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## BIDDING REQUIREMENTS

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WTR-03	WATER – 150mm PROFILE
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**Part 1            General**

**1.1                WORK COVERED BY CONTRACT DOCUMENTS**

- .1        Work of this Contract comprises general construction of the 4x4 track located at the RCMP training facility in Regina Saskatchewan and new waterline.

**1.2                CONTRACT METHOD**

- .1        Construct Work under stipulated price contract.
- .2        An estimate of quantities is provided for reference only. Contractor is required to attend the site meeting, to review the site and evaluate the work that is required to complete the construction to the design specifications independent of the quantities provided. Unit rates are to be provided so that any changes to the scope can be valued and an appropriate Change Order can be prepared.

**1.3                WORK BY OTHERS**

- .1        Co-operate with other Contractors in carrying out their respective works and carry out instructions from Departmental Representative.
- .2        Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.

**1.4                WORK SEQUENCE**

- .1        Construct Work in stages to accommodate Owner's continued use of site during construction.
- .2        Co-ordinate Progress Schedule during construction.
- .3        Maintain fire access/control.

**1.5                CONTRACTOR USE OF SITE**

- .1        The site is a secure restricted access area. All contractor staff and subcontractors will require appropriate security clearance.
- .2        Owner supplied escort staff may be required while working on site.
- .3        Co-ordinate use of premises under direction of Departmental Representative.
- .4        Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5        Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .6        At completion of operations condition of existing work: equal to or better than that which existed before new work started.

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**1.6 OWNER OCCUPANCY**

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

**1.7 OWNER FURNISHED ITEMS**

- .1 Owner has supplied common fill material onsite.
- .2 Contractor is responsible for all effort to utilize the material into the project that will include, loading, hauling, placing and compacting the material.
- .3 Notify the Departmental Representative if common fill material is insufficient.

**1.8 EXISTING SERVICES**

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to operations.
- .3 Provide alternative routes for personnel and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .7 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .8 Record locations of maintained, re-routed and abandoned service lines.
- .9 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.9 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Reviewed Shop Drawings.
  - .5 List of Outstanding Shop Drawings.
  - .6 Change Orders.

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- .7 Other Modifications to Contract.
  - .8 Field Test Reports.
  - .9 Copy of Approved Work Schedule.
  - .10 Health and Safety Plan and Other Safety Related Documents.
  - .11 Other documents as specified
- .2

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

## 4X4 Course

Item	Description	Quant.	Units	Unit Price	Amount
<b>1</b>	<b>Sitework</b>				
	Clearing existing vegetation and disposal	33,800	m2		
	Extra over for tree removal	1	Allow	\$1,200	\$1,200
	Stripping Topsoil	10,200	m3		
	Bulk Excavation	3,878	m3		
	Extra Over for rock Removal	1	Allow	\$9,000	\$9,000
	Minor Dewatering	1	Allow	\$10,000	\$10,000
	Sub-Grade Preparation	4,280	m2		
	Backfill with imported material	63,000	m3		
	Geotextiles and/or geogrid soil stabilization (allowance)	33,800	m2		
	Site Rough Grading	51,610	m2		
	Final Grading & Compaction to main roadway	46,960	m2		
	Final Grading & compaction to sediment pond (assumed liner not required)	2,575	m2		
	Concrete Roadway c/w traffic topping	128	m2		
	Asphalt vehicle staging area	340	m2		
	Replace existing topsoil & hydro seed	33,550	m2		
	Tree, shrubs and ground cover planting (allowance)	32,800	m2		
	Traffic signage (allowance)	1	Allow	\$9,000	\$9,000
<b>2</b>	<b>Course Elements</b>				
	Concrete "Mud" Pad	35	m2		
	concrete 200mm thick	7	m3		
	rebar	300	kg		
	formwork	4	m2		
	screed/cure/finish	35	m2		
	extra for grooves	18	m2		
	isolation/control joints	35	lm		
	gravel base, 200mm thick	7	m3		
	e/O for traffic topping	35	m2		
	Angled Berms, 45m2 ea, measured flat, 6 No. average depth 900mm	243	m3		
	Pea Gravel Pit	185	m2		
	pea gravel, loose compaction 5-10mm, 500mm thick	93	m3		
	concrete 200mm thick	37	m3		
	rebar	1,555	kg		
	formwork	9	m2		
	screed/cure/finish	185	m2		
	isolation/control joints	35	m2		
	gravel base, 200mm thick	37	m3		
	concrete lock block, 750 x 750 x 1500mm	44	no.		
	Static Winch Hill	4	no.		
	Tree Slalom	38	no.		
	Delineator bollard, 60 mm dia. X 1200mm, c/w reactive spring	38	no.		
	driveable base, 56mmx457mm	38	no.		

Item	Description	Quant.	Units	Unit Price	Amount
<b>2</b>	<b>Course Elements (Continued)</b>				
	Creek Crossing 4 No.	88	m2		
	river rock, 50-300mm	39	m3		
	compacted clay base	49	m3		
	Parallel Telephone Poles, 375mm dia x 4550mm wood pole	9	no.		
	Parallel Offset Railroad Ties, 150 x 2600mm	12	no.		
	Water Ford				
	large river rock	54	m3		
	concrete, 200mm thick	36	m3		
	rebar	1,500	kg		
	formwork	8	m2		
	screed/cure/finish	180	m2		
	isolation/control joints	180	m2		
	gravel base, 200mm thick	36	m3		
	concrete curb, 300mm	13	m		
	concrete lock block, 750 x 750 x 1500mm	30	no.		
	Staggered Railroad Ties, 150 x 2600mm	18	no.		
	Texas Gate	2			
	texas gate	32	m2		
	concrete pile, 150 x 450 mm	12	no.		
	Multiple Berms, 24m2 each, measured flat, 9 no. average depth 500mm	108	m3		
	Rail Crossing				
	segment rail track, 20m	4	no.		
	rail ties, 150 x 250mm	19	no.		
	compacted gravel base	27	m3		
	Ditch Crossing	1	sum		

Item	Description	Quant.	Units	Unit Price	Amount
<b>3</b>	<b>Water Line</b>				
	PVC 150	300	m		
	PVC 50	100	m		
	Valve 250	2	each		
	Valve 150	2	each		
	Valve 50	1	each		
	Hose Bib	1	each		
	Hydrant 150	1	each		
	Tee 250 x 150	1	each		
	Tee 150 x 50	1	each		
	Tie to existing	2	each		
	Testing and disinfection	400	m		



<b>4</b>	<b>Sub-total</b>		
	Contingency	10%	
	Escalation Allowance		Excluded
	Construction Allowance		Excluded
<b>5</b>	<b>Total Construction Estimate Including Contingencies</b>		
	GST		Excluded

**Part 1            General**

**1.1            ACCESS AND EGRESS**

- .1      Design, construct and maintain temporary "access to" and "egress from" work areas, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

**1.2            USE OF SITE AND FACILITIES**

- .1      Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2      Maintain existing services and provide for personnel and vehicle access.
- .3      Where security is reduced by work provide temporary means to maintain security.
- .4      Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .5      Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

**1.3            EXISTING SERVICES**

- .1      Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2      Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum. Carry out interruptions after normal working hours of occupants, preferably on weekends.
- .3      Provide for personnel and vehicular traffic.
- .4      Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**1.4            SPECIAL REQUIREMENTS**

- .1      Submit schedule in accordance with Section 01 32 00 - Construction Progress Documentation.
- .2      Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .3      Keep within limits of work and avenues of ingress and egress.
- .4      Ingress and egress of Contractor vehicles at site is limited to designated access gate.

**1.5            SECURITY**

- .1      Security clearances:
  - .1      Personnel employed on this project will be subject to security check.

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- .2 Obtain CPIC clearance, for each individual who will require Site Access, and Facility Access will be with escort.
  - .3 Personnel will be checked daily at start of work shift and provided with pass which must be worn at all times. Pass must be returned at end of work shift and personnel checked out. Personnel will have to leave photo ID when picking up there pass.
  - .4 Contractor's personnel will require CPIC RCMP initiated security screening in order to complete Work in premises and on site.
- .2 Security escort:
- .1 Personnel employed on this project must be escorted when executing work in non-public areas during normal working hours. Personnel must be escorted in all areas after normal working hours.
  - .2 Submit an escort request to Departmental Representative at least 14 days before service is needed. For requests submitted within time noted above, costs of security escort will be paid for by Departmental Representative. Cost incurred by late request will be Contractor's responsibility.
  - .3 Any escort request may be cancelled free of charge if notification of cancellation is given at least 4 hours before scheduled time of escort. Cost incurred by late request will be Contractor's responsibility.
  - .4 Calculation of costs will be based on average hourly rate of security officer for minimum of 8 hours per day for late service request and of 4 hours for late cancellations

**1.6 SMOKING ENVIRONMENT**

- .1 Comply with smoking restrictions. Smoking is not permitted.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used

**END OF SECTION**

**Part 1            General**

**1.1                APPOINTMENT AND PAYMENT**

- .1      Departmental Representative will appoint and pay for services of testing laboratory except follows:
  - .1          Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
  - .2          Inspection and testing performed exclusively for Contractor's convenience.
  - .3          Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
  - .4          Mill tests and certificates of compliance.
  - .5          Tests specified to be carried out by Contractor under supervision of Departmental Representative.
- .2      Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Departmental Representative to verify acceptability of corrected work.

**1.2                CONTRACTOR'S RESPONSIBILITIES**

- .1      Provide labour, equipment and facilities to:
  - .1          Provide access to Work for inspection and testing.
  - .2          Facilitate inspections and tests.
  - .3          Make good Work disturbed by inspection and test.
  - .4          Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2      Notify Departmental Representative 48 hours minimum sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3      Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4      Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Departmental Representative.

**Part 2            Products**

**2.1                NOT USED**

- .1      Not Used.

**Part 3            Execution**

**3.1                NOT USED**

- .1      Not Used.

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**END OF SECTION**

**Part 1            General**

**1.1                ADMINISTRATIVE**

- .1      Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2      Prepare agenda for meetings.
- .3      Distribute written notice of each meeting four (4) days in advance of meeting date to Departmental Representative.
- .4      Provide physical space and make arrangements for meetings.
- .5      Preside at meetings.
- .6      Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7      Reproduce and distribute copies of minutes within three (3) days after meetings and transmit to meeting participants, affected parties not in attendance and Departmental Representative.
- .8      Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents

**1.2                PRECONSTRUCTION MEETING**

- .1      Within 10 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2      Departmental Representative, Contractor, major Subcontractors, field inspectors and Owner Representatives will be in attendance.
- .3      Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4      Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5      Agenda to include:
  - .1      Appointment of official representative of participants in the Work.
  - .2      Schedule of Work: in accordance with Section 01 32 00 - Construction Progress Documentation
  - .3      Schedule of submission of shop drawings, samples. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .4      Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.
  - .5      Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.
  - .6      Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .7      Owner provided products.

- .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .9 Monthly progress claims, administrative procedures, photographs, hold backs.
- .10 Appointment of inspection and testing agencies or firms.
- .11 Insurances, transcript of policies.

**1.3 PROGRESS MEETINGS**

- .1 During course of Work, schedule progress meetings monthly.
- .2 Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.
- .3 Notify parties minimum 5 days prior to meetings.
- .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting.
- .5 Agenda to include the following
  - .1 Review, approval of minutes of previous meeting.
  - .2 Review of Work progress since previous meeting.
  - .3 Field observations, problems, conflicts.
  - .4 Problems which impede construction schedule.
  - .5 Review of off-site fabrication delivery schedules.
  - .6 Corrective measures and procedures to regain projected schedule.
  - .7 Revision to construction schedule.
  - .8 Progress schedule, during succeeding work period.
  - .9 Review submittal schedules: expedite as required.
  - .10 Maintenance of quality standards.
  - .11 Review proposed changes for affect on construction schedule and on completion date.
  - .12 Other business

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used

**END OF SECTION**

**Part 1            General**

**1.1            SECTION INCLUDES**

- .1      Schedule, form, content.
- .2      Staged construction.
- .3      Scheduled revisions.
- .4      Critical path scheduling.

**1.2            SCHEDULES REQUIRED**

- .1      Submit schedules as follows:
  - .1          Construction Progress Schedule.
  - .2          Submittal Schedule for Shop Drawings and Product Data.
  - .3          Submittal Schedule for Samples.
  - .4          Submittal Schedule for timeliness of Owner furnished Products.
  - .5          Product Delivery Schedule.
  - .6          Cash Allowance Schedule for purchasing Products.
  - .7          Shutdown or closure activity.

**1.3            FORMAT**

- .1      Prepare schedule in form of a horizontal bar chart.
- .2      Provide a separate bar for each major item of work or operation.
- .3      Split horizontally for projected and actual performance.
- .4      Provide horizontal time scale identifying last work day of each week.
- .5      Format for listings: chronological order of start of each item of work.
- .6      Identification of listings: Systems description.

**1.4            SUBMISSION**

- .1      Submit initial format of schedules within 10 days after Award of Contract.
- .2      Submit schedules in electronic format, forward through e-mail as pdf files.
- .3      Engineer will review schedule and return review copy within 10 days after receipt.
- .4      Resubmit finalized schedule within 7 days after return of review copy.
- .5      Submit revised progress schedule with each application for payment.
- .6      Distribute copies of revised schedule to Departmental Representative and all subcontractors:
- .7      Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.



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**1.5 CRITICAL PATH SCHEDULING**

- .1 Include complete sequence of construction activities.
- .2 Include dates for commencement and completion of each major element of construction.
- .3 Show projected percentage of completion of each item as of first day of month.
- .4 Indicate progress of each activity to date of submission schedule.
- .5 Show changes occurring since previous submission of schedule:
  - .1 Major changes in scope.
  - .2 Activities modified since previous submission.
  - .3 Revised projections of progress and completion.
  - .4 Other identifiable changes.
- .6 Provide a narrative report to define:
  - .1 Problem areas, anticipated delays, and impact on schedule.
  - .2 Corrective action recommended and its effect.
  - .3 Effect of changes on schedules of other prime contractors.

**1.6 PROGRESS PHOTOGRAPHS**

- .1 Submit electronic copy of colour digital photography in jpg format, fine resolution.
- .2 Identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: two. Locations of viewpoints determined by Departmental Representative.
- .4 Frequency: monthly with progress statement and as directed by Departmental Representative.

**1.7 SUBMITTALS SCHEDULE**

- .1 Include schedule for submitting shop drawings, product data, and samples.
- .2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.

**END OF SECTION**

**Part 1 General**

**1.1 ADMINISTRATIVE**

- .1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10 Keep one reviewed copy of each submission on site.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow 14 days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

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- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
  - .7 Accompany submissions with transmittal letter, in duplicate, containing:
    - .1 Date.
    - .2 Project title and number.
    - .3 Contractor's name and address.
    - .4 Identification and quantity of each shop drawing, product data and sample.
    - .5 Other pertinent data.
  - .8 Submissions include:
    - .1 Date and revision dates.
    - .2 Project title and number.
    - .3 Name and address of:
      - .1 Subcontractor.
      - .2 Supplier.
      - .3 Manufacturer.
    - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
    - .5 Details of appropriate portions of Work as applicable:
      - .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.
  - .9 After Departmental Representative's review, distribute copies.
  - .10 Submit electronic copy and 4 prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
  - .11 Submit electronic copy and 4 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
  - .12 Submit electronic and 4 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

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- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
    - .2 Testing must have been within 3 years of date of contract award for project.
  - .13 Submit electronic copy and 4 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
    - .2 Certificates must be dated after award of project contract complete with project name.
  - .14 Submit electronic and 4 copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
    - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
  - .15 Submit electronic and 4 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
  - .17 Submit electronic and 4 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
  - .18 Delete information not applicable to project.
  - .19 Supplement standard information to provide details applicable to project.
  - .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
  - .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
    - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
    - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

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**1.3 SAMPLES**

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.
- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

**1.4 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of digital photography in jpg format, monthly with progress statement as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 2 locations.
  - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly as directed by Departmental Representative.

**1.5 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Saskatchewan
  - .1 Occupational Health and Safety Act, 1993, S.S. - Updated 2012.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
  - .1 Results of site specific safety hazard assessment.
  - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with and Section 02 81 01 - Hazardous Materials.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 7 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

**1.3 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.
- .3 Work zone locations include:

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- .1 Construction area within the RCMP Track 3 and any areas where material, equipment, stockpiles are located.
  - .2 Construction and hauling roads.
  - .3 Any areas where material, equipment and/or workers are present.
  - .4 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.
- 1.4 SAFETY ASSESSMENT**
- .1 Perform site specific safety hazard assessment related to project.
- 1.5 MEETINGS**
- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.
- 1.6 REGULATORY REQUIREMENTS**
- .1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.
- 1.7 GENERAL REQUIREMENTS**
- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
  - .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.
- 1.8 RESPONSIBILITY**
- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- 1.9 COMPLIANCE REQUIREMENTS**
- .1 Comply with Occupational Health and Safety Regulations, 1996.
  - .2 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C. latest.
  - .3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
- 1.10 UNFORSEEN HAZARDS**
- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.
  - .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Safety Officer and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

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**1.11 HEALTH AND SAFETY CO-ORDINATOR**

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have site-related working experience specific to activities associated with Earth work.
  - .2 Have working knowledge of occupational safety and health regulations.
  - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
  - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
  - .5 Be on site during execution of Work and report directly to site supervisor.

**1.12 POSTING OF DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Departmental Representative.

**1.13 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

**1.14 BLASTING**

- .1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.

**1.15 POWDER ACTUATED DEVICES**

- .1 Use powder actuated devices only after receipt of written permission from Departmental Representative.

**1.16 WORK STOPPAGE**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.



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**Part 3            Execution**

**3.1                NOT USED**

.1            Not used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES AND CODES**

- .1        Perform Work in accordance with latest edition (2015) of National Building Code of Canada (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2        Meet or exceed requirements of:
  - .1            Contract documents.
  - .2            Specified standards, codes and referenced documents.

**1.2                BUILDING SMOKING ENVIRONMENT**

- .1        Comply with smoking restrictions and municipal by-laws.

**Part 2            Products**

**2.1                NOT USED**

- .1        Not Used.

**Part 3            Execution**

**3.1                NOT USED**

- .1        Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                INSPECTION**

- .1      Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2      Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative instructions, or law of Place of Work.
- .3      If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .4      Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, Departmental Representative shall pay cost of examination and replacement.

**1.2                INDEPENDENT INSPECTION AGENCIES**

- .1      Independent Inspection/Testing Agencies will be engaged by Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by Departmental Representative.
- .2      Provide equipment required for executing inspection and testing by appointed agencies.
- .3      Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4      If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

**1.3                ACCESS TO WORK**

- .1      Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2      Co-operate to provide reasonable facilities for such access.

**1.4                PROCEDURES**

- .1      Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.
- .2      Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.
- .3      Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

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**1.5 REJECTED WORK**

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

**1.6 REPORTS**

- .1 Submit 4 copies of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested.

**1.7 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.
- .2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

**1.8 MILL TESTS**

- .1 Submit mill test certificates as required of specification Sections.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CGSB 1.59, Alkyd Exterior Gloss Enamel.
  - .2 CAN/CGSB 1.189, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
  - .1 CSA-O121, Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

**1.2 INSTALLATION AND REMOVAL**

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

**1.3 HOARDING**

- .1 Erect temporary site enclosure using new 1.2 m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4 m on centre. Maintain fence in good repair.
- .2 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

**1.4 GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations.
- .2 Provide as required by governing authorities.

**1.5 ACCESS TO SITE**

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

**1.6 FIRE ROUTES**

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

**1.7 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

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**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .2 If there is question as to whether products or systems are in conformance with applicable standards, Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .3 Cost for such testing will be born by Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

**1.2 QUALITY**

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

**1.3 AVAILABILITY**

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

#### **1.4 STORAGE, HANDLING AND PROTECTION**

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

#### **1.5 TRANSPORTATION**

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by Owner will be paid for by Departmental Representative. Unload, handle and store such products.

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

#### **1.7 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.



- .2 Do not employ anyone unskilled in their required duties. Departmental Representative reserves right to require dismissal from site, workers deemed incompetent or careless.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

#### **1.8 CO-ORDINATION**

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

#### **1.9 CONCEALMENT**

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

#### **1.10 REMEDIAL WORK**

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

#### **1.11 LOCATION OF FIXTURES**

- .1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform Departmental Representative of conflicting installation. Install as directed.

#### **1.12 FASTENINGS**

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

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**1.13 FASTENINGS - EQUIPMENT**

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

**1.14 PROTECTION OF WORK IN PROGRESS**

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

**1.15 EXISTING UTILITIES**

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 PROJECT CLEANLINESS**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Dispose of waste materials and debris as directed by Departmental Representative.
- .5 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

**1.2 FINAL CLEANING**

- .1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris including that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove dirt and other disfiguration from exterior surfaces.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

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**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT AND PAYMENT**

- .1 Measurement Procedures.
  - .1 Measure removal of asphaltic concrete pavement in square metres.
  - .2 Measure removal of base and sub-base pavement materials in square metres.
  - .3 Payment for salvage, stockpiling, backfilling and restoration will be included in lump sum bid price.

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Demolition: rapid destruction of building following removal of hazardous materials.

**1.3 ADMINISTRATIVE REQUIREMENTS**

- .1 Site Meetings.
  - .1 Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.
  - .2 Hold project meetings every week.
  - .3 Ensure key personnel and project manager attend.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province Saskatchewan, Canada.
  - .2 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
  - .3 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Storage and Protection.
  - .1 Protect in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
  - .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative and at no cost to Departmental Representative.
  - .3 Remove and store materials to be salvaged, in manner to prevent damage.

- .4 Store and protect in accordance with requirements for maximum preservation of material.
- .5 Handle salvaged materials as new materials.

## **1.6 SITE CONDITIONS**

- .1 Site Environmental Requirements.
  - .1 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
  - .2 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
    - .1 Ensure proper disposal procedures are maintained throughout the project.
  - .3 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
  - .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities and as directed by Departmental Representative.
  - .5 Protect trees, plants and foliage on site and adjacent properties where indicated.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect and Cap Mechanical Services.
  - .1 Other Underground Services: remove and dispose of as directed by Departmental Representative.

### **3.2 REMOVAL OF HAZARDOUS WASTES**

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

### **3.3 REMOVAL OPERATIONS**

- .1 Remove items as indicated.
- .2 Do not disturb items designated to remain in place.
- .3 Removal of pavements, curbs and gutters:
  - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental 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 for subsequent incorporation into hot mix asphalt concrete paving.
- .5 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.
- .6 Decommission water wells and monitoring wells in accordance with regulations.
- .7 Stockpile topsoil for final grading and landscaping:
  - .1 Provide erosion control and seeding if not immediately used.
- .8 Disposal of Material:
  - .1 Dispose of materials not designated for salvage or reuse on site as instructed by Departmental Representative.
- .9 Backfill:
  - .1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### **3.4 STOCKPILING**

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

**3.5 REMOVAL FROM SITE**

- .1 Remove stockpiled material as directed by Departmental Representative, when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

**3.6 RESTORATION**

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

**3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Remove debris, trim surfaces and leave work site clean, upon completion of Work
  - .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.8 PROTECTION**

- .1 Repair damage to adjacent materials or property caused by selective site demolition.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 Definitions:
  - .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
  - .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
  - .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .2 Reference Standards:
  - .1 Canadian Environmental Protection Act, 1999 (CEPA 1999)
    - .1 Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149).
  - .2 Department of Justice Canada (Jus)
    - .1 Transportation of Dangerous Goods Act, 1992 (TDG Act), (c. 34).
    - .2 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2001-286).
  - .3 Green Seal Environmental Standards (GS)
    - .1 GS-11, Paints and Coatings.
    - .2 GS-36, Commercial Adhesives.
  - .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
  - .5 National Research Council Canada Institute for Research in Construction (NRC-IRC)
    - .1 National Fire Code of Canada.
- .3 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113, Architectural Coatings.
  - .2 SCAQMD Rule 1168], Adhesive and Sealant Applications.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
- .3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
- .3 Sustainable Design Submittals:
  - .1 Low-Emitting Materials: submit listing of adhesives and sealants used in building, comply with VOC and chemical component limits or restrictions requirements.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
  - .1 When exporting hazardous waste to another country, ensure compliance with Export and Import of Hazardous Waste and Hazardous Recyclable Materials Regulations.
- .4 Storage and Handling Requirements:
  - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
  - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
  - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
  - .4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.
    - .1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.
    - .2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the Departmental Representative.
  - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
  - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
  - .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.

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- .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
  - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
  - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
    - .1 Store hazardous materials and wastes in closed and sealed containers.
    - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
    - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
    - .4 Segregate incompatible materials and wastes.
    - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
    - .6 Store hazardous materials and wastes in secure storage area with controlled access.
    - .7 Maintain clear egress from storage area.
    - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
    - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
    - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
    - .11 When hazardous waste is generated on site:
      - .1 Co-ordinate transportation and disposal with Departmental Representative.
      - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
      - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
      - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
      - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.
      - .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
      - .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
      - .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
      - .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate

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provincial authority. Take reasonable measures to control release.

- .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Description:
  - .1 Bring on site only quantities hazardous material required to perform Work.
  - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.
  - .3 Sustainability Characteristics:
    - .1 Adhesives and Sealants in accordance with Section 07 92 00 - Joint Sealants.

## **Part 3 Execution**

### **3.1 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1 Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CSA-O86-01, Engineering Design in Wood.
  - .3 CSA O121, Douglas Fir Plywood.
  - .4 CSA S269.1, Falsework for Construction Purposes.
  - .5 CAN/CSA-S269.3, Concrete Formwork.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121 and CAN/CSA-O86.1.
- .2 Form ties:
  - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
  - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .5 Falsework materials: to CSA-S269.1.
- .6 Sealant: to Section 07 92 00 - Joint Sealants.

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**Part 3            Execution**

**3.1                FABRICATION AND ERECTION**

- .1      Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2      Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3      Fabricate and erect falsework in accordance with CSA S269.1.
- .4      Do not place shores and mud sills on frozen ground.
- .5      Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .6      Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .7      Align form joints and make watertight.
  - .1          Keep form joints to minimum.
- .8      Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9      Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .10     Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

**3.2                REMOVAL AND RESHORING**

- .1      Leave formwork in place for following minimum periods of time after placing concrete.
  - .1          1days for footings and abutments.
- .2      Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

**Part 1 General**

**1.1 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 No measurement will be made under this Section.
    - .1 Include reinforcement costs in items of concrete work in Section 03 30 00 - Cast-In-Place Concrete.

**1.2 REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 SP-66, ACI Detailing Manual 2004.
- .2 ASTM International
  - .1 ASTM A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - .2 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
  - .3 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
  - .4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .3 CSA International
  - .1 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CSA-A23.3, Design of Concrete Structures.
  - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
  - .4 CSA-G40.21, Structural Quality Steel.
  - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
  - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.
    - .1 Indicate placing of reinforcement and:
      - .1 Bar bending details.

- .2 Lists.
- .3 Quantities of reinforcement.
- .4 Sizes, spacings, locations of reinforcement and mechanical splices.

.2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Engineer.
- .2 Reinforcing steel: billet steel, grade 300, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A82/A82M.
- .6 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .7 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .8 Mechanical splices: subject to approval of Engineer.
- .9 Plain round bars: to CSA-G40.20/G40.21.

#### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Engineer's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Engineer, weld reinforcement in accordance with CSA W186.

#### **2.3 SOURCE QUALITY CONTROL**

- .1 Provide Engineer with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to beginning reinforcing work.



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- .2 Upon request inform Engineer of proposed source of material to be supplied.

**Part 3 Execution**

**3.1 FIELD BENDING**

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

**3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
- .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
- .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.
- .5 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

**3.3 FIELD TOUCH-UP**

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcing steel with compatible finish to provide continuous coating.

**3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 Measurement Procedures: in accordance with Section 01 29 00 - Payment Procedures.
  - .2 Cast-in-place concrete will not be measured but will be paid for as an included lump sum bid price item.
  - .3 Supply and installation of anchor bolts, nuts and washers and bolt grouting will not be measured but considered incidental to work.

**1.2 REFERENCES**

- .1 Abbreviations and Acronyms:
  - .1 Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
    - .1 Type GU, GUb and GUL - General use cement.
    - .2 Type MS and MSb - 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 and HSb - High sulphate-resistant cement.
  - .2 Fly ash:
    - .1 Type F - with CaO content less than 15%.
    - .2 Type CI - with CaO content ranging from 15 to 20%.
    - .3 Type CH - with CaO greater than 20%.
  - .3 GGBFS - Ground, granulated blast-furnace slag.
- .2 Reference Standards:
  - .1 ASTM International
    - .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 C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
    - .5 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
    - .6 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

- .7 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .8 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-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
  - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA International
  - .1 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
  - .3 CSA A3000], Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing results for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.

### **1.4 QUALITY ASSURANCE**

- .1 Provide Engineer and Departmental Representative, minimum 2 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .2 Minimum 2 weeks prior to starting concrete work, provide proposed quality control procedures for review by Engineer on following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.
  - .6 Formwork removal.
  - .7 Joints.

### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.

- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

## **Part 2 Products**

### **2.1 PERFORMANCE CRITERIA**

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Departmental Representative and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

### **2.2 MATERIALS**

- .1 Portland Cement: to CSA A3001, Type HS.
- .2 Water: to CSA A23.1.
- .3 Aggregates: to CSA A23.1/A23.2.

### **2.3 MIXES**

- .1 Concrete to meet performance criteria to CSA A23.1/A23.2.
  - .1 Ensure materials used in concrete mix have been submitted for testing and meet requirements of CSA A23.1.
  - .2 Provide concrete mix to meet following hard state requirements:
    - .1 Compressive strength at 28 days: 30 MPa minimum.
    - .2 Slump of 80 mm max.
    - .3 Air entrainment 5-8.
  - .3 Chemical admixtures: to ASTM 494. Engineer to approve all admixtures
  - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
  - .5 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .2 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Protect previous Work from staining.
- .5 Do not place load upon new concrete until authorized by Engineer.

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### 3.2 INSTALLATION/APPLICATION

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Anchor bolts:
  - .1 Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
  - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
  - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
  - .4 Set bolts and fill holes with epoxy grout.
  - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .3 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .4 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Use procedures as reviewed by Engineer or those noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete. Provide written declaration that compounds used are compatible.
  - .4 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

### 3.3 FIELD QUALITY CONTROL

- .1 Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7 and 28 days.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.

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- .4 Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
  - .5 Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
  - .6 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

**3.4 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
  - .2 CAN/CGSB-19.13, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .3 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
  - .4 CAN/CGSB-19.17, One-Component Acrylic Emulsion Base Sealing Compound.
  - .5 CAN/CGSB-19.24, Multi-component, Chemical Curing Sealing Compound.
- .3 General Services Administration (GSA) - Federal Specifications (FS)
  - .1 FS-SS-S-200, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168, Adhesives and Sealants Applications.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Manufacturer's product to describe:
    - .1 Caulking compound.
    - .2 Primers.
    - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
  - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.
- .3 Samples:
  - .1 Submit 2 samples of each type of material and colour.

- .2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.4 Manufacturer's Instructions:

- .1 Submit instructions to include installation instructions for each product used.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

**1.5 SITE CONDITIONS**

- .1 Ambient Conditions:
  - .1 Proceed with installation of joint sealants only when:
    - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
    - .2 Joint substrates are dry.
    - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
  - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
  - .1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

**1.6 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.



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**Part 2 Products**

**2.1 SEALANT MATERIALS**

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .3 Where sealants are qualified with primers use only these primers.

**2.2 SEALANT MATERIAL DESIGNATIONS**

- .1 Silicones one part: to CAN/CGSB-19.13.
- .2 Acrylics one part: to CGSB 19-GP-5M.
- .3 Acrylic latex one part: to CAN/CGSB-19.17.
- .4 Butyl: to CGSB 19-GP-14M.

**2.3 SEALANT SELECTION**

- .1 Expansion and control joints in exterior surfaces of poured-in-place concrete walls: sealant type: Mastic.

**2.4 JOINT CLEANER**

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.
- .2 Primer: in accordance with sealant manufacturer's written recommendations.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 SURFACE PREPARATION**

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

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- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
  - .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
  - .4 Ensure joint surfaces are dry and frost free.
  - .5 Prepare surfaces in accordance with manufacturer's directions.

### **3.3 PRIMING**

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

### **3.4 BACKUP MATERIAL**

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

### **3.5 MIXING**

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

### **3.6 APPLICATION**

- .1 Sealant:
  - .1 Apply sealant in accordance with manufacturer's written instructions.
  - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3 Apply sealant in continuous beads.
  - .4 Apply sealant using gun with proper size nozzle.
  - .5 Use sufficient pressure to fill voids and joints solid.
  - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
  - .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.

### **3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.

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- .2 Clean adjacent surfaces immediately.
  - .3 Remove excess and droppings, using recommended cleaners as work progresses.
  - .4 Remove masking tape after initial set of sealant.
  - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.8 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by joint sealants installation.

**END OF SECTION**

**Part 1 General**

**1.1 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement and Payment:
  - .1 Measurement for supply, installation and painting of signboards will be included in the lump sum price.
  - .2 Measurement for supply, installation and painting of sign supports will be included in the lump sum price.
  - .3 Measurement for supply, installation and painting of signboards, sign supports will be included in the lump sum price.

**1.2 REFERENCES**

- .1 American Association of State Highway and Transportation Officials (AASHTO)
  - .1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, (5th Edition).
- .2 ASTM International
  - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.
  - .3 ASTM B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - .4 ASTM B210M, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes [Metric].
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 62-GP-11M, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing and Amendment.
- .4 CSA International
  - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA O80 Series, Wood Preservation.
  - .3 CSA O121, Douglas Fir Plywood.
  - .4 CSA W47.2, Certification of Companies for Fusion Welding of Aluminum.
  - .5 CAN/CSA-Z809, Sustainable Forest Management.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.

- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan, Canada.
- .4 Sustainable Design Submittals:
  - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.
  - .2 Low-Emitting Materials:
    - .1 Submit listing of adhesives and sealants, and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 DESIGN CRITERIA**

- .1 Sign supports to be capable of withstanding the combination of following loads:
  - .1 Wind loads in any direction on signboards and on sign supports.
  - .2 Dead load of signboards and sign supports.
  - .3 Ice load on face of signboards and around surface of structural members.
- .2 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

#### **2.2 MATERIALS**

- .1 Sign supports:
  - .1 Steel posts: to CSA G40.21, 4 m long, flanged "U" shaped in cross section, measuring 65 mm wide x 30 mm deep. Metal thickness: 4.5 mm. Hot dipped galvanized: to ASTM A123/A123M.
  - .2 Standard tubular supports for small signs: to ASTM B210M.
  - .3 Timber posts:
    - .1 Sawn timber posts:
      - .1 Type: pressure treated.

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- .2 Dimensions: as indicated.
      - .3 CAN/CSA-Z809.
    - .2 Posts to be treated in accordance with CAN/CSA O80 Series.
  - .4 Vertical tubular supports and connecting diagonal members: to ASTM B210M.
  - .5 Truss members: to ASTM B210M.
  - .6 Aluminum tubular members: belt ground satin finish.
  - .7 Base plates for ground mounted signs: to ASTM B209M. Base plates for overhead supports: to ASTM B209M.
  - .8 Tubular support caps for ground mounted signs: to ASTM B210M or fabricated from aluminum plate as specified in ASTM B209M. Castings for overhead signs: to ASTM B211M.
  - .9 Aluminum flanges: to ASTM B211M.
  - .10 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.
- .2 Signboards:
- .1 Plywood: to CSA O121, 19 mm thick. Overlaid Douglas Fir, Medium Density CAN/CSA-Z809, overlaid one side only with fibre or plastic sheet surfacing material.
  - .2 Aluminum sheet: to ASTM B209M, precut to required dimensions.
    - .1 Thickness for signboards up to 750 mm wide: 1.6 mm minimum.
    - .2 Thickness for signboards 750-1200 mm wide: 2.1 mm minimum.
    - .3 Thickness for refurbishing existing sign panels: 1.0 mm minimum.
  - .3 Aluminum extrusions: to ASTM B211M, 150 mm or 300 mm panels suitable for bolting together.
  - .4 T-shape stiffeners for signboards: to ASTM B210M.
  - .5 Connecting straps and brackets: to ASTM B209M.
  - .6 Aluminum materials: to ASTM B209M.
  - .7 Silk screen ink:
    - .1 Transparent or opaque colours: selected by Departmental Representative, or as indicated.
  - .8 Reflective sheeting and tape: to CGSB 62-GP-11M. Adhesive, class of reflectivity and colour as indicated.
  - .9 Transparent tape: flexible, smooth-surfaced, moisture resistant tape with pressure sensitive adhesive.

## 2.3 FABRICATION

- .1 Supports:
  - .1 Connect aluminum support members by welding in accordance with CSA W47.2. Work to be performed by Canadian Welding Bureau qualified members only. Flame cutting of members not permitted.
  - .2 Welds to be of same strength as adjacent member or casting.

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- .3 Reinforce in area of electrical hand holes to equal strength of full section member.
  - .4 Remove sharp edges and burrs.
  - .2 Signboards:
    - .1 Plywood blanks:
      - .1 Cut plywood blanks to required shapes and dimensions. Fill edges with wood filler suitable for outdoor use and sand smooth.
      - .2 Lightly sand surfaces, wipe clean with xylene thinner and allow to dry for 8 hours.
      - .3 Spray signboard back and edges with one prime coat and two finish coats.
    - .2 Aluminum blanks:
      - .1 Degrease, etch and bonderize with chemical conversion coating.
      - .2 Clean surfaces with xylene thinner. Dry.
      - .3 For non-reflective signs, spray face with one coat vinyl pretreatment coating and two finish coats of required colour.
      - .4 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with MPI-EXT 5.4A.
    - .3 Reflective background sheeting and lettering:
      - .1 Cut and apply in accordance with manufacturer's instructions.
      - .2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.
      - .3 Edge wrap sheeting on each extrusion prior to bolting extrusions. Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.
      - .4 Reflective signboard faces may be prepared using silk screen transparent ink.
    - .4 Non-reflective lettering and symbols: cut from vinyl film as specified in CGSB 62-GP-9M, or paint using required colour of finish paint or silk screen transparent ink.
    - .5 Clean signboards completely and apply transparent tape over top edge and extending 25 mm minimum down back and front of signboard.
    - .6 Protect finished signboard faces with one coat of clear varnish.
    - .7 Apply two coats of paint to wooden sign posts. Allow initial coat to dry before applying second coat. Apply paint only when relative humidity is below 85% and ambient temperature is above 5 degrees C.
  - .3 Sign identification:
    - .1 Apply sign number and date of installation with 25 mm high black letters on lower left back face of each signboard.

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**Part 3            Execution**

**3.1                INSTALLATION**

- .1    Sign support:
  - .1    Erect supports as indicated. Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers. Permissible tolerance: 12 mm maximum departure from vertical.
  - .2    Coat underside of base plate with corrosion protective paint before installation. Connect shoe base to shaft with inside and outside fillet welds.
  - .3    Close open aluminum tubes and posts with aluminum cap. Cut oblong holes in shoe bases to drain condensation. Install aluminum bolt cover on each base plate restraining nut.
  - .4    Erect posts plumb and square to details as indicated.
  - .5    Single channel steel posts:
    - .1    Drive to required depth without damage to posts.
    - .2    If rock or concrete is encountered, drill hole to required depth and set post in sand.
    - .3    In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
  - .6    Wooden post installation:
    - .1    Excavate post holes to specified diameter. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.
    - .2    Leave or make depression, approximately 150 mm deep, around posts until paint is dry, then backfill and compact with excavated material to ground elevation.
- .2    Signboard:
  - .1    Fasten signboard to supporting posts and brackets as indicated.
  - .2    Fasten lane markers to signboard.
  - .3    Use strapping with crimped or bolted connections where signs fastened to utility poles.
  - .4    Use T-shape aluminum stiffeners to join portions of sign panel on site. Cover face of T-stiffener with material identical to face of sign panel.

**3.2                REPAIR/ RESTORATION**

- .1    Prepare new message on 1.0 minimum mm aluminum sheet.
- .2    Install new message on existing signboard in place, or remove existing signboard and install new message before re-erection.



- .3 Rivet new message to existing using 3 mm blind rivets at 300 mm centre to centre maximum around each portion of sheeting and with four, 6 mm diameter stainless steel bolts at corners.

### **3.3 CORRECTING DEFECTS**

- .1 Correct defects, identified by Departmental Representative, in sign message, consistency of reflectivity, colour or illumination. Correct angle of signboard and adjust luminaire aiming angle for optimum performance during night conditions to approval of Departmental Representative.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1     ASTM International
  - .1     ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m<sup>3</sup>).
- .2     CSA International
  - .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     Ontario Provincial Standard Specifications (OPSS PROV)/Ontario Ministry of Transportation
  - .1     OPSS 1004, Material Specification for Aggregates - Miscellaneous.
  - .2     OPSS 1010, Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Material.
- .4     U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1     EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.2                ADMINISTRATIVE REQUIREMENTS**

- .1     Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
  - .1     Pay costs of relocating services.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1     Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2     Samples: submit to designated testing agency, 23 kg sample of backfill for fill material proposed for use, no later than 1 week before backfilling or filling work.
- .3     Site Quality Control Submittals: submit in accordance with Section 01 45 00 - Quality Control.
  - .1     Submit condition survey of existing conditions as described in EXISTING CONDITIONS article.
  - .2     Submit testing results as described in PART 3 - FIELD QUALITY CONTROL.
- .4     Sustainable Design Submittals:
  - .1     Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Granular A, B Type I, B Type II and Select Subgrade to OPSS.PROV 1010. Clear Stone to OPSS.PROV 1004.
- .2 Unshrinkable fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 0.4 MPa at 28 days.
  - .2 Maximum Portland cement content of 25 kg/m<sup>3</sup>.
  - .3 Minimum strength of 0.07 MPa at 24 hours.
  - .4 Concrete aggregates: to CSA A23.1/A23.2.
  - .5 Cement: to CSA A3000, Type GU.
  - .6 Slump: 160 to 200 mm.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions:
  - .1 Examine soil report from Departmental Representative.
  - .2 Before commencing work establish locations of buried services on and adjacent to site.
- .2 Evaluation and Assessment:
  - .1 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.
  - .2 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Departmental Representative.
  - .3 Not later than 1 week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill material proposed for use.
  - .4 Not later than 48 hours before backfilling or filling with approved material, notify Departmental Representative so that compaction tests can be carried out by designated testing agency.
  - .5 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

**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 requirements of 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 areas disturbed during removal.
- .2 Protection of in-place conditions:
  - .1 Protect excavations from freezing.
  - .2 Keep excavations clean, 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 Departmental Representative's approval.
  - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
  - .5 Protect buried services that are required to remain undisturbed.
- .3 Removal:
  - .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
  - .2 Remove stumps and tree roots below footings, slabs, roadways and paving, and to 600 mm below finished grade elsewhere.
  - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

### 3.3 EXCAVATION

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial regulations.
- .2 Perform blasting in accordance with Provincial regulations: repair damage as directed by Departmental Representative.
  - .1 Do not blast within 3 m of building and where damage would result.
- .3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.
  - .1 Stockpile topsoil on site for later use.
- .4 Excavate as required to carry out work.
  - .1 Do not disturb soil or rock below bearing surfaces.
  - .2 Notify Departmental Representative when excavations are complete.
  - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
  - .4 Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .5 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground.

- .1 Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .6 Excavate for slabs and paving to subgrade levels.
  - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

### 3.4 FIELD QUALITY CONTROL

- .1 Testing of materials and compaction of backfill and fill will be carried out by testing laboratory designated by Departmental Representative.
- .2 Not later than 1 week minimum before backfilling or filling, submit to designated testing agency, samples of backfill as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .3 Do not begin backfilling or filling operations until material has been approved for use by Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify Departmental Representative to allow compaction tests to be carried out by designated testing agency.

### 3.5 BACKFILLING

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .3 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
  - .1 Fill excavated areas with selected subgrade material compacted as specified for fill.
- .4 Placing:
  - .1 Place backfill, fill and base course material in maximum 120 mm lifts: add water as required to achieve specified density.
- .5 Compaction: compact each layer of material to following densities for material to ASTM D698:
  - .1 To underside of base courses: 97%.
  - .2 Base courses: 100%.
  - .3 Elsewhere: 95%.
- .6 Under slabs and paving:
  - .1 Use native material or selected subgrade material up to bottom of granular base courses.
  - .2 Use granular material and sand as specified for base courses.
- .7 In trenches:

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- .1 Up to 300 mm above pipe or conduit: sand placed by hand.
  - .2 Over 300 mm above pipe or conduit: native material approved by Departmental Representative.
  - .8 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
  - .9 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material

**3.6 GRADING**

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas as indicated.
  - .1 Grade to be gradual between finished spot elevations shown on drawings.

**3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
  - .2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .3 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - .4 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

**1.2 DEFINITIONS**

- .1 Corrected maximum dry density is defined as:
  - .1  $D = (F1 \times D1) + (0.9 \times D2 \times F2)$
  - .2 Where: D = corrected maximum dry density kg/m<sup>3</sup>.
    - .1 F1 = fraction (decimal) of total field sample passing 5 mm sieve
    - .2 F2 = fraction (decimal) of total field sample retained on 5 mm sieve (equal to 1.00 - F1)
    - .3 D1 = maximum dry density, kg/m<sup>3</sup> of material passing 5 mm sieve determined in accordance with Method of ASTM C127.
    - .4 D2 = bulk density, kg/m<sup>3</sup>, of material retained on mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.
  - .3 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM D4791, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for aggregate materials and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit 5 samples.
  - .2 Allow continual sampling by Departmental Representative during production.
  - .3 Provide Departmental Representative with access to source and processed material for sampling.
  - .4 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
  - .5 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Departmental Representative.
  - .6 Supply new or clean sample bags or containers according appropriate to aggregate materials.
  - .7 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
  - .8 Provide water, electric power and propane to Departmental Representative laboratory trailer at production site.
- .4 Sustainable Design Submittals:
  - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.



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**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
  - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
  - .2 Reclaimed asphalt pavement.
  - .3 Reclaimed concrete material.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
  - .1 Crushed rock.
  - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
  - .3 Light weight aggregate, including slag and expanded shale.
  - .4 Reclaimed asphalt pavement.
  - .5 Reclaimed concrete material.

**2.2 SOURCE QUALITY CONTROL**

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 4 weeks minimum before starting production.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise Departmental Representative 4 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

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**Part 3            Execution**

**3.1                EXAMINATION**

- .1    Verification of Conditions: verify that conditions are acceptable for topsoil stripping.
  - .1    Visually inspect substrate in presence of Departmental Representative.
  - .2    Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3    Proceed with topsoil stripping only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2                PREPARATION**

- .1    Topsoil stripping:
  - .1    Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
  - .2    Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds and grasses and removed from site.
  - .3    Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.
  - .4    Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 3 m.
  - .5    Dispose of topsoil as directed by Departmental Representative.
- .2    Aggregate source preparation:
  - .1    Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as directed by Departmental Representative.
  - .2    Where clearing is required, leave screen of trees between cleared area and roadways as directed.
  - .3    Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.
  - .4    When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.
  - .5    Trim off and dress slopes of waste material piles and leave site in neat condition.
  - .6    Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.
- .3    Processing:
  - .1    Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
  - .2    Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.
    - .1    Use methods and equipment approved in writing by Departmental Representative.

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- .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.
  - .5 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.
    - .1 Use only equipment approved in writing by Departmental Representative.
  - .6 Stockpiling:
    - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
    - .2 Stockpile aggregates in sufficient quantities to meet project schedules.
    - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
    - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
    - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
    - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
    - .7 Stockpile materials in uniform layers of thickness as follows:
      - .1 Maximum 1.5 m for coarse aggregate and base course materials.
      - .2 Maximum 1.5 m for fine aggregate and sub-base materials.
      - .3 Maximum 1.5 m for other materials.
    - .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
    - .9 Do not cone piles or spill material over edges of piles.
    - .10 Do not use conveying stackers.
    - .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

### 3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .4 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

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- .6 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                NOT USED**

- .1        Not Used.

**Part 2            Products**

**2.1                NOT USED**

- .1        Not Used.

**Part 3            Execution**

**3.1                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 sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .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 areas disturbed during removal.

**3.2                STRIPPING OF TOPSOIL**

- .1        Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2        Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3        Handle topsoil only when it is dry and warm.
- .4        Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation by composting.
- .5        Strip topsoil to depths as directed by Departmental Representative.
  - .1        Avoid mixing topsoil with subsoil.
- .6        Pile topsoil in berms in locations as directed by Departmental Representative.
  - .1        Stockpile height not to exceed 2.5 - 3 m.
- .7        Dispose of unused topsoil in location as indicated by Departmental Representative.
- .8        Protect stockpiles from contamination and compaction.

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- .9 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

### **3.3 PREPARATION OF GRADE**

- .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur. Do not begin work until instructed by Departmental Representative.
  - .1 Grade area only when soil is dry to lessen soil compaction.
  - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

### **3.4 PLACING OF TOPSOIL**

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 150 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

### **3.5 SUB-SOILING**

- .1 Apply sub-soil, following spreading and cultivating procedures to designated areas to improve drainage and agricultural potential of soil.
- .2 Work sub-soil area following natural grade contour lines, with vibrating sub-soiler to depth of 40 cm.
- .3 Cross sub-soil the area following the first pass.
- .4 Cultivate the soil with a chain harrow to de-clod the soil.

### **3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 ASTM International
  - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).
- .2 Underwriters' Laboratories of Canada (ULC)

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Sustainable Design Submittals:
  - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

**1.3 EXISTING CONDITIONS**

- .1 Examine subsurface investigation report which is available from the Departmental Representative.
- .2 Known underground and surface utility lines and buried objects are as indicated on site plan.
- .3 Refer to dewatering in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Fill material: In accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 STRIPPING OF TOPSOIL**

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.
- .2 Commence topsoil stripping of areas as indicated after area has been cleared of grasses and removed from site.
- .3 Strip topsoil to depths as directed by Departmental Representative. Rototill weeds and grasses and retain as topsoil on site. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil as directed by Departmental Representative.

### **3.3 GRADING**

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
  - .1 150 mm for grassed areas.
  - .2 200 mm for gravel paving.
- .3 Grade ditches to depth as directed.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .5 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
  - .1 85% under landscaped areas.
  - .2 95% under gravel roads.
- .6 Do not disturb soil within branch spread of trees or shrubs to remain.

### **3.4 TESTING**

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid by Owner in accordance with Sections 01 29 83 - Payment Procedures for Testing Laboratory Services and 01 45 00 - Quality Control.
- .2 Submit testing procedure, frequency of tests, to Departmental Representative for approval.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.



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- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 – Cleaning.

**3.6 PROTECTION**

- .1 Protect pavement, surface or underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT PROCEDURES**

- .1 Measure reshaping subgrade in square metres reshaped.
- .2 Measure additional subgrade material under Section 31 24 13 - Roadway Embankments.
- .3 Payment will be included with the lump sum bid price.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roadway subgrade reshaping installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 SCARIFYING AND RESHAPING**

- .1 Scarify subgrade to full width as indicated Departmental Representative and to depth of 300 mm minimum.
- .2 Pulverize and break down scarified material to 25 mm maximum soil clod size, except that stones larger than this size may be left intact as directed by Departmental Representative.

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- .3 Blade and trim pulverized material to elevation and cross section dimensions as indicated.
  - .4 Where deficiency of material exists, add and blend additional subgrade material as directed by Departmental Representative.
  - .5 Re-use excess material in areas of material deficiency as directed by Departmental Representative.

### **3.3 COMPACTING**

- .1 Compact to minimum corrected maximum dry density.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.
- .3 Apply water as necessary during compaction to obtain specified density.
- .4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected to value not greater than 3% moisture above optimum value for compaction to ASTM D698.

### **3.4 SITE TOLERANCES**

- .1 Reshaped compacted surface to be within plus or minus 10 mm of elevation as indicated but not uniformly high or low.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.6 PROTECTION**

- .1 Protect and maintain reshaped surface in condition conforming to this Section until succeeding material is applied or until after receipt of written acceptance from Departmental Representative.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT PROCEDURES**

- .1 Payment will be included in the lump sum price bid.
- .2 Excavated materials will be measured in cubic metres in their original location.
  - .1 Common excavation quantities measured will be actual volume removed within following limits:
    - .1 Width for trench excavation as indicated.
    - .2 Width for excavation for structures as indicated.
    - .3 Depth from ground elevation immediately prior to excavation, to elevation as indicated by Departmental Representative.
  - .2 Rock quantities measured will be actual volume removed within following limits:
    - .1 Width for trench excavation as indicated.
    - .2 Width for excavation for structures to be bounded by vertical planes up to 500 mm outside of and parallel to neat lines of footings as indicated.
    - .3 Depth from rock surface elevations immediately prior to excavation, to elevation as indicated.
    - .4 Where design elevation is less than 300 mm below original rock surface, depth will be considered to be 300 mm below original rock surface.
    - .5 Volume of individual boulders and rock fragments will be determined by measuring three maximum mutually perpendicular dimensions.
- .3 Sheet piling and bracing left in place on direction of Departmental Representative will be measured in square metres of surface area of plane surface of sheet piling.
- .4 Shoring, bracing, cofferdams, underpinning and de-watering of excavation will not be measured separately for payment.
- .5 Backfilling to authorized excavation limits will be measured in cubic metres compacted in place for each type of material specified.
- .6 Placing and spreading of topsoil will be measured for payment in cubic metres calculated from cross sections taken in area of excavation from original location.
  - .1 If double handling of topsoil is directed by Departmental Representative (stockpiling and later placing), then quantities will be measured twice; on excavation from original location and on excavation from stockpile.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-63, Standard Test Method for Particle-Size Analysis of Soils.

- .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).
- .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m<sup>3</sup>).
- .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
  - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### 1.3 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock : solid material in excess of 1.00 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment. Frozen material not classified as rock.
  - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 mm in any dimension.
- .3 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .4 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .5 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .6 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:

- .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422: Sieve sizes to CAN/CGSB-8.2.

- .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45

- .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

- .7 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

#### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
  - .2 Submit for review by Departmental Representative proposed dewatering and heave prevention methods as described in PART 3 of this Section.
  - .3 Submit to Departmental Representative written notice at least 7 days prior to excavation work, to ensure cross sections are taken.
  - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
  - .5 Submit to Departmental Representative testing results as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
  - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
  - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field location plan of relocated and abandoned services, as required.
- .4 Samples:
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
  - .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
  - .4 Ship samples prepaid to Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.

.5 At least 4 weeks prior to beginning Work, inform Departmental Representative source of fly ash and submit samples to Departmental Representative.

.1 Do not change source of Fly Ash without written approval of Departmental Representative.

## **1.5 QUALITY ASSURANCE**

.1 Qualification Statement: submit proof of insurance coverage for professional liability.

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

.3 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of Saskatchewan, Canada.

.4 Keep design and supporting data on site.

.5 Engage services of qualified professional Engineer who is registered or licensed in the Province of Saskatchewan, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.6 Do not use soil material until written report of soil test results are approved by Departmental Representative.

.7 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## **1.6 EXISTING CONDITIONS**

.1 Examine soil report available from Departmental Representative.

.2 Buried services:

.1 Before commencing work verify location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.6 Confirm locations of buried utilities by careful soil hydrovac methods.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing. Costs for such Work to be paid by Departmental Representative.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 Confirm locations of recent excavations adjacent to area of excavation.

- .3 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

## Part 2 Products

### 2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.2.
  - .3 Table:

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
25 mm	100	-
19 mm	75-100	-
9.5 mm	50-100	-
4.75 mm	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Unshrinkable fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 0.4 MPa at 28 days.
  - .2 Maximum cement content of 25 kg/m<sup>3</sup>: to CSA-A3001, Type GU.
  - .3 Minimum strength of 0.07 MPa at 24 h.
  - .4 Concrete aggregates: to CSA-A23.1/A23.2.
  - .5 Cement: Type GU.
  - .6 Slump: 160 to 200 mm.
- .4 Shearmat: honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.



- .5 Geotextiles: to Section 31 32 19.01 - Geotextiles.

### **Part 3 Execution**

#### **3.1 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 requirements of 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 areas disturbed during removal.

#### **3.2 SITE PREPARATION**

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

#### **3.3 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Keep excavations clean, 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 Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

#### **3.4 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds, and/or grasses and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative.
  - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 3 m and should be protected from erosion.
- .4 Dispose of unused topsoil as directed by Departmental Representative.

#### **3.5 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative.
  - .1 Stockpile granular materials in manner to prevent segregation.

- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

### **3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING**

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Health and Safety Act for the Province of Saskatchewan.
  - .1 Where conditions are unstable, Departmental Representative to verify and advise methods.
- .2 Obtain permit from authority having jurisdiction for diversion of water course.
- .3 Construct temporary Works to depths, heights and locations as indicated.
- .4 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental 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 elevation at least 500 mm above toe of sheeting.
- .5 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .6 Upon completion of substructure construction:
  - .1 Remove cofferdams, shoring and bracing.
  - .2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

### **3.7 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative's approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
  - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .4 Protect open excavations against flooding and damage due to surface run-off.
- .5 Dispose of water in runoff areas in manner not detrimental to public and private property, or portion of Work completed or under construction.
  - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

### 3.8 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Remove obstructions encountered during excavation in accordance with Section 02 41 13 - Selective Site Demolition.
- .4 Excavation must not interfere with bearing capacity of adjacent foundations.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.
- .7 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .8 Restrict vehicle operations directly adjacent to open trenches.
- .9 Dispose of surplus and unsuitable excavated material in approved location on site.
- .10 Do not obstruct flow of surface drainage or natural watercourses.
- .11 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .12 Notify Departmental Representative when bottom of excavation is reached.
- .13 Obtain Departmental Representative approval of completed excavation.
- .14 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.
- .15 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with Type 2 fill compacted to not less than 99% of corrected Standard Proctor maximum dry density in accordance with Section 31 05 10 - Corrected Maximum Dry Density for Fill.
  - .2 Fill under other areas with Type 2 or 3 fill compacted to not less than 95% of corrected Standard Proctor maximum dry density in accordance with Section 31 05 10 - Corrected Maximum Dry density fir Fill.
- .16 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.
- .17 Install geotextiles in accordance with Section 31 32 19.01 - Geotextiles.

### **3.9 FILL TYPES AND COMPACTION**

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698 in accordance with Section 31 05 10 - Corrected Maximum Dry Density for Fill.
  - .1 Exterior side of perimeter walls: use Type 2 or 3 fill to subgrade level. Compact to 95% of corrected maximum dry density.
  - .2 Within roadway area: use Type 2 fill to underside of sub-base course. Compact to 100% of corrected maximum dry density.
  - .3 Under concrete slabs: provide 150 mm compacted thickness base course of Type 1 fill to underside of slab. Compact base course to 100%.
  - .4 Retaining walls: use Type 2 fill to subgrade level on high side for minimum 500 mm from wall and compact to 95%. For remaining portion, use Type 2 or 3 fill compacted to 95%.
  - .5 Place unshrinkable fill in areas as indicated.

### **3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.11 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:
  - .1 Departmental Representative has inspected and approved installations.
  - .2 Departmental Representative has inspected and approved of construction below finish grade.
  - .3 Inspection, testing, approval, and recording location of underground utilities.
  - .4 Removal of concrete formwork.
  - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Place bedding and surround material as specified elsewhere.
  - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
  - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 1.0 m.
  - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

- .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative:
- .2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Place recycled fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Install drainage system in backfill as indicated.

### **3.12 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as directed by Departmental Representative.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .7 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

**Part 1            General**

**1.1                MEASUREMENT PROCEDURES**

- .1        Payment will be included in the lump sum bid.
- .2        Stripping: measure in cubic metres calculated from cross sections taken by Departmental Representative in areas of excavation.
  - .1        Departmental Representative will take initial cross sections after clearing and grubbing completed.
  - .2        Stripping unit price to include cost of placing material on slopes upon completion of excavation and embankment.
- .3        Common Excavation: measure in cubic metres calculated from cross sections taken by Departmental Representative in areas of excavation.
  - .1        Departmental Representative will take initial cross sections after clearing, grubbing and stripping completed and immediately prior to excavation of material to be incorporated into work.
- .4        Borrow: measure in cubic metres calculated from cross sections taken by Departmental Representative in areas of excavation.
  - .1        Departmental Representative will take initial cross sections after clearing, grubbing and stripping completed and immediately prior to excavation of material to be incorporated into work.
- .5        Rock Excavation:
  - .1        Calculate volume excavated from solid rock masses in cubic metres from cross sections of original rock surface and design grade line for excavation.
  - .2        Departmental Representative will take initial cross sections after clearing, grubbing and stripping completed and immediately prior to excavation of material to be incorporated into work.
  - .3        Measure rock excavated beyond design grade as Common Excavation when placed in embankment within established lines and grades.
  - .4        Measure excavated boulders and rock fragments measured individually. Determine volume of excavated boulders and rock fragments by measuring three maximum mutually perpendicular dimensions.
- .6        Unclassified excavation:
  - .1        Measure in cubic metres calculated from cross sections taken by Departmental Representative in areas of excavation.
  - .2        Departmental Representative will take initial cross sections after clearing, grubbing and stripping completed and immediately prior to excavation of material to be incorporated into work.
- .7        Measure overhaul in cubic metre-kilometres and computed by "Mass Diagram Method". Overhaul as designated by Departmental Representative.
- .8        No separate payment for:

- .1 Excavating unnecessarily beyond lines established by Departmental Representative, with exception of unavoidable slide material. Do not measure slide material, when such slides are attributable to negligence.
- .2 Ripping and/or drilling and blasting of material.
- .3 Scarifying or benching existing slopes or existing road surfaces.
- .4 Removing and disposing of roots, stumps and other materials excavated during waste operation.
- .5 Burying existing culverts from old road.
- .6 Removing unsuitable material from embankment attributable to negligence.
- .7 Shattering rock to 300 mm below subgrade elevation.
- .8 Scaling and removing loose rock from rock face.
- .9 Watering, drying and compacting.
- .10 Finishing.

## 1.2 REFERENCES

- .1 Definitions:
  - .1 Rock Excavation: excavation of:
    - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
    - .2 Boulder or rock fragments measuring in volume 1 cubic metre or more.
  - .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
  - .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the Work.
  - .4 Free Haul: distance that excavated material is hauled without compensation. Free haul distance to be 1.0 km or less.
  - .5 Stripping: excavation of organic material covering original ground.
  - .6 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.
  - .7 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
  - .8 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
  - .9 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.
  - .10 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .2 Reference Standards:
  - .1 ASTM International

- .1 ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).
- .2 American Association of State Highway and Transportation Officials (AASHTO)
  - .1 AASHTO T99, Standard Method of test for Moisture-Density Relations of Soils Using a 2.5 kg (5.5lb) Rammer and 305 mm (12 in) Drop.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval and review blasting program including preshear details, powder factors fly-rock control, and vibration monitoring methods.

### 1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements:
  - .1 Adhere to regulations of authority having jurisdiction when blasting is required.
  - .2 Adhere to Provincial and National Environmental requirements when toxic materials are involved.

## Part 2 Products

### 2.1 MATERIALS

- .1 Embankment materials require approval by Departmental Representative.
- .2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.
- .3 Borrow material:
  - .1 Obtain from sources such as quarry, or borrow pit as approved by Departmental Representative.
    - .1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.
    - .2 Rock Embankment material to consist of fragmented rock produced by drilling and blasting operations, and boulders which cannot be placed in layers as specified for Earth Embankments.
      - .1 Rock Embankment to conform to gradation as follows:

Sieve Designation	Percent Passing by Weight
150 mm	100
100 mm	85 - 100
75 mm	10 - 50
No. 200	* 0 - 3

- .2 \* Gradation is determined by that portion passing 75 mm screen.



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**Part 3            Execution**

**3.1                EXAMINATION**

- .1    Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
  - .1       Visually inspect substrate in presence of Departmental Representative.
  - .2       Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3       Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2                COMPACTION EQUIPMENT**

- .1    Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.
  - .1       Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
  - .2       Replace or supplement equipment that does not achieve specified densities.
- .2    Operate compaction equipment continuously in each embankment when placing material.

**3.3                WATER DISTRIBUTORS**

- .1    Apply water with equipment capable of uniform distribution.

**3.4                STRIPPING OF TOPSOIL**

- .1    Place top soil and finish grading in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
- .2    Commence topsoil stripping of areas as directed by Departmental Representative after grasses have been removed from these areas.
- .3    Strip topsoil to depths as indicated. Do not mix topsoil with subsoil.
- .4    Stockpile in locations as directed by Departmental Representative.
  - .1       Stockpile height: not to exceed 3 m.
- .5    Dispose of unused topsoil as directed by Departmental Representative.
- .6    Remove clearing and grubbing debris from stripping.
- .7    Spread organic stripping, on completion of excavation and embankment construction, on slopes and trim or remove from site if quantity exceeds ability to grade on site.

**3.5                EXCAVATING**

- .1    General:
  - .1       Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.

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- .2 Sub-excavate 500 mm below subgrade in cut sections unless otherwise directed by Departmental Representative.
    - .1 Compact top 150 mm below sub-excavate to minimum 95% maximum dry density, to ASTM D698.
    - .2 Replace with approved embankment material and compact to specified embankment density.
  - .3 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Departmental Representative.
  - .2 Drainage:
    - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
    - .2 Provide ditches as work progresses to provide drainage.
    - .3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
  - .3 Rock excavation:
    - .1 Notify Departmental Representative, when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide 24 hour notification.
    - .2 Submit blasting program to Departmental Representative, for approval 48 hours minimum before start of Work.
      - .1 Do not proceed without written approval of blasting program from Departmental Representative.
    - .3 Shatter rock to 300 mm below subgrade elevation as indicated.
    - .4 Reduce overbreak and increase stability of rock faces by using smooth blasting techniques.
    - .5 Use smooth blast and excavate short sections in rock cuts to determine optimum spacing of holes when requested by Departmental Representative.
    - .6 Stem holes as necessary to contain blast.
    - .7 Do not use prilled type ammonium nitrate and fuel oil (ANFO) explosives within 4 m of final cut line.
    - .8 Form back wall by pre-splitting at least 10 m in advance of production blasting.
      - .1 Smooth wall blast just prior to or just after production blast as determined by approved blast program.
    - .9 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.
    - .10 Control blasting to minimize flying particles.
  - .4 Borrow Excavation:
    - .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
    - .2 Obtain embankment materials, in excess of what is available from cut areas, from designated borrow areas.
      - .1 Departmental Representative to designate extent of borrow areas and allowable depth of excavation.

- .2 Remove waste and stripping material from borrow pits to designated locations.
- .3 Slope edges of borrow areas to minimum 3:1 and provide drainage as directed.
- .4 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

### 3.6 EMBANKMENTS

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized by Departmental Representative.
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
  - .1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .6 Where material consists of rock:
  - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.
  - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
  - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
  - .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

### 3.7 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Deposit, spread, and level, embankment material in layers 200 mm maximum thickness before compaction.
  - .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
  - .2 Ensure required compaction for each layer before placing any material for next layer.
- .3 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.

- .4 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results
  - .1 For tamping rollers, use equipment that exerts 1000 kPa minimum of pressure on tamping surface of each tamping foot in transverse row.
- .5 Compact each layer to minimum 95% maximum dry density: ASTM D698 except top 150 mm of subgrade.
  - .1 Compact top 150 mm to 100% maximum dry density.
- .6 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

### **3.8 FINISHING**

- .1 Shape entire roadbed to within 25 mm of design elevations.
- .2 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable. Scale slope by removing loose fragments, for cut slopes in bedrock steeper than 1:1.
- .3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .4 Hand finish slopes that cannot be finished satisfactorily by machine.
- .5 Round top of backslope 1.5 m both sides of top of slope.
- .6 Run tractor tracks over slopes exceeding 3 m in height to leave tracks parallel to centreline of highway.
- .7 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

### **3.9 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.10 PROTECTION**

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Departmental Representative.
- .2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT PROCEDURES**

- .1 Payment will be included in the lump sum bid price.
- .2 Measure chemical control of vegetation in square metres of area treated. Measurement to be surface area.

**1.2 REFERENCES**

- .1 Department of Justice
  - .1 Pest Control Products Act, RS, 1985, c. P-9 (current to March 3, 2006).
- .2 Health Canada (HC)/Pest Management Regulatory Agency (PMRA)
  - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).

**1.3 PERFORMANCE REQUIREMENTS**

- .1 For weed control, achieve within 30 days of treatment, minimum of 90 % kill of target plants without damaging desirable vegetation and grasses.
- .2 For brush control, achieve within 12 months of treatment, minimum of 90 % kill of target plants without damaging desirable vegetation.
- .3 For stump control, achieve within 12 months of treatment, minimum of 80 % kill of target stumps without damaging surrounding vegetation.
- .4 For soil sterilization, achieve within 12 months of treatment, 100 % kill of vegetation.

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's installation instructions, including printed product literature, specifications and datasheet.
  - .2 Submit 2 copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS) in accordance with Section 02 81 01 - Hazardous Materials.
    - .1 WHMIS acceptable to Human Resources Development Canada - Labour and Health Canada for herbicides and pesticides.
    - .2 Indicate VOC content.
    - .3 Provide copy of on-site stored products to local fire department.
  - .3 Quality Control Reports: within 7 days of work completion, submit to Departmental Representative written report containing following information:
    - .1 Full name and PCP Registration number of herbicide products used including adjuvants.

- .2 Copies of provincial applicator's license and pesticide project application permit.
- .3 Copy of equipment log indicating spray calibration used during pesticide application.

## **1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Safety Requirements:
  - .1 Comply with label directions on the use of herbicide products.
  - .2 Worker protection:
    - .1 Comply with label directions as to ambient temperature ranges for application.
    - .2 Ensure workers wear gloves, respirators, dust masks, long sleeved clothing, eye protection, and protective clothing when applying pesticides.
    - .3 Ensure workers do not eat, drink or smoke while applying pesticides.
  - .3 Comply with applicable personnel safety standards for handling and use of pesticides.
- .4 Regulatory Requirements:
  - .1 Provincial Territorial Pesticide Certification Programs: comply with Provincial, and Municipal and local pesticide control regulations of locality] in which operation is to be carried out.
  - .2 Obtain permits and licenses necessary to complete work.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and maintain packaged materials with manufacturer's seals and labels intact.
- .3 Provide storage facility with non-porous floor capable of preventing leaching of spilled pesticides.
  - .1 Locate storage above 1 year flood plains.
- .4 Prevent damage, adulteration and soiling of material during delivery, handling and storage.
- .5 Store material in accordance with label directions, including those on maximum and minimum storage temperatures.
- .6 Store herbicide products in original containers as supplied by manufacturer and keep sealed until used.

- .7 Store herbicide products in sheltered, well ventilated, controlled access location as reviewed by Departmental Representative.
- .8 Do not store herbicides near feeds and food stuffs, agricultural plants, seeds, fungicides, insecticides, fertilizers or other agricultural chemicals.
- .9 Identify storage area as pesticide storage facility for fire protection purposes.
- .10 Prominently post:
  - .1 List of medical and fire department telephone numbers.
  - .2 Location outside of storage area list of products stored and keep list up-to-date.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Triple rinse empty herbicide containers with diluent and add rinsate to spray mixture in tank.
- .2 Puncture and crush triple rinsed containers making them unsuitable for further use and dispose of material at appropriate recycling drop point.
- .3 Crush containers and dispose of material at appropriate recycling facility.
- .4 Dispose of containers in accordance with provincial requirements.
- .5 Do not rinse or wash spray tanks and equipment on site.
- .6 Dispose of wash water from spray tanks and equipment in non-crop, non-graze area away from water sources including wells and ponds.
- .7 Dispose of unwanted or contaminated pesticides through appropriate environmental management facilities that will dispose of pesticide by methods as reviewed by Departmental Representative in accordance with Pest Control Products Act.
- .8 Dispose of water soluble packaging (usually PVA - poly vinyl acetate) in accordance with manufacturer's instructions in sprayer tank. All safety precautions for handling and use of PVA packaging must be adhered to.
  - .1 Adhere to safety precautions for handling and use of PVA packaging.
- .9 Place materials defined as hazardous or toxic waste in designated containers.
- .10 Ensure emptied containers are sealed and stored safely for disposal away from children.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Herbicides:
  - .1 Select appropriate herbicides to achieve specified control requirement.
  - .2 Herbicide products used must be currently registered for such in accordance with Pest Control Products Act.
- .2 Adjuvants: compatible with herbicide product used.
- .3 Adjuvants:
  - .1 Choose adjuvants with lowest toxicity levels and residual effects.

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## 2.2 EQUIPMENT

- .1 Tank Sprayer: do not use airblast, mist or fog sprayer.
  - .1 Set pressure setting at minimal functional level to minimize spray drift.
  - .2 Provide with adjustable height boom, hose and handgun for spot treatments, strainers and nozzles to produce spray pattern compatible with job.
  - .3 Equip tank continuous agitation device.
  - .4 Ensure pressure gauge and regulator capable of maintaining uniform pressure between 100 and 450 kPa.
  - .5 Ensure equipment operated on turf has low pressure, wide profile turf tires.
- .2 Backpack or handheld sprayer:
  - .1 With hose and handgun for spot treatment.
- .3 Dry formulation applicator:
  - .1 Drop or Rotary type capable of calibration.
  - .2 Ensure equipment operated on turf has low pressure, wide profile turf tires.
- .4 Equip spray tank loading pipe with check valve located within one metre of pump or hydrant to prevent siphoning from spray tank resulting in contamination of water source.

## Part 3 Execution

### 3.1 NOTICE OF SPRAY OPERATION

- .1 Post areas to be treated with signs placed at each road access.
- .2 Indicate on signs that spray program is being implemented. Obtain approval for signs from Departmental Representative prior to placement.
- .3 Put signs in place prior to beginning of spray operation and retain in place for 24 hours after spray operation is completed.
- .4 In non-urban areas, advise local beekeepers of intended time, date and product to be used during application with sufficient lead time to allow them to contain their colonies until residual effects of application have subsided.

### 3.2 ENVIRONMENTAL PROTECTION

- .1 Application may continue only when wind velocities range between 2 and 10 km/h.
- .2 Do not spray when air turbulence will prevent uniform application.
- .3 Do not apply herbicides or pesticides within 100 m of wells, rivers, streams, lakes, marshes or other environmentally sensitive areas unless otherwise sanctioned by provincial permit.
  - .1 Eliminate areas of steep grade from targeted areas as precipitation can facilitate leaching to non targeted areas before degradation of the chemical has occurred.
- .4 In case of herbicide or pesticide spill, notify Departmental Representative and provincial Ministry of Environment verbally immediately and subsequently in writing.



- .1 Minor spill: use dry soil or other absorbent materials to remove excess liquid and sweep up powders or granular material.
- .2 Spread contaminated soils or sweepings over large area of bare soil to facilitate degradation.
- .3 Dispose of paper, cardboard or paper packaging contaminated during spill as dictated by the provincial Ministry of the Environment.
- .5 Do not allow drifting beyond target area.
  - .1 Use mechanical method to minimize herbicide drift.
- .6 Use sprayer fitted with protective hood suitable to prevent contamination while spray is in progress adjacent to flowerbeds and desirable vegetation.
- .7 Do not apply sterilants to slopes greater than 3 to 1 where killing vegetation would lead to erosion problems.
- .8 Mix concentrate and water at least 50 m away from any water supply.

### **3.3 APPLICATION OF HERBICIDES**

- .1 Application's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.
- .2 Treat as directed by Departmental Representative with appropriate herbicides.
- .3 Calibrate equipment to achieve manufacturer's recommended application rates.
- .4 Confine herbicide application to areas as designated by Departmental Representative to achieve specified control requirements.
- .5 Space successive passes to provide uniform coverage of treated area.
- .6 Use flagmen or other aids as necessary to indicate successive passes.
- .7 Apply spray in accordance with label directions.
- .8 Spray lower 500 mm of trunk on target brush] to point of runoff [in accordance with label directions].
- .9 Apply dry formulations in accordance with label directions.
- .10 Arrange flight paths crosswind with each successive pass upwind from previous pass.
- .11 Where roots of desirable vegetation run under treatment area, use contact herbicides.
- .12 Ensure formulation and rate of sterilant will not lead to leaching outside treatment area.
- .13 Retreat areas in accordance with label directions until specified control requirements are achieved.
- .14 Use appropriate buffer zones and berms to avoid surface contamination of wells, ponds and streams.

### **3.4 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

- 
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT PROCEDURES**

- .1 Payment will be included in the lump sum bid price.
- .2 Measure rip-rap without cement mortar in tonnes of material placed.
- .3 Measure rip-rap with cement mortar in square metres in place.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
  - .2 ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
- .2 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.
  - .2 CAN/CSA-A3000, Cementitious Materials Compendium.

**1.3 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert left over aggregate materials from landfill for reuse as approved by Departmental Representative.
- .2 Divert left over hardened cement materials from landfill for reuse as approved by Departmental Representative.

**Part 2 Products**

**2.1 STONE**

- .1 Hard, dense, durable quarry stone, free from seams, cracks or other structural defects, to meet following size distribution for use intended:
  - .1 Hand placed rip-rap:
    - .1 Minimum size of individual stones 10 dm<sup>3</sup>.
    - .2 Not less than 75% of total volume of stones with individual volume of 25 dm<sup>3</sup> or more.
    - .3 Supply rock spalls or cobbles to fill open joints.

**2.2 CEMENT MORTAR**

- .1 Cement: to CAN/CSA-A3000, type 50.
- .2 Sand for mortar: to ASTM C144.
- .3 Mortar mix: 1 part by volume of cement to 3 parts sand, to consistency approved by Departmental Representative.

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**2.3 GEOTEXTILE FILTER**

- .1 Geotextile: in accordance with Section 31 32 19.01 - Geotextiles.

**Part 3 Execution**

**3.1 PLACING**

- .1 Where rip-rap is to be placed on slopes, excavate trench at toe of slope to dimensions as indicated.
- .2 Fine grade area to be rip-rapped to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .3 Place geotextile on prepared surface in accordance with Section 31 32 19.01- Geotextiles and as indicated. Avoid puncturing geotextile. Vehicular traffic over geotextile not permitted.
- .4 Place rip-rap to thickness and details as indicated.
- .5 Place stones in manner approved by Departmental Representative to secure surface and create a stable mass. Place larger stones at bottom of slopes.
- .6 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 evenly, free of large openings and neat in appearance.
- .7 Mortar:
- .1 Use mortar within one hour after water has been added. Do not add additional water after initial mixing.
- .2 Begin applying mortar at bottom courses and work upwards completely filling voids except for sub drainage relief holes as indicated, and leaving outer faces of stones exposed. Remove excess mortar to expose faces of stones as indicated.
- .3 Cure and protect mortar in accordance with CAN/CSA-A23.1 by using absorptive mats.

**END OF SECTION**

**Part 1 General**

**1.1 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Granular based material: supplied by Departmental Representative at stockpile.

**1.2 MEASUREMENT AND PAYMENT**

- .1 Payment will be included in the lump sum bid price.
- .2 Measure granular sub-base in cubic metres measured in place by cross section and calculated by average end area method of material incorporated into Work and accepted by Departmental Representative.
- .3 Measure excavation of sub-base and subgrade materials to correct deficiencies in subgrade discovered during proof rolling as common excavation under Section 31 23 33.01 - Excavating, Trenching and Backfilling.
  - .1 Measure backfill of subgrade with sub-base material and replacement of sub-base material under this Section.
- .4 Measure hauling granular sub-base material in cubic metre-kilometres, computed by taking product of number of cubic metres of material placed multiplied by haul distance in kilometres.
  - .1 Measure haul distance from source of material to centre of volume of material after placing, measured along shortest route determined by Departmental Representative as being feasible and satisfactory.
- .5 Measure water in units of 1000 L for water authorized by Departmental Representative and applied.
- .6 Measure compaction of granular sub-base in hours for particular compaction units employed including operator, fuel and maintenance.

**1.3 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
  - .5 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m<sup>3</sup>).
  - .6 ASTM D1557, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m<sup>3</sup>).
  - .7 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

- .8 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

#### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

#### **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials in accordance with erosion and sedimentation control plan.
  - .2 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.
  - .3 Table

Sieve Designation	Percent Passing Canadian Metric Sieve Series
50 mm	100
2.00 mm	0-90
0.400 mm	0-60
0.160 mm	0-25
0.071 mm	0-15

- .4 Other properties as follows:
  - .1 Liquid Limit: to ASTM D4318, Maximum 25.
  - .2 Plasticity Index: to ASTM D4318, Maximum 6.
  - .3 Los Angeles degradation: to ASTM C131.

- .1 Maximum loss by mass: 40 %.
- .4 Particles smaller than 0.02 mm: to ASTM D422, Maximum 3%.
- .5 Soaked CBR: to ASTM D1883, Minimum 40 when compacted to 100% of ASTM D1557.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **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 requirements of 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 areas disturbed during removal.

### **3.3 PLACING**

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 120 mm compacted thickness.

- .1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.

### **3.4 COMPACTION**

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
- .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compact to density of not less than 98% corrected maximum dry density.
- .5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .6 Apply water as necessary during compaction to obtain specified density.
- .7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### **3.5 PROOF ROLLING**

- .1 For proof rolling use standard roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated.
  - .1 If non-standard proof rolling equipment is approved, Departmental Representative will determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
  - .2 Backfill excavated subgrade with sub-base material and compact in accordance with this section.
  - .3 Replace sub-base material and compact.
- .6 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.



**3.6 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**3.7 SITE TOLERANCES**

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

**3.8 PROTECTION**

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

**END OF SECTION**

**Part 1 General**

**1.1 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION**

- .1 Departmental Representative to supply granular base material at stockpile.

**1.2 MEASUREMENT AND PAYMENT**

- .1 Payment will be included in the lump sum bid price.
- .2 Measure granular base in cubic metres of material incorporated into Work and accepted in writing by Departmental Representative.
- .3 Measure excavation of base, sub-base and sub-grade materials to correct deficiencies in sub-grade as common excavation.
  - .1 Measure backfill of sub-grade with common materials, approved in writing by Departmental Representative, as common excavation and sub-grade compaction.
  - .2 Measure backfill of sub-grade with sub-base material and replacement of sub-base material to Section 32 11 16.01 - Granular Sub-base.
  - .3 Measure subsequent replacement of base materials under this Section.
- .4 Measure hauling granular base material in tonne-kilometres computed by taking product of number of tonnes of material placed multiplied by haul distance in kilometres.
  - .1 Measure haul distance from source of material to centre of volume of material after placing, measured along shortest route determined by Departmental Representative as being feasible and satisfactory.
- .5 Measure water in units of 1000L for water authorized by Departmental Representative and applied.
- .6 Measure compaction of granular base in hours for each type of compaction unit employed as shown on recording devices approved in writing by Departmental Representative.

**1.3 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136, 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 (600kN-m/m<sup>3</sup>).
  - .5 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m<sup>3</sup>).
  - .6 ASTM D1883, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

- .7 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- 1.4 ACTION AND INFORMATIONAL SUBMITTALS**
  - .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Sustainable Design Submittals:
    - .1 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction.
- 1.5 DELIVERY, STORAGE AND HANDLING**
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 31 05 16 - Aggregate Materials.
  - .2 Storage and Handling Requirements:
    - .1 Stockpile minimum 50% of total aggregate required prior to beginning operation.
    - .2 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
    - .3 Replace defective or damaged materials with new.
    - .4 Store cement in weather tight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed stone or gravel.
  - .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.2.
    - .1 Table:

Sieve Designation	% Passing
31.5 mm	100
18.0 mm	75-90
12.5 mm	65-83
5.00 mm	40-69
2.00 mm	26-47
0.900 mm	17-32
0.400 mm	12-22
0.160 mm	7-14
0.071 mm	6-11

- .2 Material to level surface depressions to meet gradation limits in accordance with Table.
- .3 Liquid limit: to ASTM D4318, maximum 25
- .4 Plasticity index: to ASTM D4318, maximum 7.
- .5 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45
- .6 Crushed particles: at least 50% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.

Passing	Retained on	
31.5 mm	to	18.0 mm
18.0 mm	to	5.00 mm

- .7 Soaked CBR: to ASTM D1883, minimum 80, when compacted to 100% of ASTM D1557.

## **Part 3 Execution**

### **3.1 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 requirements of sediment and erosion control plan, specific to site, that complies requirements of authorities having jurisdiction, whichever is more stringent.
  - .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 areas disturbed during removal.

### **3.2 PLACEMENT AND INSTALLATION**

- .1 Place granular base after subgrade surface is inspected and approved in writing by Departmental Representative.
- .2 Placing:
  - .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Place material only on clean unfrozen surface, free from snow and ice.
  - .4 Begin spreading base material on crown line or on high side of one-way slope.
  - .5 Place material using methods which do not lead to segregation or degradation of aggregate.

- 
- .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
  - .7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
    - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
  - .3 Compaction Equipment:
    - .1 Ensure compaction equipment is capable of obtaining required material densities.
    - .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.
    - .3 Equipped with device that records hours of actual work, not motor running hours.
  - .4 Compacting:
    - .1 Compact to density not less than 100% corrected maximum dry density ASTM D698.
    - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
    - .3 Apply water as necessary during compacting to obtain specified density.
    - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
    - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
  - .5 Proof rolling:
    - .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
    - .2 Obtain written approval from Departmental Representative to use non standard proof rolling equipment.
    - .3 Proof roll at level in granular base as indicated.
      - .1 If use of non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
    - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
    - .5 Where proof rolling reveals areas of defective subgrade:
      - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
      - .2 Backfill excavated subgrade with Section 32 11 16.01 - Granular Sub-Base.

- 
- .3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.
  - .4 Replace base material and compact in accordance with this Section.
  - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with Section 32 11 16.01 - Granular Sub-base and this section at no extra cost.

### **3.3 SITE TOLERANCES**

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

### **3.5 PROTECTION**

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

**END OF SECTION**

**Part 1            General**

**1.1                PRICE AND PAYMENT PROCEDURES**

- .1      Measurement and Payment: Will be included in the lump sum bid price.
- .2      Measure supply and application of calcium chloride in litres applied.
- .3      Measure supply and application of water for dust control in litres.
- .4      No extra compensation will be paid for calcium chloride and water ordered and applied on Saturdays, Sundays or holidays.

**1.2                REFERENCES**

- .1      Canadian General Standards Board (CGSB)
  - .1          CAN/CGSB-15.1, Calcium Chloride.
- .2      U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1          EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1      Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Sustainable Design Submittals:
  - .1          Erosion and Sedimentation Control: submit erosion and sedimentation control plan in accordance with authorities having jurisdiction.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1      Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2      Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1          Supply calcium chloride in quantities and at times as directed by Departmental Representative.
  - .2          Deliver calcium chloride to site in moisture-proof bags or covered trucks. Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.
- .3      Storage and Handling Requirements:
  - .1          Store bags of calcium chloride in weather-proof enclosures.

**Part 2            Products**

**2.1                MATERIALS**

- .1      Calcium chloride, Type I: to CAN/CGSB-15.1.

- 
- .2 Water: in accordance with Departmental Representative's approval.

**Part 3 Execution**

**3.1 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 requirements of authorities having jurisdiction.

**3.2 APPLICATION**

- .1 Apply calcium chloride and/or water, as directed by Departmental Representative with equipment approved by Departmental Representative at rate of 0.40 L/m<sup>2</sup> for liquid.
- .2 Apply calcium chloride and/or water with distributors equipped with means of shut-off and with spray system to ensure uniform application.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**



**Part 1 General**

**1.1 MEASUREMENT PROCEDURES**

- .1 Payment will be included in the lump sum bid price.
- .2 Preparation of sub-grade for placing of topsoil will not be measured for payment.
- .3 Topsoil stripping will be measured by Departmental Representative in cubic metres of stockpiled topsoil and volume will be determined by average end area method.
- .4 Measure placing of topsoil in cubic metres removed from stockpile.
  - .1 Stockpiles will be measured by Departmental Representative and volume of topsoil removed calculated by average end area method.
- .5 Measure supply and application of soil amendments, including fertilizer, in square metres of area treated as determined by Departmental Representative.
- .6 Measure supplying, placing and spreading topsoil in cubic metres as determined from actual surface area covered and depth of topsoil specified.
  - .1 Specified depth of topsoil: measured and approved by Departmental Representative after settlement and consolidation as specified.
- .7 Measure finish grading in square metres from actual surface measurements as determined by Departmental Representative.

**1.2 REFERENCES**

- .1 Agriculture and Agri-Food Canada
  - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
  - .1 PN1340, Guidelines for Compost Quality.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 DEFINITIONS**

- .1 Compost:
  - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
  - .2 Compost is processed organic matter containing 40% or more organic matter as determined by 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 contain no toxic or growth inhibiting contaminants.
  - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A).

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**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals:
  - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
  - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**Part 2 Products**

**2.1 TOPSOIL**

- .1 Topsoil for seeded areas: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
  - .2 Contain no toxic elements or growth inhibiting materials.
  - .3 Finished surface free from:
    - .1 Debris and stones over 50 mm diameter.
    - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
  - .4 Consistence: friable when moist.

**2.2 SOIL AMENDMENTS**

- .1 Fertilizer:
  - .1 Fertility: major soil nutrients present in following amounts:
    - .1 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
    - .2 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
    - .3 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
  - .2 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .3 Ph value: 6.5 to 8.0.
- .2 Sand: washed coarse silica sand, medium to course textured.
- .3 Organic matter: compost Category A in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .4 Limestone:
  - .1 Ground agricultural limestone.

- .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .5 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

## **2.3 SOURCE QUALITY CONTROL**

- .1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative.
  - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

## **Part 3 Execution**

### **3.1 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 requirements of 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 areas disturbed during removal.

### **3.2 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds and/or grasses and removed from site.
- .2 Strip topsoil to depths as directed by Departmental Representative.
  - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 3 m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner.
- .5 Protect stockpiles from contamination and compaction.

### **3.3 PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct.

- 
- .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
  - .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
  - .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
    - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
    - .2 Remove debris which protrudes more than 75 mm above surface.
    - .3 Dispose of removed material off site.
  - .4 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
    - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 15 mm below finished grade.
- .4 Spread topsoil to following minimum depths after settlement.
  - .1 150 mm for seeded areas.
  - .2 135 mm for sodded areas.
  - .3 300 mm for shrub beds.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

### **3.5 FINISH GRADING**

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative.
  - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

### **3.6 ACCEPTANCE**

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

### **3.7 SURPLUS MATERIAL**

- .1 Dispose of materials except topsoil not required where directed by Departmental Representative.

### **3.8 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.

- .2      Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT AND PAYMENT**

- .1 Payment will be included in the lump sum bid price.
- .2 Measure hydraulic seeding square metres of actual surface area for:
  - .1 Grass mixture including fertilizer.
  - .2 Areas of blending into existing turf grass will not be measured for payment.
- .3 Measure maintenance during warranty period of areas seeded in square metres.
- .4 Payment for seeding made at unit price bid of actual area surface measurements taken and computed by Departmental Representative.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
  - .2 Schedule hydraulic seeding using grass mixtures between dates recommended by Provincial Agricultural Department.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.
- .3 Submit in writing 5 days prior to commencing work:
  - .1 Volume capacity of hydraulic seeder in litres.
  - .2 Amount of material to be used per tank based on volume.
  - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.
- .4 Samples:
  - .1 Submit 0.5 kg container of each type of fertilizer used.
- .5 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .6 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

**1.4 QUALITY ASSURANCE**

- .1 Qualifications:

- .1 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
- .2 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
  - .2 Inoculant containers to be tagged with expiry date.
- .3 Storage and Handling Requirements:
  - .1 Store fertilizer off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **1.6 WARRANTY**

- .1 For seeding, 12 months warranty period is extended to 1 full growing season.
- .2 Contractor hereby warrants that seeding will remain free of defects for 1 full growing season.
- .3 End-of-warranty inspection will be conducted by Departmental Representative.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
  - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
    - .1 Mixture composition:
      - .1 20% Mat Muhly / Muhlenbergia richardsonis.
      - .2 20% Blue Grama / Bouteloua gracillis.
      - .3 20% Plains rough fescue / Festuca hallii.
      - .4 20% June grass / Koeleria macrantha
      - .5 10% Rocky Mountain Sheep's fescue / Festuca ovina var.saximontana
      - .6 5% Northern wheatgrass / Agropyron dasystachyum
      - .7 5% Western wheatgrass / Agropyron smithii.

- .2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
  - .1 Type I mulch:
    - .1 Made from wood cellulose fibre.
    - .2 Organic matter content: 95% plus or minus 0.5%.
    - .3 Value of pH: 6.0.
    - .4 Potential water absorption: 900%.
  - .2 Type II mulch:
    - .1 Made from newsprint, raw cotton fibre or straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.
- .3 Tackifier: water dilutable, liquid dispersion.
- .4 Water: free of impurities that would inhibit germination and growth.
- .5 Fertilizer:
  - .1 To Canada "Fertilizers Act" and Regulations.
  - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
- .6 Inoculants: inoculant containers to be tagged with expiry date.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic seeding in accordance with manufacturer's written instructions.
  - .1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

#### **3.2 PROTECTION OF EXISTING CONDITIONS**

- .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.

#### **3.3 PREPARATION OF SURFACES**

- .1 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.
- .2 Fine grade areas to be seeded free of humps and hollows.
  - .1 Ensure areas are free of deleterious and refuse materials.



- .3 Cultivated areas identified as requiring cultivation to depth of 25 mm.
- .4 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .5 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.

### 3.4 FERTILIZING PROGRAM

- .1 Fertilize prior to fine grading applying fertilizer equally distributed in accordance with the following program:

Date Range	Application Rate	Formulation (NPK Ratio)
1 month after seeding or postpone until spring if application falls within four week period prior to expected end of growing season	kg/ 100 m <sup>2</sup>	16-32-6

### 3.5 PREPARATION OF SLURRY

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After materials are in seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

### 3.6 SLURRY APPLICATION

- .1 Ensure seed is placed under supervision of certified Landscape Planting Supervisor.
- .2 Hydraulic seeding equipment:
  - .1 Slurry tank.
  - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.
  - .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
  - .4 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".
- .3 Slurry mixture applied per hectare.
  - .1 Seed: grass mixture 23 kg.
  - .2 Mulch: Type I 2,200 kg.
  - .3 Tackifier: 340 kg.
  - .4 Water: Minimum 30,000 L.
  - .5 Fertilizer: 2.5 kg, ratio 16-32-6.
- .4 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
  - .1 Using correct nozzle for application.
  - .2 Using hoses for surfaces difficult to reach and to control application.

- .5 Blend application 300 mm into adjacent grass areas or sodded areas and previous applications to form uniform surfaces.
- .6 Re-apply where application is not uniform.
- .7 Remove slurry from items and areas not designated to be sprayed.

### **3.7 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Clean and reinstate areas affected by Work.

### **3.8 PROTECTION**

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by Departmental Representative.

### **3.9 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Ensure maintenance is carried out under supervision of certified Landscape Maintenance Supervisor.
- .2 Perform following operations from time of seed application until acceptance by Departmental Representative.
- .3 Grass Mixture:
  - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
  - .2 Mow grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass.
  - .3 Fertilize seeded areas after first cutting in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles; water in well.
  - .4 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
    - .1 If chemical means are used, comply with Section 31 31 19.13 - Chemical Vegetation Control.
  - .5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

### **3.10 ACCEPTANCE**

- .1 Seeded areas will be accepted by Departmental Representative provided that:
  - .1 Plants are uniformly established.

- .2 Areas have been mown at least twice.
- .3 Areas have been fertilized.
- .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

### 3.11 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
  - .2 Mow areas seeded, as directed by Departmental Representative and in accordance with following schedule:

Requirements for Cutting	Height of Cut
Cut to 40-50 mm. Remove clippings that exceed 10 mm	60 mm

- .3 Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.
  - .1 If chemical means are used, comply with Section 31 31 19.13 - Chemical Vegetation Control.

**END OF SECTION**

**Part 1 General**

**1.1 DEFINITIONS**

- .1 Water Service: Exterior domestic water piping.
- .2 Abbreviations used in this Section and considered standard to the industry include, but are not limited to, the following:
  - .1 **PVC:** Polyvinyl chloride plastic.

**1.2 SUBMITTALS**

- .1 Submit product data for the following materials:
  - .1 Piping specialties.
  - .2 Valves and accessories.
  - .3 Fire hydrants.
- .2 Submit manufacturer's test data and certification that pipe materials meet the requirements of this section a minimum of two (2) weeks prior to commencing work.

**1.3 DELIVERY, STORAGE, AND HANDLING**

- .1 Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
  - .1 Ensure that valves are dry and internally protected against rust and corrosion.
  - .2 Protect valves against damage to threaded ends and flange faces.
  - .3 Set valves in best position for handling. Set valves closed to prevent rattling.
- .2 During Storage: Use precautions for valves, including fire hydrants, according to the following:
  - .1 Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - .2 Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- .3 Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- .4 Deliver piping with factory applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- .5 Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- .6 Protect flanges, fittings, and specialties from moisture and dirt.
- .7 Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

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**1.4 PROJECT CONDITIONS**

- .1 In accordance with City of Regina Specification.

**1.5 COORDINATION**

- .1 Coordinate connection to water main with utility company.

**Part 2 Products**

**2.1 MANUFACTURERS**

- .1 Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
- .2 Products: Subject to compliance with requirements, provide one of the products specified.
- .3 Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
- .4 Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

**2.2 PIPING MATERIALS**

- .1 Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

**2.3 DUCTILE IRON PIPE AND FITTINGS**

- .1 In accordance with City of Regina Specification.

**2.4 PIPING SPECIALTIES**

- .1 Flexible Connectors.
  - .1 Nonferrous Metal Piping: Bronze hose covered with bronze wire braid; with copper tube, pressure type, solder joint ends or bronze flanged ends brazed to hose.
  - .2 Ferrous Piping: Stainless steel hose covered with stainless steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.
- .2 Dielectric Fittings: Combination of copper alloy and ferrous; threaded, solder, or plain end types; and matching piping system materials.
  - .1 Dielectric Unions: Factory fabricated union assembly, designed for 250 psig (1725 kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material that isolates dissimilar metals and ends with inside threads according to ASME B1.20.1.
  - .2 Dielectric Flanges: Factory fabricated companion flange assembly, for 150 or 300 psig (1035 or 2070 kPa) minimum working pressure to suit system pressures.

- .3 Dielectric Flange Insulation Kits: Field assembled companion flange assembly, full face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
- .4 Provide separate companion flanges and steel bolts and nuts for 150 or 300 psig (1035 or 2070 kPa) minimum working pressure to suit system pressures.
- .5 Dielectric Couplings: Galvanized steel couplings with inert and noncorrosive thermoplastic lining, with threaded ends and 300.
- .6 psig (2070 kPa) minimum working pressure at 225 deg F (107 deg C).
- .7 Dielectric Nipples: Electroplated steel nipples with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300 psig (2070 kPa) minimum working pressure at 225 deg F (107 deg C).

## **2.5 GATE VALVES**

- .1 In accordance with City of Regina Specification.

## **2.6 GATE VALVE ACCESSORIES AND SPECIALTIES**

- .1 In accordance with City of Regina Specification.

## **2.7 CHECK VALVES**

- .1 In accordance with City of Regina Specification.

## **2.8 CORPORATION VALVES AND CURB VALVES**

- .1 In accordance with City of Regina Specification.

## **2.9 WATER METERS**

- .1 Water meters will be furnished by utility company.
- .2 Description: AWWA C700, displacement type, bronze main case. Register flow in gallons (liters) unless cubic feet (cubic meters) are indicated.
- .3 Description: AWWA C701, turbine type. Register flow in gallons (liters) unless cubic feet (cubic meters) are indicated.
- .4 Description: AWWA C702, compound type, bronze case. Register flow in gallons (liters) unless cubic feet (cubic meters) are indicated.
- .5 Remote Registration System: Utility company standard; direct reading type complying with AWWA C706. Include meter modified with signal transmitting assembly, low voltage connecting wiring, and remote register assembly.
- .6 Remote Registration System: Utility company standard; encoder type complying with AWWA C707. Include meter modified with signal transmitting assembly, low voltage connecting wiring, and remote register assembly.
  - .1 Data Acquisition Units: Comply with utility company requirements for type and quantity.
  - .2 Visible Display Units: Comply with utility company requirements for type and quantity.

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**2.10 WATER METER BOXES**

- .1 Description: Cast iron body and cover for disc type water meter with lettering "WATER METER" in cover; and slotted, open bottom base section of length to fit over service piping.
  - .1 Option: Base section may be cast iron, PVC, clay, or other pipe.
- .2 Description: Cast iron body and double cover for disc type water meter with lettering "WATER METER" in top cover; separate inner cover; air space between covers; and slotted, open bottom base section of length to fit over service piping.
- .3 Description: Polymer concrete body and cover for disc type water meter with lettering "WATER" in cover; and slotted, open bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 by 254 mm) square.

**2.11 HOSE CONNECTION, BACKFLOW PREVENTION DEVICES**

- .1 General: ASSE standard, nonremovable type, backflow prevention devices with ASME B1.20.7, garden hose threads on outlet.
- .2 Hose Connection Vacuum Breakers: ASSE 1011, nickel plated, with manual drain feature. Units attached to rough bronze finish hose connections may be rough bronze.
- .3 Hose Connection Backflow Preventers: ASSE 1052, suitable for at least 3 gpm (0.19 L/s) flow and applications with up to 10 foot head of water (30 kPa) back pressure. Include two check valves and intermediate atmospheric vent.

**2.12 FREESTANDING FIRE HYDRANTS**

- .1 In accordance with City of Regina Specification.

**Part 3 Execution**

**3.1 EARTHWORK**

- .1 In accordance with City of Regina Specification.

**3.2 PIPING APPLICATIONS**

- .1 In accordance with City of Regina Specification.

**3.3 VALVE APPLICATIONS**

- .1 In accordance with City of Regina Specification.

**3.4 JOINT CONSTRUCTION**

- .1 In accordance with City of Regina Specification.

**3.5 PIPING INSTALLATION**

- .1 In accordance with City of Regina Specification.

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**3.6 ANCHORAGE INSTALLATION**

- .1 In accordance with City of Regina Specification.

**3.7 VALVE INSTALLATION**

- .1 AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- .2 UL/FM Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast iron indicator post.
- .3 Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.
- .4 Water Regulating Valves: Install in vault or aboveground between shutoff valves.
- .5 Relief Valves: Install aboveground with shutoff valve on inlet.
- .6 Detector Check Valves: Install in vault or aboveground.

**3.8 PROTECTIVE ENCLOSURE INSTALLATION**

- .1 Install concrete base level and with top approximately 50 mm (2 inches) above grade.
- .2 Install protective enclosure over valves and equipment.
- .3 Anchor protective enclosure to concrete base.

**3.9 FIRE HYDRANT INSTALLATION**

- .1 In accordance with City of Regina Specification.

**3.10 CONNECTIONS**

- .1 In accordance with City of Regina Specification.

**3.11 FIELD QUALITY CONTROL**

- .1 Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- .2 Hydrostatic Tests: Test at not less than 1 1/2 times working pressure for 2 hours.
  - .1 Increase pressure in 50 psig (350 kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- .3 Prepare reports of testing activities.

**3.12 IDENTIFICATION**

- .1 Install continuous underground detectable warning tape during backfilling of trench for underground water service piping. Locate below finished grade, directly over piping. See Division 31 Section "Earthwork" for underground warning tapes.



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- .2 Permanently attach equipment nameplate or marker, indicating plastic water service piping, on main electrical meter panel. See Division 33 Section "Utility Materials" for identifying devices.

### **3.13 CLEANING**

- .1 Clean and disinfect water distribution piping as follows:
  - .1 Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
  - .2 Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
  - .3 Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:
    - .1 Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    - .2 Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    - .3 After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    - .4 Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
  - .4 Prepare reports of purging and disinfecting activities.
  - .5 After completing drinking fountain installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

**END OF SECTION**

**Part 1 General**

**1.1 MEASUREMENT AND PAYMENT**

- .1 Payment will be included in the lump sum bid price.
- .2 Measure excavation for culverts in accordance with Section 31 24 13 - Roadway Embankments.
- .3 Measure supply of pipe culvert in metres for each size, type and class of pipe supplied.
  - .1 No separate measurement will be made for couplings and fittings for steel pipe and plastic pipe culverts.
- .4 Measure, supply and installation of pipe culvert including excavation and backfill in metres in place for each size, type and class of pipe.
- .5 Measure granular material for culvert bedding and backfill in cubic metres, compacted in place, to excavation limits authorized by Departmental Representative in accordance with Section 31 24 13 - Roadway Embankments.
- .6 Cost of supply and installation will include any necessary dewatering prior to placing of bedding.
- .7 Measure supply and installation of corrugated fluming material in metres for each size, type and class and to include necessary hardware, as indicated.
- .8 Installation of fluming will include cost of excavating and tamping of material around fluming, driving anchor pins, assembling cross angles and hoops and any other work required to install fluming.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C14M, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
  - .2 ASTM C76M, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
  - .3 ASTM C117, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .4 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .5 ASTM C144, Standard Specification for Aggregate for Masonry Mortar.
  - .6 ASTM C443M, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
  - .7 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .8 ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
  - .9 ASTM F667, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
- .3 CSA International
  - .1 CSA A3000, Cementitious Materials Compendium.
  - .2 CSA A257 Series, Standards for Concrete Pipe and Manhole Sections.
  - .3 CAN/CSA G401, Corrugated Steel Pipe Products.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Inform Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.
  - .2 Submit to Departmental Representative for testing, at least 4 weeks before beginning Work, samples of materials proposed for use.
- .4 Certification: to be marked on pipe.
- .5 Test and Evaluation Reports:
  - .1 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Store and protect pipes from damage.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 CORRUGATED STEEL PIPE**

- .1 Corrugated steel pipe: to CAN/CSA-G401.
- .2 Water-tight cut-off collars: as indicated.

- .3 Prefabricated end sections.
- .4 Corrugated fluming: to CAN/CSA-G401.

## 2.2 CONCRETE PIPE

- .1 All concrete pipe and structures to be made using type 50 sulphate resistant Portland Cement to CSA 3000.
- .2 Non-reinforced concrete pipe: to CSA A257.
- .3 Reinforced concrete pipe: to CSA A257.
- .4 Rubber gaskets for joints: to CSA A257.
- .5 Cement mortar joint filler:
  - .1 Portland cement: to CSA A3000 type 50.
  - .2 Sand: to ASTM C144.
  - .3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

## 2.3 CORRUGATED POLYETHYLENE PIPE AND FITTINGS

- .1 To ASTM F667.
  - .1 Polyethylene resin: to ASTM D1248.
  - .2 Weathering resistance: to ASTM D1248.

## 2.4 GRANULAR BEDDING AND BACKFILL

- .1 Granular bedding and backfill material to Section 31 05 16 - Aggregate Materials and following requirements:
  - .1 Crushed pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
- .2 Table:

Sieve Designation	% Passing
200 mm	-
75 mm	100
50 mm	-
38.1 mm	-
25 mm	-
19 mm	-
12.5 mm	-
9.5 mm	-
4.75 mm	25-85
2.00 mm	-
0.425 mm	5-30
0.180 mm	-
0.075 mm	0-10

- .3 Concrete mixes and materials for bedding, cradles, encasement, supports: to Section 03 30 00- Cast-in-Place Concrete.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

#### **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 sediment and erosion control plan, specific to site, or requirements of authorities having jurisdiction, whichever is more stringent.
  - .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 areas disturbed during removal.

#### **3.3 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

#### **3.4 BEDDING**

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of maximum density to ASTM D698.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

### **3.5 LAYING CORRUGATED STEEL PIPE CULVERTS**

- .1 Begin pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.
- .5 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

### **3.6 JOINTS: CORRUGATED STEEL CULVERTS**

- .1 Corrugated steel pipe:
  - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
  - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
  - .3 Insert and tighten bolts.
  - .4 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved in writing by Departmental Representative.
- .2 Structural plate:
  - .1 Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.
  - .2 Drift pins may be used to facilitate matching of holes.
  - .3 Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.
  - .4 Draw bolts up tight, without overstress, before beginning backfill.
  - .5 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved by Departmental Representative.

### **3.7 LAYING CONCRETE PIPE CULVERTS**

- .1 Begin at downstream end of culvert with flanged end of first pipe section facing upstream.
- .2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.
- .3 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

### **3.8 JOINTS: CONCRETE PIPE CULVERTS**

- .1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar.
  - .1 Rubber gasket joints:

- .1 Install in accordance with manufacturer's written recommendations.
- .2 Ensure that tapered ends are fully entered into flanged ends.
- .2 Bituminous filled joint:
  - .1 Make joint with excess of filler to form continuous bead around outside of pipe and finish smooth on inside.
- .3 Mortar joints:
  - .1 Prepare mortar as specified herein.
  - .2 Clean pipe ends and wet with water before joint is made.
  - .3 Place mortar in lower half of flanged end of pipe section in place.
  - .4 Apply mortar to upper half of tapered end of pipe section being installed.
  - .5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.
  - .6 Clean inside of pipe and annular space between ends of pipes after each joint is made.
  - .7 Fill joint with mortar and finish smooth and even.
  - .8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.
  - .9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

### **3.9 LAYING CORRUGATED POLYETHYLENE PIPE CULVERTS**

- .1 Begin laying at downstream end of culvert.
- .2 Install pipe in trench by lowering.
- .3 Ensure bottom of pipe is in contact with shaped bedding throughout pipe length.
- .4 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

### **3.10 JOINTS FOR POLYETHYLENE CULVERTS**

- .1 Install couplings in accordance with manufacturer's instructions.

### **3.11 BACKFILLING**

- .1 Backfill around and over culverts as indicated or as directed by Departmental Representative.
- .2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .3 Compact each layer to 95% maximum density to ASTM D698 taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.
  - .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

- .5 Place backfill in unfrozen condition.

**3.12 FLUMING**

- .1 Assemble and install fluming as indicated.
- .2 Set top edges of fluming flush with side slope.

**3.13 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**



**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
  - .1 ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 Canadian General Standards Board (CGSB)
  - .1 CGSB 62-GP-11M, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.
- .3 Manual of Uniform Traffic Control Devices for Canada 2014.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Samples
  - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Submit to Departmental Representative at least 3 weeks prior to commencing work, following samples of materials proposed for use:
    - .1 Delineator Bollard – 60 mm x 1200 mm with reactive spring and driveable base.
    - .2 Reflective markers.

**1.3 MEASUREMENT PROCEDURES**

- .1 Measure supply and installation of delineators on number of individual units.

**1.4 QUALITY ASSURANCE**

- .1 Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Section 01 45 00 Quality Control.

**Part 2 Products**

**2.1 DESIGN CRITERIA**

- .1 Bollards to be capable of withstanding bumps and have the ability to deflect without permanent deformation and not create damage to the vehicles used for training.

**2.2 MATERIALS**

- .1 Delineator Bollard – 60 mm x 1200 mm
- .2 Driveable base.
- .3 Spring Assembly

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**Part 3            Execution**

**3.1                ASSEMBLY**

- .1        Fasten delineator to driveable base using bolts, washers, spacers and nuts as per manufacturers instructions.

**3.2                INSTALLATION**

- .1        Do work in accordance with "Manual of Uniform Traffic Control Devices for Canada", (MUTCDC) except where specified otherwise.
- .2        Install posts vertically as indicated.
- .3        On alignment, space delineator units as indicated.

**3.3                CLEANING**

- .1        Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

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**Part 3            Execution**

**3.1                ASSEMBLY**

- .1        Fasten delineator to driveable base using bolts, washers, spacers and nuts as per manufacturers instructions.

**3.2                INSTALLATION**

- .1        Do work in accordance with "Manual of Uniform Traffic Control Devices for Canada", (MUTCDC) except where specified otherwise.
- .2        Install posts vertically as indicated.
- .3        On alignment, space delineator units as indicated.

**3.3                CLEANING**

- .1        Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**