where the location of the new markings conflict with existing pavement markings, the new marking shall be installed in the same line as the existing marking.

.2 Remove conflicting markings.

3.2 APPLICATION

.1 Sweep or air blow the pavement surface to ensure it is clean and dry prior to application of the cold plastic pavement markings.

.2 Mix components and apply cold plastic pavement markings in accordance with the manufacturer's surface application procedure, to a minimum thickness of 2.0 mm and a maximum thickness of 3.0 mm.

.3 Apply glass beads to the surface of the extruded material, before it has set, at a rate of 140 g/m^2 to 250 g/m^2.

.4 Do not permit traffic over applied markings until they have adequately hardened.

.5 The markings shall not be installed over a longitudinal joint or seam, except transverse markings such as stop bars and crosswalk lines.

3.3 TRAFFIC CONTROL AND WORK AREA

.1 The Contractor shall keep traffic congestion to a minimum. The Work shall be undertaken from one lane and all workers, materials, and equipment shall be contained as much as possible in that lane. The Work shall be carried out as quickly as possible to prevent excessive delay and inconvenience to traffic.

3.4 PRE-MARKINGS

.1 The Contractor is responsible for pre-marking all Work. Pre-marking must be done on a clean, dry road surface. All pre-marking shall be done with pre-marking paint approved by the Owner's Representative.

.2 All pre-marking shall be approved by the Owner's Representative prior to the installation of the cold plastic markings. Changes in the alignment of markings that do not correspond to the Drawings may be made in the field by the Owner's Representative. Any changes made in the field must be recorded by the Contractor on Drawings issued by

the Owner and returned to the Owner within 7 working days after completion of the Work.

.3 Any pre-marking lines remaining after a period of 6 weeks must be removed or blacked out by the Contractor at their expense.

.4 Final markings should be installed as soon as possible but no later than 7 calendar days after pre-marking.

3.5 ADHESION TO PAVEMENT

.1 The Contractor shall make all tests and take all samples necessary to assure adequate adhesion between the pavement marking material and the pavement.

3.6 WORKMANSHIP

.1 Faulty markings such as incorrect thickness, crooked lines, and non-uniform lengths shall be re-done within 5 working days.

Part 4 Measurement and Payment

4.1 COLD PLASTIC PAVEMENT MARKINGS

.1 Measurement and payment for cold plastic line markings, of the types and colours indicated, will be per metre.

.2 Measurement and payment for cold plastic arrows, symbols, and letters, of the types and colours specified, will be per each arrow, symbol, and letter applied.

.3 Unit price to include surface preparation, pre-marking, supply and installation of the cold plastic material and glass beads, protection as required, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

.2 ASTM A90/A90M, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

.3 ASTM A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire

.4 ASTM A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric

.5 ASTM F626, Standard Specification for Fence Fittings

.6 ASTM F668, Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1, Fabric for Chain Link Fence

.2 CAN/CGSB-138.2, Steel Framework for Chain Link Fence

.3 CAN/CGSB-138.3, Installation of Chain Link Fence

.4 CAN/CGSB-138.4, Gates for Chain Link Fence

Part 2 Products

2.1 CHAIN LINK FABRIC

.1 To CAN/CGSB-138.1.

.1 Manufactured from the highest quality zinc-coated wire in accordance with CAN/CGSB-138.1, Type 1, Class B, medium style, Grade 1 or Grade 2, or vinyl coated in accordance with ASTM F668, Class 1.

.2 Nominal wire diameter: 3.5 mm (9-gauge)

.3 Mesh Size: 50 mm

.4 Fabric height: 0.9 m – 3.65 m

.5 Coating: Zinc – Grade 1,366 g/m^2
Zinc – Grade 2,490 g/m^2

.2 Selvage: twisted or knuckled top and knuckled bottom.

2.2 FENCE FRAMEWORK

.1 To CAN/CGSB-138.2.

.1 Posts and rails: hot-dip galvanized, cold-rolled welded steel pipe (ASTM A53/A53M, Grade A, Schedule 40), zinc-coated at a minimum of 550 g/m^2 and with the following minimum dimensions:

Top Rail	
Outside Diameter (OD)	42.2 mm – 3.56 mm wall
Line Post	
Outside Diameter (OD)	
- Fabric height under 1.8 m	48.3 mm – 3.68 mm wall
- Fabric height between 1.8 m and 2.4 m	60.3 mm – 3.91 mm wall
- Fabric height over 2.4 m	73.0 mm - 5.16 mm wall
Length	762 mm longer than height of fabric
Terminal Post – End and Corners	
Outside diameter (OD)	
- Fabric height under 1.8 m	73.0 mm – 3.68 mm wall
- Fabric height between 1.8 m and 2.4 m	88.9 mm – 5.49 mm wall
- Fabric height over 2.4 m	114.3 mm – 6.02 mm wall
Length	
- Fence without barbed wire and	1.066 m longer than height of fabric
- Corner posts for fence with barbed wire	1.066 m longer than height of fabric
- Fence with barbed wire	1.372 m longer than height of fabric
Terminal Post - Gates	
Outside diameter (OD)	
- Gate with panel length* under 3.0 m	88.9 mm – 5.489 mm wall
- Gate with panel length between 3.0 m and 4.5 m*	114.3 mm – 6.902 mm wall
- Gate and panel length* between 4.5 m and 7.5 m	168.3 mm - 7.11 mm wall
Length	
- Fence without barbed wire	1.066 m longer than height of fabric
- Fence with barbed wire	1.372 m longer than height of fabric

*Panel length is the opening size for single swinging gates and one half of the opening size for double swinging gates.

.2 Bottom Tension wire: 3.5 mm (9-gauge) galvanized steel wire, zinc-coated to match chain link fabric, attached at 600 mm intervals.

2.3 BARBED WIRE OVERHANG

.1 As specified on the Drawings and in accordance with the following:

.1 End, Corner, and Gate Posts:

.1 End and gate posts to be 1.372 m longer than the fabric height when barbed wire overhang is specified.

.2 Corner posts to be 1.066 m longer than the fabric height, with corner barbed wire arms, when barbed wire overhang is specified.

.2 Barbed Wire Arms:

.1 With eyes to hold top rail; to hold 3 strands of barbed wire, top strand to be 300 mm above fabric; vertical or at 45° overhang, as specified.

.3 Barbed Wire:

.1 To ASTM A121, with 3 strands, 2 wires each strand, each wire 2.5 mm diameter (12.5-gauge), zinc-coated at a minimum of 245 g/m^2 (Class 3). Barbs to have 4 points at 150 mm maximum spacing.

2.4 GATES

.1 Fabric: to match fence fabric as per article 2.1.

.2 Frame: 42.2 mm OD for panels up to 3.0 m in length and 48.3 mm OD for panels over 3.0 m in length, electrically welded at all points.

.3 Fittings: galvanized steel industrial hinges allowing an opening of at least 90°; drop pin latch with provision for a padlock. Both latch and padlock shall be accessible from both sides.

.4 Double Gate: complete with one foot bolt.

.5 Barbed Wire: to match fence barbed wire as per article 2.3.

2.5 FITTINGS

.1 To ASTM F626 as follows:

Item	Minimum Dimensions (mm)	Minimum Zinc Coating	Material
Post Cap and Rail End	N/A	366 g/m^2	Pressed Steel, Cast Iron, or Die Cast Aluminum
Top Rail Sleeve	150 long	366 g/m^2	Round Steel Tubing
Tie Wire	3.5 diameter (9-guage)	N/A	Aluminum
Tension & Brace Bands	2.0 thick x 19.0 wide	366 g/m^2	Pressed Steel
Tension Bar	4.75 x 19.0	366 g/m^2	Steel Strip
Barbed Wire Arm	2.0 thick (14-gauge)	366 g/m^2	Pressed Steel

2.6 CONCRETE FOR POST FOOTING

.1 30 MPa at 28 days.

Part 3 Execution

3.1 SITE PREPARATION

.1 Remove debris and correct any ground undulations along the fence line to obtain a smooth, uniform gradient between posts.

.1 Provide 30 mm to 50 mm of clearance between the bottom of the fence and the ground surface.

3.2 ERECTION OF FENCE

.1 Erect fence along the lines as indicated on the Drawings and to CAN/CGSB-138.3.

.2 Excavate post holes to the dimensions indicated in article 3.3.1.

.3 Space line posts 3 m apart, measured parallel to the ground surface.

.4 Space straining posts at equal intervals not exceeding 150 m.

.5 Install additional straining posts at sharp changes in grade and where directed by the Owner's Representative.

.6 Install corner posts where changes in alignment exceed 10°.

.7 Install end posts at the ends of the fence and at buildings.

.1 Install gate posts on both sides of gate openings.

.8 Place concrete in post holes, then embed posts into concrete to the depths indicated.

.1 Slope concrete to ensure positive drainage away from the posts.

.2 Brace to hold posts in plumb position and true to alignment and elevation until concrete has cured.

.9 Install fence fabric after concrete has cured.

.10 Install a brace between end and gate posts and the nearest line post.

.1 Install braces on both sides of corner and straining posts in a similar manner.

.11 Install the overhang tops and caps.

.12 Install the top rail between posts, fasten securely to posts, and secure the waterproof caps and overhang tops.

.13 Install the bottom tension wire, stretch tightly, and fasten securely to end, corner, gate, and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to the tension recommended by the manufacturer and fasten to end, corner, gate, and straining posts with the tension bar secured to the post with tension bar bands spaced at 300 mm intervals.

.1 Knuckled selvage at bottom.

.2 Knuckled or twisted selvage at top.

.15 Secure fabric to top rails, line posts, and bottom tension wire with tie wires at 450 mm intervals.

.1 Give tie wires a minimum of two twists.

.16 Install the barbed wire strands and clip securely to the lugs of each projection as indicated.

.17 Install grounding rods as indicated.

3.3 POST SETTING

.1 Post holes shall be drilled to the following minimum diameters and depths.

Pipe Diameter	Hole Diameter	Depth of Hole
60.3 mm	250 mm	1,200 mm
73.0 mm	300 mm	1,200 mm
88.9 mm	350 mm	1,400 mm
114.3 mm	450 mm	1,600 mm

.2 Concrete shall be placed in the post hole and the post embedded in the concrete.

3.4 TOP RAIL

.1 The top rail shall be supported at each line post with a line post cap so that a continuous brace is formed between terminal posts. Rails shall be joined with sleeves to allow for expansion and contraction.

.2 The top rail shall be securely fastened to terminal posts using rail ends and brace bands.

3.5 TERMINAL POST BRACING

.1 Bracing shall be installed from end and gate posts to the nearest line post at mid-panel and parallel to the top rail. Bracing is not required for fences up to and including 1.83 m in height.

.2 Braces shall be installed on both sides of corner posts in a similar manner.

3.6 BOTTOM TENSION WIRE

.1 Bottom tension wire shall be installed within the bottom 150 mm of fabric. The wire shall be stretched taut and free of sags, fastened securely to end, corner, gate, and straining posts. Hog rings shall be used to fasten the wire to the fabric at 600 mm spacing.

3.7 CHAIN LINK FABRIC

.1 Fabric shall be placed outside of the area to be enclosed.

.2 Fabric shall be stretched to tension recommended by the manufacturer and fastened to end, corner, and gate posts using a tension bar and tension bands at 300 mm spacing.

.3 Fabric shall be secured to line posts with tie wire at 300 mm spacing and to the top rail with tie wire at 450 mm spacing.

.4 Installed fabric shall have a smooth, uniform appearance free of sags, dents, and bulges.

3.8 BARBED WIRE OVERHANG

.1 If barbed wire is specified, barbed wire arms shall be installed in lieu of caps on top of line posts. Overhang shall be positioned towards the area enclosed, unless otherwise indicated.

.2 Each barbed wire strand shall be stretched taut and free of sags, firmly attached into the slots of the barbed wire arms, and secured to end and gate posts.

3.9 WORKMANSHIP

.1 The installed chain link fence shall be free of any defect or imperfection that can affect its serviceability and appearance. The fence shall follow the ground contours smoothly, without sharp changes in grade.

Part 4 Measurement and Payment

4.1 CHAIN LINK FENCE

.1 Measurement and payment for the supply and installation of chain link fence, for the heights specified, will be per metre installed, including gates and removable panels.

.2 Unit price to include the supply and installation of the chain link fence, gates, removable panels if required, barbed wire overhang if required, drilling of the post holes, concrete footings, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM D4595/D4595M, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Method

.2 National Concrete Masonry Association (NCMA):

.1 Segmental Retaining Wall Best Practices Guide

.2 Segmental Retaining Wall Installation Guide (TR146A)

.3 Design Manual for Segmental Retaining Walls

1.2 DELIVERY, STORAGE, AND HANDLING

.1 Store and protect retaining wall components in accordance with the manufacturer's recommendations.

.2 Do not incorporate damaged components into the Work.

1.3 SUBMITTALS

.1 Submit shop drawings showing wall geometry, construction, and details to the Owner's Representative for review in accordance with Section 1 04 00 – Submittal Procedures.

.2 Shop drawings shall be Authenticated by a Professional Engineer in good standing with APEGA.

1.4 DEFINITION

.1 Coping units: the last course of concrete units used to finish the top of the wall.

Part 2 Products

2.1 INTERLOCKING BLOCKS

.1 As specified on the Drawings.

2.2 RETAINED SOIL

.1 The retained soil shall be on-site soils or as per the Geotechnical Report.

.2 If imported fill is required, provide the sieve results to the Owner's Representative in accordance with Section 3 04 00 – Aggregate Materials.

2.3 FOUNDATION SOIL

.1 The foundation soil shall be the undisturbed insitu soil.

.2 The foundation soil shall be inspected and approved by the Owner's Representative prior to placement of the leveling material.

2.4 LEVELING MATERIAL

.1 The leveling material shall not be susceptible to frost, shall be well-graded, compacted crushed stone or a concrete leveling base, as indicated in the Geotechnical Report.

2.5 DRAINAGE AGGREGATE

.1 The drainage aggregate shall be a free-draining, angular, granular material as indicated in the Geotechnical Report.

2.6 DRAINAGE PIPE

.1 The drainage pipe shall be perforated PVC or HDPE pipe, with a diameter as specified on the Drawings, wrapped by geotextile filter fabric to prevent the migration of soil particles into the pipe.

2.7 GEOTEXTILE

.1 Non-woven geotextile filter fabric shall be as indicated on the Drawings.

.2 Approved Products: as per Section 3 05 30 – Geotextiles.

2.8 GEOGRID

.1 Geogrid shall be as indicated on the Drawings.

.2 Approved Products: as per Section 3 05 20 – Geogrid Soil Reinforcement.

Part 3 Execution

3.1 CONSTRUCTION TOLERANCES

.1 The following tolerances are the maximum allowable deviations from the engineered design.

.1 Vertical Control: ± 30 mm over a 3 m distance, ± 75 mm total
.2 Horizontal Control: ± 30 mm over a 3 m distance, 300 mm total
.3 Rotation: ± 2 degrees from planned wall batter
.4 Bulging: 25 mm over a 3 m distance

3.2 SITE PREPARATION

.1 The foundation soil shall be excavated or filled as required to the grades and dimensions indicated on the Drawings or as directed by the Owner's Representative.

.2 The foundation soil shall be proofrolled in the presence of the Owner's Representative and a representative from a qualified independent testing laboratory to ensure it meets the minimum strength requirements.

.3 If unacceptable foundation soil is encountered, the Contractor shall excavate the affected areas and replace with suitable material under the direction of the representative of the qualified independent testing laboratory.

3.3 INSTALLATION OF DRAINAGE SYSTEM

.1 The approved non-woven geotextile shall be set against the back of the first retaining wall unit, over the prepared foundation, and extended towards the back of the excavation, up the excavation face and back over the top of the drainage material, to the retaining wall, or as indicated on the Drawings.

.2 The drainage pipe shall be placed behind the leveling material, or lower course of facing units, or as directed by the Owner's Representative. The pipe shall be laid at a minimum grade of 2% to the outlets.

.3 Tees and outlet pipes shall be installed on the drainage pipe at 15 m spacing or as indicated on the Drawings.

.4 The remaining length of geotextile shall be pulled taut and pinned over the face of the retained soil. Geotextile overlaps shall be a minimum of 300 mm and shall be positioned to prevent the infiltration of retained soil into the drainage aggregate.

3.4 INSTALLATION OF MODULAR CONCRETE RETAINING WALL UNITS

.1 The bottom row of retaining wall modules shall be placed on the prepared leveling material as indicated on the Drawings. Care shall be taken to ensure that the wall modules are aligned properly, leveled from side to side and front to back and are in complete contact with the levelling material.

.2 The wall modules above the bottom course shall be placed such that the interlocking arrangement provides the design batter (i.e., setback) of the wall face. Successive courses shall be placed to create a running bond pattern with the edge of all units aligned with the middle of the unit in the course below it.

.3 The wall modules shall be swept clean before placing additional levels to ensure that no dirt, concrete, or other foreign materials become lodged between successive lifts of the wall modules.

.4 A maximum of 3 courses of wall units shall be placed above the level of the drainage material.

.5 The Contractor shall check the level of wall modules with each lift to ensure that no gaps are formed between successive lifts.

3.5 PLACEMENT OF LEVELING MATERIAL OR SPREAD FOOTING

.1 Granular leveling material shall be compacted to 98% Standard Proctor Maximum Dry Density.

.2 Concrete leveling material shall be vibrated.

3.6 PLACEMENT OF DRAINAGE AGGREGATE

.1 Drainage aggregate shall be placed behind the retaining wall modules to a minimum width of 600 mm and separated from other soils using the approved non-woven geotextile.

.2 Drainage aggregate shall be placed behind the wall facing in maximum lifts of 150 mm and compacted to a minimum of 95% Standard Proctor Maximum Dry Density.

.3 Do not permit heavy compaction equipment within 1 m of the back of the wall facia.

3.7 RETAINED SOIL

.1 Retained soils shall be placed and compacted, to the required density indicated on the Drawings, behind the drainage aggregate in maximum lifts of 150 mm.

.2 Do not permit heavy compaction equipment within 1 m of the back of the wall modules.

3.8 FINISHING

.1 Coping units shall be secured to the top of the wall with two 10 mm beads of approved flexible concrete adhesive positioned 50 mm in front and behind the tongue of the last course of retaining wall units.

.2 Finish grading above the wall shall direct surface runoff away from the retaining wall.

Part 4 Measurement and Payment

4.1 INTERLOCKING BLOCK RETAINING WALL

.1 Measurement and payment for the supply and installation of an interlocking block retaining wall, of the type specified, will be per square metre (m^2) of exposed surface area, as measured from the finished grade to the top of the wall.

.2 Unit price to include excavation, backfilling, and compaction of the foundation soil, supply, placement, and compaction of imported material as required, supply, placement, and compaction of the leveling material, supply and installation of the non-woven geotextile, drainage pipe, and drainage aggregate, supply and installation of the retaining wall units, compaction of the retained soil, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM B209/B209M, Standard Specification for Aluminium and Aluminium-Alloy Sheet and Plate

.2 Canadian Standards Association (CSA)

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

.2 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles

.3 Transportation Association of Canada (TAC)

.1 Manual of Uniform Traffic Control Devices for Canada (MUTCDC)

Part 2 Products

2.1 MATERIALS

.1 Standard Supports for Small Signs (maximum sign size: 750 mm x 750 mm):

.1 To be Telespar Signpost System installed in soil.

.2 One 2.4 m or 3.0 m post section of 12-gauge, 44 mm square tubing, hot dipped galvanized steel with 11 mm diameter punched holes on 25 mm centres, full length on four sides.

.3 One 1 m base section of 12-gauge, 50 mm square tubing, hot dipped galvanized steel with 11 mm diameter punched holes on 25 mm centres, full length on four sides.

.4 One 46 cm sleeve section of 12-gauge, 57 mm square tubing, hot dipped galvanized steel with 11 mm diameter punched holes on 25 mm centres, full length on four sides.

.2 Vertical Supports:

.1 Steel breakaways shall be used for all signs installed in medians, in concrete, or where the presence of underground utilities prevents the use of a Telespar post.

.1 May be used for signs ranging in size from 750 mm x 750 mm to a maximum of 1200 mm x 900 mm.

.2 The aboveground post structure shall consist of:

.1 Pipe: 60 mm Schedule 40 galvanized, pre-cut to required length.

.2 Plate: 102 mm x 102 mm x 6.35 mm steel plate, with a pre-drilled 10 mm hole at each corner, 20 mm in from plate edge.

.3 Plate to be welded to one end of pipe.

.4 Drill a 15 mm hole in the post 30 mm above the plate for water drainage from the post.

.3 At/below ground post structure shall consist of:

.1 Plate: 102 mm x 102 mm x 6.35 mm steel plate, with a pre-drilled 10 mm hole at each corner, 20 mm in from plate edge.

.2 Pipe: 50 mm black steel pipe or approved equivalent, 305 mm in length.

.3 Weld a 102 mm x 19 mm rebar horizontally onto the pipe approximately 115 mm from the bottom.

.4 Weld the plate to the top of the post (on the opposite end as the rebar).

.2 Oversize Breakaways:

.1 To be used on signs larger than 1200 mm x 900 mm.

.2 Aboveground post structure shall consist of:

.1 Pipe: 90 mm Schedule 40 galvanized, pre-cut to required length.

.2 Plate: 150 mm x 150 mm x 10 mm steel plate, with a pre-drilled 12 mm hole at each corner, 30 mm in from plate edge.

.3 Drill a 15 mm hole in the post 30 mm above the plate for water drainage from the post.

.3 At/below ground post structure shall consist of:

.1 Plate: 150 mm x 150 mm x 10 mm steel plate, with a pre-drilled 12 mm hole at each corner, 30 mm in from plate edge.

.2 Pipe: 95 mm black steel pipe or approved equivalent, 760 mm in length.

.3 Weld a 150 mm x 30 mm rebar horizontally onto the pipe approximately 1200 mm from the bottom.

.4 Weld the plate to the top of the post (on the opposite end as the rebar).

.3 Signboards:

.1 Aluminium Sheet:

.1 Sign grade aluminum to ASTM B209/B209M, pre-cut to required dimensions with corners rounded to meet MUTCDC standards.

.2 Thickness to be 2 mm.

.2 Aluminium Extrusions:

.1 Pre-cut to required dimensions.

.2 Extruded aluminium Alcan 6063-T6 street name blade.

.3 Crezon:

.1 19 mm, medium-density overlaid (MDO) Douglas Fir, premium grade, good one side.

.2 Primer for Crezon: as recommended by the manufacturer.

.4 Finish paint:

.1 Exterior grade enamel to the appropriate colour(s).

.4 Fasteners:

.1 Bolts, nuts, washers, and other hardware for roadside signs shall be cast aluminium alloy or galvanized steel.

.2 Stainless gear clamp HS32. Coarse plated 6 mm x 32 mm. NC Grade 5 hexicap screws from breakaway posts (concrete base).

.3 Street name blades: use the appropriate bracket suitable for the installation, supplied by Alberta Traffic Supply or approved equivalent.

.4 Bandit strapping materials for 13 mm bandit strapping.

.5 Silk Screen Ink:

.1 Appropriate ink for the substrate being printed on shall be used.

.2 Acceptable ink product:

.1 3M Process Colour 880I Series.

.6 Reflective Sheeting and Tape:

.1 3M Diamond Grade VIP Reflective Sheeting 3990 Series on all stop, yield, playground, and school zone signs and 3M High Intensity Prismatic Reflective Sheeting Series 3930 on all other regulatory signs.

.2 Gerber High Performance Series 220 vinyl film or approved equivalent.

.7 Clear Vinyl Protective Coat:

.1 3M Protective Overlay Film 1150.

2.2 FABRICATION

.1 Crezon Blanks:

.1 Cut crezon blanks to the required shapes and dimensions. Fill the edges with wood filler suitable for outdoor use and sand smooth.

.2 Lightly sand surfaces and wipe clean.

.3 Paint the back edges of the signboard with one prime coat and two finish coats in the same colour as the sign face.

.2 Aluminium Blanks:

.1 Clean surfaces with Dupont Enamel Reducer or approved equivalent and allow to thoroughly dry.

.2 Reflective background sheeting and lettering:

.1 Cut and apply in accordance with the manufacturer’s instructions.

.2 Apply pressure sensitive material with roller or squeegee.

.3 Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.

.4 Reflective signboard faces must be prepared using 3M Process Colour 880I Series ink for silkscreen.

.5 Non-reflective lettering and symbols shall be cut from Gerber High Performance Series 220 vinyl film, or approved equivalent, or silkscreen ink appropriate for the type of sheeting.

.6 Protect finished signboard faces with cut lettering with one overlay of transparent film.

.3 Sign Identification:

.1 Mark the back of each sign with “Regional Municipality of Wood Buffalo”. Lettering to be 13 mm (minimum) high black letters, using outdoor, non-fading ink covered with 3M 3669 transparent film.

Part 3 Execution

3.1 INSTALLATION

.1 Sign Support:

.1 Erect posts plumb and square to details as indicated.

.2 Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports.

.2 Telespar Signpost Systems:

.1 Attach sleeve and base together such that they are flush at the top and drive the completed unit to the required depth, without damage, leaving 150 mm (minimum) of base/sleeve exposed. Attach post to exposed base/sleeve unit.

.3 Steel Breakaways:

.1 Place base in concrete with a maximum of 75 mm to 100 mm of pipe exposed aboveground, ensuring drainage away from the pipe.

.2 Use four 25 mm x 10 mm steel bolts to attach the post to the base plate.

.3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until concrete has cured.

.4 Signboard:

.1 Fasten signboards to Telespar posts with bolts, nuts, and washers.

.2 Fasten signboards to steel breakaways with stainless steel gear clamps (HS32).

.3 Fasten signboards to street or traffic light standards with bandit strapping materials.

.1 Use strapping with crimped or bolted connections where signs are fastened to light poles.

.2 Signs are not permitted to be fastened to wooden utility poles.

.4 Fasten street name blades using approved bracket and aluminium bolts.

3.2 PROTECTION

.1 Place temporary covering on signboards as indicated on the Drawings.

.2 Covering to be capable of withstanding rain, snow, and wind, and shall be non-injurious to the signboard.

.3 Replace deteriorated coverings and remove covers as directed by the Owner’s Representative.

3.3 CORRECTION OF DEFECTS

.1 Correct defects identified by the Owner's Representative.

.2 Correct angle of signboard and adjust luminaire aiming angle for optimum performance during night conditions to the approval of the Owner's Representative.

3.4 REMOVAL AND SALVAGE

.1 Carefully dismantle and salvage aluminium materials.

.2 Salvage or dispose of existing materials in an approved method.

.3 Contact the Municipality to determine a delivery time and designated location.

.4 Deliver materials to the Municipality at the designated location.

3.5 COMPLIANCE

.1 Regulatory Signs:

.1 Regulatory signs must be completely installed in accordance with the MUTCDC prior to eliminating construction zone signage and allowing non-construction motor vehicles to travel on the constructed roadway.

.2 Non-Regulatory Signs:

.1 Non-regulatory signs must be completely installed in accordance with the MUTCDC within two weeks of Substantial Completion.

Part 4 Measurement and Payment

4.1 TRAFFIC SIGNAGE

.1 Measurement and payment for the supply and installation of traffic signage, of the types specified, will be per each unit installed.

.2 Unit price to include the supply and installation of the signpost and support, signboard, steel breakaway if required, fasteners, hardware, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American Association of State Highway and Transportation Officials (AASHTO)

.1 AASHTO M180, Standard Specification for Steel Components for Highway Guardrail

.2 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM A36/A36M, Standard Specification for Carbon Structural Steel

.2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

.3 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 psi Tensile Strength

.3 Canadian Standards Association (CSA)

.1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel

.2 CSA G164, Hot Dip Galvanizing of Irregularly Shaped Articles

.3 CSA O80 Series, Wood Preservation

.4 CSA O86, Engineering Design in Wood

Part 2 PRODUCTS

2.1 STEEL W-BEAM GUIDE RAIL

.1 Steel rail and terminal sections: to AASHTO M180, Class A (Type 1 zinc coated).

.2 Bolts, nuts and washers: to ASTM A307, hot dip galvanized to CSA G164.

.3 Organic zinc-rich coating shall be used for the repair of damaged surfaces.

2.2 WOODEN POSTS

.1 Posts and offset blocks shall be Douglas Fir, Hemlock, or Lodgepole Pine and shall meet the requirements of the National Lumber Grades Authority (NLGA) for structural posts and timbers.

.2 Posts and offset blocks shall be rough sawn with holes drilled to the finished dimensions indicated in Alberta Transportation's *Roadside Design Guideline*. Surfacing shall be completed and incised prior to treatment, with an allowable tolerance of 1.5 mm.

.3 Wanes on any face shall not exceed 25 mm aboveground (including blocks) or 6 mm below ground.

.4 Posts and offset blocks shall be pressure treated in accordance with CSA O86.

.5 The retention of preservatives shall be per assay and shall conform to the requirements of CSA O80 Table 1, minimum retention of preservatives in pressure treated wood for

highway construction, under the headings “Post Guardrail, Guide, Sign and Sight” for posts and “Bridge Hand Rails, Guard Rails, and Posts” for timbers not in contact with the ground or water.

2.3 STEEL POSTS

.1 Steel for posts, spacers, and hardware shall conform to the requirements of CSA G40.20/G40.21 Grade 350W or ASTM A36/A36M and shall be hot dip galvanized after fabrication in accordance with ASTM A123/A123M. A copy of mill test reports shall be submitted to the Owner’s Representative for review.

Part 3 EXECUTION

3.1 W-BEAM GUIDE RAIL INSTALLATION

.1 Install posts plumb at the locations and to the depths as indicated on the Drawings.

.2 Excavate post holes and compact the bottom to provide a firm foundation. Set the post plumb and square in the hole.

.3 Backfill to ground elevation around the post using excavated material and compact in uniform layers not exceeding 150 mm compacted thickness.

.4 Place 50 mm of compacted material above the existing ground elevation to ensure positive drainage away from the posts.

.5 Cut off tops of posts as indicated on the Drawings.

.6 Construct anchors to the details as indicated on the Drawings. Place and compact backfill for anchors as directed by the Owner’s Representative.

.7 Erect steel W-beam components to the details as indicated on the Drawings. Lap joints in the direction of traffic. Tighten nuts to 100 N-m torque. The maximum protrusion of the bolt shall be 6 mm beyond the nut.

3.2 ATTACHMENT TO CONCRETE STRUCTURE

.1 When the terminal point is attached to a concrete structure, install a galvanized C150 x 12 x 7.6 m long channel below the W-beam guide rail, as shown on the Drawings.

3.3 GALVANIZED STEEL TOUCH UP

.1 Clean damaged surfaces with a wire brush to remove loose and cracked coatings.

.2 Pre-treat damaged surfaces according to the manufacturer's instructions for zinc-rich paint.

.3 Apply two coats of organic zinc-rich paint to damaged areas.

Part 4 Measurement and Payment

4.1 W-BEAM GUIDE RAIL

.1 Measurement and payment for the supply and installation of steel w-beam guide rails shall be per metre of guide rail installed.

.2 Unit price to include the supply and installation of the wooden or steel posts, anchors, and steel w-beam guide rail, excavation, backfill, and compaction of post holes, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

.1 Not used.

Part 2 Products

2.1 GENERAL

.1 The Contractor shall supply flexible guideposts which return to upright positions following repeated impacts and passages of vehicles over them. Such collisions shall not cause serious damage to the post or vehicle.

.2 The posts shall be of uniform high quality and workmanship and shall be free from defects.

.3 Prior to installation, the Contractor shall provide a complete report of the physical properties of the post to the Owner's Representative. This report shall include properties such as low temperature impact resistance, after-impact recoverability, and weather resistance.

2.2 DIMENSIONS, COLOUR, AND CONSTRUCTION

.1 Round posts shall have a minimum outside diameter of 90 mm and an overall length of 1.67 m. Semi-flat fibreglass posts shall have a minimum width of 90 mm and an overall length of 1.67 m.

.2 The top 250 mm of the post shall be black, and the remainder of the post shall be white.

.3 Posts shall be straight. Straight is defined as having no point along the length of the post in excess of 6 mm from a straightedge placed parallel to any side of the post.

.4 Round posts shall be open at the top and bottom.

.5 The surface of the post shall be smooth and free from irregularities or defects. The surface of the post shall not be affected by cleaning using scrapers, detergent with water, or solvent.

.6 Reflective sheeting shall be securely fastened to the black portion of the post with three stainless steel staples inserted through the overlapped portion of the reflective strip.

.7 If one piece construction is not used, the connections between the pieces shall be at least as strong as if constructed of a single piece.

.8 The reflective portion of round posts shall be visible from all directions and shall be of sufficient size to be recognizable in the dark as a guidepost delineator. The reflective portion of semi-flat posts shall be visible to traffic.

2.3 WEATHER RESISTANCE AND DURABILITY

.1 The post shall not be seriously affected by ozone, exhaust fumes, asphalt or road oils, dirt, vegetation, de-icing salts, or any other types of air contamination or materials likely to be encountered after installation.

.2 The post shall withstand, without serious damage, all elements likely to be encountered after installation including hot (50°C) or cold (-50°C) temperatures, rain, snow, hail, abrasion, and physical abuse.

2.4 STRENGTH AND FLEXIBILITY

.1 The posts shall resist, without breaking, tearing, shattering or other serious damage, one highway vehicle impact at a speed of 100 km/h at a test temperature of -33°C.

.2 The post shall not bend, warp, or distort when installed at temperatures up to 50°C or installed in wind velocities up to 120 km/h.

2.5 REFLECTIVE SHEETING

.1 The reflective sheeting material shall be super-high intensity retro-reflective sheeting in accordance with ASTM D4956 for a Type X sheeting with Class I pressure sensitive adhesive backing.

.2 Each post shall have a 100 mm wide x 330 mm long strip of reflective sheeting fastened onto the black portion of the post. The reflective sheeting shall be centred in such a manner that 75 mm of the black portion is exposed both above and below the attached reflective strip.

.3 Generally, the colour of the reflective sheeting shall be either white or fluorescent yellow to match the colour of the nearest painted roadway edge line. When marking the edges of approaches located on curves or other concealed access points, the colour of the reflective sheeting shall be green. When green reflective sheeting is required, white sheeting shall be screen-printed green using a process recommended by the sheeting manufacturer.

Part 3 Execution

3.1 GUIDEPOST INSTALLATION

.1 Guideposts shall be set to the required depth and alignment, in a manner resulting in a smooth, continuous installation as shown on the Drawings. The maximum permissible tolerance for plumb and grade of posts shall be 6 mm.

.2 Holes shall be excavated by auger. The diameter of the augered holes shall be of sufficient size to allow for pneumatic tamping.

.3 Unsuitable material at the bottom of the augured holes shall be replaced with granular material, as directed by the Owner’s Representative. The Contractor shall thoroughly compact the bottom of the hole. The guideposts shall rest directly and solidly on the bottom of the hole at the time of installation.

.4 Excavated material which is unsuitable for use as backfill shall be replaced with granular material, as directed by the Owner's Representative. Backfill shall be thoroughly compacted, using pneumatic tampers, in layers not exceeding 150 mm compacted thickness, for the full depth of the excavation.

.5 Reflective sheeting shall be attached by mechanical means such as stapling. Fastening by adhesives alone will not be accepted.

.6 Upon completion of the installation, the Work area shall be restored to its original condition.

3.2 FINISH TOLERANCE

.1 At the end of the Warranty Period, the maximum permissible tolerance for plumb and grade of all posts shall be 13 mm.

Part 4 Measurement and Payment

4.1 GUIDEPOSTS

.1 Measurement and payment for the supply and installation of guideposts, of the types specified, will be per each guidepost installed.

.2 Unit price to include the supply and installation of the guideposts, augering post holes, backfill and compaction of post holes, and all other incidentals necessary to perform the Work.

.3 Separate payment will not be made for guidepost removal. The removal and disposal of existing guideposts is considered incidental to the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International (formerly the American Society for Testing and Materials)

.1 ASTM C144, Standard Specification for Aggregate for Masonry Mortar

.2 ASTM C618, Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

.2 Canadian Standards Association (CSA)

.1 CSA A23.1, Concrete Materials and Methods of Concrete Construction

.2 CSA A3000, Cementitious Materials Compendium

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of leftover aggregate materials, hardened cement materials, and geotextiles at the appropriate local facility(ies) for reuse as approved by the Owner's Representative.

Part 2 Products

2.1 STONE

.1 Hard, dense (with a relative density of not less than 2.65), durable quarry stone, free from seams, cracks, and other structural defects.

.2 Granite, quartzite, and limestone are acceptable; sandstone, mudstone, shale, and slate are not acceptable.

.3 Stone rip rap shall have a smooth surface and shall meet the following requirements:

.1 Class 1 Rip Rap:

.1 No stones greater than 450 mm.

.2 20% to 50% of stones with individual size of 350 mm.

.3 50% to 80% of stones with individual size of 300 mm.

.4 No stones less than 200 mm.

.2 Class 2 Rip Rap:

.1 No stones greater than 800 mm.

.2 20% to 50% of stones with individual size of 600 mm.

.3 50% to 80% of stones with individual size of 500 mm.

.4 No stones less than 300 mm.

.3 Class 3 Rip Rap:

.1 No stones greater than 1,100 mm.

.2 20% to 50% of stones with individual size of 900 mm.

.3 50% to 80% of stones with individual size of 800 mm.

.4 No stones less than 500 mm.

2.2 CEMENT

.1 To CSA A3000.

.2 Aggregates: to CSA A23.1.

.3 Fly ash: to ASTM C618.

2.3 GEOTEXTILE

.1 In accordance with Section 3 05 30 - Geotextiles.

Part 3 Execution

3.1 PLACEMENT

.1 Fine grade the area to be rip rapped to a uniform, even surface. Fill depressions with suitable material and compact to provide a firm bed.

.2 Prepare a trench at the toe and top of the slope, as shown on the Drawings.

.3 Place geotextile on prepared surface. Anchor geotextile by backfilling trench with granular material. Do not drive vehicles directly on the geotextile.

.4 Place rip rap in a manner that minimizes cracking and spalling, avoids damage to the geotextile, and such that segregation does not occur.

.5 Remove material that does not comply with the gradation or specifications.

.6 Do not use heavy machinery on material in place.

.7 Place rip rap to a depth equal to or exceeding the largest permitted rock size for the class specified.

.8 Place stones in a manner approved by the Owner’s Representative to secure the surface and create a stable mass. Place larger stones at the bottom of slopes.

.9 Hand placing:

.1 Use larger stones for lower courses and as headers for subsequent courses.

.2 Stagger vertical joints and fill voids with rock spalls or cobbles.

.3 Finish surface even, free of large openings, and neat in appearance.

Part 4 Measurement and Payment

4.1 RIP RAP

.1 Measurement and payment for the supply and placement of rip rap, of the types specified, will be per square metre (m^2) of rip rap installed.

.2 Unit price to include the supply and placement of the rip rap, geotextile, excavation and backfill of key trench, fine grading, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Clearing: cutting off trees and brush to a specified height above the ground surface and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Close-cut clearing: cutting off trees and brush to a specified height at or close to the existing ground surface and disposing of fallen timber and surface debris.

.3 Clearing isolated trees: cutting off designated trees to a specified height above the ground surface and disposing of felled trees and debris.

.4 Underbrush clearing: removal of undergrowth, deadwood, and trees smaller than 50 mm in trunk diameter and disposing of all fallen timber and surface debris.

.5 Grubbing: excavation and disposal of stumps and roots, boulders, and rock fragments of specified size to not less than a specified depth below the existing ground surface.

.6 Mulching: shredding trees, tree stumps, and tree roots into wood chips small enough to be used for landscaping purposes.

Part 2 Products

.1 Not used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control (ESC) measures in accordance with the ESC Plan and site-specific Environmental Construction Operations (ECO) Plan.

3.2 PREPARATION

.1 Together with the Owner’s Representative, inspect the Site and confirm the condition of items designated to remain.

.2 Tree clearing shall conducted be in accordance with Section 1 07 00 – Environmental Procedures.

.3 Work within Caribou Habitat, Key Wildlife, and Biodiversity Zones shall be conducted in accordance with Section 1 07 00 – Environmental Procedures.

.4 Notify utility authorities before starting clearing.

.5 The Contractor shall locate and protect all utilities and associated appurtenances, survey control monuments, plant material and root systems that are designated to remain, natural features, pavement, concrete, fencing, structures, and other surface features.

.1 Maintain active utilities traversing the Site in operating condition.

.2 Repair any damaged items to the approval of the Owner's Representative.

.3 Replace any trees designated to remain, if damaged, as directed by the Owner's Representative or the Municipality.

.6 Plant material shall not be removed from a Municipal or Environmental Reserve without written approval from the Municipality.

.7 Root systems shall not be disturbed within 10 m, or the drip line, of any plant material to remain, whichever is greater.

.8 Areas disturbed during construction shall be restored to the satisfaction of the Owner's Representative.

3.3 CLEARING

.1 Cut trees and brush to a height of not more than 300 mm above the ground surface and trim or cut into sections as necessary.

.2 Remove previously uprooted trees, downed timber, brush, and debris from the area cleared.

.3 Cut off branches or fell trees that overhang the area cleared as directed by the Owner's Representative.

3.4 CLOSE-CUT CLEARING

.1 Cut trees and brush to at or near the ground surface.

.2 Remove previously uprooted trees, downed timber, brush, and debris from the area cleared.

.3 Cut off branches or fell trees that overhang the area cleared as directed by the Owner's Representative.

.4 Cut off unsound branches on trees designated to remain as directed by the Owner's Representative.

3.5 ISOLATED TREE CLEARING

.1 Cut designated trees to a height of not more than 300 mm above ground surface.

.2 Remove previously uprooted trees, downed timber, brush, and debris from the area cleared.

3.6 UNDERBRUSH CLEARING

.1 Remove undergrowth, deadwood, and trees smaller than 50 mm in trunk diameter.

.2 Remove downed timber, brush, and debris from the area cleared.

3.7 GRUBBING

.1 Excavate stumps and roots to not less than 600 mm below the ground surface.

.2 Excavate visible rock fragments and boulders, greater than 300 mm in the greatest dimension and less than 0.25 m^3.

3.8 MULCHING

.1 On Site mulching is permitted provided the Contractor removes and disposes the mulch at an approved location off-site.

3.9 REMOVAL AND DISPOSAL

.1 All plant material designated to be removed shall be disposed of at an approved off-site location, in an environmentally safe manner. Burning will not be permitted.

.2 Cut timber greater than 125 mm in diameter and stockpile. Stockpiled timber becomes the property of the Contractor.

.1 The Contractor shall remove stockpiled timber from the Site in a timely manner.

3.10 FINISHED SURFACE

.1 Leave the ground surface in a condition suitable for the stripping of topsoil, to the approval of the Owner's Representative.

Part 4 Measurement and Payment

4.1 CLEARING AND GRUBBING

.1 Measurement and payment for clearing and grubbing will be per hectare (ha) of land cleared, as measured by field survey.

.2 Unit price to include clearing, grubbing, mulching, loading, hauling, disposal of all material off-site, disposal fees (if any), and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 PROTECTION OF EXISTING FEATURES

.1 The Contractor shall locate and protect all utilities and associated appurtenances, survey control monuments, plant material and root systems that are designated to remain, natural features, pavement, concrete, fencing, structures, and other surface features.

.1 Repair any damaged items to the approval of the Owner's Representative.

.2 Maintain access roads in accordance with Section 1 09 00 – Temporary Facilities.

Part 2 Products

2.1 MATERIALS

.1 Native fill: in accordance with Section 3 04 00 – Aggregate Materials.

.2 Imported fill (Type 2): in accordance with Section 3 04 00 – Aggregate Materials.

Part 3 Execution

3.1 TOPSOIL STRIPPING AND STOCKPILING

.1 Limit the area to be stripped to the area required to complete the Work or as indicated on the Drawings.

.2 Begin topsoil stripping after the area has been cleared of vegetation and grubbed.

.3 Strip topsoil to the depth(s) as indicated on the Drawings or as directed by the Owner's Representative.

.4 Keep topsoil stockpiles separate and do not mix topsoil with subsoil, common excavation, or other stockpiled materials. Maintain a minimum separation of 1 m between stockpiled topsoil and other stockpiled materials.

.1 If topsoil and subsoil are mixed and the topsoil is adversely affected, the Contractor shall, at their own expense, engage a soils specialist to determine the necessary remedial work and the Contractor shall perform the required remedial work.

.5 Load, haul, and place stripped topsoil in stockpiles at the location(s) indicated on the Drawings or as directed by the Owner's Representative.

.6 Stockpile topsoil in a manner that will not endanger persons, the Work, or adjacent properties.

.7 The height of topsoil stockpiles shall not exceed 2 m.

.8 For long-term storage of stockpiled material, provide weed and erosion control measures.

.9 Dispose of surplus topsoil at an approved off-site facility, as indicated on the Drawings or as directed by the Owner's Representative.

3.2 COMMON EXCAVATION AND PLACEMENT

.1 Do not disturb soil within the drip line of plant material to remain.

.2 Rough grade to levels, profiles, and contours indicated, allowing for designated surface treatment.

.3 Ensure positive drainage is maintained.

.4 Excavate required fill from areas within the Work area as indicated. These areas will be those where the finish grade is lower than the original ground elevation.

.5 Prior to placing fill over the existing ground surface, scarify the surface to depth of 150 mm. Maintain the fill material and existing surface at approximately the same moisture content to facilitate bonding.

3.3 COMPACTION

.1 In accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Quality Control and Quality Assurance testing: in accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

3.4 DISPOSAL OF SURPLUS MATERIAL

.1 In accordance with Section 2 01 00 – Excavating, Trenching, and Backfilling.

Part 4 Measurement and Payment

4.1 TOPSOIL STRIPPING AND STOCKPILING

.1 Measurement and payment for the stripping and stockpiling of topsoil, to the depths specified, will be per cubic metre (m^3) of topsoil stripped and stockpiled, as measured by field survey.

.2 Unit price to include stripping, loading, hauling, disposing of sod at an approved off-site facility, disposal fees (if any), on-site stockpiling, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 COMMON EXCAVATION

.1 In accordance with Section 3 07 00 – Roadway Embankment and Compaction.

4.3 BORROW

.1 In accordance with Section 3 07 00 – Roadway Embankment and Compaction.

4.4 DISPOSAL OF SURPLUS MATERIAL

.1 Refer to Section 2 01 00 – Excavating, Trenching, and Backfilling.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification

.2 Canadian Council of Ministers of the Environment

.1 PN 1340, Guidelines for Compost Quality

1.2 DEFINITIONS

.1 Topsoil:

.1 As per Section 2 01 00 – Excavating, Trenching, and Backfilling.

.2 Compost:

.1 A mixture of soil and decomposing organic matter used as fertilizer, mulch, or for amending topsoil.

.2 Processed organic matter containing 40% or more organic matter as determined by the Walkley-Black or Loss on Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e., stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below 25) and must not contain toxic or growth inhibiting contaminates.

1.3 SUBMITTALS

.1 Make submissions in accordance with Section 1 04 00 – Submittal Procedures.

.2 Quality Control:

.1 Soil testing: submit certified test reports showing compliance with the specified performance characteristics and physical properties as described in article 2.3.

.2 Certificates: submit product certificates signed by the manufacturer certifying that the materials comply with the specified performance characteristics, criteria, and physical requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of unused chemical soil amendments at an appropriate hazardous material collections site approved by the Owner’s Representative.

.2 Do not dispose of unused chemical soil amendments into sewer systems, watercourses, or the environment.

Part 2 Products

2.1 TOPSOIL

.1 A mixture of particulates, micro-organisms, and organic matter which provides a suitable medium for supporting the intended plant growth.

.2 Topsoil shall be free of any material larger than 25 mm in diameter, shall contain no toxic materials, shall be free of non-native weeds or seeds or parts thereof, and shall be capable of sustaining vigorous plant growth.

.1 Acceptable minimum levels for general use are as follows:

Sand	20% - 40%
Clay	25% - 40%
Silt	15% - 50%
Organic Matter	10%
Nitrogen (N)	45 ppm
Phosphorus (P)	70 ppm
Potassium (K)	125 ppm
Toxic Chemicals	None
Electrical Conductivity	2.0 dS/m
Sodium Adsorption Ratio	4.0 maximum
pH Value	6.0 to 7.5

.2 All soils must fall within the Clay Loam classification, as defined by the *Canadian System of Soil Classification*, and total composition of silts and clays must not exceed 65% of the total particle distribution.

.3 The Contractor shall make every effort to preserve and reuse existing topsoil on Site.

2.2 SOIL AMENDMENTS

.1 The Contractor shall amend the topsoil as required based on recommendations provided in the soil tests and to the satisfaction of the Owner's Representative.

.2 Acceptable materials for use in soil amendments include the following:

.1 Lime:

.1 Dry, free-flowing, ground limestone containing not less than 85% of total combined carbonates, meeting the following gradation:

Sieve Size (mm)	Minimum % Passing (by Mass)
2.5 (No. 8)	100
1.25 (No. 16)	90 – 100

.2 Organic Matter:

.1 Compost or unprocessed organic matter such as rotted manure, hay, straw, bark residue, or sawdust, meeting the specified organic matter, stability, and contaminant requirements.

.2 Decomposed plant material, elastic and homogenous, free of toxic material, live plants, live roots, seeds, decomposed colloidal residue, wood, clay lumps, ice, sulphur, noxious weeds, and iron.

.3 Compost shall meet the *Guidelines for Compost Quality* published by the Canadian Council of Ministers of the Environment.

.3 Peat Moss:

.1 Decomposed plant material, elastic and homogenous, free of toxic material, live plants, live roots, seeds, decomposed colloidal residue, wood, clay lumps, ice, sulphur, noxious weeds, and iron.

.2 Must have a pH value between 4.5 and 6.0 with a conductivity of less than 2.0 dS/m.

.3 Shall not contain more than 200 ppm of sulphate.

.4 Shall not contain lime.

.5 Shall be delivered in a pulverized condition and pass through a 33 mm screen.

.4 Fertilizer:

.1 An industry accepted standard medium containing nitrogen, phosphorous, potassium, and other micro-nutrients suitable to the specific plant species or application or as defined by the soil test.

2.3 SOURCE QUALITY CONTROL

.1 The Contractor shall provide two soil analysis reports, one for the original soil and one for the amended soil, to the Owner's Representative. All soil must be approved by the Owner's Representative prior to placement.

.2 The soil analysis report shall include the topsoil source, noted deficiencies, and any recommendations for amendment/correction to meet the nutritional growing requirements of the specified plant materials. Recommendations shall clearly state the type and quantity of soil additives and application procedure to be used.

.3 Topsoil shall be tested for particle size, organic matter (volume), Nitrogen, Phosphorus, Potassium, electrical conductivity (salinity), sodium adsorption ratio, and pH value.

.4 Testing of topsoil shall be carried out by an approved qualified testing laboratory.

.1 Soil sampling, testing, and analysis shall be in accordance with provincial standards.

.2 All costs related to testing shall be borne by the Contractor.

.3 The Contractor is responsible for any necessary amendments to the topsoil in accordance with article 2.2.

Part 3 Execution

3.1 PREPARATION

.1 Remove all foreign material, undesirable plants, roots, stones larger than 25 mm, debris and soil contaminated with oil or gasoline, and any other toxic substance from the Site and dispose at an appropriate local facility.

.2 Verify that grades are correct.

.1 If discrepancies occur, notify the Owner's Representative and do not commence Work until instructed by the Owner's Representative.

.3 Scarify the area which is to receive topsoil to a minimum depth of 100 mm.

.1 Re-scarify those areas where equipment used for hauling and spreading has compacted the soil.

3.2 PLACEMENT OF TOPSOIL AND FINISH GRADING

.1 Do not place topsoil until the Owner's Representative has inspected the subgrade.

.2 Do not handle topsoil in a wet or frozen condition or in any manner that may adversely impact the soil structure.

.3 In areas to be sodded, keep the topsoil 15 mm below the finished grade or 25 mm below adjacent walks, curbs, and manholes.

.4 Spread topsoil in uniform layers, not exceeding 100 mm in depth, to the following depths after settlement:

.1 100 mm in areas to be sodded.
.2 150 mm in areas to be seeded.
.3 300 mm in perennial beds.
.4 500 mm in tree and shrub beds.

.5 Manually spread topsoil around trees, shrubs, and obstacles.

.6 Float the area until the surface is smooth. Smooth areas adjacent to catch basins to be flush with the grate. Remove all lumps, rocks, roots, and other debris from the finished material and dispose of same at an approved off-site facility.

.7 Compact topsoil by light rolling such that it is firm against deep footprints. Do not over-compact.

.1 Scarify and recompact those areas which are over-compacted.

.8 Fine grade to eliminate rough or low areas and to ensure positive drainage. The finished topsoil surface shall be free of tire ruts and large equipment tracks.

3.3 ACCEPTANCE

.1 The Owner's Representative must inspect the topsoil in place to confirm the acceptability of the material, depth, and finish grading.

3.4 DISPOSAL OF SURPLUS TOPSOIL

.1 Do not dispose of surplus topsoil. Haul surplus topsoil off-site and stockpile at a location approved by the Municipality.

Part 4 Measurement and Payment

4.1 PLACEMENT OF STOCKPILED TOPSOIL

.1 Measurement and payment for the placement of stockpiled topsoil, to the depths specified, will be per cubic metre (m^3) of topsoil placed, as measured by field survey.

.2 Unit price to include loading, hauling from stockpile, placement of stockpiled topsoil deemed suitable for re-use, any necessary amendments to the topsoil, disposing of stockpiled topsoil deemed unsuitable for re-use, disposal fees (if any), clean-up of stockpile location, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Separate payment will not be made for the supply and placement of topsoil in tree pits. Include costs in related items.

4.2 PLACEMENT OF IMPORTED TOPSOIL

.1 Measurement and payment for the placement of imported topsoil, to the depths specified, will be per cubic metre (m^3) of imported topsoil placed, as measured by field survey.

.2 Unit price to include the supply, loading, hauling to Site, and placement of imported topsoil, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

.3 Separate payment will not be made for the supply and placement of topsoil in tree pits. Include costs in related items.

END OF SECTION

Part 1 General

.1 Not used.

Part 2 Products

2.1 GRASS SEED

.1 Fine Grass Mixture: certified Canada #1 Grade Seed in accordance with the Government of Canada *Seeds Act* and Seeds Regulations.

.2 The composition of seed mixes shall meet the following, depending on the application.

Parks/Boulevards	**Rural Roadside**
• 30% Mercury Kentucky Bluegrass • 20% Midnight Kentucky Bluegrass • 20% Creeping Red Fescue • 30% Perennial Ryegrass • Application Rate of 75 kg/ha	• 35% Slender/Awned Wheatgrass • 20% Rocky Mountain Fescue • 10% Ticklegrass • 10% Fringed Brome • 10% Canada Wildrye • 10% Tufted Hairgrass • 5% Fowl Bluegrass • Application Rate of 75 kg/ha
Sports Fields - Irrigated	**Sports Fields – Dry Land**
• 20% Award Kentucky Bluegrass • 20% Jumpstart Kentucky Bluegrass • 20% Midnight Kentucky Bluegrass • 20% Mercury Kentucky Bluegrass • 20% Perennial Ryegrass • Application Rate of 75 kg/ha	• 20% Midnight Kentucky Bluegrass • 20% Jumpstart Kentucky Bluegrass • 20% Mercury Kentucky Bluegrass • 20% Tomcat Tall Fescue • 20% Perennial Ryegrass • Application Rate of 75 kg/ha
Natural Areas (tall growing mix)	**Natural Areas (low growing mix)**
• 30% Rocky Mountain Fescue • 25% Indian Ricegrass • 20% Hairy Wildrye • 10% Junegrass • 10% Canada Bluegrass • 5% Canada Wildrye • Application Rate of 35 kg/ha	• 35% Sheep Fescue • 30% Rocky Mountain Fescue • 15% Junegrass • 15% Canada Bluegrass • 5% Tufted Hairgrass • Application Rate of 35 kg/ha

Salt Tolerant Mix
• 40% Fults Alkali Grass • 20% Tomcat Tall Fescue • 20% Midnight Kentucky Bluegrass • 20% Perennial Ryegrass • Application Rate of 75 kg/ha

.3 The seed shall be delivered in the original containers, with the following information identified:

.1 Analysis of seed mixture.
.2 Percentage of pure seed production.
.3 Year of seed production.
.4 Net weight.
.5 Data when bagged, and location.
.6 Name of supplier.

.4 At the request of the Owner's Representative, provide a copy of the Certification of Compliance with the *Seeds Act*.

.5 Seed must be capable of producing a minimum germination rate of 75% with a minimum purity of 97%.

2.2 WATER

.1 Free of impurities that would inhibit germination and growth.

.2 To be supplied by the Contractor at no cost to the Owner.

2.3 FERTILIZER

.1 To the Government of Canada *Fertilizers Act* and Fertilizers Regulations.

.2 The type and application rate of fertilizer shall be determined by a soil test.

Part 3 Execution

3.1 WORKMANSHIP

.1 Do not perform Work when there are adverse field conditions such as wind speeds over 20 km/h, frozen soil, excessively wet soil, or soil covered with snow, ice, or standing water.

3.2 PREPARATION

.1 In accordance with Section 4 01 40 – Topsoil Placement and Finish Grading.

Seed Placement

.2 For mechanical seeding:

.1 Use a "Brillion" type mechanical landscape seeder with sand discs which accurately places seeds at the specified depth and rate and rolls in a single operation.

.2 Use equipment and methodology acceptable to the Owner's Representative.

.3 Consolidate mechanically seeded areas by rolling the area if soil conditions warrant or, if directed by the Owner's Representative, with equipment approved by the Owner's Representative immediately after seeding.

.3 For manual seeding:

.1 Use a "Cyclone" type manually operated seeder.

.2 Rake the surface to ensure the seed is properly embedded.

.3 Remove any topsoil lumps more than 50 mm in size.

.4 Use equipment and methodology acceptable to the Owner's Representative.

.5 On cultivated surfaces, uniformly sow grass seed at the specified rate.

.6 Blend applications 150 mm to 300 mm into adjacent grassed areas and previous applications to form uniform surfaces.

.7 Sow half of the required amount of seed in one direction and the remainder at a right angle.

.8 Embed the seed into the topsoil to depth of 6 mm to 10 mm. At least 85% of the seed shall be placed at the specified depth and covered by topsoil.

.9 Consolidate manually seeded areas by rolling the area with equipment approved by the Owner's Representative immediately after seeding.

.4 After seeding, lightly water with a fine spray to a maximum depth of 25 mm.

.5 Provide and maintain adequate barricades and signs to protect freshly seeded areas until the turf is established.

.6 Avoid seeding along a roadway edge when freshly applied pavement markings may be contaminated or damaged by seed. Commence seeding along roadway edges after pavement markings have set.

3.3 ACCEPTANCE

.1 Seeded areas will be accepted by the Owner's Representative provided that:

.1 They are uniformly established, graded, and seeded in accordance with this Section.

.2 They have less than 5% weed cover.

.3 They are free of rocks, debris, and prohibited noxious weeds.

3.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Planting Supervisor: “Landscape Industry Certified” Technician as regulated by the Canadian Nursery Landscape Association (CNLA).

Part 4 Measurement and Payment

4.1 MECHANICAL SEEDING

.1 Measurement and payment for mechanical seeding, for the mixes specified, will be per square metre (m^2) of area seeded, as measured by field survey.

.2 Unit price to include preparation of the seed bed, mechanical or manual placement of the seed, maintenance from seed application to acceptance, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Make submissions in accordance with Section 1 04 00 – Submittal Procedures.

.2 Provide product data for:

.1 Seed.
.2 Mulch.
.3 Tackifier.
.4 Fertilizer.
.5 Erosion control blankets and anchors.

.3 Submit the following to the Owner's Representative at least 14 days prior to commencing Work:

.1 Size of the truck's slurry tank in litres.
.2 Amount of material to be used per tank based on the size of the slurry tank.
.3 Number of tank loads required per hectare to achieve the specified seed application rate.

Part 2 Products

2.1 GRASS SEED

.1 Fine Grass Mixture: certified Canada #1 Grade Seed in accordance with the Government of Canada *Seeds Act* and Seeds Regulations.

.2 The composition of seed mixes shall meet the following, depending on the application.

Parks/Boulevards	**Rural Roadside**
• 30% Mercury Kentucky Bluegrass • 20% Midnight Kentucky Bluegrass • 20% Creeping Red Fescue • 30% Perennial Ryegrass	• 35% Slender/Awned Wheatgrass • 20% Rocky Mountain Fescue • 10% Ticklegrass • 10% Fringed Brome • 10% Canada Wildrye • 10% Tufted Hairgrass • 5% Fowl Bluegrass
Sports Fields - Irrigated	**Sports Fields – Dry Land**
• 20% Award Kentucky Bluegrass • 20% Jumpstart Kentucky Bluegrass • 20% Midnight Kentucky Bluegrass • 20% Mercury Kentucky Bluegrass • 20% Perennial Ryegrass	• 20% Midnight Kentucky Bluegrass • 20% Jumpstart Kentucky Bluegrass • 20% Mercury Kentucky Bluegrass • 20% Tomcat Tall Fescue • 20% Perennial Ryegrass

Natural Areas (tall growing mix)	Natural Areas (low growing mix)
• 30% Rocky Mountain Fescue • 25% Indian Ricegrass • 20% Hairy Wildrye • 10% Junegrass • 10% Canada Bluegrass • 5% Canada Wildrye	• 35% Sheep Fescue • 30% Rocky Mountain Fescue • 15% Junegrass • 15% Canada Bluegrass • 5% Tufted Hairgrass
Salt Tolerant Mix	
• 40% Fults Alkali Grass • 20% Tomcat Tall Fescue • 20% Midnight Kentucky Bluegrass • 20% Perennial Ryegrass	

.3 The seed shall be delivered in the original containers, with the following information identified:

.1 Analysis of seed mixture.
.2 Percentage of pure seed production.
.3 Year of seed production.
.4 Net weight.
.5 Data when bagged, and location.
.6 Name of supplier.

.4 At the request of the Owner's Representative, provide a copy of the Certification of Compliance with the *Seeds Act*.

.5 Seed must be capable of producing a minimum germination rate of 75% with a minimum purity of 97%.

2.2 MULCH

.1 Fibres: 99% organic content.

.2 Free of growth inhibiting substances.

.3 100% potential water uptake by weight.

.4 Capable of dispersing in water to form a homogeneous slurry.

.5 Capable of forming an absorptive mat ground cover allowing water percolation.

2.3 TACKIFIER

.1 Capable of water dilutable liquid dispersion and containing polyvinyl acetate terpolymer emulsion.

2.4 EROSION CONTROL BLANKETS

.1 As specified.

.2 Anchors:

.1 In accordance with the manufacturer's specifications.

2.5 WATER

.1 Free of impurities that would inhibit germination and growth.

.2 In sufficient quantity as required to form the slurry mixture in accordance with this Section.

.3 To be supplied by the Contractor at no cost to the Owner.

2.6 FERTILIZER

.1 To the Government of Canada *Fertilizers Act* and Fertilizers Regulations.

.2 The type and application rate of fertilizer shall be determined by a soil test.

2.7 EQUIPMENT

.1 Truck shall be equipped with a minimum 4,500 L slurry tank and pumps capable of maintaining continuous, non-fluctuating flow of the mixture.

Part 3 Execution

3.1 WORKMANSHIP

.1 Take reasonable care to prevent spraying items such as structures, signs, guardrails, fences, plant materials, and utilities.

.2 Do not perform Work when there are adverse field conditions such as wind speeds over 20 km/h, frozen soil, excessively wet soil, or soil covered with snow, ice, or standing water.

3.2 PREPARATION

.1 In accordance with Section 4 01 40 – Topsoil Placement and Finish Grading.

3.3 SEED PLACEMENT

.1 The slurry mixture shall consist of the following, per hectare:

.1 Seed: 300 kg.
.2 Mulch: 1,600 kg.
.3 Tackifier: 50 kg.

.2 Apply the seed slurry uniformly.

.3 Blend applications 150 mm to 300 mm into adjacent grassed areas and previous applications to form uniform surfaces.

.4 Avoid seeding along a roadway edge when freshly applied pavement markings may be contaminated or damaged by seed. Commence seeding along roadway edges after pavement markings have set.

.5 Reshoot areas where the application is not uniform.

.6 Remove slurry from items and areas not designated to be sprayed, within 4 hours.

3.4 EROSION CONTROL

.1 Apply erosion control blankets over designated areas in accordance with the manufacturer's instructions.

.2 Anchor erosion control blankets in accordance with the manufacturer's recommendations and ensure that the erosion control blankets maintain firm contact with the soil.

3.5 ACCEPTANCE

.1 Seeded areas will be accepted by the Owner’s Representative provided that:

.1 They are uniformly graded and seeded in accordance with this Section.

.2 They have less than 5% weed cover.

.3 They are free of rocks, debris, and prohibited noxious weeds.

3.6 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Planting Supervisor: “Landscape Industry Certified” Technician as regulated by the Canadian Nursery Landscape Association (CNLA).

Part 4 Measurement and Payment

4.1 HYDRAULIC SEEDING

.1 Measurement and payment for hydraulic seeding, for the mixes specified, will be per square metre (m^2) of area seeded, as measured by field survey.

.2 Unit price to include preparation of the seed bed, hydraulic placement of the seed, maintenance from seed application to acceptance, and labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Make submissions in accordance with Section 1 04 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature, and data sheets for sod and fertilizer and include the product characteristics, performance criteria, physical size, finish, and limitations to the Owner’s Representative.

.3 Submit product certificates, signed by the manufacturer, certifying that the materials comply with the specified performance characteristics, criteria, and physical requirements of the seed mix, seed purity, and sod quality.

1.2 SCHEDULING

.1 Schedule the delivery of sod such that it is delivered within 24 hours of being lifted and that it is placed within 36 hours of being lifted.

.1 Sod must be placed on the day of arrival to Site. If delays in placement occur due to weather, protect the sod on Site from the sun, keep the sod moist, and store the sod in a cool place until placement. Sod that is dried out and not in a healthy growing condition will be rejected.

.2 Schedule the placement of sod to coincide with the preparation of the soil surface.

.3 Schedule the placement of sod when frost is not present in the ground.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with the supplier’s written instructions.

.2 Deliver materials to the Site in the original factory packaging, labelled with the manufacturer’s name and address.

.3 Store materials in accordance with the supplier’s recommendations.

.4 Replace defective or damaged materials with new.

Part 2 Products

2.1 SOD

.1 No.1 Turfgrass Nursery Sod consisting of a uniform mixture in the following proportions:

.1 Touchdown Kentucky Bluegrass – 30% by weight
.2 Creeping Red Fescue – 30% by weight
.3 Kentucky Bluegrass – 40% by weight.

.2 The sod shall be:

.1 A minimum of 18 months old.

.2 Free of stones, burns, dry or bare spots, tears, prohibited noxious weeds, and debris.

.3 30 mm to 50 mm in thickness.

.4 Cut in strips of uniform width.

.5 Sufficiently moist.

.6 Freshly cut and healthy, with a strong, fibrous root system.

.7 Cultivated in a nursery field as turf crop containing a maximum of 2% of other grass species.

.3 Sod showing signs of deterioration due to age or lack of moisture will be rejected.

2.2 WATER

.1 Free of impurities that would inhibit germination and growth.

.2 To be supplied by the Contractor at no cost to the Owner.

2.3 FERTILIZER

.1 To the Government of Canada *Fertilizers Act* and Fertilizers Regulations.

.2 The type and application rate of fertilizer shall be determined by a soil test.

2.4 SOD ESTABLISHMENT SUPPORT

.1 Wooden pegs: 25 mm x 25 mm x 230 mm.

.2 Geotextile fabric: biodegradable, 25 mm square mesh.

2.5 SOURCE QUALITY CONTROL

.1 Obtain approval of the source of sod from the Owner's Representative.

.2 Do not use any other source of sod without prior approval from the Owner's Representative.

Part 3 Execution

3.1 WORKMANSHIP

.1 Do not perform Work when there are adverse field conditions such as frozen soil, excessively wet soil, or soil covered with snow, ice, or standing water.

3.2 PREPARATION

.1 In accordance with Section 4 01 40 – Topsoil Placement and Finish Grading.

3.3 SOD PLACEMENT

.1 Ensure sod placement is done under the supervision of a certified Landscape Planting Supervisor.

.2 Lay sod sections in rows, with staggered joints. 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 the Owner's Representative. Provide close contact between the sod and soil by light rolling. Use of a heavy roller to correct irregularities in grade is not permitted.

3.4 SOD PLACEMENT ON SLOPES

.1 Install and secure the geotextile fabric in areas indicated, in accordance with the manufacturer's instructions.

.2 Sod shall be placed at right angles to all slopes. Start laying sod at the bottom of the slope.

.3 Sod shall be secured with wooden pegs in the following situations:

- .1 On slopes up to a maximum of 3H:1V.
- .2 Within 1 m of catch basin.
- .3 Within 1 m of drainage channels and ditches.

.4 Install wooden pegs to the following pattern:

- .1 100 mm below top edge at 200 mm on centre for the first sod sections along the contours of slopes.
- .2 At least 25 pegs per 10 m^2.

.5 Pegs shall not protrude above the surface of the sod. Remove any potential trip hazards cause by pegs.

3.5 PROTECTION

.1 Provide and maintain adequate barricades and signs to protect freshly sodded areas until the turf is established.

3.6 ACCEPTANCE

.1 Sodded areas will be accepted by the Owner's Representative provided that:

- .1 They are properly established.
- .2 They are free of bare and dead spots.
- .3 They have less than 5% weed cover.
- .4 They are free of rocks, debris, and prohibited noxious weeds.
- .5 They have been cut at least 3 times.

.2 Areas sodded in fall will be accepted in the following spring, one month after the start of the growing season, provided that the acceptance conditions outlined in article 3.6.1 are fulfilled.

3.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Planting Supervisor: “Landscape Industry Certified” Technician as regulated by the Canadian Nursery Landscape Association (CNLA).

Part 4 Measurement and Payment

4.1 SODDING

.1 Measurement and payment for sodding, for the types specified, will be per square metre (m^2) of area sodded, as measured by field survey.

.2 Unit price to include the supply and placement of sod, geotextile fabric if required, wooden pegs, maintenance from sod placement to acceptance, and all labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 Natural Resources Canada

.1 Canada’s Plant Hardiness Zones

.2 Canadian Nursery Landscape Association (CNLA)

.1 Canadian Nursery Stock Standard

1.2 SUBMITTALS

.1 Make submissions in accordance with Section 01 04 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature, and data sheets for trees, shrubs, ground covers, fertilizer, anti-desiccant, and anchoring equipment and include the product characteristics, performance criteria, physical size, finish, and limitations to the Owner’s Representative.

1.3 SCHEDULING

.1 Submit a schedule to the Owner’s Representative at least 7 days in advance of the shipment of plant material. The schedule shall include:

.1 Quantity and type of plant material.
.2 Shipping dates.
.3 Arrival dates on Site.
.4 Planting dates.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials to the Site in the original factory packaging, labelled with the manufacturer's name and address.

.1 Protect plant material from frost, excessive heat, wind, and sun upon delivery.
.2 Protect plant material from damage during transportation:
.1 When the delivery distance is less than 30 km and the delivery vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over the vehicle box.
.2 When the delivery distance exceeds 30 km or the delivery vehicle travels at speeds over 80 km/h, use an enclosed vehicle.
.3 Protect foliage and rootballs using anti-desiccants and tarpaulins when the use of an enclosed vehicle is impractical due to the size and weight of the plant material.

.2 Immediately store and protect plant material which will not be installed within 24 hours, in accordance with the supplier's written recommendations, in a location approved by the Owner’s Representative.

.3 Protect stored plant material from frost, wind, and the sun and as follows:

.1 For pots and containers, maintain the moisture level in the containers.

.2 For balled and burlapped and wire basket rootballs, place to protect the branches from damage. Maintain the moisture level in the root zones.

.4 Store and manage hazardous materials in accordance with the manufacturer's written instructions.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of burlap, wire, and plastic plant containers and materials at an appropriate local recycling facility as approved by the Owner's Representative.

.2 Dispose of unused fertilizer at an appropriate hazardous material collection site as approved by the Owner's Representative.

.3 Dispose of unused wood and mulch materials at an appropriate recycling/composting facility as approved by the Owner's Representative.

Part 2 Products

2.1 PLANT MATERIAL

.1 Type of root preparation, sizing, grading, and quality: in accordance with the Canadian Nursery Stock Standard.

.1 The source of plant material shall be in Zone 2A in accordance with Canada's Plant Hardiness Zones and shall be located no more than 800 km from the Regional Municipality of Wood Buffalo.

.2 Plant material: in accordance with the Municipality's *Design Servicing Standards and Development Procedures* and the Drawings.

.1 Structurally sound, with a strong, fibrous root system, free of disease, insects, defects, and injuries.

.2 Densely foliated when in leaf.

.3 Trees:

.1 Shall have straight stems unless that would be uncharacteristic to the tree species.

.2 Clump or multi-stem trees shall have three or more stems originating from a common base.

.4 Collected Plants:

.1 Shall only be used upon written approval from the Owner's Representative.

.2 Collected Plants shall be a maximum of 40 mm in caliper, with well developed crowns and shall be characteristically branched; no more than 40% of the overall height may be free of branches.

.5 Shrubs:

.1 Shall have a natural form typical of the species with a minimum of four canes.

.6 Vines:

.1 Shall have at least four runners, each of a minimum length of 300 mm.

.7 Ground Covers:

.1 Shall have well developed tops, size proportionate to the developed roots typical of the species.

.8 Plant sizes: in accordance with the Municipality's *Design Servicing Standards and Development Procedures*.

.1 Plant sizes may be reduced, at the discretion of the Owner's Representative, depending on the species and application.

2.2 WATER

.1 Free of impurities that would inhibit plant growth.

2.3 STAKES

.1 T-bar or wooden 50 mm x 50 mm x 2,500 mm.

.2 The top 200 mm of tree stakes shall be painted to match the Municipality's annual colour codes in accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

2.4 WIRE TIGHTENER

.1 Type 1 galvanized steel, stamped plate type rod, triangular in shape.

2.5 GUY WIRE

.1 Galvanized #12 guy wire or approved equivalent.

2.6 GUY WIRE COLLAR

.1 2 ply, reinforced, black rubber hose, or approved equivalent.

2.7 MULCH

.1 Random-sized wood chips collected from a woodchipper being fed disease-free tree limbs, branches, and brush.

.2 Wood chips shall sit for a minimum of 6 months before use to ensure the chips are free of any pathogens and to lower the acidity. Sawdust, peat moss, twigs, and leafy material shall not exceed 5% of the total mulch volume.

.3 Non-wood type mulches must be approved by the Owner's Representative prior to installation.

2.8 FERTILIZER

.1 To the Government of Canada *Fertilizers Act* and Fertilizers Regulations.

.2 The type and application rate of fertilizer shall be determined by a soil test.

2.9 ANTI-DESICCANT

.1 Wax-like emulsion.

2.10 FLAGGING TAPE

.1 Fluorescent, orange in colour.

2.11 SOURCE QUALITY CONTROL

.1 Obtain approval of plant material from the Owner's Representative prior to planting.

.2 Imported plant material must be accompanied by any necessary permits and import licenses in accordance with federal and provincial regulations.

Part 3 Execution

3.1 PRE-PLANTING PREPARATION

.1 Remove damaged roots and branches from the plant material.

.2 Apply an anti-desiccant to conifers and deciduous trees in leaf in accordance with the manufacturer's instructions.

3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS

.1 Excavate and prepare planting beds to the depths shown on the Drawings.

.2 For individual planting holes:

.1 Stake out the location and obtain approval from the Owner's Representative prior to excavating.

.2 Excavate to the depth and width as indicated on the Drawings.

.1 With the approval of the Owner's Representative, the finished elevation of tree pits can be raised for improved drainage.

.3 Remove rocks, roots, debris, and toxic material from the excavated material that will be used as planting soil for trees and shrubs. Dispose of excess material at an appropriate off-site facility.

.4 Scarify the sides of the planting hole.

.5 Remove water which enters the excavation prior to planting. Notify the Owner's Representative if the water source is ground water.

3.3 PLANTING

.1 Refer to the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures*.

.2 For jute burlapped rootballs, cut away the top one third of the wrapping and wire basket without damaging the rootball.

- .1 Do not pull burlap or rope from under the rootball.

.3 For container stock or rootballs in non-biodegradable wrapping, remove the entire container or wrapping without damaging the rootball.

.4 Plant vertically in locations as indicated.

- .1 The root flare must be level with the surrounding soil. If not readily apparent, remove excess soil by hand to reveal the root flare.
- .2 Orient plant material to give best appearance in relation to structures, roads, and walkways.

.5 For trees and shrubs:

- .1 Backfill soil in 150 mm lifts.
  - .1 Lightly tamp each lift to eliminate air pockets.
  - .2 When two thirds of the depth of the planting pit has been backfilled, fill the remaining space with water.
  - .3 After the water has penetrated the soil, backfill to finish grade.
  - .4 Form a watering saucer as indicated on the Drawings.

.6 For ground covers:

- .1 Backfill the soil evenly to finish grade and lightly tamp to eliminate air pockets.
- .2 Water plant material thoroughly.
- .3 After soil settlement has occurred, fill with soil to finish grade.

.7 Apply fertilizer.

3.4 INSTALLATION OF TREE SUPPORTS

.1 Install tree stakes as indicated.

- .1 Use 2 stakes for deciduous trees 3 m or less in height, and coniferous trees 2 m or less in height.
- .2 Use 3 stakes and anchors for deciduous trees greater than 3 m in height and coniferous trees greater than 20 m in height.
- .3 Install stakes at equal intervals around the tree.
- .4 Drive stakes a minimum of 900 mm into undisturbed ground.
  - .1 Ensure stakes are secure, vertical, and unsplit.
  - .2 Install stakes away from the trunk so the guy wire will form a minimum 30° angle with the ground.
  - .3 Install stakes at an angle to achieve the maximum resistance for the guy wire.

.2 Install guy wire collars above the first strong branches to prevent slipping: approximately two thirds the height for coniferous trees and one half the height for deciduous trees. The guy wire collar mounting height shall not exceed 2.5 m above grade.

.1 Guy wire collars shall be of sufficient length to encircle the tree plus 50 mm space for trunk clearance.

.3 Thread the guy wire through the collar, encircling the tree trunk, and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally about the trunk.

.4 Attach guy wire to stakes. Tension the wire and secure by installing clamps.

.1 Install wire tightener to ensure that guy wires are secure and leave room for slight movement of the tree.

.5 Install flagging tape to guy wires as indicated on the Drawings.

.6 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.5 MULCHING

.1 Ensure soil settlement has been corrected prior to mulching.

.2 There shall be a maximum of 80 mm to 100 mm of mulch placed in planting beds and tree wells.

.3 Mulch shall be pulled back a minimum of 50 mm from the shrub or tree trunk and shall not bury any branches.

.4 The entire surface area of the excavated hole shall be covered with mulch.

.5 Thoroughly water the mulch after it has been installed.

3.6 CLOSEOUT ACTIVITIES

.1 Submit maintenance reports for trees, shrubs, and other plantings to the Owner's Representative in accordance with Section 4 04 00 – Landscape Maintenance.

3.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Contractor: to be a member in good standing of the Landscape Alberta Nursery Trades Association (LANTA).

.2 Landscape Planting Supervisor: "Landscape Industry Certified" Technician as regulated by the Canadian Nursery Landscape Association (CNLA).

Part 4 Measurement and Payment

4.1 TREES

.1 Measurement and payment for the supply and planting of trees, of the types and sizes specified, will be per each tree planted.

.2 Unit price to include excavation and preparation of the tree pit, supply and placement of the topsoil, mulch, tree, tree stakes, guy wires and collars, flagging, painting of the tree stakes, maintenance from planting to acceptance, and all labour, equipment, tools, and all other incidentals necessary to perform the Work.

4.2 SHRUBS

.1 Measurement and payment for the supply and planting of shrubs, of the types and sizes specified, will be per each shrub planted.

.2 Unit price to include excavation and preparation of the planting bed, supply and placement of the topsoil, mulch, shrub, maintenance from planting to acceptance, and all labour, equipment, tools, and all other incidentals necessary to perform the Work.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

- .1 ANSI A300 (Part 1), Tree Care Standards – Pruning
- .2 ANSI A300 (Part 2), Tree Care Standards – Soil Management
- .3 ANSI A300 (Part 3), Tree Care Standards – Supplemental Support Systems

.2 Canadian Nursery Landscape Association (CNLA)

.3 International Society of Arboriculture (ISA)

1.2 DEFINITIONS

.1 Crown Cleaning: selective removal of one or more of following items: dead, dying, or diseased branches, weak branches, and water sprouts.

.2 Crown Thinning: selective removal of branches to increase light penetration, air movement, and reduce weight.

.3 Crown Raising: removal of lower tree branches to provide clearance.

.4 Crown Reduction or Crown Shaping: decreasing tree height and/or spread.

.5 Vista Pruning: selective thinning of framework limbs or specific crown areas to improve views.

.6 Crown Restoration: improving the structure, form, and appearance of trees that have been severely headed or vandalized.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Place materials defined as hazardous or toxic in designated containers and dispose of at an appropriate local facility as approved by the Owner's Representative.

.2 Dispose of unused disinfectant at an appropriate local facility as approved by the Owner's Representative.

.3 Dispose of wood materials at an appropriate composting facility as approved by the Owner's Representative.

1.4 TOOL MAINTENANCE

.1 Ensure that tools are clean and sharp throughout the pruning operation. Do not use tools that will crush or tear bark.

.2 Disinfect tools before each tree is pruned.

.3 When pruning diseased plant material, disinfect tools after each cut.

Part 2 Products

2.1 DISINFECTANT

.1 20% solution of sodium hypochlorite or 70% solution of ethyl alcohol.

Part 3 Execution

3.1 GENERAL

.1 Comply with manufacturers' written recommendations or specifications, including product technical bulletins, handling, storage, and installation instructions, and datasheets.

.2 Prune in accordance with ANSI A300 and as directed by the Owner's Representative. Where discrepancies occur between ANSI A300 and these specifications, these specifications will govern.

.3 Notify the Owner's Representative of conditions which are detrimental to the health of plant material or operations.

.4 Prune during the plant's dormant period or after its leaves have matured. Avoid pruning during leaf formation, at the time of leaf fall, or when the seasonal temperature drops below -10°C.

.5 Prune Birch and Populus sp. in late spring when they are in full leaf.

.6 Retain the natural form and shape of each plant species.

.7 Do not:

- .1 Flush cut branches.
- .2 Crush or tear bark.
- .3 Cut behind branch bark ridge.
- .4 Damage branch collars.
- .5 Damage branches which are to remain.

3.2 PRUNING

.1 Remove dead, dying, diseased, and weak growth as designated by the Owner's Representative to promote healthy growth.

.2 Remove live branches that:

- .1 Interfere with healthy development and structural strength, including branches crossing or rubbing more important branches.
- .2 Are of weak structure, including narrow crotches.
- .3 Obstruct development of more important branches.
- .4 Are broken.

.3 Remove live branches to re-establish the natural species' form, including:

.1 One or more developing leaders.

.2 Multiple growth due to previous topping.

.3 Branches extending outward from the natural form.

.4 Undesirable sucker growth.

.4 Remove loose branches, twigs, and other debris lodged in the tree.

.5 Remove vines.

.6 For branches under 50 mm in diameter:

.1 Locate the branch bark ridge and make cuts smooth and flush with the outer edge of the branch collar to ensure retention of the branch collar. Cut the target area to the bottom of the branch collar at an angle equal to that formed by a line opposite to the branch bark ridge.

.2 Make cuts on dead branches smooth and flush with the swollen callus collar. Do not injure or remove the callus collar.

.3 Do not cut lead branches unless directed by the Owner's Representative.

.7 For branches greater than 50 mm in diameter:

.1 Make the first cut on the lower side of the branch, 300 mm from the trunk, for one third the diameter of the branch.

.2 Make the second cut on the upper side of branch, 500 mm from trunk, until the branch falls off.

.3 Make the final cut adjacent to and outside the branch collar.

.8 Ensure that the trunk bark and branch collar are not damaged or torn during limb removal.

.1 Repair areas which are damaged or remove damaged areas back to the next branch collar.

.9 Remove additional growth as designated by the Owner's Representative.

3.3 ROOT GIRDLING

.1 For girdling roots one-quarter the size of the trunk diameter or larger: V-cut girdle the root halfway through at the point where the root is crossing.

.2 Remove the exposed portion of the girdling root as directed by the Owner's Representative after cleanly cutting the root flush with the grade on each side of the parent root. Do not injure the bark or parent root.

3.4 CARE OF WOUNDS

.1 Shape bark around the wound to an oblong configuration, ensuring a minimal increase in wound size. Retain the peninsulas of existing live bark.

3.5 CLEAN-UP

.1 Collect and compost pruned material when applicable.

3.6 QUALITY ASSURANCE

.1 Provide a CNLA certificate to the Owner's Representative.

.2 Field Samples: do sample pruning in a manner to enable the Owner's Representative to identify:

.1 Knowledge of the target areas, including the branch bark ridge and branch collars.

.2 The technique for the selection process and pruning used to establish the desired form and shape for each species.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include cost in related items.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 International Organization for Standardization (ISO)

.1 ISO 6935-3, Steel for the Reinforcement of Concrete – Part 3: Welded Fabric

.2 Government of Canada

.1 Standard for Pesticide Education, Training, and Certification in Canada

1.2 DEFINITIONS

.1 Mycorrhiza: a symbiotic association between fungi and the roots of plants. This symbiosis enhances plant establishment in newly landscaped and imported soils.

1.3 SUBMITTALS

.1 Make submissions in accordance with Section 1 04 00 – Submittal Procedures.

.2 Submit written reports of Maintenance undertaken during the Warranty Period to Owner's Representative, in accordance with Section 4 04 00 – Landscape Maintenance.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Dispose of unused metal and wiring materials at an appropriate metal recycling facility as approved by the Owner's Representative.

.2 Dispose of wood materials at an appropriate composting or mulching facility as approved by the Owner's Representative.

.3 Place materials designated as hazardous or toxic in designated containers and dispose of at an appropriate local facility as approved by the Owner's Representative.

.4 Dispose of unused fertilizer at an appropriate hazardous material collection site as approved by the Owner's Representative. Do not dispose of unused fertilizer into sewer systems, watercourses, or the environment.

1.5 SCHEDULING

.1 Obtain approval of the schedule from the Owner's Representative prior to beginning Work.

Part 2 Materials

2.1 TOPSOIL

.1 In accordance with Section 4 01 40 - Topsoil Placement and Finish Grading.

2.2 FERTILIZER

.1 To the Government of Canada *Fertilizers Act* and Fertilizers Regulations.

.2 The type and application rate of fertilizer shall be determined by a soil test.

2.3 ANTI-DESICCANT

.1 Wax-like emulsion.

2.4 HOARDING

.1 Wooden posts: 89 mm x 89 mm untreated wood, of sufficient length to result in a minimum height of 1,200 mm above grade.

.2 Wooden bracing: 38 mm x 89 mm untreated wood, 2,400 mm in length.

.3 Plywood: 19 mm thick untreated wood.

.4 Safety fencing: 38 mm x 38 mm orange plastic mesh, 1,200 mm high.

.5 T-bar: steel, 40 mm x 40 mm x 5 mm, length to suit.

.6 Welded wire fabric: 100 mm x 100 mm, to ISO 6935-3.

Part 3 Execution

3.1 IDENTIFICATION AND PROTECTION

.1 Together with the Owner's Representative, identify any plants and the limits of root systems to be preserved as identified on the Drawings.

.2 Protect tree roots from compaction and contamination resulting from construction.

.1 The Plant Material Protection Zone (PMPZ) shall be as identified on the Drawings.

.2 The PMPZ shall be delineated by orange safety fencing, secured with iron stakes or wooden posts spaced at a minimum of 2.4 m on centre, to the satisfaction of the Owner's Representative.

.3 The limits of the PMPZ shall be inspected and approved by the Municipality prior to commencement of Work.

.3 The safety fencing shall be maintained in good condition and shall not be removed or altered without obtaining permission from the Municipality.

.4 Tree protection measures require sign-off from the Municipality.

.5 There shall be no excavation, grubbing, filling (raising the elevation of the ground), cutting (lowering the elevation of the ground), vehicular traffic, soil compaction, storage of equipment or materials, or disposal of liquids or other substances within the PMPZ.

3.2 EXCAVATION NEAR TREES

.1 Identify the limits for construction excavation in the presence of the Owner's Representative.

.2 The Owner's Representative shall be present during excavation operations.

.3 Excavation within 2.0 m of trees:

.1 Air spading is required for excavation near critical root zones. Air spading must be done in the presence of the Owner's Representative and the Municipality.

.4 Excavation beyond 2.0 m of trees:

.1 Air spading is not required. Immediately after excavation, prune all tree roots.

.5 Prune exposed roots cleanly at the side of the trench nearest the plants to be preserved. Pruned ends shall point obliquely downwards.

.6 Place a tarpaulin over the excavation wall to prevent exposed roots from drying out.

.7 Backfill around tree roots as soon as possible, with a soil mix of 3 parts topsoil, 1 part sand, and 1 part peat moss.

.8 Erect hoarding in accordance with the applicable Standard Detail in the Municipality's *Design Servicing Standards and Development Procedures* and the Drawings.

.9 Remove hoarding only at the direction of the Owner's Representative.

3.3 PRUNING

.1 Prune in accordance with Section 4 03 10 – Tree Pruning.

.2 Prune the crown to compensate for root loss while maintaining the general form and character of the plant. Dispose of debris through composting or mulching.

3.4 APPLICATION OF ANTI-DESICCANT

.1 Apply anti-desiccant to foliage where applicable and as directed by the Owner's Representative.

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Make submissions in accordance with Section 1 04 00 – Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature, and data sheets for fertilizer and include product characteristics, performance criteria, physical size, finish, and limitations to the Owner's Representative.

.3 Maintenance Reports:

.1 To be submitted on a bi-monthly basis, unless directed otherwise by the Owner's Representative.

.2 Shall include:

.1 Owner's name.

.2 Contractor's name.

.3 Neighbourhood.

.4 Phase.

.5 Lot number(s).

.6 Date and time.

.7 Crew foreman.

.8 Current Site conditions, including the weather and moisture levels.

.9 Description of Maintenance activities.

.10 Development and condition of plant material.

.11 Preventative or corrective measures required which are outside the Contractor's responsibility.

.3 Shall be in a form acceptable to the Owner's Representative.

1.2 TESTING

.1 Perform soil tests when directed by the Owner's Representative to verify the fertilizer applications and the results of corrective measures taken to improve the soil condition as recommended in the soil test reports.

.2 Use a soil moisture meter or probe to test and measure the availability of moisture in turf and plant soil areas. Test monthly and record in the Maintenance Report.

1.3 MAINTENANCE PERIOD

.1 Unless specified otherwise, the Contractor shall be responsible for regular weekly maintenance of all landscaped areas for a period of 2 years from the date of the Construction Completion Certificate.

.2 If the Warranty responsibilities of the Contractor are extended, the maintenance period shall be extended accordingly.

1.4 SCHEDULING

.1 Submit a Watering Schedule to the Owner's Representative. The Water Schedule must be approved by the Municipality prior to starting Maintenance Work.

Part 2 Products

2.1 TOPSOIL

.1 In accordance with Section 4 01 40 - Topsoil Placement and Finish Grading.

2.2 FERTILIZER

.1 To the Government of Canada *Fertilizers Act* and Fertilizers Regulations.

.2 Trees and shrubs: 10-6-4 or similar.

.3 Seeded and sodded areas: high nitrogen fertilizer (e.g., 25-5-10).

2.3 WATER

.1 Free of impurities that would inhibit germination and growth.

.2 To be supplied by the Contractor at no cost to the Owner.

2.4 PLANTING ACCESSORIES

.1 Stakes, guy wire, tree protection, and other accessories as needed shall be in accordance with Section 4 03 00 - Trees, Shrubs, and Ground Covers.

Part 3 Execution

3.1 GENERAL

.1 The Contractor is responsible to monitor the Site and advise the Owner's Representative of conditions that might void the Contractor's Warranty responsibilities.

.2 The Contractor shall notify the Owner's Representative of the exact time the Contractor proposes to commence each application.

3.2 SPRING CLEAN-UP

.1 The Maintenance period will commence on the date of the Construction Completion Certificate for the related Work.

.2 Complete spring clean-up as soon as working conditions are favourable.

.3 Remove protective coverings and mulch used in winter protection and dispose off-site at an appropriate facility as approved by the Owner's Representative.

.4 Clean, collect, and remove sand, gravel, and debris accumulated during the winter months from Maintained turf and paved areas. Dispose off-site at an appropriate facility as approved by the Owner's Representative.

.5 Remove construction fencing, stakes, and sand containers.

.6 Rake, clean, and remove dead vegetation, leaves, debris, and snow mould from turf areas.

.7 Roll turf areas lightly where grass has lifted due to frost action.

.8 Clean planting beds and planters of debris and dead plant material and remove from Site. Loosen and lightly cultivate soil without disturbing roots and permanent plants.

3.3 TREE AND SHRUB MAINTENANCE

.1 The Contractor shall develop Maintenance guidelines for newly planted and young trees. The Maintenance guidelines must be approved by the Owner's Representative.

.2 Perform the following Maintenance operations:

- .1 Remove weeds monthly.
- .2 Replace or re-spread damaged, missing, or disturbed mulch.
- .3 For non-mulched areas, cultivate as required to keep top layer of soil friable.
- .4 Maintain watering saucers around the perimeter of planting pits. At the completion of the Maintenance period, remove saucers and blend into adjacent grade.
- .5 Supply and add soil amendments according to soil testing.
- .6 Add topsoil as necessary where settlement has occurred.
- .7 Fertilizing:
  - .1 Apply fertilizer at a rate of 18 g/25 mm of caliper per tree, from the trunk to the drip line of the tree.
  - .2 Apply fertilizer at rate of 5 kg/100 m^2 into the upper surface of planting beds.
  - .3 Apply adequate watering after fertilizing to ensure penetration into the root zone.
- .8 If required to control insects, fungus, and disease, use appropriate control methods in accordance with federal, provincial and municipal regulations.
- .9 Remove dead and broken branches from plant material.
- .10 Prune trees in accordance with Section 4 03 10 - Tree Pruning.
- .11 Keep stakes, guy wires, and tree protection measures in proper repair and adjustment. Remove stakes and accessories prior to Final Acceptance.
- .12 Remove and replace dead plants and plants not in a healthy growing condition. Make replacements in the same manner as specified for the original plantings, in accordance with Section 4 03 00 – Trees, Shrubs, and Ground Covers.

.3 All shrub and tree beds shall be maintained weed free, with a well-defined edge.

.4 When herbicides or pesticides are used, they shall be applied in accordance with the manufacturers' recommendations and shall be applied by a licensed pesticide applicator.

.1 Damage resulting from the Contractor's use of herbicides or pesticides shall be repaired at the Contractor's expense.

.5 All plant material shall be watered individually.

.6 Trees shall be watered, to the point of saturation, at a rate of 1.2 L per mm of caliper per week. Do not overwater trees.

.1 Trees may require more than one watering per week.

.7 After planting, limit pruning to the removal of dead, broken, and/or diseased branches.

3.4 SODDED AND SEEDED AREA MAINTENANCE

.1 Perform the following Maintenance operations:

.1 Water sodded areas at weekly intervals to obtain optimum soil moisture conditions to depth of 100 mm.

.2 Repair and reseed or resod dead or bare spots to the satisfaction of the Owner's Representative.

.3 Repair rutting and areas of settlement to the satisfaction of the Owner's Representative.

.4 Repaired areas must be cut at least 3 times and seed must be fully established before the area will be accepted.

.5 Cut grass and remove clippings at regular intervals, as directed by the Owner's Representative, to:

.1 Reflect seed mix.

.2 Maintain a minimum height of 60 mm and a maximum height of 75 mm.

.3 Ensure that no more than one third of blade height is removed in a single cut.

.6 Fertilizing:

.1 Apply fertilizer three times per season to establish vigorous growth in accordance with the manufacturer's recommendations.

.2 Use only mechanical equipment, checking the calibration of the spreader to ensure the specified rate is achieved.

.3 Spread 50% of the fertilizer in one direction, and 50% at right angles.

.4 Water immediately after fertilizing, according to the manufacturer's recommendations. Obtain moisture penetration to a minimum depth of 50 mm.

.7 Eliminate weeds by mechanical or chemical means to an extent acceptable to the Owner's Representative.

.1 If chemical means are used, comply with all federal, provincial, and municipal regulations.

3.5 AUTUMN PREPARATION

.1 Deep water trees and shrubs prior to freeze-up. Continue deep watering plants where unseasonably warm/dry temperatures are experienced.

.2 Protect plants from rodent, animal, and sun damage through the use of appropriate materials. Use chemical repellent, rodent wire mesh, plastic perforated strips, burlap, or other approved materials.

3.6 CLOSEOUT

.1 Submit Maintenance reports for trees, shrubs, and other plantings to the Owner's Representative in accordance with Section 1 11 00 – Closeout Procedures.

.2 Maintenance reports must include records of watering.

3.7 QUALITY ASSURANCE

.1 Qualifications:

.1 Landscape Maintenance Supervisor: "Landscape Industry Certified" Technician as regulated by the Canadian Nursery Landscape Association (CNLA).

Part 4 Measurement and Payment

.1 Separate payment will not be made for Work specified in this Section. Include costs in related items.

END OF SECTION