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Appendix A

Lake Louise Utilities Upgrade Geotechnical Investigation Revision 4, September 2019
Lake Louise Water and Sanitary Infrastructure Upgrades – Mitigation Measures

LIST OF DRAWINGS

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END OF TABLE

DIVISION 01
GENERAL REQUIRMENTS

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 The work consists of various water system improvement projects and sanitary sewer improvement projects within the Village of Lake Louise. Work of the contract includes, but is not limited to the total performance of the work (plant, labour, materials, and equipment).
- .2 The scope of work includes:
 - Pipestone River Water Main Crossing Upgrade (**to be completed June 24, 2021**)
- .3 The drawings and the specification sections more completely describe the full scope of work and material requirements.

1.2 CONTRACT METHOD

- .1 Construct Work under unit price contract.

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 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises for Work, for storage, and for access, to allow:
 - .1 Departmental Representative occupancy according to Canadian Environmental Assessment Act (CEAA).
 - .2 Departmental Representative usage.
 - .3 Work by other contractors, if any.
- .2 Co-ordinate use of premises under direction of the Departmental Representative.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .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 the Departmental Representative.

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- .6 At completion of operations condition of existing work: to make good any work disturbed during construction to that of its original state.

1.5 DEPARTMENTAL REPRESENTATIVE OCCUPANCY

- .1 The Departmental Representative will have access to the premises during entire construction period for execution of normal operations.
- .2 The Departmental Representative will require no interruption to the water distribution and sanitary collection services during construction.
- .3 Co-operate with the Departmental Representative in scheduling operations to minimize conflict with the institution and to facilitate the Departmental Representative's usage.
- .4 Construct Work to accommodate the Departmental Representative's use of premises during construction.
- .5 Co-ordinate Progress Schedule and co-ordinate with the Departmental Representative during construction.
- .6 Maintain fire access/control to the work site at all times.

1.6 ALTERATIONS, ADDITIONS OR REPAIRS

- .1 Execute work with least possible interference or disturbance to village business, campground operations, occupants, staff and normal use of premises. Arrange with the Departmental Representative to facilitate execution of work.
- .2 Execute work according to CEAA and National Parks Act.

1.7 EXISTING SERVICES

- .1 Notify the 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 the Departmental Representative 96 hour's 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 campground operations, occupants, staff and normal use of premises.
- .3 Contractor shall inform Departmental Representative 96 hours in advance of interruption of underground utilities.
- .4 Contractor is to receive approval from Departmental Representative prior to any shutdowns.
- .5 Where work involves underground services, the Contractor must inform and obtain approval from the Departmental Representative before any excavation may commence.

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- .6 Provide alternative routes for personnel and vehicular traffic.
 - .7 Provide flagging, barricades and traffic controls at all times during work.
 - .8 Establish location and extent of service lines in area of work before starting Work. Notify the Departmental Representative of findings.
 - .9 Submit schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility including power and communications services or roadways. Adhere to approved schedule and provide notice to affected parties. Only ½ of any road(s) may only be shut down at a given time.
 - .10 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic where required. Normal traffic includes buses and large trailers
 - .11 Where unknown services are encountered, immediately advise the Departmental Representative and confirm findings in writing.
 - .12 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
 - .13 Record locations of maintained, re-routed and abandoned service lines.
 - .14 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.8 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.
 - .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 Minutes of Safety Meetings
 - .12 Performance Bond
 - .13 Other documents as specified.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas and businesses, including stairs, runways, roads, ramps or ladders and scaffolding, 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 the Departmental Representative to facilitate work as stated. Maintain village access to public at all times.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 The Contractor will provide onsite sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .5 Contractor shall provide its own waste bins and shall dispose of domestic waste on a daily basis. Contractor shall not use existing public waste bins. All construction waste to be placed in Contractor supplied bins on site.
- .6 Closures: protect work temporarily until permanent enclosures are completed.

1.3 EXISTING SERVICES

- .1 Notify the Departmental Representative and utility companies with at least 2 weeks notice of intended interruption of services and obtain required permission.
- .2 Where unknown services are encountered, immediately advise the Departmental Representative and confirm findings in writing.
- .3 Establish location and extent of service lines in the area(s) before starting work. Notify the Departmental Representative of findings.
- .4 Submit schedule to, and obtain approval from the Departmental representative for any shut-down or closure of active service or facility, including power and communications services. Adhere to the approved schedule and provide notice to the affected parties.
- .5 Where Work involves breaking into or connecting to existing services, give the Departmental Representative 96 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal hours of occupants.
- .6 Provide for personnel and vehicular traffic. Provide detours, flagging, barricades and traffic controls before beginning work.

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- .7 Where unknown services are encountered, immediately advise the Departmental Representative and confirm findings in writing.
 - .8 Protect, relocate, or maintain existing active services. When inactive services are encountered, cap off in a manner approved by authorities having jurisdiction.
 - .9 Record locations of maintained, re-routed and abandoned service lines.
 - .10 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 18 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic, security regulations, the National Parks Act, Canadian Environmental Assessment Act, site specific Basic Impact Analysis (BIA) (to be provided upon contract award) and the site specific Mitigation Measures found in Appendix A.
- .3 Keep within limits of work and avenues of ingress and egress.
- .4 Deliver materials during normal working hours unless otherwise approved by the Departmental Representative.
- .5 Hours of work are normally from 7am to 7pm.
- .6 No work will be permitted from noon Thursday before any long weekend until 7am on the Tuesday following the long weekend. The departmental representative will provide a list of non-working during scheduling of construction.
- .7 Trenches adjacent to the roadway must be safe for public transportation and not affect the support or structure of adjacent roadways at any time.
- .8 Trenches must be barricaded and blocked off at the end of each working day.
- .9 No more than 30 metres of open trench may be left open at the end of the working day.
- .10 At the end of each work day, all roads affected by the work shall be opened to the public. In the event where such road(s) could not be opened to the public, the Contractor shall provide flagmen on 24-hour shifts until such road(s) is opened and placed back into operation.
- .11 Where trenches are required along and across roadway(s), the Contractor shall ensure that trenches are covered at the end of each working day and shall be safe for public transportation.

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- .12 2021 work identified in Section 01 11 00 Summary of Work is to be completed during the 2021 calendar year.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 GENERAL

1.1 REFERENCES

- .1 General Conditions.

1.2 PRIME COST SUM

- 1. Included in Contract price a total Prime Cost Sum of **\$200,000.00** for items listed below.
- 2. Do not include in the Contract Price, additional contingency allowances for products, installation, overhead or profit.
- 3. Prime Cost Sum provided for in the Lump Sum Arrangement Table is not a sum due to the Contractor. Rather, payment will be made against it for miscellaneous work not included in the unit price table under the General Conditions of the Contract.
- 4. No interpretation of the items listed under Prime Cost Sum Allowances shall indicate that work will be included under the Prime Cost Sum. Items, tasks, and activities included in the Works elsewhere in the Contract, including Unit Price and Lump Sum Items, shall be paid as indicated in those sections and not under the Prime Cost Sum.
- 5. Any and all additional work must be approved in writing by the Departmental Representative prior to commencement.
- 6. All expenditures must be substantiated with verified invoices and/or accepted daily extra work reports as noted in Measurement and Payment Procedures below.
- 7. Such work may include, but not be limited to:
 - .1 Additional abandonment of existing pipe in place not listed in the contract documents;
 - .2 Additional installation of new valves not listed in the Contract documents.
 - .3 Repair, and removal of existing valves;
 - .4 Additional supply and installation of asphalt concrete pavement;
 - .5 Additional pavement removal;
 - .6 Additional clearing and grubbing;
 - .7 Stripping, excavation and disposal of waste materials as directed by the Departmental Representative;
 - .8 Danger tree assessment and removal;
 - .9 Relocation or removal and disposal of existing signs, guide posts and other miscellaneous items;
 - .10 Additional supply and installation of permanent signs (not construction signs);
 - .11 Removal and disposal or plugging of existing culverts;
 - .12 Additional supply and installation of permanent lane markings;
 - .13 Additional survey resulting from changes made by the Departmental Representative;
 - .14 Relocation / protection of existing utilities, including payment of utility service provider costs;
 - .15 Utility Pole Relocation;

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- .16 Remediation or removal and replacement of unsuitable or contaminated soils not described in the Contract documents;
 - .17 Import of dry material to replace frozen backfill.
 - .18 Supply and installation of wildlife fencing not described in the Contract documents;
 - .19 Supply and installation of seeding not described in the Contract documents.
 - .20 Supply and installation of additional landscaping;
 - .21 Additional road structure repairs;
 - .22 Drainage improvements; ditching; culvert repairs; and cleaning;
 - .23 Supply and installation of Riprap;
 - .24 Sub-drainage not specified in the tender documents;
 - .25 Traffic control equipment additional as is required by the applicable regulations
 - .26 and standards.
 - .27 Relocation of existing structures;
 - .28 Additional manhole adjustments;
 - .29 Miscellaneous work as directed by the Departmental Representative.
8. The Contract Price, and not Prime Cost Sum, includes Contractor's overhead and profit in connection with the Work.

Part 2 Products

2.1 NOT USED

Part 3 General

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 APPLICATION FOR PROGRESS PAYMENT

- .1 Submit to Departmental Representative, at least 10 calendar days after contract award and before first application for payment, schedule of values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment. After approval by Departmental Representative, Cost Breakdown will be used as basis for progress payments.
- .2 Contractor shall submit PWGSC-TPSGC Form 1792 Request for Progress Payment when applying for progress payment.
- .3 Support claims for products delivered to place of Work but not yet incorporated into work by such evidence as Departmental Representative may reasonably require to establish value and delivery of Products.

1.2 PWGSC STANDARD STATUTORY DECLARATION

- .1 The Contractor shall complete and attach PWGSC-TPSGC Form 2835 - Statutory Declaration to all applications for progress payment, including the first progress claim.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 Payments shall be made on the basis of the lump sum prices and the unit prices bid in the Unit Price Schedules in the Tender Form.
- .2 The prices bid for various items of work, unless specifically noted otherwise, shall include the supply of all labour, material, plant and equipment required to construct the work in accordance with the drawings and specifications.
- .3 The method of measurement of the quantities for payment and the basis for payment will be in accordance with the following items of this section. All measurement will be done by the Departmental Representative.
- .4 The prices bid for supply and installation of materials shall be full compensation for supplying, delivering, loading, unloading, handling, storage, breakage, waste, hauling, installing, cleaning, testing and placing in service the work together with all work subsidiary and incidentals thereto for which separate payment is not provided elsewhere.
Payment shall be only for materials actually installed.
- .5 All existing materials on-site whether structures, vegetation, topsoil, gravel, sand or other excavated, or piled materials are the property of the Owner on which the work is located. Only those materials specifically noted in the specifications or on the drawings as belonging to the Contractor shall become the Contractor's property.
- .6 Where there are excess excavated materials, unsuitable materials or materials of any kind that are not used in the work, such materials are not the property of the Contractor unless authorized in writing by the Departmental Representative or specified to be disposed of by the Contractor.
- .7 The sum of the payments in the Unit Price Schedules of the Tender Form shall constitute full payment for the complete works as described in these documents. Extra payment will only be made for items adding to the scope of the works, as described in these documents and/or shown on the drawings and as evident from inspection of the site of the works.

Part 2 Non-Payment Items

2.1 DESCRIPTION

- .1 Supply of all equipment, labour, materials, plant, and services required to complete the Work for which no specific payment item has been assigned in the Unit Price Schedules of the Tender Form shall be considered incidental to the Works.
- .2 There shall be no separate payment for incidental work. Payment for incidental work shall be considered to be included in the total tendered price of the Unit Price Schedules of the Tender Form.
- .3 All work shown on the plans and drawings, or referred to in the General Conditions, the Supplementary General Conditions, or the General Specifications shall be considered as part of the complete work unless specifically deleted.

Part 3 Measurement and Payment Clauses

3.1 Part A - Site Works

.1 Prime Cost Sum

- .1 No measurement shall be made.
- .2 Payment shall be made using negotiated rates by material, labour and equipment rates as per the following:
 - .1 Construction Association's rate schedule and will be all inclusive and fully operated.
 - .2 Vehicles (ie. Pickup trucks) will be paid either at daily rates as per the Alberta Roadbuilders & Heavy Construction Association's (most recent) or by mileage using National Joint Council (NJC) rates, whichever is lower. The Contractor will not be permitted to claim both daily rental and mileage rates.
 - .3 Hourly rental of equipment will be measured in actual working time and necessary travel time within project limits. Transportation time to and from site to be reimbursed only if equipment is used exclusively for additional work.
 - .4 Equipment paid on standby will be paid on 50% of the relevant Less Operator rates to a maximum of 10 hours per day.
 - .5 When based upon actual costs for additional works under Prime Cost Sum, payment will be based upon supplied invoices and other work records.
 - .6 The Prime Contractor may apply a 10% mark-up to subcontractor or supplier invoices only, as accepted by the Departmental Representative. No mark-up will be allowed on relevant equipment and labour rates.
 - .7 A claim for additional payment will be considered submitted when all required documentation has been received by the Departmental Representative.
 - .8 The Departmental Representative's, or their delegate's, signature on extra work reports is only a record of the equipment, materials and labour hours utilized on the task, not an agreement to entitlement or quantification of that Work. Review and acceptance may be based on Contractor submitted finalized extra work reports, which are to include appropriate rates, quantities and applicable invoices. Labour and equipment rates are to be reviewed by the Departmental Representative against the appropriate accepted rates when submitted for payment.
 - .9 The Contractor shall submit extra work reports to the Departmental Representative within 24 hours of the day of extra work.
 - .10 The Departmental Representative's, or their delegate's, signature on any of the Contractor's Daily Extra Work Reports shall not be an agreement to waive any portion of the Contract regardless of any wording to the contrary.
 - .11 Unless otherwise provided for in the Contract, payment on a Force Account basis represents complete payment (exclusive of GST) and reimbursement for all impacts, related costs and expenses, including,

without limitation: time; labour; materials; equipment; mobilization; subcontracting; overhead; profit; general supervision; occupational tax and any other Federal or Provincial revenue legislation exclusive of GST; premiums for public liability and property damage insurance policies; bonding; for the use of all tools and equipment for which no specific rental payment provision exists; and for all costs incurred by the Contractor in supplying materials.

.2 Erosion Control Fencing

- .1 No measurement shall be made.
- .2 Payment shall be made on lump sum (L.S.) price bid, pro-rated on a monthly basis according to the percentage of contract completion.
- .3 Payment shall include the supply of all labour, material and plant to provide erosion control fencing throughout the entire project. The work includes:
 - .1 Supply and installation of erosion control fencing as outlined on the drawings and in Section 01-35-43 and as directed by the Departmental Representative.
 - .2 Maintenance, replacement and removal after construction completion.
 - .3 All incidental work and items required to complete the work for which payment is not specified elsewhere.

.3 Traffic Control, Barricades and Signs

- .1 No measurement shall be made.
- .2 Payment shall be made on the lump sum (L.S.) price bid, pro-rated on a monthly basis according to the percentage of contract completion.
- .3 Payment shall include the supply of all labour, material and plant to provide traffic control and to produce, install and relocate the barricades and signs as required. The work includes:
 - .1 Traffic, parking and pedestrian control as outlined in Sections 01 35 00.06 and 01 56 00 and as directed by the Departmental Representative.
 - .2 Supply and installation of work zone barriers as outlined on the drawings and in Section 01 35 43 and as directed by the Departmental Representative.
 - .3 Manufacturing, supply, erection and relocation as required of all barricades, flashers and signs required for completion of the project.
 - .4 Maintenance, replacement and removal after construction completion.
 - .5 All incidental work and items required to complete the work for which payment is not specified elsewhere.

.4 General Requirements

- .1 No measurement shall be made.
- .2 Payment shall be made on the lump sum (L.S.) price bid, pro-rated on a monthly basis according to the percentage of contract completion.
- .3 Payment shall include the supply of all labour, material and plant for the following work:

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- .1 Mobilization and demobilization.
 - .2 Dust control.
 - .3 Dewatering.
 - .4 Site safety.
 - .5 Temporary power for construction purposes.
 - .6 Accommodation.
 - .7 Temporary toilets.
 - .8 Environmental protection.
 - .9 Survey and drawings of record.
 - .10 Clean-up and removal of debris.
 - .11 Decommissioning, removal and disposal of the existing overland temporary sanitary bypass.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .5 Landscape Rehabilitation
- .1 No measurement shall be made.
 - .2 Payment shall be made on the lump sum (L.S) price bid, pro-rated on a monthly basis according to the percentage of contract completion.
 - .3 Payment shall include the supply of all labour, material and plant to remove and replace existing landscaping as required. The work includes:
 - .1 Sawcutting, breaking, excavating, loading, hauling.
 - .2 Locating and protecting existing utilities and structures.
 - .3 Preservation of trees and brush where required.
 - .4 Removal of grass, weeds, bark mulch, fabric, insulation, soil and other deleterious material.
 - .5 Removal and disposal of waste material to an approved disposal site outside of the National Park.
 - .6 Dump fees.
 - .7 Restore landscaping to existing or better condition, or as approved by the departmental representative and Parks Canada Agency.
 - .8 Landscape Maintenance as per Section 32 03 11
 - .9 Maintain plant life immediately after planting until plants are well established. Continue until termination of warranty period or as directed by Parks Canada Agency.
 - .10 Regular weed control and watering as required
 - .11 Maintenance schedule program as submitted to Parks Canada Agency including monthly maintenance logs.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .6 Topsoil Stripping (Haul off-site)

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- .1 Measurement shall be made in square metres (S.M.). The quantity shall be the actual area stripped with an assumed topsoil depth of 150mm.
 - .2 Payment shall be made on the unit price bid per square metre (S.M.).
 - .3 Payment shall include the supply of all labour, material and plant to strip and haul materials offsite. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Excavating, loading and hauling to an approved dump site outside the Park.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .7 Clearing & Grubbing
 - .1 Measurement shall be made in square metres (S.M.). The quantity shall be the actual area cleared and grubbed.
 - .2 Payment shall be made on the unit price bid per square metre (S.M.).
 - .3 Payment shall include the supply of all labour, material and plant to clear the site. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Cutting trees and brush, removal of stumps where required.
 - .4 Salvage of usable timber.
 - .5 Trees larger than 150 mm (DBH) shall be mulched and delivered to Lake Louise Waste Water Treatment Plant (WWTP) between the hours of 9am and 4pm. The Contractor must attend a site orientation with WWTP Operations staff prior to stockpiling. Stockpiled timber becomes property of Parks Canada.
 - .6 Trees less than 150 mm (DBH), stumps, tops and limbs shall be mulched and delivered to Lake Louise Waste Water Treatment Plant (WWTP) between the hours of 9am and 4pm. The Contractor must attend a site orientation with WWTP Operations staff prior to stockpiling. Stockpiled timber becomes property of Parks Canada.
 - .7 Preservation of trees and brush where required.
 - .8 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .9 Cleared material not required to be salvaged, and grubbed material, shall be disposed of off site at an approved landfill site.

3.2 Part B – Water Mains

- .1 Water Main –300mm Stainless 316 Watermain c/w fittings (includes 300mm Stainless 316 Pipe, 3" Insulation, HDPE outer jacket and Heat Tracing System)
 - .1 Measurement shall be along the horizontal centreline of the pipe installed and tested.

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- .2 Payment shall be made on the unit price bid per lineal metre (L.M.) of pipe installed for the size specified.
 - .3 Payment shall include the supply of all labour, material and plant to install the new water main to lines and grades shown on the plans. The work includes:
 - .1 Construction survey, layout, setting grades
 - .2 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump Fees
 - .4 Locating and protecting existing utilities.
 - .5 Water control and disposal.
 - .6 Temporary fencing.
 - .7 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .8 Excavation, trench or ground support system, shoring, and sheeting.
 - .9 Pipe supply, installation of pipe and fittings incl. valves, bedding, jointing, placing, concrete thrust blocking, cleaning, flushing and disinfecting, pressure and leakage testing.
 - .10 Supply and install of heat tracking system and all associated components.
 - .11 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .2 Water Main –300mm PVC Watermain c/w fittings (includes 300mm PVC Pipe, 3" Insulation, HDPE outer jacket and Heat Tracing System)
 - .1 Measurement shall be along the horizontal centreline of the pipe installed and tested.
 - .2 Payment shall be made on the unit price bid per lineal metre (L.M.) of pipe installed for the size specified.
 - .3 Payment shall include the supply of all labour, material and plant to install the new water main to lines and grades shown on the plans. The work includes:
 - .1 Construction survey, layout, setting grades
 - .2 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump Fees
 - .4 Locating and protecting existing utilities.
 - .5 Water control and disposal.
 - .6 Temporary fencing.
 - .7 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .8 Excavation, trench or ground support system, shoring, and sheeting.
 - .9 Pipe supply, installation of pipe and fittings incl. valves, bedding, jointing, placing, concrete thrust blocking, cleaning, flushing and disinfecting, pressure and leakage testing.

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- .10 Supply and install of heat tracking system and all associated components.
 - .11 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .3 Steel Casing – 600mm
- .1 Measurement shall be along the horizontal centreline of the casing installed and tested.
 - .2 Payment shall be made on the unit price bid per lineal metre (L.M.) of casing installed for the size specified.
 - .3 Payment shall include the supply of all labour, material and plant to install the new steel casing to the lines and grades shown on the plans. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Dump Fees.
 - .3 Locating/exposing/protecting all existing utilities to allow the proposed alignment.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .7 Trench or ground support system, shoring, sheeting and pit maintenance.
 - .8 Supply, installation, bracing and removal of installation equipment.
 - .9 Supply and installation of casing pipe, joining, welding, anchoring, cleaning and testing.
 - .10 Pipe supply, installation of pipe and fittings, bedding, jointing, placing, concrete thrust blocking, cleaning, flushing and disinfecting, pressure and leakage testing.
 - .11 Supply and installation of spacers, bedding, jointing, placing, cleaning, leakage testing, and CCTV testing.
 - .12 Water main installation within casing pipe, strapping and spacer supply and installation.
 - .13 Pulling of carrier pipe to provide adequate exposure of both pipe ends for ease of attachment to adjoining pipes.
 - .14 Backfilling of all pits, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .15 No payment will be made for installation deemed unacceptable due to incorrect anchor or hanger installation resulting in an alignment beyond the specified tolerances.
 - .16 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Casing Pipe Sliding Supports

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- .1 Measurement shall be made on a complete unit (EA.) supplied and installed to the casing pipe.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) for each support supplied and installed to the new casing pipe.
 - .3 Payment shall include the supply of all labour, material and plant to supply and install the supports to the new casing pipe. The work includes:
 - .4 The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Locating/exposing/protecting all existing utilities to allow the proposed alignment.
 - .3 Cleaning, and removal of debris.
 - .4 Dump Fees.
 - .5 Supply and installation of fasteners, bolts, nuts and washers and bolt grouting and shim plates not measured but considered incidental to work.
 - .6 Supply and installation of anchor bolts, rod, nuts and washers, bolt grouting and epoxy not measured but considered incidental to work.
 - .7 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .5 Watermain Valve – 300mm
 - .1 Measurement shall be made on each (EA.) complete unit installed.
 - .2 Payment shall be made on the unit price bid per complete valve installed.
 - .3 Payment shall include the supply of all labour, material and plant to install the watermain valve. The work includes:
 - .1 Protecting existing utilities and structures.
 - .2 Traffic accommodations, barricades, flag men or temporary traffic control as required
 - .3 Excavation, trench or ground support system, shoring, sheeting.
 - .4 Dump fees.
 - .5 Removal of excavated material to disposal or stockpile areas.
 - .6 Excavation and trench backfilling, compaction, grading, supply of granular materials, spreading, placing, trimming, testing, subgrade restoration, and marker posts.
 - .7 Water control and disposal.
 - .8 Temporary fencing.
 - .9 The supply and installation of fittings, fasteners, wiring and electrical connections.
 - .10 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .6 Thrust/Anchor Blocks
 - .1 Measurement shall be made on each (EA.) complete unit installed.
 - .2 Payment shall be made on the unit price bid per complete thrust block installed.

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- .3 Payment shall include the supply of all labour, material and plant to install the thrust blocks. The work includes:
- .1 Protecting existing utilities and structures.
 - .2 Traffic accommodations, barricades, flag men or temporary traffic control as required.
 - .3 Dump fees.
 - .4 Excavation, trench or ground support system, shoring, sheeting.
 - .5 Removal of excavated material to disposal or stockpile areas.
 - .6 Excavation and trench backfilling, compaction, grading, supply of granular materials, spreading, placing, trimming, testing, subgrade restoration, and marker posts.
 - .7 Water control and disposal.
 - .8 Temporary fencing.
 - .9 The supply and installation of reinforcement.
 - .10 Supply and placement of granular levelling course.
 - .11 Forming, jointing, finishing, curing and testing.
 - .12 Grading, compaction, topsoil and seed of all disturbed work area
 - .13 Cleaning, removal of debris.
 - .14 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .7 Connection to Existing Water Main c/w Valve
- .1 Measurement shall be made on a complete unit (EA.) connected to the existing water main.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) for each size and type specified.
 - .3 Payment shall include the supply of all labour, material and plant to reconnect the new water main to the existing water main. The work includes:
 - .1 Construction survey, layout, setting grades
 - .2 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump Fees
 - .4 Locating and protecting existing utilities.
 - .5 Water control and disposal.
 - .6 Temporary fencing.
 - .7 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .8 Excavation, trench or ground support system, shoring, and sheeting.
 - .9 The supply and installation of tapping sleeve, valve, valve box, operating rod, concrete thrust blocking, bedding, epoxy coating, cathodic protection, cleaning, flushing and disinfecting, pressure and leakage testing.

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- .10 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .11 All incidental work and items required to complete the work for which payment is not specified elsewhere
- .8 Air Release Valves c/w Enclosure and Heater
- .1 Measurement shall be made on each (EA.) complete unit installed.
 - .2 Payment shall be made on the unit price bid per complete air release valve installed with enclosure and heater.
 - .3 Payment shall include the supply of all labour, material and plant to install the air release valves, enclosure and heater. The work includes:
 - .1 Protecting existing utilities and structures.
 - .2 Traffic accommodations, barricades, flag men or temporary traffic control as required
 - .3 Dump Fees.
 - .4 Excavation, trench or ground support system, shoring, sheeting.
 - .5 Removal of excavated material to disposal or stockpile areas.
 - .6 Excavation and trench backfilling, compaction, grading, supply of granular materials, spreading, placing, trimming, testing, subgrade restoration, and marker posts.
 - .7 Water control and disposal.
 - .8 Temporary fencing.
 - .9 The supply and installation of fittings, fasteners, wiring and electrical connections.
 - .10 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .9 Expansion Joint
- .1 Measurement shall be made on a complete unit (EA.) supplied and installed.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) for each expansion joint supplied and installed.
 - .3 Payment shall include the supply of all labour, material and plant to supply and install the expansion joint. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Locating/exposing/protecting all existing utilities to allow the proposed alignment.
 - .3 Cleaning, and removal of debris.
 - .4 Dump Fees.
 - .5 Supply and installation of fasteners, bolts, nuts and washers and bolt grouting not measured but considered incidental to work.
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.

.10 Temporary Water Service

- .1 No measurement shall be made.
- .2 Payment shall be made on lump sum (L.S.) price bid, pro-rated on a monthly basis according to the percentage of contract completion.
- .3 Payment shall include the supply of all labour, material and plant to provide temporary water supply to buildings during the installation of the water main system. The work includes:
 - .1 Traffic accommodation, barricades, flag-person or temporary traffic control as required.
 - .2 Supply all labour, supervision, tools, equipment, time materials and incidentals necessary to perform all operations in connection with providing temporary water supply.
 - .3 Submit plan for implementation and sequencing of temporary water service for review and approval by the Department Representative 4 weeks prior to implementation of Temporary Water service.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.3 Part C – Structural

.1 Work Platform and Environmental Containment

- .1 No measurement shall be made.
- .2 Payment shall be made on lump sum (L.S.) price bid, pro-rated on a monthly basis according to the percentage of contract completion.
- .3 Payment shall include the supply of all labour, material and plant to provide work platforms and environmental containment to complete con throughout the entire project. The work includes:
 - .1 Supply and installation of work platforms and environmental containment as required and outlined in Section 01-35-43 and as directed by the Departmental Representative.
 - .2 Maintenance, replacement and removal after construction completion.
 - .3 All incidental work and items required to complete the work for which payment is not specified elsewhere.

.2 Structural Steel – Supply and Delivery

- .1 Measurement shall be made by kilograms (K.G.).
- .2 Payment shall be made on the unit price bid per kilograms (K.G.) of Structural Steel supplied and delivered.
- .3 Payment shall include the supply of all labour, material and plant for the supply and delivery of new Structural Steel. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Loading, hauling, unloading, delivery, stockpiling.

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- .3 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .3 Structural Steel
 - .1 Measurement shall be made by kilograms (K.G.).
 - .2 Payment shall be made on the unit price bid per kilograms (K.G.) of new Structural Steel installed.
 - .3 Payment shall include the supply of all labour, material and plant for the installation of new Structural Steel. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Dump fees.
 - .3 Locating and protecting existing utilities and structures.
 - .4 Temporary fencing.
 - .5 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .6 Excavation, trench or ground support system, shoring, sheeting.
 - .7 Steel supply, installation, placing, welding, bolting, fasteners, cleaning, testing.
 - .8 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .4 Embedment Stainless Steel Anchor – Supply and Delivery
 - .1 Measurement shall be made at the unit price bid for each (E.A.) embedment anchor supplied and delivered.
 - .2 Payment for the supply and delivery of embedment anchors shall be made at the unit price bid for (E.A.) embedment anchor supplied and delivered.
 - .3 Payment shall include the supply of all labour, material and plant for the supply and delivery of each embedment anchor. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .2 Loading, hauling, unloading, delivery, stockpiling.
 - .3 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .5 Embedment Stainless Steel Anchor
 - .1 Measurement shall be made at the unit price bid for each (E.A.) embedment anchor installed.
 - .2 Payment shall be made on the unit price bid for each (E.A.) embedment anchor installed.
 - .3 Payment shall include the supply of all labour, material and plant to install the embedment anchors. The work includes:
 - .1 Locating and protection of existing utilities, structures and embedded items.

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- .2 Cleaning, and removal of debris.
 - .3 Supply and installation of anchor bolts, rod, nuts and washers, bolt grouting and epoxy not measured but considered incidental to work.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .6 Concrete Removal and Patching
- .1 Measurement shall be made in square metres (S.M.).
 - .2 Payment shall be made on the unit price bid per square metres (S.M.) of concrete removed and patched.
 - .3 Concrete Removal and Patching quantities shall be paid to actual material removed and patched as required based on Hammer Testing and approved by Department Representative. Any removal and disposal over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for removal and patching of existing concrete. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .2 Sawcutting, breaking, excavation, loading, hauling.
 - .3 Determination of a suitable disposal site outside the Park and providing the Department Representative with signoff of acceptance of waste material.
 - .4 Removal of material to disposal site.
 - .5 Dump fees.
 - .6 Cleaning, removal of debris.
 - .7 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.4 Part D – Electrical

- .1 Conduit
 - .1 Measurement for conduit shall be made at the unit price per linear meter (L.M.) bid for each size of conduit indicated and installed.
 - .2 Payment for wiring shall be made at the unit price per linear meter (L.M.) bid for each size of conduit indicated and installed.
 - .3 Payment shall include the supply of all labour, material and plant to install each size of conduit indicated. The work includes:
 - .1 Protecting existing utilities and structures.
 - .2 Excavation, sand bedding, marker tape and backfill.
 - .3 Couplings, factory bends and labour for a complete installation.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere
- .2 Wiring

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- .1 Measurement shall be made in linear meters (L.M.) for each size of wire indicated and installed.
 - .2 Payment for wiring shall be made at the unit price per linear meter (L.M.) bid for each size of wire indicated and installed.
 - .3 Payment shall include the supply of all labour, material and plant to install each size wire installed.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere
- .3 Concrete Pull boxes
- .1 Measurement and payment for concrete pull boxes shall be made at the unit price bid for each (E.A.) size of concrete pull box installed.
 - .2 Payment for concrete pull boxes shall be made at the unit price bid for (E.A.) concrete pull box installed.
 - .3 Payment shall include the supply of all labour, material and plant to install each concrete pull box. Work includes:
 - .1 Protecting existing utilities and structures.
 - .2 All necessary sand bedding, drain plate, cover plate, and labour for a complete installation.
 - .3 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Transformer
- .1 Measurement and payment for a transformer shall be made at the unit price bid for each (E.A.) transformer indicated and installed.
 - .2 Payment for a transformer shall be made at the unit price bid for (E.A.) transformer indicated and installed.
 - .3 Payment shall include the supply of all labour, material and plant to install each transformer installed.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere
- .5 Remove and Reinstall Existing Lamp Standards
- .1 Measurement to remove and reinstall existing lamp standards shall be made at the unit price bid for each (E.A.) lamp standard removed and reinstalled.
 - .2 Payment for concrete pull boxes shall be made at the unit price bid for (E.A.) lamp standard removed and reinstalled.
 - .3 Payment shall include the supply of all labour, material and plant to remove and reinstall each lamp standard. The work includes:
 - .1 Protecting existing utilities and structures.
 - .2 Removal of existing lamp standard and protection from damages for temporary storage in a location approved by the Departmental Representative.

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- .3 Damages to the existing lamp standard shall be the responsibility of the contractor.
 - .4 Supply of steel shaft, base plate, lights, concrete foundations including reinforcement and all materials to reinstall existing lamp standard.
 - .5 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .6 Temporary Lighting c/w Wood Poles
 - .1 Measurement for temporary lighting shall be made at the unit price bid for each (E.A.) temporary light installed.
 - .2 Payment temporary lighting shall be made at the unit price bid for each (E.A.) temporary light installed.
 - .3 Payment shall include the supply of all labour, material and plant for each temporary light installed. The work includes:
 - .1 Protecting existing utilities and structures.
 - .2 Removal and disposal of temporary lighting outside of the National Park.
 - .3 Dump Fees.
 - .4 Damages to the existing lamp standard shall be the responsibility of the contractor.
 - .5 Supply of wood poles, lights, concrete foundations as needed including reinforcement and all materials to reinstall temporary lighting.
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .7 Temporary Wiring for Temporary Lighting
 - .1 Measurement shall be made in linear meters (L.M.).
 - .2 Payment for wiring shall be made at the unit price per linear meter (L.M.) bid for temporary wiring for temporary lighting.
 - .3 Payment shall include the supply of all labour, material and plant to supply and install temporary wiring for temporary lighting.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere
 - .8 Hydrovac'ing – Around buildings, propane tanks and air handling units
 - .1 Measurement for hydrovac'ing shall be made at the unit price per linear meter (L.M.) bid for hydrovac'ing around indicated locations. Any hydrovac'ing over and above this amount will require prior approval from the Department Representative.
 - .2 Payment for hydrovac'ing shall be made at the unit price per linear meter (L.M.) bid for hydrovac'ing.
 - .3 Payment shall include the supply of all labour, material and plant to hydrovac around buildings, propane tanks and other indicated structures.

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- .4 All incidental work and items required to complete the work for which payment is not specified elsewhere
 - .9 Electrical Works for Parks Facility
 - .1 No measurement shall be made.
 - .2 Payment for all work to be completed inside of the Parks Facility are to be lump sum (L.S.) for the work indicated.
 - .3 Payment shall include the supply of all labour, material and plant to complete all required works for the Parks Facility. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Electrical work shown on drawings; supply and install new circuit breaker, transformer, alarm panels, junction boxes and base for heat trace controllers, install heat trace, temperature sensor wiring and heat trace controllers, terminate all wiring and test all systems.
 - .3 Traffic and pedestrian accommodations, barricades, flag-person or temporary traffic control as required.
 - .4 Dump fees.
 - .5 Locating and protecting existing utilities and structures.
 - .6 Damages to the existing building shall be the responsibility of the contractor.
 - .7 Structural review prior to work to ensure structural integrity of building is not undermined during coring or other parts of construction.
 - .8 Foundation remediation, waterproofing, reinstating any damaged or modified building infrastructure (insulation, etc.) back to its original state or better.
 - .9 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.5 Part E – Roadworks

- .1 Waste Excavation
 - .1 Measurement shall be made in cubic metres (C.M.). The quantity shall be the volume measured in its original location by means of cross-sections taken before and after excavation and computed by the average end area method.
 - .2 Payment shall be made on the unit price bid per cubic metre (C.M.).
 - .3 Waste excavation quantities shall be paid to the maximum volume required to maintain safe trenching. Any waste excavation over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant to remove and dispose of the material. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Excavating, loading and hauling to a dump site outside the Park.

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- .4 Determination of a suitable disposal site outside the Park and providing the Department Representative with signoff of acceptance of waste material.
 - .5 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .5 Waste material does not include concrete or asphalt.
 - .2 Removal and Disposal of Existing Asphalt
 - .1 Measurement shall be made in square metres (S.M.).
 - .2 Payment shall be made on the unit price bid square metres (S.M.) of asphalt removed, with an assumed thickness of 150mm.
 - .3 Asphalt removal and disposal quantities shall be paid to the maximum area required to maintain safe trenching. Any removal and disposal over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for removal and disposal of existing asphalt pavement. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Sawcutting, breaking, excavation, loading, hauling.
 - .3 Determination of a suitable disposal site outside the Park and providing the Department Representative with signoff of acceptance of waste material.
 - .4 Removal of material to disposal site.
 - .5 Dump fees.
 - .6 Cleaning, removal of debris.
 - .7 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .3 Removal and Disposal of Existing Concrete Curb and Gutter
 - .1 Measurement shall be made by lineal metres (L.M.).
 - .2 Payment shall be made on the unit price bid per lineal metres (L.M.) of concrete curb and gutter removed.
 - .3 Concrete removal and disposal quantities shall be paid to the maximum area required to maintain safe trenching. Any removal and disposal over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for removal and disposal of existing concrete curb and gutter. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Sawcutting, breaking, excavation, loading, hauling.
 - .3 Determination of a suitable disposal site outside the Park and providing the Department Representative with signoff of acceptance of waste material.
 - .4 Removal of material to disposal site.

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- .5 Dump fees.
 - .6 Cleaning, removal of debris.
 - .7 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Removal and Disposal of Existing Concrete Sidewalk
- .1 Measurement shall be made in square metres (S.M.).
 - .2 Payment shall be made on the unit price bid per square metres (S.M.) of concrete sidewalk removed.
 - .3 Concrete removal and disposal quantities shall be paid to the maximum area required to maintain safe trenching. Any removal and disposal over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for removal and disposal of existing concrete sidewalk. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Sawcutting, breaking, excavation, loading, hauling.
 - .3 Determination of a suitable disposal site outside the Park and providing the Department Representative with signoff of acceptance of waste material.
 - .4 Removal of material to disposal site.
 - .5 Dump fees.
 - .6 Cleaning, removal of debris.
 - .7 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .5 Subgrade Preparation
- .1 Measurement shall be made in square metres (S.M.).
 - .2 Payment shall be made on the unit price bid per square metre (S.M.).
 - .3 Roadwork replacement quantities shall be paid to the maximum area required to maintain safe trenching. Any replacement over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for subgrade preparation. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Cutting, trimming and removal of material to disposal or stockpile area.
 - .4 Scarifying subgrade 300mm deep.
 - .5 Shaping, watering, aerating, compacting, trimming and testing.
 - .6 Proof Rolling per section 31 11 16.01 Granular Sub-base, Part 3.1 Proof Rolling. Proof rolling must be observed by the Department Representative.

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- .7 Minimum of 2 complete coverages of the surface area.
 - .8 Proof-rolling should be observed by the geotechnical consultant.
 - .9 Locating and protecting existing utilities and structures.
 - .10 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .6 Granular Sub-base, Pit Run Gravel
- .1 Measurement shall be made in square metres (S.M.) for the thickness specified.
 - .2 Payment shall be made on the unit price bid per square metre (S.M.).
 - .3 Roadwork replacement quantities shall be paid to the maximum area required to maintain safe trenching. Any replacement over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for the sub-base and granular base. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Locating and protection of existing utilities and structures.
 - .4 Supply of all materials, transporting and placing.
 - .5 Grading, compaction, watering, aerating, compaction and testing
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .7 Granular Base, 25 mm Crushed Gravel
- .1 Measurement shall be made in square metres (S.M.) for the thickness specified.
 - .2 Payment shall be made on the unit price bid per square metre (S.M.).
 - .3 Roadwork replacement quantities shall be paid to the maximum area required to maintain safe trenching. Any replacement over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for the sub-base and granular base. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Locating and protection of existing utilities and structures.
 - .4 Supply of all materials, transporting and placing.
 - .5 Grading, compaction, watering, aerating, compaction and testing
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .8 Prime Coat
- .1 Measurement shall be made in square metres (S.M.).

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- .2 Payment shall be made on the unit price bid per square metre (S.M.).
 - .3 Roadwork replacement quantities shall be paid to the maximum area required to maintain safe trenching. Any replacement over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for application of the prime coat. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Supply of all materials, transporting, and placing.
 - .4 Painting contact surfaces of curbs, gutters, manholes, catch basin, valves and other surface features.
 - .5 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .9 Asphaltic Concrete Pavement
- .1 Measurement shall be made in square metres (S.M.) for the type and thickness specified.
 - .2 Payment shall be made in the unit price bid per square metre (S.M.).
 - .3 Roadwork replacement quantities shall be paid to the maximum area required to maintain safe trenching. Any replacement over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for asphaltic concrete. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Locating and protection of existing utilities and structures.
 - .4 Supply of all materials, mixing, transporting, placing, compaction and testing.
 - .5 Asphalt mix design.
 - .6 Setting of manhole and catch basin frames and covers, valve boxes and all other surface features to make a smooth surface.
 - .7 Cleaning, removal of debris.
 - .8 All incidental work and items required to complete the work for payment is not specified elsewhere.
- .10 Concrete Curb & Gutter
- .1 Measurement for curb and gutter and swale gutter shall be made per lineal metre (L.M.) along the face line of the curb.
 - .2 Payment shall be made on the unit price bid per lineal metre (L.M.) for each type of gutter bid.

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- .3 Roadwork replacement quantities shall be paid to the maximum area required to maintain safe trenching. Any replacement over and above this amount will require prior approval from the Department Representative.
 - .4 Payment shall include the supply of all labour, material and plant for the concrete work. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Construction survey, layout, setting grades
 - .3 Locating and protection of existing utilities and structures.
 - .4 Excavation, subgrade preparation and compaction.
 - .5 Removal of excavated material to disposal or stockpile areas.
 - .6 Supply and placement of granular levelling course.
 - .7 Supply and placing of concrete and reinforcing steel.
 - .8 Connection to existing curb & gutter with 10M dowels where required
 - .9 Forming, jointing, finishing, curing and testing.
 - .10 Grading, compaction, topsoil and seed of all disturbed work area
 - .11 Cleaning, removal of debris.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .11 New Concrete Sidewalks
 - .1 Measurement shall be made in square metres (S.M.).
 - .2 Payment shall be made on the unit price bid per square metre (S.M.) installed.
 - .3 Payment shall include the supply of all labour, material and plant for concrete sidewalks. The work includes:
 - .1 Excavation, grading, subgrade preparation and compaction.
 - .2 Removal of excavated material to disposal areas.
 - .3 Supply, placement and compaction of sub base material.
 - .4 Connection to existing sidewalk with 10M dowels where required.
 - .5 Supply and placing of fibre reinforced concrete, and rebar reinforcement for thickenings.
 - .6 Forming, jointing, finishing, curing and testing.
 - .7 Grading, compaction, topsoil and seed of all disturbed work area
 - .8 Cleaning, removal of debris.
 - .9 All incidental work and items required to complete the work for which payment is not included elsewhere.
 - .12 Permanent Precast Barriers
 - .1 Measurement shall be made by lineal metres (L.M.).
 - .2 Payment shall be made on the unit price bid per lineal metres (L.M.) of Permanent precast barriers supplied and installed.

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- .3 Payment shall include the supply of all labour, material and plant for the supply and installation of new permanent precast barriers. The work includes:
- .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .2 Supply, placement and install of barriers.
 - .3 Supply and installation of anchor bolts, rod, nuts and washers, bolt grouting and epoxy not measured but considered incidental to work.
 - .4 Cleaning, removal of debris.
 - .5 All incidental work and items required to complete the work for which payment is not specified elsewhere.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by the Departmental Representative are specified under various sections.
- .2 Contractor shall provide test requirements and inspection milestones to Departmental Representative.

1.2 APPOINTMENT AND PAYMENT

- .1 The Departmental Representative will appoint and pay for Quality Assurance testing services only. The Contractor is responsible for all Quality Control testing in accordance with Section 01 45 00 – Quality Control.

1.3 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 the Departmental Representative 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 the Departmental Representative.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 PRECONSTRUCTION MEETING

- .1 Preconstruction meeting will be arranged by the Departmental Representative after the Contract is awarded.

1.2 PROGRESS MEETINGS

- .1 The Contractor shall provide a site trailer for progress meetings on-site.
- .2 Progress meetings will be held on a bi-weekly basis or as assigned by the Departmental Representative. Meeting frequency will be determined by the work in progress.
- .3 Contractor, major Subcontractors involved in Work and the Departmental Representative are to be in attendance. Representatives of the Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.
- .4 The Departmental Representative will give to all parties advance notice of meeting dates, times and locations.
- .5 Minutes will be taken by the Consultant and copies will be distributed to attendees within three (3) working days after each meeting.
- .6 The Contractor shall keep one complete set of contract documents and drawings at the site at all times. Ensure that the documents and the drawings are the current "issued for construction" set.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Will define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to the Departmental Representative within 10 working days of Award of Contract Bar (GANTT) Chart schedule that details monitoring and reporting of project progress.

1.4 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Sanitary Sewer Piping.
 - .7 Water Main Piping.
 - .8 Backfill.
 - .9 Trenchless Installations.
 - .10 CIPP Liner.
 - .11 Paving.
 - .12 Initiation and completion of traffic control measures.

1.5 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on a monthly basis reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule. Progress payments may be withheld if Contractor does not provide an acceptable schedule upon request of the Department Representative.

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- .2 Do not start work until the schedule has been reviewed and approved by Departmental Representative.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to the 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, and samples in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to the 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.
- .5 Notify the Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations, and any cost changes.
- .6 Verify field measurements and affected adjacent works are co-ordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .9 Keep one reviewed copy of each submission on site.
- .10 Electronic submittals in PDF format only.

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 the Contractor to illustrate details of a portion of Work.
- .2 Submit shop drawings bearing stamp and signature of the Contractor's Engineer registered or licensed in the Province of Alberta, Canada, or the suppliers' certified stamp.
- .3 Submittals pertaining to structural steel, structural timber, prefabricated or post tensioned structures shall be accompanied by an affidavit (seal on drawings or written statement) of a qualified Professional Engineer registered in the Province of Alberta, certifying their acceptance/approval of indicated design/details. Additionally, the submittals of any

other discipline, which by reason of the various codes of practice, shall be accompanied by a similar affidavit. 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 10 days Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings by the Departmental Representative do not change the Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to submittal and proceeding with Work.
- .6 For additional work not included in the original contract, Contractor shall not proceed with work unless the Departmental Representative issues a change order.
- .7 Do not proceed with work without an approved Change Order (CO).
- .8 Make changes in shop drawings as the Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify the Departmental Representative in writing of revisions other than those requested.
- .9 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.
- .10 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier 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.

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- .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
 - .11 After Departmental Representative's review, distribute copies of approved drawings.
 - .12 Submit electronic or 6 copies of shop drawings for each requirement requested in specification Sections and as the Departmental Representative may reasonably request.
 - .13 Submit electronic or 6 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by the Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
 - .14 Submit electronic or 6 copies of test reports for requirements requested in specification Sections and as requested by the Departmental Representative.
 - .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.
 - .15 Submit electronic or 6 copies of certificates for requirements requested in specification Sections and as requested by the 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.
 - .16 Submit electronic or 6 copies of manufacturers instructions for requirements requested in specification Sections and as requested by the 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.
 - .17 Submit electronic or 6 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by the Departmental Representative. Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .18 Submit electronic copies in PDF format or 6 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by the Departmental Representative.
 - .19 Delete information not applicable to project.
 - .20 Supplement standard information to provide details applicable to project.

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- .21 If upon review by the 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.

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 the Departmental Representative.
- .3 Notify the 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 the Departmental Representative do not change the Contract Price. If adjustments affect value of Work, state such in writing to the Departmental Representative prior to submittal and proceeding with Work.
- .6 Make changes in samples which the 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.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General**1.1 WORK SITE ENVIRONMENTAL HEALTH & SAFETY**

- .1 This Contractor is "Prime Contractor"
- .2 The Contractor shall, for the purposes of the Occupational Health and Safety Act (Alberta), and for the duration of their work on this site:
 - .1 Be the "Prime Contractor" for the "work site",
 - .2 Do everything that is reasonably practicable to establish and maintain a system or process that will ensure compliance with this Act and the regulations in respect of the work site, and
 - .3 Will remain "Prime Contractor" until the majority of their work on the site is completed and the Departmental Representative or his Departmental Representative have assigned the responsibility of "Prime Contractor" to another company.
- .3 The "prime contractor" shall direct all sub-contractors, other contractors, employers, workers and any other persons at the "work site" on all specific Environmental Health & Safety Policies and Procedures relating to the site in order to meet the definition of "due diligence" as outlined in the Occupational Health and Safety Act & Regulations regardless of:
 - .1 Whether or not any contractual relationship exists between the "Prime Contractor" and any of these entities, and
 - .2 Whether or not such entities have been specifically identified in this Contract.
- .4 The Departmental Representative does not anticipate that there will be any contractors, other than those performing the Work of this Contract, engaged in work at the "work site" during the performance of the Work of this Contract.

1.2 GENERAL

- .1 The Contractor shall observe and enforce construction safety measures required by Federal and Provincial Governments, Worker's Compensation Board and municipal statutes and authorities.
- .2 In the event of conflict between any provisions of above authorities the most stringent provision governs.
- .3 The "Prime Contractor" shall be responsible for the environmental health & safety of all persons and property on or about the project and for ensuring that the work is performed in accordance with all applicable safety requirements.
- .4 The "Prime Contractor" will have the responsibility to ensure that all personnel entering the site receive an appropriate orientation of all identified hazards and accompanying Environmental Health & Safety Policies and Procedures that have been used in risk mitigation.

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- .5 The “Prime Contractor” will remain in the position of authority until such a time as the Departmental Representative assign the role of Prime to another contractor. This will be achieved through a signed document that clearly relinquishes the responsibilities of Prime from one contractor to another.

1.3 NOTICE

- .1 The Contractor shall provide at least seventy-two (72) hours written notice to all utility companies and property owners in the immediate vicinity of the operations prior to the commencement of construction and, if requested, co-operate with such parties in the protection, removal or relocation of their installations and property.

1.4 ENVIRONMENTAL HEALTH & SAFETY PROGRAM

- .1 The Contractor shall develop, maintain and supervise for the duration of the work a comprehensive environmental health & safety program that will effectively incorporate and implement all required environmental health & safety risk mitigation. An environmental health & safety plan will be submitted to and approved by the Department Representative within two (2) weeks of award. Ongoing environmental health & safety documentation will be submitted to the Department Representative weekly.
- .2 The program shall, as a minimum, respond fully to the requirements of all applicable laws, ordinances, rules, regulations and orders and general construction practices for the environmental health & safety of persons or property, including without limitation any general environmental health & safety rules and regulations of the Departmental Representative and any Worker's Compensation or Occupational Health and Safety legislation or regulations that may be applicable.
- .3 The Contractor must perform a hazard assessment prior to the start of the project and at such intervals to ensure that all identified hazards are eliminated, controlled and that appropriate personal protective equipment is used as a mitigating facture.

1.5 ENVIRONMENTAL HEALTH & SAFETY OFFICER

- .1 The Contractor shall designate an Environmental Health & Safety Coordinator who shall be qualified and authorized to supervise and enforce compliance with the site environmental health & safety program.

1.6 JOINT ENVIRONMENTAL HEALTH & SAFETY MEETINGS

- .1 The Contractor shall arrange environmental health & safety meetings at his own expense.
- .2 The Departmental Representative shall be invited to all safety meetings
- .3 Such meetings shall occur no less frequently than once per week.
- .4 The Contractor shall record the minutes of such meetings and maintain a complete file for review by the Departmental Representative as well as any or all regulatory agencies.

1.7 SAFETY EQUIPMENT

- .1 The Contractor shall supply and maintain, at his own expense, at the office or other well-known place at the job site, safety equipment necessary to protect the workers and general public against incident or injury as prescribed by the governing authorities.

1.8 EXPLOSIVES

- .1 When the use of explosives is necessary for the performance of the work, the Contractor shall observe the utmost care not to endanger life or property.
- .2 The method of storing and handling explosives and highly inflammable materials shall conform to all applicable statutes, bylaws and regulations and the "Prime Contractor" shall be responsible for obtaining all required permits thereunder.

1.9 FIRE PREVENTION AND PROTECTION

- .1 All work shall be performed in a fire prevention manner.
- .2 The Contractor shall comply with all applicable governmental requirements and, without limiting the generality of the foregoing, and supply and maintain at the job site adequate and proper fire-fighting equipment.

1.10 PROVIDING FIRST AID SERVICES

- .1 As outlined in the Alberta Occupational Health & Safety Code, Section 178 (2), a "Prime Contractor" must ensure that first aid services, supplies, equipment and a first aid room are available at the work site for the type of work and the total number of workers at the site in accordance with the applicable requirements of Schedule 2 of the Occupational Health & Safety Code.

1.11 INJURY, ILLNESS AND NEAR MISS REPORTING

- .1 The "Prime Contractor" will report immediately all incidents that have resulted in an injury that required care outside of the definitions of first aid treatment to the Departmental Representative. The "Prime Contractor" will provide a written report on the incident investigation, root cause analysis and any action plans that have been implemented as mitigation tools.
- .2 The "Prime Contractor" will report, in writing, all Near Misses in a weekly report that will include any changes in policies or procedures that occurred as a result of the Near Miss Report.
- .3 If death or serious injuries or damages are caused, the accident shall be promptly reported by the "Prime Contractor" to the Departmental Representative by telephone or messenger in addition to any reporting required under provincial laws and regulations.
- .4 If a claim is made by anyone against the "Prime Contractor" or any subcontractor on account of any incident, the "Prime Contractor" shall promptly report the facts in writing to the Departmental Representative, giving full details of the claim.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants. All work as per Environmental Assessment Report, to be included as Appendix "A".
- .3 Canada National Parks Act: Federal law that regulates protection of natural areas of national significance.
- .4 Canada Environmental Assessment Act (CEAA). The CEAA is a federal statute that requires federal departments to conduct environmental assessments for prescribed projects and activities before providing federal approval or financial support.
- .5 Environmental Surveillance Officer Briefing: Officers communicate information such as the geological and cultural histories of the parks, as well as messages dealing with safety and accident prevention on site.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review and approval by the Departmental Representative. The Environmental Protection Plan is to present a comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 The Environmental protection plan shall include:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting

requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.

- .6 Drawings, if any, showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
- .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
- .9 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
- .12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .13 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .14 Environmental/spill response plan that identifies contacts and provides methods and procedures to be undertaken in the case of an environmental incident or emergency.

1.3 FIRES

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

1.4 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site. All rubbish and waste materials are to be removed and hauled to an approved waste facility.
- .2 All commercial waste must be removed from Banff National Park.
- .3 All construction waste must be removed from Banff National Park.
- .4 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

- .5 All food and domestic waste is to be removed daily. Contractor to supply bear proof waste bins.
- .6 Contractor to provide portable sanitary facilities (Porta Potties) for Contractor's use. Existing campground or village facilities are not to be used.

1.5 DRAINAGE

- .1 Provide erosion and sediment control plan that identifies type and location of erosion and sediment controls to be provided. Plan: include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .3 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.6 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Trees to be protected as per environmental mitigations in Environmental Screening Document.
- .3 Protect roots of any designated trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by the Departmental Representative.

1.7 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material without the Departmental Representative's approval.
- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

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- .7 Do not blast under water or within 100m of indicated spawning beds.

1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

1.9 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.
- .5 Cover or wet down dry materials and dispose of rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.10 BANFF NATIONAL PARK DIRECTIVE

- .1 Comply with all requirements of Parks Canada - Canadian Heritage Directive Number BNP-93/ 17 "Environmental Guidelines for Development Projects" (copy attached).

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

**BANFF NATIONAL PARK DIRECTIVE
PARKS CANADA - CANADIAN HERITAGE**

DATE: 17-MAR-88 as amended 03-JUN-98

NUMBER: BNP-93/17
(originally BNP/32)

SUBJECT: Environmental Guidelines for Development Projects

PURPOSE:

To provide guidelines for development projects within Banff National Park (BNP), in order to protect natural and cultural resources by minimizing adverse environmental effects resulting from these projects.

SCOPE:

This directive will apply to all development which may impact the natural and cultural environments in BNP (including Banff Townsite), and/or development which may be affected by these environments. This directive will also apply to development which alters the function and appearance of existing structures.

DEFINITION:

Project Manager - that person responsible for coordination and completion of a project.

Banff Park Project Officer - appointed by the Superintendent as the coordinator for both park projects and private development projects within the park. This project officer will be the park contact person for a specific project.

BACKGROUND:

Parks Canada, through the Government of Canada and on behalf of the people of Canada, has been entrusted with the task of responsibly managing the land and resources within our national parks. Within BNP, Heritage Resource Conservation (HRC) has the responsibility for the management and protection of natural and cultural resources, and the promotion of the philosophy of environmental stewardship. Environmental stewardship is not only the special awareness of the importance and benefit of natural and cultural resources; it is also the incorporation of such awareness into all day to day activities and practices, such that impacts to these resources are minimized.

**BANFF NATIONAL PARK DIRECTIVE
PARKS CANADA - CANADIAN HERITAGE**

DATE: 17-MAR-88 as amended 03-JUN-98

NUMBER: BNP-93/17
(originally BNP/32)

SUBJECT: Environmental Guidelines for Development Projects

National Parks are special places. Development projects within National Parks boundaries will require special attention. Individuals carrying out such projects will require a heightened awareness of environmental stewardship. While some projects will provide the needed services to the park resident and visitor; other projects, without care or consideration for the environment, may do serious harm.

For each project, the Canadian Environmental Assessment Act (C.E.A.A.) will be applied to the required level to identify concerns and provide mitigating measures. Further direction in the form of specific guidelines for development will be provided below to assist in ensuring environmentally sound practices on the development sites.

POLICY:

1. Project Coordination

After project approval and contract awards, and prior to the start of development activities, a pre-construction meeting will be scheduled by the project manager and will include:

- the Superintendent or his delegate (major projects);
- the Park Project Manager;
- the Project Manager;
- the CEEA or Environmental Surveillance Officer;
- the monitoring Park Warden (where required);
- the Contractor;
- the Engineer (where required);
- other personnel who have concerns involving the project (ie: Archaeology, etc.).

Periodic on-site meetings with the Environmental Surveillance Officer (ESO) and the Project Manager may be required during the development phase to discuss environmental concerns. Outstanding problems or significant deviations from approved plans which cannot be resolved at the field level will be presented to the park Superintendent, or his delegate, for final decision.

NOTE: A PARK WARDEN IS RESPONSIBLE FOR THE PROTECTION OF NATURAL AND CULTURAL RESOURCES WITHIN NATIONAL PARKS AND HAS AUTHORITY AS A PEACE OFFICER, TO ENFORCE THE NATIONAL PARKS ACT, ITS REGULATIONS AND RELATED GUIDELINES AND DIRECTIVES. A PARK WARDEN MAY STOP WORK AT ANY TIME, IF NECESSARY, TO PREVENT UNDUE ENVIRONMENTAL DAMAGE.

**BANFF NATIONAL PARK DIRECTIVE
PARKS CANADA - CANADIAN HERITAGE**

DATE: 17-MAR-88 as amended 03-JUN-98

NUMBER: BNP-93/17
(originally BNP/32)

SUBJECT: Environmental Guidelines for Development Projects

2. Specific Direction for Project Managers

For each project, specific instructions will be prepared by HRC for issue to the project manager. These will include environmental concerns and permit/license requirements. The following guidelines shall apply.

GUIDELINES:

1. **Site Access** - Access to the work site should be identified in the contract documents, especially if access is going to be a problem, so that contractors can estimate costs in their bids. Access to the construction site will be clarified in detail at the initial pre-construction meeting. The contractor will ensure that:
 - 1.1. Only designated access routes are used.
 - 1.2. Vehicle parking is restricted to established roads or identified parking area(s).
 - 1.3. Load restrictions (when necessary) on access routes are implemented, to prevent damage to structures or road surfaces. Overweight permits may not be issued during certain periods of the year.
 - 1.4. Construction equipment is operated and parked only within the confines of the construction site. Construction site boundaries will be delineated by flagging or fencing materials and maintained throughout the duration of the project.
 - 1.5. Roads, sidewalks and other public accesses are maintained with minimal interference.
2. **Employee Briefing** - The contractor will conduct briefing sessions for all employees and sub-contractor employees and will cover the following topics:
 - 2.1. Care of the environment in the area where the work is being performed.
 - 2.2. Harassment or attraction of wildlife.
 - 2.3. Pollution and garbage management.
 - 2.4. Relevant Park Regulations, and the authority and responsibilities of the Park Warden.
 - 2.5. Relations between workers, tourists and residents.

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2.6 Specific vehicle access to the work site, and requirement for National Park Vehicle Entry Permits.

3. Sanitary and Garbage Facilities

3.1. The contractor shall be required to provide regularly serviced sanitary (toilet) facilities to adequately provide for the number of employees anticipated on-site.

3.2. All garbage must be stored and handled in conformance with the *National Park Garbage Regulations*.

3.3. The contractor shall be required to provide approved bear-proof storage for any edible garbage or food containers that may be disposed of on-site. No littering will be tolerated.

4. Wildlife - The contractor shall ensure that there is no harassment of wildlife as a result of his operation and that no action is permitted which will attract wildlife to the site. The contractor will notify HRC in BNP of wildlife encounters on or around the work site or crew accommodation, as soon as the problem arises or within 24 hours at the latest.

5. Cultural Resources - The contractor will immediately inform the ESO and/or the Project Manager of any items of historic interest or evidence of archaeological finds that are discovered on the development site (ie: old garbage dump sites, cabin sites, etc.). The ESO monitoring the project will inspect the site immediately and provide written direction to the Project Manager as to the method in which to proceed with the work after consultation with Alberta Regional Archaeologists. All historical and prehistorical finds must be protected and will remain the property of Parks Canada. (See also "12. Excavating".)

6. Site Investigation and Surveys - Any site investigation work involving disturbances to the natural environment requires prior approval from the Superintendent. Some site disturbance is necessary at the planning stage for most projects. The impacts of such disturbances will be minimized, especially if the disturbed area is likely to be outside the eventual construction site.

6.1 Wildfire Considerations (from "*Wildland-Urban Interface Forest Fire Potential and Fuel Reduction Plan for Banff Townsite and Surrounding Area*"). Within the past several decades, fire suppression has resulted in relatively few large fires in the park. During the same period, considerable development has taken place within the park. Not only have the communities of Banff and Lake Louise grown into the surrounding forest areas, but a number of recreational and service centres have been constructed throughout the forest. These structural values are now increasingly at risk from potential high intensity forest fires, and protection of people and property within the zone, referred to as the wildland-urban interface, is becoming more urgent.

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- 6.2 Site specific investigations and considerations should focus on an assessment of forest fuels build-up at the periphery of the development site. A number of factors are of concern for each specific location. These include:
- fuel type
 - slope
 - nature and position of threatened values
 - degree of safety to be attained by the fuel modification treatment
 - appearance, aesthetics of the treated area
 - economics of the project
 - capabilities of the organization to conduct the project.
- 6.3 An urban-wildland interface fire assessment that provides information concerning values at risk with respect to facility development in a forested environment is available from HRC in BNP.
7. **Site Preparation** - The area to be cleared will be delineated using biodegradable flagging tape. Prior to tree or vegetation removal, the site will be inspected by HRC to ensure compliance with Section 16(1)(2)(3) of the *National Parks Building Regulations* concerning preservation of trees and vegetation in general. Trees are to be cut so that they fall inside the cleared perimeters. Tree removal will be detailed on approved site plan or landscaping plan.
8. **Disposal of Trees**
- 8.1 Trees larger than 15 cm (DBH) shall be:
- cut into blocks not to exceed 35 cm. and stockpiled at a designated location for use as firewood; or if deemed necessary by the department;
 - marked, felled, and piled at a designated location for use as sawlogs.
- 8.2 Trees under 15 cm (DBH) and other woody materials such as stumps, tops, and limbs can be disposed of in the following manner:
- the materials may be processed by chipper and deposited at a designated site; or
 - depending on fire hazard and weather conditions, on-site burning may be permitted. A burning permit is required from HRC. As part of the conditions for granting a burning permit, the contractor may be required to provide the following:
- 8.2.1 For the period Nov.1 to April 14:
- slash pile must be surrounded by 10 meters of mineral soil;
 - slash pile must be a minimum of 20 meters from standing timber;
 - 24 hour supervision when fire is active; a smoldering fire may be left unguarded if above safeguards are met;
 - a front-end loader, cat and / or water truck must be readily available;
 - information of the maximum size of the fire and number of fires going at one time;
 - burning must be done on road right-of-way unless a cleared area has been given prior approval.

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8.2.2. In addition to the above, for the period of April 15 to October 31:

- fire weather index (FWI) readings must be less than 10. Note: under certain conditions and with special precautions, a fire permit may be issued when the FWI is greater than 10.

8.3. The following are the conditions that may be imposed on the burning permit to minimize smoke pollution:

- a hot continuous hot fire produces minimum amounts of smoke; a continuous burning operation may be required to ensure minimum smoke pollution;
- the number of fires;
- burning permits may not be issued until upper level winds are forecast which will help dissipate the smoke.

9. Construction Materials

- 9.1 Materials Storage - Construction material shall normally be stored within the confines of the development site. Under no circumstances may construction materials be stockpiled in the trees along the perimeter of the site or upon any area designated for protection within the site. Off-site storage of materials in undisturbed areas may be allowed only if permission is obtained from the lessee of the land involved in concurrence with HRC, or in another location designated by the ESO assigned to the project.
- 9.2 Trade Waste - Trade waste (construction waste) materials will be disposed of at the designated trade waste area only. The designated Trade Waste area for Banff National Park is the Castle Junction Tradewaste Site. This facility is located on Highway # 93 South, near Castle Junction, and is administered by the Town of Banff, as an Alberta Class III, Industrial landfill restricted to inert solid wastes only. A permit is required and can be obtained from the Town of Banff Administration Office between 0900 and 1630 hrs., Monday through Friday.
- 9.3 No food, domestic garbage, recyclable materials, or hazardous wastes may be deposited in the trade waste area.

NOTE: *National Park Garbage Regulations* Sec.6(1): "No person shall convey or cause to be conveyed any garbage in a vehicle that is not properly constructed and covered so as to prevent the contents thereof from escaping".

10. Soil Materials

- 10.1 Clean Fill - Clean fill (stripping or excavated materials) will be deposited in an area designated for this purpose, and in accordance with Banff National Park Directive # 22, "*Guidelines for Management of Excavated Materials*".

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- 10.2 Stripping - The topsoil layer in the BNP area is frequently very thin. Successful site rehabilitation depends on either careful saving of the limited topsoil resource, or undertaking the expensive alternative of hauling topsoil from outside the Park.
- Measures required to conserve the valuable topsoil resource must be identified. This may include stockpiling on-site for immediate rehabilitation, or disposal at an area designated by the Superintendent.
 - Care must be taken during both grubbing and stripping operations to ensure that the trees and roots on the edge of the clearing limits are not disturbed or damaged. This phase will be closely monitored by HRC.
 - In some instances where steep backslopes are involved, grubbing and stripping may not be permitted. Stumps would be cut flush with the ground, and the ground cover left undisturbed to promote slope stability. This will be determined by an on-site inspection by the ESO.
 - Material encountered below the topsoil layer, which is not suitable for construction purposes may be disposed of at designated locations in accordance with Park Directive # 22, "*Guidelines for Management of Excavated Materials*". Arrangements to dispose of the surplus material must be made with the ESO responsible for monitoring the project.
 - Depending on the type and volume of material encountered, special conditions may be imposed regarding compaction and rehabilitation at the disposal area.
- 10.3 Contaminated Soil - The issue of contaminated soils and disposal practices will normally be identified through CEAA. However, where past and present land use practices have led to soil contamination, certain actions will be required. These include:
- Soil testing at the expense of the proponent. Level of contamination will be in accordance with the Canadian Council of Ministers of the Environment guidelines, and acceptable levels will be decided by the park. Minimum acceptable standards for in-park soil contamination and remediation will be to the "Parkland" level.
 - Soil disposal at the expense of the proponent. All contaminated soils will be removed from the park. No treatment of contaminated soils (ie. bio-remediation, land-farming, etc.) will be allowed within the park. Disposal of contaminated soil material will be at provincially certified disposal sites. Written proof of disposal of contaminated soils will be required.

11. Control of Toxic/Hazardous Materials, Fuels.

- 11.1 Toxic/Hazardous Materials - All toxic/hazardous materials will be stored and used in accordance with relevant federal and provincial legislation pertaining to these materials. Spill contingency plans and equipment will be on-site, and employees will be aware of such emergency procedures as required. The ESO will be made immediately aware of any and all spills of toxic or hazardous materials. All hazardous wastes will be disposed outside BNP. This material will be disposed of in conformance with all relevant Federal and Provincial legislation and regulations pertaining to the transport and disposition of hazardous wastes.

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11.2 **Fuels** Permits for on-site storage of fuel or other inflammable liquids must be obtained from the ESO monitoring the project. Depending on the volume and location of the storage site, the following conditions may apply.

- Fuel storage and refuelling areas will be designated.
- The designated storage area will be bermed to enclose 125 % of anticipated storage tank volume. The bermed storage area will be underlain with an impermeable liner. All contaminated rainwater, contained within the berm, will be collected and removed from the park. Other special protection measures may be required to prevent mechanical damage of the tank.
- All soil material contaminated during refuelling operations will be collected and disposed of outside BNP at an appropriate facility. Written verification of such disposal will be provided to the ESO.
- Spill contingency plans will be developed and appropriate equipment to implement such plans will be in place, in the event of accidental spillage or tank malfunction. Fire protection equipment will be available on-site. The ESO will be made immediately aware of any spills.

12. **Excavating** - Disposal of surplus excavation material shall be handled in a similar manner to the disposal of surplus stripping material.

- It is extremely important in all excavations to ensure that excavated material is not permitted to sluff into the surrounding tree cover, or to bury any plant material that is to be retained. Trees and shrubs on the perimeter of the site can be severely damaged by burial or damage involved in retrieving this material at a later date.
- Rocks rolling down steep slopes during excavation or dumping of fill material can severely damage vegetation below. Special attention by equipment operators and extensive downslope protection work may be required.
- Careful equipment operation is required to ensure that mechanical damage to trees and surrounding vegetation does not occur. If damage does occur, an approved horticultural sealant will be applied to the tree damage as soon as possible.
- All equipment operators should be instructed that the operation of construction equipment off-site is not permitted. This applies both to the perimeter of the site, and to any areas within the site that are protected in a natural state.
- Alberta Region archaeologists must be informed of any projects in the park that require excavation. This will be scheduled at the preliminary/design phase of the project. Archaeological/Historical concerns will be cleared by Alberta Region Archaeological Division prior to initiation of excavation.
- Material sources, material storage areas and width of excavation ditches will be identified and recognized as part of the cost estimate of the project (trucking requirements, etc.).
- All open excavations will be signed and fenced appropriately in order to minimize hazards to both the general public and to wildlife.

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- 13. Foundation and Concrete Work** - Indiscriminate disposal of concrete or concrete residues around the site perimeter is not permitted. A concrete truck cleanout area will be identified for each project. Concrete residues will be disposed of at the Castle Junction Trade Waste Pit, or outside the Park at the proponents expense.
- 14. Pollution of Rivers or Streams**
- 14.1 No rock, silt, cement, grout, asphalt, petroleum product, lumber, vegetation, domestic waste, or any deleterious substance shall be placed or allowed to disperse into any stream, river, pond, storm or sanitary sewer, or other water course.
 - 14.2 All fuels, oils, lubricants and other petrochemical products will not be stored within 100 meters of any waterbody (including wetlands).
 - 14.3 The crossing of any waterbody (including wetlands) by construction equipment, or the use of such equipment within waterbodies is strictly prohibited unless prior approval has been confirmed through CEAA.
 - 14.4 Only approved chemically treated wood will be allowed near water courses. Sawdust and wood scraps will not be allowed to enter waterbodies.
 - 14.5 Erosion control measures will be implemented on all development sites in order to ensure that off-site run-off is minimized and sediments contained within site perimeters. All pumping of water will be subject to approval of the ESO.
 - 14.6 Site rehabilitation will be an urgent priority. For construction areas adjacent to watercourses, special protection and / or reclamation measures may be required.
 - 14.7 River or streambeds will not be used for borrow materials
 - 14.8 Excavated fill or debris will not be dumped into waterways.
- 15. Pollution Control**
- 15.1 Equipment and generator plants will operate in accordance with the Alberta Clean Air Act, and Federal Environmental Protection Service emission control regulations/guidelines.
 - 15.2 Work schedules and equipment use may be controlled to prevent excessive noise and disturbance to park visitors. Any such control measures should be specified in the contract documents.

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- 15.3 Materials and work site areas will be wetted down as necessary, to prevent blowing dust and debris. Measures will be taken to contain and control and collect windblown debris.
- 15.4 All hazardous and potentially toxic materials used in development projects will be securely stored in a responsible manner during development activities.

16. Site Rehabilitation

- 16.1 Site rehabilitation will receive the highest level of attention. A well conceived landscape plan that identifies rehabilitation goals and identifies physical limitations (ie. water, soil nutrients, suitable species, etc.) to rehabilitation success, will not only serve the best interest of the national park, but also result in the least cost approach in the long term.
- 16.2 Any deviation from the park approved landscape plan will require permission from the Superintendent.
- 16.3 All survey stakes, flagging tape, etc. is to be removed at the conclusion of the project.
- 16.4 The Project Manager will inspect the construction site for the following:
- a thorough site cleanup including general litter.
 - any required topsoil is clean and weed free. Sources of topsoil introduced into the park will be approved by the project manager before being allowed into the park. The proponent will ensure numbers and species of approved plant material as per the landscape plan.
 - the application of appropriate types and amounts of fertilizers

17. Blasting (see Park Directive #14 "*Control of Explosives*")

- 17.1 All blasting must conform with existing regulations and be accomplished under the supervision of a licensed blaster.
- 17.2 No blasting will be allowed under water or within 100 meters of spawning beds.
- 17.3 Storage of explosives will be subject to National Parks Regulations.
- 17.4 Fly rock shall not be permitted to damage surrounding vegetation. Use of blasting mats may be required.

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18. Development in Backcountry Areas - Special conditions apply to development in backcountry areas. The more sensitive nature of backcountry wilderness areas and the high value placed upon wilderness experience by park visitors, will often necessitate more rigorous standards for approved development projects. (See Park Directives #19 *"Redevelopment of Commercial Backcountry Lodges"* and #20 *"Redevelopment of Existing Alpine Huts and Backcountry Shelters"*).

(original signed by) _____

C. Zinkan
Superintendent
Banff National Park

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with 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.
 - .3 Provincial Codes.
 - .4 Parks Canada Permits and Codes.
 - .5 Government of Canada Codes.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 GENERAL ABBREVIATIONS

AASHTO	American Association of State Highways and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CAN	National Standard of Canada
CCA	Canadian Construction Association
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
ISO	International Organization for Standardization
SSPC	Steel Structures Painting Council
NBC	National Building Code
RTAC	Roads and Transportation Association of Canada
WCB	Worker's Compensation Board

1.2 UTILITIES

API	American Petroleum Institute
AWWA	American Water Works Association
CGA	Canadian Gas Association
CGSB	Canadian General Standards Board
CSPI	Corrugated Steel Pipe Institute
FM	Factory Mutual
IAO	Insurer's Advisory Organization
ULC	Underwriters Laboratories of Canada
TAC	Transportation Association of Canada

1.3 METRIC ABBREVIATIONS

- .1 The specifications are metric and metric usage is based upon SI units in accordance with CSA Standard CAN/CSA-Z234.1-89 Canadian Metric Practice Guide. In this specification SI units are abbreviated in accordance with the Metric Units and Abbreviations below.

.1	Linear Measure	
.1	Metre	m
.2	Millimetre	mm
.3	Kilometre	km
.4	Micrometre	micro-m
.2	Area	
.1	Square metre	m ²

	.2	Square millimetre	mm ²
	.3	Hectare	ha
.3	Volume		
	.1	Cubic metre	m ³
	.2	Litre	L
.4	Mass and Density		
	.1	Kilogram	kg
	.2	Gram	g
	.3	Tonne	t
	.4	Kilogram per metre	kg/m
	.5	Gram per metre	g/m
	.6	Kilogram per square metre	kg/m ²
	.7	Gram per square metre	g/m ²
	.8	Kilogram per cubic metre	kg/m ³
.5	Temperature		
	.1	Degree Celsius	°C
.6	Force, Pressure and Stress		
	.1	Newton	N
	.2	Kilonewton	kN
	.3	Pascal	Pa
	.4	Kilopascal	kPa
	.5	Megapascal	MPa
.7	Velocity, Rate of Flow		
	.1	Metre per second	m/s
	.2	Metre per hour	m/h
	.3	Kilometre per hour	km/h
	.4	Litre per second	L/s
	.5	Cubic metre per second	m ³ /s
.8	Power, Energy, Heat, Work		
	.1	Watt	W
	.2	Kilowatt	kW
	.3	Kilowatt hour	kWh
	.4	Joule	J

- .9 Electricity
- .1 Ampere A
- .2 Volt V
- .10 Illumination
- .1 Footcandle fc
- .2 Lumen lm
- .3 Lux lx
- .11 Metric Pipe Size Equivalents – ISO Diameter Nominal (DN)

Metric (mm)	Imperial (in.)
8	1 / 4"
10	3 / 8"
15	1 / 2"
20	3 / 4"
25	1"
32	1-1/4"
40	1-1/2"
50	2"
65	2-1/2"
80	3"
90	3-1/2"
100	4"
125	5"
150	6"
200	8"
250	10"
300	12"
350	14"
400	16"
450	18"
500	20"
600	24"

1.4 USE OF ABBREVIATIONS

- .1 The abbreviations refer to Specifications, Methods and Standards issued by the respective Association, and the abbreviations are used in the specifications.
- .2 Alphanumeric designations following the abbreviations denote the specification, method, or standard.

Part 2	Products
2.1	NOT USED
Part 3	Execution
3.1	NOT USED

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Quality Control (QC): The process of checking specific product or services to determine if they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory product or service performed.
- .2 Quality Assurance (QA): The process of ensuring that the Contractor's Quality Management Plan (QMP) (QC, non-conformances, etc.) is being followed. The results of the QA are provided as feedback to both the Contractor and the Departmental Representative. Where required, the Contractor shall implement changes to the project based on the feedback received from the QA process.

1.2 QUALITY MANAGEMENT PROGRAM

- .1 The Contractor shall prepare a Quality Management Program. The purpose of the program shall be to ensure the performance of the Work in accordance with Contract requirements.
- .2 The Quality Management Program shall be described in a Quality Management Plan. The Contractor shall submit the Quality Management Plan to the Departmental Representative for acceptance in accordance with Division 01. The Plan shall develop a logical system for tracking and documenting the Quality Control of the Work, as well as the Contractor's internal Quality Assurance procedures to verify the compliance of the Quality Control process. A systematic format and a set of procedures patterned on a recognized Quality Control Standard will be acceptable, subject to review by the Departmental Representative.
- .3 The Quality Management Plan shall, at a minimum, include the following information:
 - .1 Distribution list, providing a list of names to whom the Manual shall be distributed.
 - .2 Title page, identifying the Contract, Contractor and copy number.
 - .3 Revision page, identifying the revision number and date of the Manual.
 - .4 Table of Contents.
 - .5 Revision control, tabulating the revision number, date of revision, description of revisions and authorized signature.
 - .6 Details of measuring and test equipment including methods and frequency of calibration.
 - .7 Purchasing details of all materials and equipment including procurement documents and vendor's Quality Control Program standards.
 - .8 Procedures for inspection of incoming items, in-process inspection and final inspection and tagging of all supply items.
 - .9 Details of special processes as identified by the Departmental Representative, including qualifications of personnel and certification.
 - .10 Procedures for shipping, packaging and storage of materials.

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- .11 Procedures for maintain quality records and Statements of Compliance, including filing and storage of documents for a period of one year after Completion of the Works.
 - .12 Details of any non-conformance, including identification and recording of deficiencies, tagging procedures for “HOLD” or “REJECT” items, and final disposition of non-conformance forms by the Quality Control Manager.
 - .13 Inspection and test checklists, including tabulated checklists describing all manufacturing and deliver activities such as Inspection or Test, frequency of tests, description of tests, acceptance criteria of tests, such as verification, witnessing or holding tests and sign-off by the Quality Control Manager and the Quality Assurance Manager, if the Quality Assurance manager witnesses the tests.
 - .14 Forms used to ensure the application of the inspection and test checklist requirements. These forms shall be identified in the checklists and describe all testing requirements for Specification compliance.
 - .15 Details of the Quality Assurance Program including the Contractor’s procedures to verify the compliance to the Quality Control process of on-site work and off-site work by fabricators.
- .4 The Contractor shall appoint qualified and experienced Quality Control Personnel, who are dedicated to quality matters and who will report regularly to the Quality Control Manager, as well as Contractor's management, at a level which shall ensure that Quality Control requirements are not to be subordinated to manufacturing, construction or delivery. The Quality Control Personnel shall be empowered by the Contractor to resolve quality matters. Personnel involved in Quality Assurance shall be independent of the Quality Control Process.
- .5 The Quality Management Plan shall include samples of all forms to be filled in by the Quality Control Personnel. All forms shall be signed by the Quality Control Manager and submitted promptly to the Departmental Representative.
- .6 An independent check of all Work shall be performed by the Contractor. The Contractor shall appoint Quality Control Inspectors to ensure compliance of products and workmanship with Contract requirements. Quality Assurance Inspectors retained by the Departmental Representative, will periodically perform a second independent check to assess if the Quality Control process is being followed.
- .7 The Contractor must facilitate any independent Quality Assurance checks by representatives designated by the Department Representative.
- .8 At completion of the Work, a bound and itemised copy of all Quality Control documents and reports shall be prepared by the Contractor’s Quality Control Manager and submitted to the Department Representative.

1.3 TESTING

- .1 Testing required to provide Quality Control to assure that the Work strictly complies with the Contract requirements shall include, and not be limited to:

-
- .1 Testing of all structural concrete, granular material and compaction, asphalt and all source acceptance testing.
 - .2 All testing specified in the Contract Documents.
 - .3 Any other testing required as a condition for deviation from the specified Contract procedures.
 - .2 The quality control testing proposed and testing frequency shall at a minimum, achieve the requirements of the following:
 - .1 Wherever these standard Specifications refer to standards (e.g., CSA, ASTM, and others) the minimum testing frequencies in these standards shall be utilized.
 - .2 The Contractor and its independent Quality Assurance testing agency that will carry out the testing must satisfy themselves that the test frequencies being completed are sufficient to ensure the quality requirements of the QMP.
 - .3 The Contractor shall be fully responsible and bear all costs for all quality control testing and shall conduct such testing in the following manner:
 - .1 Provide testing facilities and personnel for the tests and inform the Departmental Representative in advance to enable the Departmental Representative to witness the tests if it so desired.
 - .2 Notify the Departmental Representative when sampling will be conducted.
 - .3 Within one (1) day after completion of testing, submit test results to the Departmental Representative.
 - .4 Identify test reports with the name and address of the organization performing all tests, and the date of the tests.
 - .4 Approval of tested samples will be for characteristics or use named in such approval and shall not change or modify any Contract requirements.
 - .5 Quality Assurance testing will be undertaken by the Departmental Representative through an independent CSA certified testing firm. The independent testing firm will complete random sampling, inspection, and testing for the purposes of determining the compliance with Specifications and other contract documents. The frequency, location of the inspections, sampling, and tests shall be at various stages of the reservoir construction, utility construction, concrete delivery on-site, granular base course placement and embankment.
 - .6 Cost of the independent quality assurance testing will be borne by the Departmental Representative.
 - .7 The Departmental Representative may perform quality audits as desired. Such audits will not relax the responsibility of the Contractor to perform work in accordance with specifications. To facilitate this work the Contractor shall:
 - .1 Notify appropriate agency and Departmental Representative in advance of work which the Departmental Representative may want to test.
 - .2 Submit samples and/or materials required for testing as specifically requested in the Specifications or as requested by the Departmental Representative. Submit within two (2) days so as not to cause delay in the Work.

- .3 Provide labour and facilities to obtain and handle samples and materials on-site.

1.4 INSPECTION

- .1 Refer to GC 2.5 – Review and Inspection of Work.
- .2 Further to GC 2.5, the Contractor should notify the Departmental Representative seventy-two (72) hours prior to any special tests or inspections required.

1.5 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection/Testing Agency will be engaged by the Department Representative.
- .2 The Contractor shall assist the inspector or testing agency in carrying out their duties.
- .3 Employment of inspection/testing agencies by the Departmental Representative 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 Parks Canada. Contractor shall cover the costs for retesting and re-inspection.

1.6 ACCESS TO WORK

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

1.7 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative seventy-two (72) hours 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.

1.8 REJECTED WORK

- .1 Any instances of unacceptable work discovered by either the Quality Control or Quality Assurance personnel will require the preparation of a non-conformance report (NCR).
- .2 If instances of unacceptable work are discovered by the Departmental Representative, the Departmental Representative may issue a non-conformance report (NCR).

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- .3 The Contractor shall expediently correct any non-conformances, whether the result of poor workmanship, use of defective products or damage; and whether incorporated in the Work or not, the Contractor shall replace or re-execute in accordance with the Contract Documents.
 - .4 Payment for the Work itself may be withheld until the NCR issue has been resolved to the satisfaction of the Departmental Representative.
 - .5 If in opinion of the 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 the difference in value between Work performed and that called for by Contract Documents, the amount of which will be determined by the Department Representative.

1.9 REPORTS

- .1 Submit one (1) electronic copy of all inspection and test reports to the Department Representative.
- .2 Submit to the Departmental Representative one paper copy and one electronic copy of all Non-Conformance Reports.
- .3 Provide copies to subcontractor of work being inspected or tested.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

1.3 DEWATERING

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.4 WATER SUPPLY

- .1 The Contractor shall provide continuous supply of potable water for construction use.
- .2 Arrange for connection and pay costs for installation, maintenance and removal.

1.5 TEMPORARY HEATING AND VENTILATION

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside buildings must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
- .3 Provide temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work. Protect Work and products against dampness and cold.
 - .2 Prevent moisture condensation on surfaces.
 - .3 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
 - .4 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
 - .1 Prevent accumulations of dust, fumes, mists, vapors or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.
- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
- .7 On completion of Work for which permanent heating system is used, replace filters, and clean heating system.

1.6 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools at no cost to the Departmental Representative.
- .2 Furnish and install all necessary temporary wiring, distribution boxes, panels, etc., and upon completion of the work, remove all such temporary materials.

1.7 TEMPORARY COMMUNICATION FACILITIES

- .1 Provide and pay for temporary telephone, fax, data hook up, lines, equipment necessary for own use.

1.8 TEMPORARY SANITARY FACILITIES

- .1 Contractor shall provide portable toilets for construction use. Existing campground or village facilities are not to be used.

1.9 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by organization having jurisdiction and governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

Part 2 Products

2.1 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 the requirements of authorities having jurisdiction.

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- .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.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CSA-S269.2-M1987 (R2003), Access Scaffolding for Construction Purposes.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Install and remove construction facilities only after securing approval from Departmental Representatives.
- .2 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, access to fenced area and details of fence installation.
- .3 Identify areas which have to be gravelled to prevent tracking of mud.
- .4 Indicate use of supplemental or other staging area, if required.
- .5 Provide construction facilities in order to execute work expeditiously.
- .6 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.
- .3 On major structures, employ a qualified professional engineer registered in the province of Alberta for the design of temporary works.

1.5 HOISTING

- .1 Provide, operate and maintain hoists and cranes required for moving of materials and equipment. Make arrangements with Subcontractors for their use of hoists if required.
- .2 Hoists and cranes to be operated by qualified operators.

1.6 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.

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- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.7 CONSTRUCTION PARKING

- .1 Parking will be permitted on site in areas designated by the Departmental Representative.
- .2 Provide and maintain adequate access to project site.

1.8 OFFICES

- .1 Provide a heated and ventilated office of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.10 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.

1.11 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.
- .2 Clean dirt or mud tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.
- .4 Do not stack stored new or salvaged material in construction facilities.

1.12 WINTER CONSTRUCTION

- .1 Special construction methods required to perform the work in severe weather shall be the responsibility of the Contractor.

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- .2 Where the specifications call for work to be performed within a given temperature range or above a minimum temperature, it shall be the Contractor's responsibility to provide all temporary enclosures and heat necessary to provide the conditions specified.
 - .3 Where compaction of backfill is specified, the Contractor shall perform the work in a manner such that compaction can be achieved.
 - .4 Where weather conditions are such that compaction of backfill consisting of excavated materials is not possible; the Contractor shall provide unfrozen granular material for backfill, at the Contractor's expense.

1.13 ACCESS ROADS

- .1 Construct, remove and rehabilitate access roads only after securing approval from Departmental Representative.
- .2 Construct temporary access roads as necessary to perform the work, and maintain temporary access roads until construction is over or until permanent access is established.
- .3 Locations and drainage facilities for temporary access roads are subject to the approval of the Departmental Representative.
- .4 No direct payment will be made to the Contractor for construction of temporary access roads and removal and restoration after construction completion.
- .5 If authorized to use existing roads for access to the project site, the Contractor shall maintain such roads for duration of the contract and make good damage resulting from Contractor's use of road.
- .6 Any driving off road requires prior approval from the Departmental Representative.

1.14 EXISTING UTILITIES AND STRUCTURES

- .1 Existing utilities and structures include the following: pipes, culverts, ditches or other items which are a part of an existing sewerage, drainage or water system; or which are a part of a gas, electrical, telephone, television, telecommunications or other utility system. Also included are streets, sidewalks, curbs, gutters, swales, poles, fences or any other structures encountered during construction.
- .2 The Contractor shall be responsible for protection, removal or replacement of existing utilities and structures, or for repair of any damage, which may occur during construction.
- .3 Existing utilities and structures may be shown on the drawings, or described in the specifications. Such information is shown for design purposes and the existence, location and detail given is information that is obtained during the design period and is not necessarily complete, correct or current.

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- .4 The Contractor shall pay all costs and be responsible for establishing locations and state of use of all existing utilities that may affect the work. The Contractor shall make satisfactory arrangements with the utilities companies involved for the location, protection and inspection of existing utilities.
 - .5 Notices in writing shall be given by the Contractor to the utilities companies 96 hours before work commences in the vicinity of existing utilities.
 - .6 The Contractor shall pay all the costs involved in protection of utilities, inspection of utilities, and all costs due to delays because of existing utilities and structures.
 - .7 The Contractor shall provide for the uninterrupted flow of all water courses, sewers and drains encountered during the work.
 - .8 Access shall be maintained to all existing structures such as valves, hydrants, meter chambers and control structures at all times during construction.
 - .9 If interruption of service provided by an existing utility is necessary, the planned shutdown shall be approved by the utility companies and the Departmental Representative. Requests for shutdown shall be made by the Contractor in writing at least 96 hours in advance.
 - .10 The Contractor shall notify all customers or make arrangements with the utility company and the Departmental Representative to notify all customers 96 hours in advance of a shut-down.

1.15 CONSTRUCTION SIGNAGE AND SAFETY

- .1 The Contractor shall be responsible for the regulation of traffic during construction, and shall perform the work in a manner that will cause the least disruption of traffic.
 - .1 Normal traffic includes large tour buses, large RV units and large camping trailers.
- .2 The Contractor shall co-ordinate the work with the Departmental Representative to minimize traffic problems.
- .3 Provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs and other traffic controls shall be the Contractor's responsibility and shall be in accordance with the RTAC Manual of Uniform Traffic Control Devices and shall be located to the satisfaction of the Departmental Representative.
- .4 The Contractor shall supply and maintain at no extra cost all barriers, barricades, warning signs, detours, fences, flag-persons and all other devices to protect the workers and general public against accidents or injury. All applicable safety standards shall be followed. All excavations or obstructions shall be clearly marked between sunset and sunrise with proper warning flares or lights.
- .5 Provide access and temporary relocated roads as necessary to maintain traffic.

- .6 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .7 The Contractor shall provide adequate dust control to ensure safe operation at all times.
- .8 Lighting shall provide full and clear visibility for full width of haul road and work areas during night work operations.
- .9 The Contractor to provide snow removal during period of Work.

1.16 HAUL ROUTES

- .1 Haul routes (roadways, lanes) shall be subject to the approval of the Departmental Representative. The Contractor shall be responsible for damage and/or spillage on all roads used for hauling materials and equipment to and from the site. The Contractor shall immediately clean and/or restore the affected areas.
- .2 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic
- .3 Trucks must be loaded in such a manner that no spillage occurs during the haul.

1.17 NOTIFICATION

- .1 General
 - .1 The Contractor will notify, in writing, every business/resident whose lot is fronting, backing or immediately adjacent to the construction site at least five (5) days in advance of commencing construction of the project and at least twenty four (24) in advance of any road closures. Notices will be prepared by the Departmental Representative, printed on the Contractor's letterhead and will be distributed by the Contractor. Notices will include a description of the work and how this will affect the business/resident. The Contractor shall provide in a timely manner all details required for the Departmental Representative to prepare accurate notices including a description of the work and how this will affect the business/resident, the proposed construction schedule which shall give approximate dates of construction in affected areas and indicate the Contractor's and Departmental Representative's contact information and telephone number, as well as a telephone number, which residents can call for 24-hour emergency service. The notice shall also include a contact person for reporting damage to personal property and if required, alternative parking, access, garbage disposal and temporary water systems. A notice which warns parents of the dangers that exist on construction sites should be included in a notice delivered to every household in the vicinity of construction.
- .2 Notification of Disruption of Sanitary Services
 - .1 In the event that it should become necessary to disrupt sanitary services to any building during construction, the Contractor is required to provide written notice 96 hours prior to the intended disruption.

- .2 Any disruption to private residences must be restricted to the Contractor's working hours. Temporary services shall be provided to the residents after the Contractor has completed work for the day if required. The cost shall be included in the overall tender price. No extra payments will be allowed.
- .3 Notification of Disruption of Water Services
 - .1 If water service interruption is necessary to carry out the work, provide written notice to residents or occupants of the building 96 hours in advance. Identify the duration of the water interruption.
 - .2 Provide temporary water supply to buildings if existing water service connections are shut down. The cost shall be included in the overall tender price. No extra payment will be allowed.
 - .3 Notify the Departmental Representative 96 hours in advance for shutting down of water supply to buildings and/or operating (opening/closing) of water valves.

1.18 MAINTENANCE OF UTILITY SERVICES

- .1 The Contractor shall be responsible for providing, maintaining and repairing temporary utility services. The costs for providing temporary utility services shall be included in the overall tender price and no extra payment will be allowed.
- .2 During construction and warranty periods, if the Contractor fails to respond to requests for remedial works regarding maintaining or repairing temporary utility services, within reasonable time, the Departmental Representative shall have the right to carry out the necessary remedial works and shall charge the costs of the remedial works done to the Contractor.

1.19 TRAFFIC REGULATION

- .1 The Contractor shall be responsible for the regulation of traffic during construction, and shall perform the work in a manner that will cause the least disruption of traffic.
 - .1 Normal traffic includes large tour buses, large RV units and large camping trailers.
- .2 The Contractor shall co-ordinate the work with the Departmental Representative to minimize traffic problems.
- .3 Provision of flag-persons, traffic signs, and other traffic controls shall be the Contractor's responsibility and shall be in accordance with the RTAC Manual of Uniform Traffic Control Devices and shall be located to the satisfaction of Departmental Representative.
- .4 The Contractor shall supply all barriers, barricades, warning signs, detours, fences, flag-persons and all other devices to protect the public. All applicable safety standards shall be followed.
 - .1 All excavations or obstructions shall be clearly marked between sunset and sunrise with proper warning flares or lights.
 - .2 Replace any existing road signs if they are removed or damaged during construction.

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- .5 The Contractor shall obtain prior approval to block traffic temporarily if it is necessary to do so to perform the work. Obtain the written approval of Parks Canada, and the Departmental Representative. At least 2 weeks prior to actually blocking traffic notify the following:
 - .1 Local RCMP Detachment
 - .2 Local Fire Department
 - .3 Parks Canada
 - .4 Utility Companies
 - .5 Abutting Property Owners
 - .6 The Contractor shall maintain/provide access to all residential and commercial property adjacent to the work at all times.
 - .7 Alternate access to residents and businesses to be provided in accordance with Contract Drawings. The Contractor shall provide 96 hours advance notification of access changes to residents and businesses, and shall coordinate changes with the Owner and the affected residents and business community.
 - .8 Adequate construction parking meeting local regulations shall be provided by the Contractor.
 - .2 Haul routes shall be maintained by Contractor. They shall be kept open to traffic and shall be clean at all times.
 - .9 One lane of all roads must be kept open at all times.
 - .10 Contractor may only close one half of any road at any one time during construction.

1.20 CONSTRUCTION SIGNAGE

- .1 No other signs or advertisements, other than warning signs, are permitted on site.
- .2 Direct requests any requests to any other signage to the Departmental Representative.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures in accordance with Section 01 35 43 - Environmental Procedures.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978 (R2003), Douglas Fir Plywood.

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 enclosures using construction grade lumber framing at and exterior grade fir plywood to CSA O121.
- .2 Apply plywood panels vertically, flush and butt jointed.
- .3 Erect temporary site enclosure using new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4m on centre, around the construction site and open trenching at the end of each work day. Provide one lockable truck gate. Maintain fence in good repair.
- .4 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, open shafts, open stair wells, open edges of floors and roofs.

1.5 WEATHER ENCLOSURES

- .1 Provide weather tight closures to tops of shafts and other openings in floors and roofs.
- .2 Design enclosures to withstand wind pressure and snow loading.

1.6 DUST TIGHT SCREENS

- .1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work. Obtain approval from Departmental Representative prior to installation.

1.8 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFFSITE AND PUBLIC PROPERTY

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

1.11 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Departmental Representative locations and installation schedule prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Within text of each specification section, reference may be made to reference standards.
- .2 Conform to these reference standards, in whole or in part as specifically requested in specifications.
- .3 If there is question as to whether products or systems are in conformance with applicable standards, the Departmental Representative reserves right to have such products or systems tested to prove or disprove conformance.
- .4 Cost for such testing will be born by the Departmental Representative in event of conformance with Contract Documents or by the 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. Should disputes arise as to quality or fitness of products, decision rests strictly with the Departmental Representative based upon requirements of Contract Documents.

1.3 AVAILABILITY

- .1 Within 10 working days of award of contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify the 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 the Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the 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, and 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 the Departmental Representative.
- .9 Touch-up damaged factory finished surfaces to the 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 the Departmental Representative will be paid for by the Departmental Representative. Unload, handle and store such products.

1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in the 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 the Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that the Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

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- .4 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify the Departmental Representative if required Work is such as to make it impractical to produce required results.
 - .5 Do not employ anyone unskilled in their required duties. The Departmental Representative reserves right to request dismissal from site, workers deemed incompetent or careless.
 - .6 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with the Departmental Representative whose decision is final.

1.7 COORDINATION

- .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.

1.8 CONCEALMENT

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

1.9 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.

1.10 LOCATION OF FIXTURES

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

1.11 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.

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- .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.

1.12 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.

1.13 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 the Departmental Representative.

1.14 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, and/or building occupants.
- .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

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 QUALIFICATIONS OF SURVEYOR

- .1 The Contractor shall provide and pay for the services of a land surveyor, licensed to practice in Place of Work, acceptable to the Departmental Representative.

1.2 SURVEY REFERENCE POINTS

- .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2 Make no changes or relocations without prior written notice to the Departmental Representative.
- .3 Report to the Departmental Representative when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require the surveyor to replace control points in accordance with original survey control.

1.3 SURVEY REQUIREMENTS

- .1 Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 The Contractor shall provide detailed layout for trenching, sanitary, concrete, road work, signalization, illumination, landscaping and all appurtenances installation in accordance with the requirements of the applicable specifications.
- .3 The Contractor shall provide all necessary survey instruments, stakes, and other material required to establish lines and levels and layout of the Work, by instrumentation.
- .4 The Contractor shall give 96 hours advance notice to the Departmental Representative before the respective construction starts. The Departmental Representative's check on the Contractor's survey work and grade sheets shall not relieve the Contractor responsibility.
- .5 The Contractor shall locate, confirm and protect the control points, and legal pins, or he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their loss or disturbance.
- .6 The Contractor shall not proceed with the work until he has received from the Departmental Representative such base horizontal and vertical control points and instructions required for the execution of the work.
- .7 The Contractor shall, before commencing work at any point, satisfy himself and to the meaning and correctness of all stakes and instructions. No claims shall be considered for any allowance based on alleged inaccuracies, failure to read reference points correctly, or failure to interpret instruction correctly.

- .8 If the Contractor, in the course of the work, finds any discrepancy between the drawings and the physical conditions of the locality or any errors or omissions in the drawings or in the layout as given by points and instructions, he shall inform the Departmental Representative immediately in writing, and the Departmental Representative shall promptly verify the same and issue appropriate instructions. Any work done after such discovery, before further work is authorized, will be done at the Contractor's risk.
- .9 The Contractor shall be responsible for the correctness of the elevations and dimensions from the references provided by the Departmental Representative.
- .10 The layout of the work shall be done in accordance with the current work schedule as prepared by the Contractor and reviewed by the Departmental Representative.

1.4 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify the Departmental Representative of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by the Departmental Representative.

1.5 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform the Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by the Departmental Representative.

1.6 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.7 SUBMITTALS

- .1 Submit name and address of Surveyor to the Departmental Representative. On request of the Departmental Representative, submit documentation to verify accuracy of field engineering work.

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- .2 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform to the Contract Documents.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify the Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should the Departmental Representative determine that conditions do differ materially; instructions will be issued for changes in Work as provided in Changes and Change Orders.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of elements of project.
 - .2 Integrity of weather exposed or moisture resistant elements.
 - .3 Efficiency, maintenance, or safety of operational elements.
 - .4 Visual qualities of sight exposed elements.
 - .5 Work of the Departmental Representative or separate contractor.
- .3 Include in request:
 - .1 Identification of project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of the Departmental Representative or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.2 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit a written request for substitution and do not proceed until authorized by Departmental Representative.

1.3 PREPARATION

- .1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.
- .2 After uncovering, inspect conditions affecting performance of Work.
- .3 Beginning of cutting or patching means acceptance of existing conditions.
- .4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.
- .5 Provide protection from elements for areas which are to be exposed by uncovering work; maintain excavations free of water.

1.4 EXECUTION

- .1 Execute cutting, fitting, and patching to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather exposed and moisture resistant elements, and sight exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .12 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 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, other than that caused by the Departmental Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by the Departmental Representative. Do not burn waste materials on site.
- .3 Clear snow and ice from access to site, bank/pile snow in designated areas only.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site a container for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling.
- .7 Dispose of waste materials and debris off site.
- .8 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers, and remove from premises at end of each working day.

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 other than that caused by the Departmental Representative or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by the Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .8 Clean lighting reflectors, lenses, and other lighting surfaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Text, schedules and procedures for Waste Management Program for construction, deconstruction, demolition and renovation, including:
 - .1 Diversion of Materials.
 - .2 Waste Reduction Workplan (WRW) - Schedule A.
 - .3 Materials Source Separation Program (MSSP).

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.

1.3 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with the Departmental Representative to review and discuss Waste Management Plan and Goals.
- .2 Accomplish maximum control of solid construction waste.
- .3 Preserve environment and prevent pollution and environment damage.

1.4 DEFINITIONS

- .1 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .2 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .3 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .4 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .5 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .6 Separate Condition: Refers to waste sorted into individual types.
- .7 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

- .8 Waste Management Coordinator (WMC): Contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .9 Waste Reduction Workplan (WRW): Written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule A.

1.5 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Reduction Workplan.
 - .2 Material Source Separation Plan.

1.6 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule A.
 - .2 Submit 2 copies of Materials Source Separation Program (MSSP).

1.7 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by the Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .5 Locate separated materials in areas which minimize material damage.
- .6 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition. Transport to approved and authorized recycling facility.

1.9 PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by the Departmental Representative.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify the Departmental Representative.
- .7 Protect surface drainage, mechanical and electrical from damage and blockage.
- .8 Separate and store materials produced during dismantling of structures in designated areas.
- .9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.

- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.11 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility and provide temporary security measures approved by Departmental Representative as needed.

1.12 SCHEDULING

- .1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Execution

2.1 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

2.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

2.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by the Departmental Representative, and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale of salvaged recovered reusable recyclable materials is not permitted.
- .3 Construction Waste

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard Packaging	100	
Plastic Packaging	100	
Steel	100	
Wood (uncontaminated)	100	
Plastic (piping)	100	

2.4 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule A

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (unit) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destination
Cardboard Packaging							
Plastic Packaging							
Rubble							
Steel							
Wood (uncontami nated)							
Plastic (piping)							
Other							

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and Sub-Contractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify the Departmental Representative in writing of satisfactory completion of the Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative Inspection.
- .2 Departmental Representative Inspection: The Departmental Representative and Contractor will perform inspection of Work to identify obvious defects or deficiencies. The Contractor to correct work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Required Certificates have been submitted.
 - .5 Operation of systems has been demonstrated to Departmental Representative's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative and Contractor. If Work is deemed incomplete by the Departmental Representative, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Performance: when the Departmental Representative considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.
- .6 Commencement of Lien and Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .7 Final Payment: when the Departmental Representative considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by the Departmental Representative, complete outstanding items and request re-inspection.
- .8 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with the contract.

1.2 CLEANING

- .1 Remove waste and surplus materials, rubbish and construction facilities from the site in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned after final inspection, with the Departmental Representative's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final hard copies of operating and maintenance manuals in English and electronic PDF files on USB flash drive.
- .6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .7 Furnish evidence, if requested, for type, source and quality of products provided.
- .8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .9 Pay costs of transportation.

1.2 AS-BUILTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for the Departmental Representative, one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by the Departmental Representative.

1.3 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on a clean set of black line construction drawings.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

1.4 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.5 SPARE PARTS

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.

-
- .4 Receive and catalogue items. Submit inventory listing to the Departmental Representative. Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.

1.6 MAINTENANCE MATERIALS

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

- .2 Provide items of same manufacture and quality as items in Work.

- .3 Deliver to site; place and store.

- .4 Receive and catalogue items. Submit inventory listing to the Departmental Representative. Include approved listings in Maintenance Manual.

- .5 Obtain receipt for delivered products and submit prior to final payment.

1.7 SPECIAL TOOLS

- .1 Provide special tools, in quantities specified in individual specification section.

- .2 Provide items with tags identifying their associated function and equipment.

- .3 Deliver to site; place and store.

- .4 Receive and catalogue items. Submit inventory listing to the Departmental Representative. Include approved listings in Maintenance Manual.

1.8 STORAGE, HANDLING AND PROTECTION

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.

- .3 Store components subject to damage from weather in weatherproof enclosures.

- .4 Store paints and freezable materials in a heated and ventilated room.

- .5 Remove and replace damaged products at own expense and to satisfaction of the Departmental Representative.

1.9 WARRANTIES AND BONDS

- .1 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

-
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .2 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
 - .3 Respond in a timely manner to oral or written notification of required construction warranty repair work.
 - .4 Written verification will follow oral instructions. Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.10 PRE-WARRANTY CONFERENCE

- .1 Meet with the Departmental Representative, to develop understanding of requirements of this section. Schedule meeting prior to contract completion, and at time designated by the Departmental Representative.
- .2 The Departmental Representative will establish communication procedures for:
 - .1 Notification of construction warranty defects.
 - .2 Determine priorities for type of defect.
 - .3 Determine reasonable time for response.
- .3 Provide name, telephone number and address of licensed and bonded company that is authorized to initiate and pursue construction warranty work action.
- .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

DIVISION 02
EXISTING CONDITIONS

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 11 – Cleaning

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert excess aggregate materials from landfill to local quarry or facility for reuse as directed by Departmental Representative.

Part 2 Products

2.1 EQUIPMENT

- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from string line, and capable of removing part of pavement surface to depths or grades indicated Execution
- .2 Use equipment capable of full depth and width removal where required.

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.
- .4 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.

3.2 PROTECTION

- .1 Protect existing pavement not designated for removal, light units and structures from damage. In event of damage, immediately replace or make repairs to approval of Departmental Representative at no additional cost.

3.3 REMOVAL

- .1 Remove existing asphalt pavement to lines and grades established by Departmental Representative in field.

-
- .2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
 - .3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
 - .4 Provide for suppression of dust generated by removal process.

3.4 FINISH TOLERANCES

- .1 Finished surfaces in areas where asphalt pavement has been removed to be within +/-5 mm of grade specified but not uniformly high or low.

3.5 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 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.

3.6 DISPOSAL OF MATERIAL

- .1 Dispose of removed asphalt pavement to an approved disposal site offsite or by stock-piling in location designated by Departmental Representative.
- .2 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete under this contract may be stockpiled at designated asphalt plant site.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Export and Import of Hazardous Waste Regulations SOR/2002-300.
- .2 National Fire Code of Canada 2015.
- .3 Transportation of Dangerous Goods Act (TDG Act) 1999, (c. 34).
- .4 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).
- .5 Canadian Environmental Assessment Act.
- .6 Canada National Parks Act.

1.2 DEFINITIONS

- .1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
- .2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .3 Hazardous Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .4 Workplace Hazardous Materials Information System (WHMIS): a Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.3 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative current Material Safety Data Sheet (MSDS) 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, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.4 STORAGE AND HANDLING

- .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

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- .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Fuel storage (secondary containment) shall be as per National Parks Act requirements.
 - .4 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 not mixed.
 - .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.
 - .5 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements. Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within 24 hours of incident.

1.5 TRANSPORTATION

- .1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.
- .2 If hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with the Departmental Representative.
 - .2 Ensure compliance 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 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

- .6 Ensure that 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 a photocopy of completed manifest to Departmental Representative.
- .9 Report discharge, emission, or escape of hazardous materials immediately to the Departmental Representative and the Banff National Park Warden Service Dispatch, phone no. (403) 762-1470. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

- .1 Only bring on site quantity of hazardous materials required to perform work.
- .2 Maintain MSDSs in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

- .1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
- .3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
- .4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.
- .5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited.
- .6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.
- .7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.
- .8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:
 - .1 Hazardous wastes recycled in manner constituting disposal.
 - .2 Hazardous waste burned for energy recovery.

-
- .3 Lead-acid battery recycling.
 - .4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

DIVISION 03

CONCRETE

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA A23.1-19 /A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA O86-19, Engineering Design in Wood.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA O151-17, Canadian Softwood Plywood.
 - .5 CSA O153-13, Poplar Plywood.
 - .6 CAN/CSA O325.0-16, Construction Sheathing.
 - .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .8 CSA S269.1-16, Falsework and Formwork.
 - .9 CAN/CSA S269.3-M92(R2003), Concrete Formwork.
 - .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-17, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 Council of Forest Industries of British Columbia (COFI)
 - .1 COFI Exterior Plywood for Concrete Formwork.
- 1.2 WASTE MANAGEMENT AND DISPOSAL**
- .1 Separate and recycle waste materials.
 - .2 Place materials defined as hazardous or toxic waste in designated containers.
 - .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
 - .4 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

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 CAN/CSA-O86.1.
 - .2 For concrete with special architectural features, use formwork materials to CAN/CSA-A23.1.
 - .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Form ties:

- .1 Use removable or snap off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
- .3 Form release agent: non-toxic.
- .4 Form stripping agent: colourless mineral oil, non-toxic, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40°C, flashpoint minimum 150°C, open cup.
- .5 Falsework materials: to CSA-S269.1.

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 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 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 CAN/CSA-A23.1.
- .8 Align form joints and make watertight. Keep form joints to minimum.
- .9 Locate horizontal form joints for exposed columns 2400 mm above finished floor elevation.
- .10 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .11 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .12 Construct forms for concrete, and place ties as indicated and/or as directed. Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.

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- .13 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Assure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
 - .14 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 Two (2) days for walls and sides of beams.
 - .2 Two (2) days for columns.
 - .3 Twenty-one (21) days for beam soffits, slabs, and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework.
 - .4 One (1) day for footings.
- .2 Remove shoring when concrete has reached 80 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Space reshoring in each principal direction at not more than 3000 mm apart.
- .5 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Concrete Institute (ACI).
 - .1 SP-66-04, ACI Detailing Manual 2004
- .2 ASTM International (ASTM):
 - .1 ASTM A 123/A 123M - 17 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A 641/A 641M-09a(2014), Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .3 ASTM A 775/A 775M-17, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .4 ASTM A 884/A 884M-19 Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 - .5 ASTM A 1064/A 1064M-18, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete. Language operating requirements: provide identification nameplates and labels for control items in English.
- .3 CSA Group (CSA)
 - .1 CSA A23.1-19 /A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA A23.3-19, Design of Concrete Structures.
 - .3 CSA G30.18-09(R2014), Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA G40.20/G40.21-13(R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CSA W186-M1990(R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.2 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00- Submittal Procedures.
- .2 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative with identifying code marks to permit correct placement without reference to structural drawings. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada.

- .3 Detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated. Provide Type C tension lap splices unless otherwise indicated.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Departmental Representative
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .4 Mechanical splices: subject to approval of Departmental Representative.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada unless indicated otherwise.
- .2 Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Upon request inform Departmental Representative 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 Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.

- .3 Replace bars which develop cracks or splits.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 260/C 260M-10a(2016), Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C 309-19, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C 494/C 494M-19, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM C 881/C 881M-15, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
 - .5 ASTM C 1017/C 1017M-14-03, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM C C1059/C1059M-13, Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
 - .7 ASTM D 412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .8 ASTM D 624-2020, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .9 ASTM D 1751-18, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .10 ASTM D 1752-18, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 CSA Group (CSA)
 - .11 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .12 CSA A283-19, Qualification Code for Concrete Testing Laboratories.
 - .13 CSA A3000-18, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005)

1.2 ACRONYMS AND TYPES

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended)
 - .1 Type GU or GUb - General use cement.
 - .2 Type MS or MSb - Moderate sulphate-resistant cement.
 - .3 Type MH or MHb - Moderate heat of hydration cement.
 - .4 Type HE or Heb - High early-strength cement.
 - .5 Type LH or LHb - Low heat of hydration cement.

- .6 Type HS or HSb - High sulphate-resistant cement.
- .2 Fly ash:
 - .1 Type F - with CaO content less than 8%.
 - .2 Type CI - with CaO content ranging from 8 to 20%.
 - .3 Type CH - with CaO greater than 20%.
- .3 GGBFS - Ground, granulated blast-furnace slag.

1.3 DESIGN REQUIREMENTS

- .1 Performance: in accordance with CSA-A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

1.4 CERTIFICATES

- .1 Submit certificates in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Minimum 4 weeks prior to starting concrete work submit to Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Supplementary cementing materials.
 - .3 Admixtures.
 - .4 Aggregates.
 - .5 Water.
 - .6 Waterstops.
- .3 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA A23.1.
- .4 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA A23.1.
- .5 Submit testing results and reports for review by Departmental Representative and do not proceed with work without written approval when deviations from mix design or parameters are found.
- .6 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .7 Concrete hauling time: submit for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.5 QUALITY ASSURANCE

- .1 Submit to Departmental Representative, minimum four (4) weeks prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .2 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 01 45 00 - Quality Control for Departmental Representative's approval for following items:
 - .1 Hot weather concrete.
 - .2 Cold weather concrete.
 - .3 Curing.
 - .4 Finishes.
 - .5 Formwork removal
- .3 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 – HSE Response Procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Departmental Representative, laboratory representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Designate a cleaning area for tools to limit water use and runoff.
- .3 Carefully coordinate the specified concrete work with weather conditions.
- .4 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .5 Prevent plasticizers, water reducing agents and air entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions collect liquid or solidify

liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.

- .6 Choose least harmful, appropriate cleaning method which will perform adequately.

1.8 SITE CONDITIONS

- .1 Placing concrete during rain or weather events that could damage concrete is prohibited.
- .2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.
- .3 Cold weather protection:
 - .1 Maintain protection equipment, in readiness on Site.
 - .2 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.
 - .3 Placing concrete upon or against surface at temperature below 5°C is prohibited
 - .4 Protection of concrete shall be considered incidental to its placement. The temperature of the concrete shall be maintained at or above 10°C for a minimum of three (3) days or till the concrete has reached a minimum compressive strength of 20 MPa, by whatever means are necessary. Concrete damaged as a result of inadequate protection against weather conditions shall be removed and replaced by the Contractor at their own expense. Also, concrete allowed to freeze prior to the three (3) days will not be accepted for payment.
- .4 Hot weather protection:
 - .1 Protect concrete from direct sunlight when ambient temperature above 27°C.
 - .2 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.
- .5 Protect from drying.

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001, Type HS.
- .2 Supplementary cementing materials: with minimum 20% fly ash replacement to CAN/CSA-A3001.
- .3 Water: to CSA-A23.1.
- .4 Aggregates: to CAN/CSA-A23.1/A23.2 and ASTM C330. Coarse aggregates to be normal high density.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 and ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.

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- .6 Shrinkage compensating grout: premixed compound consisting of Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.
 - .1 Compressive strength: 50 MPa (7250 psi) at 28 days.
 - .2 Net shrinkage at 28 days: maximum 0.08%.
 - .7 Non-premixed dry pack grout: composition of non metallic aggregate: Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 30 MPa at 28 days.
 - .8 Post-Tensioning ducts: to CSA-A23.1/A23.2.
 - .9 Curing compound: to CSA-A23.1/A23.2, white and ASTM C309, Type 1-chlorinated rubber.
 - .10 Pre-moulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - .11 Weep hole tubes: plastic.
 - .12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
 - .13 Dampproof membrane:
 - .1 Kraft/polyethylene membrane:
 - .1 Plain: 0.75 mm thick polyethylene film bonded to asphalt treated creped kraft.
 - .2 Membrane adhesive: as recommended by membrane manufacturer.
 - .14 Polyethylene film: 0.15 mm thickness to CAN/CGSB-51.34.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following quality for building concrete:
 - .1 Cement: Type HS Portland cement.
 - .2 Minimum compressive strength at 28 days: 30 MPa.
 - .3 Minimum cement content: 335 kg/m³ of concrete.
 - .4 Class of exposure: F-1.
 - .5 Nominal size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 80 to 100 mm.
 - .7 Air content: 5 to 7 %.
 - .8 Chemical admixtures: following admixtures in accordance with ASTM C494, type, quantity, water reducing strength increasing air entraining.
- .2 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following quality for all exterior concrete:
 - .1 Cement: Type HS Portland cement.

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- .2 Minimum compressive strength at 28 days: 32 MPa.
 - .3 Minimum cement content: 335 kg/m³ of concrete.
 - .4 Class of exposure: F-2.
 - .5 Nominal size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 80 to 100 mm.
 - .7 Air content: 6 to 8 %.
 - .8 Chemical admixtures: following admixtures in accordance with ASTM C494, type, quantity, water reducing strength increasing air entraining..
- .3 Proportion normal density concrete in accordance with CAN/CSA-A23.1, Alternative 1 to give the following quality for thrust blocks.
- .1 Cement: Type GU Portland cement.
 - .2 Minimum compressive strength at 28 days: 25 MPa.
 - .3 Minimum cement content: 335 kg/m³ of concrete.
 - .4 Class of exposure: F-2.
 - .5 Nominal size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 80 to 100 mm.
 - .7 Air content: 5.5 to 8 %.
 - .8 Chemical admixtures: following admixtures in accordance with ASTM C494, type, quantity, water reducing strength increasing air entraining..

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Departmental Representative's approval before placing concrete.
 - .1 Provide 48 hours' notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing
- .3 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.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

- .8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .9 Do not place load upon new concrete until authorized by Departmental Representative.

3.2 CONSTRUCTION

- .1 Placing Reinforcing Steel shall be in accordance with Section:
 - .1 Reinforcement shall be placed in accordance with the details shown on the Drawings, rigidly fastened together, and lowered into the excavation intact before concrete is placed.
 - .2 Spacers shall be utilized to properly locate the reinforcing steel cage in the excavation.
- .2 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.
- .3 Sleeves and inserts
 - .1 No sleeves, ducts, pipes or other openings shall pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated, must be approved by Departmental Representative.
 - .3 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Departmental Representative before placing of concrete.
 - .4 Check locations and sizes of sleeves and openings shown on drawings.
 - .5 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .4 Anchor bolts
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 With approval of Departmental Representative, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used or to manufacturer's recommendations.
 - .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.
- .5 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .6 Finishing

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- .1 Finish concrete in accordance with CSA A23.1/A23.2.
 - .2 Use procedures acceptable to Departmental Representative or those noted in CAN/CSA-A23.1 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Provide screed float steel swirl-trowelled finish unless otherwise indicated.
 - .4 Provide broom finish on all exterior concrete slabs or aprons.
 - .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
 - .7 Joint fillers
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .2 Locate and form construction joints as indicated. Install joint filler.
 - .3 Use 12 mm thick joint filler where joint fillers are indicated.

3.3 SITE TOLERANCE

- .1 Concrete tolerance in accordance with CSA A23.1/A23.2 straight edge method.

3.4 FIELD QUALITY CONTROL

- .1 Quality Control inspection and testing of concrete and concrete materials will be the responsibility of the contractor per Section 01 45 00 – Quality Control in accordance with CAN/CSA-A23.1. Department Representative may perform Quality Assurance.
- .2 The Contractor will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures: Testing Laboratory Services.
- .3 Slump and Air-Content Tests
 - .1 Make test at the time of concrete placement where strength specimens are made, as often are required by the Departmental Representative but not less frequently than one test each of slump and air content for every truckload of concrete placed.
- .4 Strength Tests
 - .1 Frequency: one strength, slump and air-content test for each 50 m³ of each class of concrete or at least one set of tests each day when concrete is poured.
 - .2 Cylinders: take not less than 3 cylinders for each test. One cylinder to be tested at 7 days, two cylinders to be tested at 28 days. Prepare cylinders in accordance with CSA A23.2.
 - .3 Compressive Strength: use the average of the compressive strength of two standard cylinders tested at the age specified. If either of the two cylinders shows definite evidence, other than low strength, of improper sampling, moulding, handling, curing or testing, discard cylinder and use the strength of the remaining cylinder for test result.
 - .4 Strength Requirements: strength requirements for each class of concrete are met if the averages of all sets of three consecutive strength tests equal or exceed the

specified strength and no single test falls more than 3.5 MPa below specified compressive strength.

- .5 The Contractor will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .6 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.
- .7 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

DIVISION 05

STEEL

PART 1 GENERAL

1.1 DESCRIPTION

.1 Work Included:

Furnish all work, labor, materials, equipment and supervision necessary to provide and install anchors in previously poured concrete and in masonry as indicated on Structural Drawings, as specified herein, or as otherwise required to anchor or support materials and equipment from structure.

1.2 MEASUREMENT PROCEDURES

.1 Measurement and Payment:

- .1 Measurement and Payment in accordance with Section 01 29 01 – Method of Measurement and Payment.
- .2 Supply and installation of stainless steel threaded rods and anchors shall be measured in “each” unit.
- .3 No separate payment will be made for anchor testing or other items of this Section in respect to anchor installation.
- .4 Supply and installation of anchor bolts, nuts and washers and bolt grouting not measured but considered incidental to work.

1.3 REFERENCE STANDARDS

- .1 Applicable Specifications: Latest edition of following specifications and recommended practices shall become part of this specification as if written herein. Wherever requirements conflict, the more stringent shall govern:
 - .1 CSA A23.3-19, Annex D
 - .2 Mechanical Anchors: ACI 355.2-19, "Qualification of Post-Installed Mechanical Anchors in Concrete".
 - .3 Adhesive Anchors: ACI 355.4-19, “Qualification of Post-Installed Adhesive Anchors in Concrete”.
 - .4 Expansion and Screw Anchors (Concrete): ICC-ES AC193.
 - .5 Expansion Anchors (Masonry) ICC-ES AC01.
 - .6 Screw Anchors (Masonry) ICC-ES AC106.
 - .7 Adhesive Anchors (Concrete) ICC-ES AC308.
 - .8 Adhesive Anchors (Masonry) ICC-ES AC58.
 - .9 Manufacturer's published specifications and installation requirements
- .2 All post-installed anchors in concrete shall have current published ICC-ES Evaluation Report indicating the anchor is approved for installation in cracked concrete and shall have seismic qualification to meet the project requirements.
- .3 Where material or equipment must be supported from the structure, the installer of that material or equipment support shall be responsible for supplying the anchors and meeting the requirements of this specification unless specifically noted otherwise on the plans.

1.4 SUBMITTALS

- .1 A current ICC-ES Evaluation Service Report shall be submitted for all anchors that will be considered for use on this project. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: Manufacturer's data sheets on each product to be used.
- .3 Substitutions:
 - .1 Substitution requests may only be made using products with ICC-ESR reports for the product in the specific base material
 - .2 Substitution request shall include calculations demonstrating that the product is capable of providing equivalent performance of the specified product for each specific location and condition when calculated using the data in the referenced ESR report and in accordance with the appropriate design procedure and standards required by the applicable building code.
 - .3 Substitution request shall specify the diameter and embedment depth of the substituted product
 - .4 Any increase in material or labor cost resulting from the substitution shall be the responsibility of the contractor.
- .4 Manufacturer's Published Installation Instructions (MPII).
- .5 Installation Training Records:
 - .1 Provide a list of names of all installers who are trained by the Manufacturer's Field Representative on this jobsite prior to installation of products. Record must include the installer name, date of training, products included in the training and trainer name and contact information
 - .2 Provide a copy of the current ACI/CRSI "Adhesive Anchor Installer" certification cards for all installers who will be installing adhesive anchors in the horizontal to vertically overhead orientation.

1.5 STORAGE AND HANDLING

- .1 Keep anchors, rod materials, nuts and washers in original manufacturer's packaging with label intact until needed for use.
- .2 Keep anchors free of dirt and debris.
- .3 Protect anchors from corrosion and deterioration.
- .4 Store all anchoring products in strict accordance with manufacturer's recommendations. For adhesive anchors, consider temperature, exposure to sunlight, and shelf life.

PART 2 PRODUCTS

2.1 PRODUCTS FOR USE IN CRACKED NORMAL WEIGHT CONCRETE AND SAND LIGHT WEIGHT CONCRETE

- .1 Expansion Anchors:
 - .1 Approved product by Alberta Transportation or Departmental Representative.
 - .2 Heavy Duty Expansion anchors:
 - .1 Approved product by Alberta Transportation or Departmental Representative.
 - .3 Screw Anchors:
 - .1 Approved product by Alberta Transportation or Departmental Representative.
 - .4 Undercut Anchors:
 - .1 Approved product by Alberta Transportation or Departmental Representative.
- Adhesive Injection Systems:
- .2 Approved product by Alberta Transportation or Departmental Representative.
- Cast-in-place Inserts:
- .3 Approved product by Alberta Transportation or Departmental Representative.

2.2 MATERIALS

- .1 Dry Interior Use (unless noted otherwise): Provide carbon steel anchors with zinc plating in accordance with ASTM B633 for use in conditioned environments free from potential moisture. For interior uses where anchor is in contact with preservative treated wood anchors must be mechanically galvanized, hot dip galvanized or 300 series stainless steel.
- .2 Exposed Use: For exterior exposure and/or damp conditions provide stainless steel anchors using Series 300 stainless steel bolts with Series 300 or Type 18-8 stainless steel nuts and washers unless noted otherwise.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Identify location of embedded items such as reinforcing steel, stressing tendons, conduit, heating tubes, etc. prior to drilling holes. Coordinate with respective trades if any apparent conflict exists. Exercise care in coring and drilling to avoid damaging any existing embedded items. If embedded items are encountered, stop drilling and contact Departmental Representative immediately for direction. Any offsets or relocations of anchors must be approved by Departmental Representative.
- .2 Drill holes of proper diameter and depth in accordance with manufacturer's published design information for that specific anchor. Use only equipment approved by anchor manufacturer. All holes shall be perpendicular to the concrete surface unless shown otherwise on structural plans and/or details.

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- .3 Do not drill holes until base material has achieved full design strength.
 - .4 Installation of all post installed anchor products shall be conducted in strict accordance with the Manufacturer's Published Installation Instructions (MPII). Use hammer drills for adhesive anchors (unless noted otherwise).
 - .5 All post installed anchors shall be installed by an installer trained for that specific product by a manufacturer's field representative. All training must be conducted on the jobsite prior to the installation of any products. A record of training must be submitted to the Departmental Representative per the submittal instructions.
 - .6 All adhesive anchor installations in the horizontal to vertically overhead orientation shall be conducted by a certified Adhesive Anchor Installer as certified by ACI/CSRI per CSA A23.3-14 D.10.2.3. Current AAI Certification must be submitted to Departmental Representative for approval prior to commencement of any adhesive anchor installations.
 - .7 Clean out holes, properly prepare substrate, and install anchors in accordance with manufacturer's instructions and current ICC-ES ESR. Proper tools must be on job site.
 - .8 For adhesive anchors, maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer. Verify that base material temperature is within manufacturer limits. Do not install adhesive anchors if any criteria do not fall within manufacturer's limits. Ensure that bore holes and anchors are free of dust, standing water, ice, debris, grease, oil, dirt and other foreign matter.

3.2 CLEANING

- .1 Clean in accordance with Section 01 74 00 - Cleaning.
- .2 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
- .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
- .4 Disposal of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location to pose health or environmental hazard is prohibited.
- .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
- .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
- .7 Dispose of waste in accordance with applicable local, Provincial and National regulations.
- .8 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 RELATED REQUIREMENTS

- .1 Section 01 29 00 – Payment Procedures.
- .2 Section 01 29 01 – Method of Measurement and Payment.
- .3 Section 01 33 00 – Submittal Procedures.
- .4 Section 01 35 29 – Health and Safety Requirements.
- .5 Section 01 35 43 – Environmental Procedures.
- .6 Section 01 45 00 – Quality Control.
- .7 Section 01 74 11 – Cleaning.
- .8 Section 01 31 19 – Project Meetings
- .9 Section 01 74 21 – Construction/Demolition Waste Management and Disposal

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measure structural steel in “kg” of steel incorporated into Work, computed on basis of CISC Code of Standard Practice including nuts, bolts and washers.
 - .1 Ensure price includes all required testing.
 - .2 Ensure price includes steel shims required for correcting the casing pipe vertical alignment on some or all cradle supports.

1.3 REFERENCES

- .1 American Association for State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO Standard Specifications for Highway Bridges-17th Edition 2002.
- .2 ASTM International
 - .1 ASTM A 325M-14, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).
 - .2 ASTM A 490M-09, Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.
- .3 CSA International
 - .1 CSA G40.20/G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA G164-M92-18, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA S6-19, Canadian Highway Bridge Design Code.
 - .4 CSA S16-19, Design of Steel Structures.

- .5 CSA S269.1-16, Falsework for Construction Purposes.
- .6 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
- .7 CSA W59-18, Welded Steel Construction, (Metal Arc Welding).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installation, with Contractor's Representative and Departmental Representative in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Review manufacturer's written installation instructions and warranty requirements.
 - .2 Ensure key personnel, site supervisor, project manager, and subcontractor representatives attend.
 - .3 Departmental Representative will provide written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.
 - .4 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work.

1.5 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 structural steel and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Alberta, Canada.
 - .2 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners, rivets and welds. Indicate welds by CSA W59, welding symbols.
 - .3 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.
 - .4 Submit description of methods, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting structural steel.

1.6 **DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Provide protective blocking for lifting, transportation and storing.
 - .1 Exercise care during fabrication, transportation and erection so as not to damage structural steel
 - .2 Do not notch edges of members.
 - .3 Do not cause excessive stresses.
- .3 Mark mass on members weighing more than 3 tonnes.
- .4 Protect unpainted weathering steel, before erection, with waterproof covering.
- .5 Ensure that no portion of steel comes into contact with ground.
- .6 Provide Departmental Representative with delivery schedules minimum 7 days prior to shipping.

1.7 **QUALITY ASSURANCE**

- .1 Preconstruction Testing:
 - .1 Provide suitable facilities and cooperate with inspection organization and Departmental Representative in carrying out inspection and tests required.

PART 2 PRODUCTS

2.1 **MATERIALS**

- .1 Structural steel: to CSA G40.20/G40.21, grade and types as indicated
 - .1 Leave atmospheric corrosive resistant steel and connections material in unpainted, include bolts, nuts, washers and weld deposits of compatible weathering characteristics.
- .2 High strength bolts, nuts and washers: to ASTM A 325M. Bolts to ASTM A490M approved by Departmental Representative.
- .3 Anchor bolts, washers and nuts and shim plates: to CSA G40.20/G40.21-13 (R2018), grade 300W galvanized.
- .4 Welding electrodes: to CSA W48 series.
- .5 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of 600 g/m².

2.2 **SOURCE QUALITY CONTROL**

- .1 Steel producer qualifications: certified in accordance with CSA G40.20/G40.21.

- .2 Submit Departmental Representative 2 copies of certified test reports for Charpy V-notch test.
- .3 Provide suitable facilities and co-operate with inspection organization and [Departmental Representative in carrying out inspection and tests required.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for structural steel installation 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 and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Clean steel surfaces as directed by Departmental Representative when staining or defacing occurs.
- .2 Verify location of substructure units, elevations and location of anchor bolts before erection of structural steel; report discrepancies to Departmental Representative.
- .3 Work near river banks or embankments in accordance with written instructions from Departmental Representative.
- .4 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes, and without distorting, kinking or sharply bending metal of any unit.
 - .1 Enlarge holes if necessary by reaming only after receipt of written approval from Departmental Representative.
 - .2 Ensure reamed holes are 2 mm maximum larger than bolt size used.
- .5 Place anchor bolts at elevations and locations indicated.
 - .1 Protect holes against entry of water and foreign material.
 - .2 Provide heating and protection as directed by Departmental Representative and completely fill space around anchor bolts with grout.

3.3 INSTALLATION

- .1 Do falsework in accordance to CSA S269.1.
- .2 Do fabrication and erection of structural steel in accordance with CAN/CSA S6-19, Design of Highway Bridges

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- .3 Do welding in accordance with CSA W59, except where specified otherwise.
- .1 For CSA G40.20/G40.21, grade 350A steel, deposited weld metal to have Charpy V-Notch value not lower than that of steel.
- .2 Do welding in shop unless otherwise permitted by Departmental Representative.
- .3 Weld only at locations indicated.
- .4 High strength bolting: in accordance with CAN/CSA S6. Use 'turn-of-nut' tightening method.
- .5 Finish: members true to line, free from twists, bends, open joints, sharp corners and sharp edges.
- .6 Allowable tolerance for bolt holes:
- .1 Matching holes for bolts to line up so that dowel 2 mm less in diameter than hole passes freely through assembled members at right angles to such members.
- .2 Finish holes not more than 2 mm in diameter larger than diameter of rivet or bolt unless otherwise specified by Departmental Representative.
- .3 Centre-to-centre distance between any two holes of group to vary by not more than 1 mm from dimensioned distance between such holes.
- .4 Centre-to-centre distance between any two groups of holes to vary not more than maximum of the following:
- | <u>Centre-to-Centre</u>
distance in metres | <u>Tolerance in plus or</u>
minus mm |
|---|---|
| less than 10 | 1 |
| 10 to 20 | 2 |
| 20 to 30 | 3 |
- .5 Correct mispunched or misdrilled members only as directed by Departmental Representative.
- .7 Shop splices:
- .1 Use complete joint penetration groove welds finished flush.
- .2 Details of butt joints to CSA W59.
- .3 Use only as approved by Departmental Representative.
- .8 Shop erection:
- .1 Support each girder on its bearing points and measure and record deflection at same points indicated for measurement of camber.
- .2 Measure deflections in plane of girder web.
- .3 Submit diagram to Departmental Representative showing deflection measurements for each girder before delivery.
- .4 Shop erection is not required for single span girders with no field splices.
- .9 Field splices: to approval of Departmental Representative.
- .10 Mark members in accordance with CSA G40.20/G40.21.

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- .1 Do not use die stamping.
 - .2 Place marking at locations hidden when viewed from exterior after erection when steel is to be left in unpainted condition.
 - .11 Match marking: shop mark bearing assemblies and splices.
 - .12 Protect exposed concrete surfaces of substructures from staining due to weathering of unpainted steel as follows:
 - .1 Apply two coats of resin to concrete surfaces prior to erection of steel.
 - .1 Resin: quick drying clear co-polymer resin, based on methyl methacrylate formulation.
 - .2 Apply resin in accordance with manufacturer's instructions.
 - .2 Protect top surfaces of concrete with waterproof cover and drain away from vertical faces.
 - .1 Install drain pipe to ground surface to discharge water.
 - .3 Use galvanized anchors for anchorage to concrete.
 - .4 Submit details of installation and methods of support to Departmental Representative for review prior to commencing protection work.
 - .5 Repair tears or holes in protective cover immediately.
 - .13 Maintain protection of concrete until completion of steel erection.
 - .1 Remove waterproof covers and drains and holding structures when steel erection complete.

3.4 **FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of steel.
- .2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Ensure manufacturer's representative or Departmental Representative is present during critical periods of installation and during testing.
- .4 Schedule site visits:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.

3.5 **CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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- .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 Waste Management: separate waste materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

DIVISION 26

ELECTRICAL

1.0 GENERAL

1.1 REFERENCES

- .1 Division 00 and Division 01 apply to and are a part of this Section.

1.2 APPLICATION

- .1 This Section specifies requirements that are common to Electrical Divisions Work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Divisions 00 or 01 to take precedence.
- .2 Be responsible for advising product vendors of requirements of this Section.

1.3 DEFINITIONS

- .1 "Concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "Exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "Finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "Provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
- .6 "Supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special cables, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "Governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .8 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.
- .9 "Mechanical Divisions" - refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.

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- .10 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
 - .11 "Parks Canada Representative" – means the Parks Canada employee or the person, firm or corporation appointed by Parks Canada to act for Parks Canada in a professional capacity in relation to the Work.
 - .12 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
 - .13 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Parks Canada Representative.

1.4 DOCUMENTS

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is arranged in accordance with CSI/CSC 50 Division Sections MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Review Drawings and Specification in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Electrical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. Any information regarding accurate measurement of building is to be taken on-site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey scope of work and do not show architectural and structural details. Provide fittings, offsets, transformations and similar items required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.
- .8 Locations of equipment and materials shown may be altered, when reviewed by Parks Canada Representative, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.

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- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.
 - .10 Drawings and Specifications are prepared solely for use by party with whom Parks Canada Representative has entered into a contract and there are no representations of any kind made by Parks Canada Representative to any other party.
 - .11 When scale and date of Drawings are same, or when discrepancy exists within Specification, include most costly arrangement to take precedence.
 - .12 In case of discrepancies or conflicts between Drawings and Specification, documents will govern in following order:
 - .1 Specification;
 - .2 Drawings of larger scale;
 - .3 Drawings of smaller scale;
 - .4 Drawings of later date when scale of Drawings is same.

1.5 METRIC AND IMPERIAL MEASUREMENTS

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Parks Canada Representative for direction.

1.6 EXAMINATION OF BID DOCUMENTS AND SITE

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Parks Canada Representative, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.
- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Parks Canada Representative, in writing.

1.7 WORK STANDARDS

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Parks Canada Representative.
- .3 Supplementary mandatory Specifications and requirements to be used in conjunction with project include but are not limited to following:
 - .1 American National Standards Institute (ANSI);
 - .2 Canadian Standards Association (CSA);
 - .3 CSA Z462, "Workplace Electrical Safety";
 - .4 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
 - .5 Electrical Safety Authority (ESA);
 - .6 National Building Code of Canada (NBC);
 - .7 National Electrical Manufacturers Association (NEMA);
 - .8 Occupational Health and Safety Act (OHSA);
 - .9 Alberta Building Code (ABC);
 - .10 Canadian Electrical Code (CEC);
 - .11 Underwriters' Laboratories of Canada (ULC);
 - .12 Material Safety Data Sheets by product manufacturers;
 - .13 local utility inspection permits;
 - .14 codes, standards, and regulations of local governing authorities having jurisdiction;
 - .15 additional codes and standards listed in Trade Sections;
 - .16 Parks Canada standards.
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
- .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
- .6 Unless otherwise specified install, equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes,

Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

- .7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of experienced journeyperson tradesman.
- .8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by Parks Canada Representative at any time.
- .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.
- .10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Parks Canada Representative and submission of reports and certificates to Parks Canada Representative.
- .11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Parks Canada Representative. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

1.8 PERMITS, CERTIFICATES, APPROVALS AND FEES

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities.
- .2 Submit required applications, shop drawings, electrical distribution system protection device coordination studies, and short circuit calculations, and any other information requested by local authority.
- .3 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliance is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.
- .4 Obtain and submit to Parks Canada Representative, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .5 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.
- .6 Where electromagnetic locks are provided whether by this Division or by others, be responsible for obtaining and paying for required certificates of work with regards to such electromagnetic lock work.

1.9 WORKPLACE SAFETY

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations.

1.10 PLANNING AND LAYOUT OF WORK

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.

1.11 COORDINATION OF WORK

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include, but not be limited to following:
 - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
 - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
 - .3 depth and routing of excavation required for work, and requirements for bedding and backfill.
- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building subject to available space as confirmed with Parks Canada Representative and protected from elements.
- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.12 COMPONENT FINAL LOCATIONS

- .1 Parks Canada Representative reserve right to relocate electrical components such as receptacles, switches, communication system, outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Parks Canada, if relocation per components do not exceed 3 m (10') from original location. No credits will be anticipated where relocation per components of up to and including 3 m (10') reduces materials, products and labour. Should relocations exceed 3 m (10') from original location, adjust contract price for that portion beyond 3 m (10') in accordance with provisions for changes in Contract Documents.

1.01 SYSTEMS COORDINATION

- .2 Be responsible for and perform specific coordination of various low voltage systems supplied by Electrical Divisions and also with systems supplied by other Divisions of Work. I nclude for but not be limited to provision of following, as applicable:
 - .1 coordinate with General Contractor and other Subcontractors, various systems of trades which in any way are interfaced with or monitored by or integrated to, or need to be coordinated with;
 - .2 review systems requirements for component back boxes and conduits; ensure that system of conduits and boxes meet respective system wiring bending radii requirements;
 - .3 review system shop drawings prior to submission to Parks Canada Representative, to verify that each system has been coordinated with other systems and that required options and features are selected to meet coordination requirements;
 - .4 be present at testing and commissioning functions of each system and provide technical assistance with regards to system operations;
 - .5 be "on-site" coordinator of respective system trades with regards to respective system coordination of installation and testing;
 - .6 coordinate and review with Parks Canada Representative with regards to ensuring that systems coordinate and integrate properly to satisfaction of Parks Canada Representative;
 - .7 document coordination and integration requirements and maintain records for submission as part of shop drawings;
 - .8 respond to coordination and integration requirements and be responsible for such work;
 - .9 where a system integrator has been included for, coordinate integration requirements with system integrator.

1.13 PRODUCTS

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.
- .3 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.
- .4 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Parks Canada Representative immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Parks Canada Representative and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Parks Canada Representative for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions in Division 01 with regards to substitutions or failure to supply product
- .5 Listing of a product as "acceptable" does not imply automatic acceptance by Parks Canada Representative. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

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- .6 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
 - .7 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Parks Canada Representative for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Parks Canada Representative that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Parks Canada Representative has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Parks Canada Representative.
 - .8 Indicate in Supplementary Electrical Bid Form, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Parks Canada Representative has been given for use of products by other manufacturers. Submit to Parks Canada Representative for review as directed.
 - .9 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Parks Canada Representative, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Parks Canada Representative. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Parks Canada Representative's rejection of proposed equivalent product.

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- .10 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Parks Canada Representative for review. Failure of submission of these documents to Parks Canada Representative in a timely manner to allow for review will result in base specified product to be supplied at Parks Canada Representative's discretion, at no additional cost to Contract.
 - .11 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Parks Canada Representative if requested in writing with full product documentation submitted, a minimum of ten (10) working days prior to Bid closing date.
 - .12 Any proposed changes initiated by Contractor after award of Contract may be considered by Parks Canada Representative at his discretion, with any additional costs for such changes if accepted by Parks Canada Representative, and costs for review, to be borne by Contractor.
 - .13 Whenever use of product other than based specified products or named as acceptable is being supplied, allow sufficient time for processing of product submissions and time for Parks Canada Representative's review, such that there will not be significant impact on contract time or work schedule.
 - .14 Requirements for low voltage systems of this project that are of technology that changes rapidly and are forever evolving and changing, resulting in systems that may be out dated by time of installation, are to include provisions to allow Parks Canada Representative option to select most updated technology. Shop drawings for such systems and equipment are to include provisions for a minimum six (6) week review time for Parks Canada Representative to review degree of technology of each system and determine acceptance. Parks Canada Representative will have right to substitute a more advanced technology subject to negotiated pricing.

1.14 SHOP DRAWINGS

- .1 At start-up meeting review with Parks Canada Representative, products to be included in shop drawing submission. Prepare and submit list of products to Parks Canada Representative for review.
- .2 Submit electronic copies of shop drawings unless otherwise directed by Parks Canada Representative. Review exact requirements with Parks Canada Representative.
- .3 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Parks Canada Representative for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
 - .1 product literature cuts;
 - .2 equipment data sheets;
 - .3 equipment dimension drawings;
 - .4 system block diagrams;
 - .5 sequence of operation;

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- .6 connection wiring schematic diagrams.
 - .4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
 - .5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
 - .6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.
 - .7 Parks Canada Representative to review shop drawings and indicate review status by stamping shop drawing copies as follows:
 - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Parks Canada Representative's review of shop drawing is final, Parks Canada Representative to stamp shop drawing;
 - .2 "RETURNED FOR CORRECTION" – If Parks Canada Representative's review of shop drawing is not final, Parks Canada Representative to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Parks Canada Representative's notations and resubmit.
 - .8 Following is to be read in conjunction with wording on Parks Canada Representative's shop drawing review stamp applied to each and every shop drawing submitted:

"THIS REVIEW BY PARKS CANADA REPRESENTATIVE IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE 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 COORDINATION OF WORK OF SUB-TRADES."
 - .9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system.
 - .10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.

- .11 Do not order product until respective shop drawing review process has been properly reviewed with Parks Canada Representative.
- .12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .13 Refer to specific requirements in other Sections.

1.15 EQUIPMENT LOADS

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Parks Canada Representative, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Parks Canada Representative for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with Parks Canada Representative prior to construction.

1.16 OPENINGS

- .1 Supply opening sizes and locations to Parks Canada Representative to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
- .2 No openings are permitted through completed structure without written approval from Parks Canada Representative and review with Parks Canada Representative. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Parks Canada Representative for review, well in advance of doing work.
- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless directed by Parks Canada Representative, do not leave any openings unprotected and unfinished overnight.

1.17 CHANGES IN THE WORK

- .1 Whenever Parks Canada Representative proposes in writing to make a change or revision to design, arrangement, quantity, or type of any work from that required by Contract Documents, prepare and submit to Parks Canada Representative for review, a quotation being proposed cost for executing change or revision.
- .2 Quotation to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.

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- .3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as reviewed with Parks Canada Representative prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.
 - .4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to quotations submitted:
 - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
 - .2 material costs are not to exceed those published in local estimating price guides;
 - .3 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labour Units at difficult level, less 25%;
 - .4 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labour Estimating Manual, less 25%;
 - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
 - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
 - .7 costs for rental tools and/or equipment are not to exceed local rental costs;
 - .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
 - .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.
 - .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Parks Canada Representative to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
 - .6 Make requests for changes or revisions to work to Parks Canada Representative in writing and, if Parks Canada Representative agrees, will issue Notice of Change.
 - .7 Do not execute any change or revision until written authorization for change or revision has been obtained from Parks Canada Representative.

1.18 PROGRESS PAYMENT BREAKDOWN

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Parks Canada Representative in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Parks Canada Representative's review and approval. Progress payments will not be processed until an approved breakdown is in place.

Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.

- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as they will be indicated on progress draw.

1.19 NOTICE FOR REQUIRED FIELD REVIEWS

- .1 Whenever there is a requirement for Parks Canada Representative to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum ten (10) working days' notice in writing to Parks Canada Representative.
- .2 If Parks Canada Representative is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until Parks Canada Representative advises that it may be concealed.
- .4 When Parks Canada Representative is requested to perform a field review and work is not ready to be reviewed, reimburse Parks Canada Representative for time and travel expenses.

1.20 PRELIMINARY TESTING

- .1 When directed by Parks Canada Representative, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Parks Canada Representative's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Parks Canada Representative's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.21 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

- .1 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Parks Canada.

- .2 During this period of construction, such systems/equipment to not become property of Parks Canada or be Parks Canada's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turnover to Parks Canada.
- .3 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Parks Canada, such systems/equipment to be cleaned, restored to "new" condition, luminaries re-lamped with "new" lamps, paint finishes "touched-up", etc.

1.22 TEMPORARY SERVICES

- .1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary electrical power, lighting, heating. Locations of exit pathways to be as decided at discretion of Prime Contractor and to be illuminated complete with emergency lighting, and provided with exit signage and fire alarm devices. Unless otherwise noted, provide required services in accordance with requirements of local governing building code and local governing inspection authorities.

1.23 CLEANING

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Parks Canada Representative. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.
- .2 At time of final cleaning, clean luminaire reflectors, lenses, and other luminary surfaces that have been exposed to construction dust and dirt, including top surface, whether it is exposed or in ceiling space.
- .3 Clean switches, receptacles, communications outlets, coverplates, and exposed surfaces.
- .4 Clean other electrical equipment and devices installed as part of this project.
- .5 For work performed in electrical equipment rooms, electrical closets and communication closets, perform following:
 - .1 HEPA vacuum and clean interiors and bus work of switchboards, panels, cabinets and other electrical equipment of construction debris and dust prior to energization;

1.24 RECORD AS-BUILT DRAWINGS

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Parks Canada Representative. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Parks Canada Representative, at expense of \$25.00 CDN plus HST, per drawing, up to first ten (10) drawings, and \$5.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.
 - .1 dimensioned location of inaccessible concealed work;

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- .2 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
 - .3 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
 - .4 identify routing and location of concealed conduits/ducts of diameter 50 mm (2") and greater.
- .2 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Parks Canada Representative for review. Make necessary revisions to drawings as per Parks Canada Representative's comments, to satisfaction of Parks Canada Representative.
 - .3 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Parks Canada Representative as-built drawings onto USB type flash drive. Provide two (2) complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Parks Canada Representative.
 - .4 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Parks Canada Representative.
 - .5 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Parks Canada Representative.

1.25 OPERATING AND MAINTENANCE MANUALS

- .1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum three (3), project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Review exact quantity of manuals with Parks Canada Representative. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 front cover: project name label; wording – "Electrical Systems Operating and Maintenance Manual"; and date;
 - .2 introduction sheet listing Parks Canada Representative, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 equipment manufacturer's authorized contact person name, telephone number and company website;
 - .4 Table of Contents sheet, and corresponding index tab sheets;
 - .5 Copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked

"REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals.

.6 Maintenance data is to include:

- .1 operation and trouble-shooting instructions for each item of equipment and each system;
- .2 schedules of tasks, frequency, tools required, and estimated task time;
- .3 recommended maintenance practices and precautions;
- .4 complete parts lists with numbers.

.7 Performance data is to include:

- .1 equipment and system start-up data sheets;
- .2 equipment test reports;
- .3 final verification and commissioning reports.

.8 wiring and connection diagrams;

.9 copies of additional and revised panelboard directories;

.10 warranties;

.11 items requested specifically in Section Articles.

.2 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.

.3 Operating and maintenance instructions are to relate to job specific equipment supplied under this project. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

.4 Before applying for a Certificate of Substantial Performance of the Work, assemble one (1) draft copy of O & M Manual and submit to Parks Canada Representative for review prior to assembling remaining copies. Incorporate Parks Canada Representative's comments into final submission.

1.26 WARRANTY

.1 Unless otherwise specified in Divisions 00 and 01, warrant work to be in accordance with Contract Documents and free from defects for a period of one (1) year from date of issue of a Certificate of Substantial Performance of the Work.

.2 Where equipment includes extended warranty period, e.g., five (5) years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment

manufacturer and/or supplier to Parks Canada. Submit signed and dated copies of extended warranties to Parks Canada Representative.

- .3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.
- .4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Parks Canada. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Parks Canada staff or agents is exempted.
- .5 Do not include Owner deductible amounts in warranties.

1.27 PROJECT CLOSE OUT SUBMITTALS

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
 - .1 Operating and Maintenance Manuals;
 - .2 as-built record drawings and associated data;
 - .3 extended warranties for equipment as specified;
 - .4 operating test certificates;
 - .5 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
 - .6 other data or products specified.

1.28 INSTRUCTIONS TO PARKS CANADA REPRESENTATIVE

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train Parks Canada Representative's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians. Supply hard copies of training materials to each attendee.
- .3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum one (1) session each consisting of minimum one (1) hour on-site, of Parks Canada Representative's designated personnel (for up to six (6) people each session), on operation and maintenance procedures of system.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:

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- .1 Operational Requirements and Criteria: equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting: diagnostic instructions, test and inspection procedures;
 - .3 Documentation: equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
 - .4 Maintenance: inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
 - .5 Repairs: diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Parks Canada Representative's designated personnel, submit to Parks Canada Representative for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Parks Canada Representative's comments in final copy.
 - .6 Obtain in writing from Parks Canada Representative, list of Parks Canada personnel to receive instructions. Submit to Parks Canada Representative prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
 - .1 date instructions were given to Parks Canada staff;
 - .2 duration of instruction;
 - .3 names of persons instructed;
 - .4 other parties present (manufacturer's representative, consultants, etc.).
 - .7 Obtain signatures of Parks Canada staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.
 - .8 Submit to Parks Canada Representative copy of electronic version of training materials loaded on USB flash drive. Include in operating and maintenance manuals submission.

1.29 FINAL INSPECTION

- .1 Submit to Parks Canada Representative, written request for final inspection of systems. Include written certification that:
 - .1 deficiencies noted during job inspections have been completed;
 - .2 field quality control procedures have been completed;
 - .3 maintenance and operating data have been completed and submitted to, reviewed with, and accepted by Parks Canada Representative;
 - .4 tags and nameplates are in place and equipment identifications have been completed;
 - .5 clean-up is complete;

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- .6 spare parts and replacement parts specified have been provided and acknowledged by Parks Canada Representative;
 - .7 as-built and record drawings have been completed and submitted to and reviewed and accepted by Parks Canada Representative;
 - .8 Parks Canada staff has been instructed in operation and maintenance of systems;
 - .9 Commissioning procedures have been completed.

1.30 ALLOWANCES

- .1 Include in Bid amount a prime cost allowance in amount of \$25,000.
- .2 Allowance is for Utility charges for design and installation of new electrical service, service equipment and metering.
- .3 Amount of allowance is to be net and is to include product and material costs (less applicable trade discounts), including delivery to site and applicable taxes.
- .4 Other costs, including unloading and handling at site, installation, overhead and profit and other burdens are to be included in Bid amount, not in allowance.
- .5 Whenever costs are more or less than amount of allowance, Contract amount is to be adjusted accordingly by change order.
- .6 Materials and products under allowance are to be selected by Parks Canada Representative in sufficient time to avoid delays to work, and Parks Canada Representative reserves right to take entire or any part of allowance out of Contract amount at any time.
- .7 Expenditure from above allowances may be made only upon receipt of order signed by Parks Canada Representative. Relationship of Contractor and Subcontractors performing work to be paid out of allowances to be strictly between Contractor and Contractor's Subcontractors.

2.0 PRODUCTS – NOT APPLICABLE

3.0 EXECUTION – NOT APPLICABLE

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-18, Canadian Electrical Code, Part 1 (24th Edition), Safety Standard for Electrical Installations.
 - .2 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
 - .1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3 National Building Code 2015 (Alberta Edition 2019).
- .4 Division 00 and Division 01 apply and are part of each electrical division section.

1.2 COMMISSIONING AUTHORITY

- .1 The Commissioning Agent has overall responsibility for planning and coordinating the commissioning process. However, commissioning incorporates all parties involved with the design and construction process, including the electrical (Division 26) contractor, as many building system components require electrical power, low voltage wiring, and controls in order to operate as specified.

1.3 CONTRACTOR'S COMMISSIONING RESPONSIBILITY

- .1 The electrical (Division 26) contractor's responsibilities are defined in Section 01 91 13 of the specifications. Each sub-contractor and supplier within Division 26 shall review Section 01 91 13, and their bids shall carry out the work described, as it applies to each Section within the Division 26 specifications, individually and collectively.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures. Product Data: submit WHMIS MSDS in accordance with Section 02 81 01 - Hazardous Materials.
- .2 Shop drawings:
 - .1 Submit drawings for products of this section and as required in other sections.
- .3 Quality Control: in accordance with Section 01 45 00 - Quality Control. Provide CSA certified equipment and material.
 - .1 Submit test results of installed electrical systems and instrumentation.
 - .2 Permits and fees: in accordance with General Conditions of contract.
 - .3 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .4 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within three (3) days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
- .3 Site Meetings:
 - .1 In accordance with Division 01.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.
- .2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.8 SYSTEM START-UP

- .1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.9 OPERATING INSTRUCTIONS

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start-up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 47 15 - Sustainable Requirements: Construction.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.
- .3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

- .1 Verify installation and coordination responsibilities related to motors, equipment and controls, as indicated.
- .2 Control wiring and conduit: in accordance with Section 26 05 21 – Wires and Cables except for conduit, wiring and connections below 50 V which are related to control systems specified in mechanical sections and as shown on mechanical drawings.

2.4 WIRING TERMINATIONS

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with nameplates and labels as follows:
 - .1 Nameplates: lamicoid 3 mm thick plastic engraving sheet, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
 - .2 Sizes as follows:

NAMEPLATE SIZES

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels: embossed plastic labels with 6mm high letters unless specified otherwise.
- .3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.
- .7 Terminal cabinets and pull boxes: indicate system and voltage.
- .8 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
Up to 250 V	Yellow	
Up to 600 V	Yellow	Green
Telephone	Green	
Other Communication Systems	Green	Blue
Fire Alarm	Red	
Other Security Systems	Red	Yellow

2.8 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish.
 - .2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Install conduit and sleeves prior to pouring of concrete.
 - .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.5 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Local switches: 1400 mm.
 - .2 Wall receptacles:
 - .1 General: 300 mm.
 - .2 In mechanical rooms: 1400 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and interphone outlets: 300 mm.
 - .5 Wall mounted telephone and interphone outlets: 1500 mm.

3.6 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 EQUIPMENT BASES AND SUPPORTS

- .1 Provide equipment bases, supports and concrete housekeeping pads for mounting of floor standing equipment and luminaire pole bases.
- .2 Secure floor mounted equipment in place on 100 mm (4") high concrete housekeeping pads, 100 mm (4") wider and longer than equipment base dimensions. Chamfer edges of bases. Include for seismic restrains as required by local governing building code.
- .3 Supply dimensioned drawings, templates, and anchor bolts for proper setting of equipment on bases and pads. Be responsible for required levelling, alignment, and grouting of equipment.
- .4 Submit to Consultant for review, dimensioned shop drawings of structurally designed concrete pads or bases for support of large, heavy equipment. Indicate on shop drawings total weight of pad or base, reinforcement, and equipment for which it is required.
- .5 Unless otherwise noted, support equipment suspended above floor level with suitable welded or bolted prime coat painted structural steel angles or channels bracketed to wall or secured by hanger rods.

3.8 FIELD QUALITY CONTROL

- .1 Load Balance:
 - .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
 - .3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.
 - .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

- .4 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

3.9 CLEANING

- .1 Clean and touch-up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

1.0 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products and accessories.

2.0 PRODUCTS

2.1 GENERAL POWER CABLES

- .1 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper and be suitable for applications as noted in governing local electrical code.
- .2 "RW90" CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
- .3 "TWU" single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 60°C (140°F) conductor temperature, -40°C (-40°F) minimum installation temperature, PVC insulated suitable for wet and buried installations, colour coded.
- .4 "AC90 ISO-BX" flexible armoured cable with "RW90" conductors with low temperature Exelene insulation and two (2) additional solid copper bonding conductors (one (1) bare, one (1) insulated) and overall interlocked aluminium tape armour, to CSA C22.2 No. 51(R2004).
- .5 "NMD90" two or three copper conductors, to CSA C22.2 No. 48, with 90°C rated XLPE (R90) insulation; bare bonding wire and overall jacket of moisture resistant and flame retardant PVC; FT1 rating and rated 300 volts.
- .6 Solid conductors to and including No. 10 AWG; stranded conductors in sizes larger than No. 10 AWG; branch circuit conductors constructed of 98% conductive copper; and approved for minimum 600 volts.
- .7 Aluminum alloy conductors to be equivalent to ALCAN "NUAL" AA8030 aluminum alloy conductors. Provide connectors and associated hardware compatible to aluminum alloy conductors. Install aluminum alloy conductors with hardware and connected in accordance with conductor manufacturer's instructions and as per requirements of local governing electrical code.

2.2 CONNECTORS

- .1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .2 Connectors for conductors connecting to devices as per local governing electrical requirements to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts, rated pressure type connectors.
- .3 For conductors sized 3/0 and greater, provide long barrel double crimp, 2 hole compression type lug connectors, unless otherwise noted.

2.3 CONDUCTOR PULLING LUBRICANT

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

2.4 TECK CABLES

- .1 Nexans, "Firex II Teck" cables as follows:
 - .1 certified to CAN/CSA C22.2 No.131, Type TECK 90 Cable;
 - .2 rated for outdoor, weather resistant and wet locations applications;
 - .3 600/1000 V rated;
 - .4 Conductor: Bare, Soft drawn, Class B Compact or Compressed Stranded Copper conductors per ASTM;
 - .5 insulation: chemically cross linked thermosetting polyethylene (XLPE);
 - .6 bonding conductor (1/C Cable): Soft drawn bare copper;
 - .7 inner jacket: sunlight resistant PVC jacket tightly applied over assembly, to prevent slipping of core in a vertical position;
 - .8 armour: flexible interlocked aluminum armour, over inner jacket for mechanical protection;
 - .9 overall PVC jacket rated -40°C (-40°F).
 - .10 barrier tape over shield.
- .2 Acceptable manufacturers are:
 - .1 Nexans;
 - .2 Prysmian Cables (Pirelli);
 - .3 General Cable;
 - .4 Aetna Cables;
 - .5 Kerite Company.

3.0 EXECUTION

3.1 PROJECT CONDITIONS

- .1 If identified in documents, verify that field measurements and conditions are as identified.
- .2 Cable routing on drawings is schematic and approximate. Route cable as required to meet project conditions. Determine exact routing and lengths on-site.

3.2 COORDINATION

- .1 Coordinate work with work provided under other electrical work and work of other trades.
- .2 Determine required separation between cable and other work.
- .3 Determine cable routing to avoid interference with other work.
- .4 Submit any alternative cable routing to Parks Canada Representative for review prior to proceeding with work.

3.3 INSTALLATION OF CONDUCTORS

- .1 Provide required conductors.
- .2 Conductors, unless otherwise noted, to be as follows:
 - .1 residential feeders – "NMD90";
 - .2 underground inside or outside building and for non-climate controlled areas - "TWU" or "RWU90";
- .3 Support flexible armoured cable in ceiling spaces and in stud wall construction with steel 2 hole cable straps to "Code" requirements. Flexible armoured cables must run in a neat manner parallel to building lines. Utilize centralized conduit runs to maintain maximum permitted runs of flexible armoured cables as specified. Provide insulating grommet at cut ends of flexible armoured cable to protect conductor insulation.
- .4 Low voltage conductors to typically be No. 18 AWG "TEW", unless otherwise noted. Conductors not installed in conduit or raceways to be fire insulated rated in accordance with latest governing Code Flame Spread requirements.
- .5 When installing type NMD90 conductors through metal studs, provide insulating grommets on stud openings to protect conductor insulation.
- .6 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance with applicable conductor voltage drop schedule appended to end of this Section.
- .7 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted. Do not use conductors smaller than No. 6 AWG for exterior luminaire wiring unless otherwise noted.
- .8 Colour code conductors throughout to identify phases, neutrals and ground by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs.

-
- .9 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraded.
 - .10 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
 - .11 Install low voltage conductors in conduits, unless otherwise noted within Documents.
 - .12 Comply with local electrical code requirements and conductor manufacturer's recommendations when terminating and connecting aluminium conductors.

3.4 INSTALLATION OF TECK CABLES

- .1 Provide cables as required for specific applications. Handle, install, and terminate in accordance with manufacturer's recommendations and instructions and as herein specified.
- .2 When pulling cable, apply pulling tension to conductor not in sheath of cable. Limit cable pulling tension to as recommended by cable manufacturer.
- .3 Terminate cable in equipment with lugs and termination kits as per cable manufacturer's instructions.
- .4 Installation of cable splices and terminations to be made by personnel skilled in this type of work.
- .5 Ground shielding as per cable manufacturer's instructions.
- .6 Take necessary precautions when handling cable on reel to ensure that no damage will result in uncoiling process.
- .7 No splices are allowed unless justified by cable pulling tension calculations and approved in writing by Parks Canada Representative. Obtain approval of splice location from Parks Canada Representative.

END OF SECTION

Part 1 Products

1.1 MATERIALS

- .1 All fixture and branch wiring joints in junction and outlet boxes shall be made with a CSA certified pressure type connector rated at 600 volts maximum. Connector body shall consist of a cone shaped coil spring insert, insulated with a colour coded flame retardant, thermoplastic shell, which shall be knurled for easy grip.
- .2 Lugs, terminals, and screws used for termination of conductors, shall be suitable for type of conductor used.
- .3 Wire connectors to CSA C22.2 No. 65-93.

Part 2 Execution

2.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten as recommended by Manufacturer as specified in CSA C22.2 No. 65-93. Installation shall meet secureness tests.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
- .2 Canadian Electrical Code – Latest Edition.
- .3 Install and rate power cables in accordance with the Canadian Electrical Code requirements or in accordance with ICEA requirements where permissible.

1.2 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 600/1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE.
- .3 Copper conductors: size as indicated, with thermoplastic insulation type T90 Nylon rated at 600 V.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 600/1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum.
- .6 Overall covering: thermoplastic polyvinyl chloride, rated -40 deg. C.

.7 Fastenings:

- .1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two (2) or more cables at 1.5 mm centers.
- .3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

- .1 Watertight approved for TECK cable.

2.3 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Type: PVC jacket over thermoplastic armour and compliant to applicable Building Code classification for this project.
- .5 Connectors: anti-short connectors.

2.4 CONTROL CABLES

- .1 Type: LVT: two (2) soft annealed copper conductors, sized as indicated:
 - .1 Insulation: thermoplastic.
 - .2 Sheath: thermoplastic jacket.
- .2 Type: low energy 300 V control cable: stranded annealed copper conductors sized as indicated LVT: two (2) soft annealed copper conductors, sized as indicated:
 - .1 In accordance with Urecon specifications; refer to manufacturers data sheets.
 - .2 Insulation: thermoplastic, outdoor rated, rated to -40C.
 - .3 Shielding: wire over each conductor pair.
 - .4 Overall covering: PVC jackets, rated to -40C.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.
- .3 Conductor length for parallel feeders to be identical.
- .4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .6 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 33.13 – Conduits for electrical systems.

3.4 INSTALLATION OF TECK90 CABLE (0-1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable securely supported by straps.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.

3.6 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit.
- .2 Ground control cable shield.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .3 Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 41, Grounding and Bonding Equipment.

1.4 PRODUCT DATA

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

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.

Part 3 Execution

3.1 INSTALLATION

- .1 Bond and ground as required to CSA C22.2 No. 41.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 0.4 – Bonding Electrical Equipment (Protective Grounding).
 - .1 CSA C22.2 No. 41 – Grounding and Bonding Equipment.
 - .2 CSA T527 – Grounding and Bonding for Telecommunications in Commercial Buildings.
 - .3 CAN/CSA Z32 – Electrical Safety and Essential Electrical Systems in Health Care Facilities.
 - .4 CSA Z32.1 – Safety in Anaesthetizing Locations.
- .2 Copper Grounding Conductors to: ASA G7.1.

1.2 SYSTEM DESCRIPTION

- .1 Supply and install a complete secondary grounding system. Securely and adequately ground all components of the electrical system in accordance with the requirements of all related sections in the latest Canadian Electrical Code, Alberta Building Code and the local Electrical Inspection Authority.
- .2 The system is to consist of cables, bus bars, connectors, supports, and all necessary materials and inter-connections to provide a complete system.
- .3 Measured resistance to ground of the network shall not exceed 5 ohms.
- .4 All ground conductors shall be run in conduit.

1.3 SUBMITTALS

- .1 Refer to Division 01 and Section 26 05 00 - Common Work Results for Electrical for general requirements pertaining to submittals and submittal procedures.
- .2 Submittals shall be included in the Operation and Maintenance Manual, specified in Division 01 and Section 26 05 00 - Common Work Results for Electrical.
- .3 Shop Drawings.

Part 2 Products

2.1 EQUIPMENT

- .1 Bonding Conductors:
 - .1 Stranded copper TWH complete with green jacket unless otherwise indicated.
 - .2 Size as indicated on Drawings. Where size is not indicated, minimum size is to comply with Canadian Electrical Code.
- .2 Bond Busbar:
 - .1 Solid copper.
 - .2 Predrilled for two-hole lug connections.
 - .3 Size: 50 mm x 9 mm x 900 mm (2" x 3/8" x 24").
 - .4 Mounting: Wall or backboard mounted using standoff insulators.
- .3 Bonding Connections:
 - .1 Below grade:
 - .1 Exothermic-welded type connectors.
 - .2 Cadweld by Erico Products, or approved equal.
 - .2 Above grade:
 - .1 Compression-type connectors.
 - .2 Exothermic-welded type permitted if approved by Consultant.
- .4 Accessories:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bonding jumpers, straps.

Part 3 Execution

3.1 GENERAL

- .1 Install complete permanent, continuous grounding system including: electrodes, conductors, connectors and accessories to conform to requirements of Consultant and local authority having jurisdiction.
- .2 Bonding Bus:
 - .1 Provide bus in the elevator machine room.
- .3 Raceway and Busduct:
 - .1 Install a separate insulated green ground conductor in each conduit system. The conduit system will not be considered as providing an adequate ground.
 - .2 Install a separate green ground conductor in each conduit system buried in earth or installed in or under grade floor slabs, whether conduits are metal or not.
 - .3 Bond expansion joints and telescoping sections of raceways using jumper cables as per Canadian Electrical Code.
 - .4 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
 - .5 Install rigid conduit sleeves where ground wires pass through concrete slabs.
 - .6 Install green ground conductor along entire length of metallic cable tray system. Securely bond to each section of the cable tray. Terminate ground conductor at the main building ground grid.
 - .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .4 Bonding Conductors:
 - .1 Protect exposed bonding conductors from mechanical injury.
 - .2 Use green insulated ground conductors for the following:
 - .1 Circuit Ground Conductors.
 - .2 Bonding Jumpers.
 - .3 Fire Alarm System.

3.2 EQUIPMENT CONNECTIONS

- .1 Install grounding connections to typical equipment including, but not limited to, elevator disconnects, power circuitry, lighting and fire alarm.
- .2 Use compression connectors for all above-ground grounding splices and terminations unless otherwise shown on Drawings.
- .3 Make buried connections, and connections to electrodes using exothermic-welded type connectors.
- .4 Soldered connections are not permitted.
- .5 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.3 FIELD QUALITY CONTROL

- .1 Perform testing as per Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Refer to Division 01 and Section 26 05 00 - Common Work Results for Electrical for general requirements pertaining to submittals and submittal procedures.
- .2 Submittals shall be included in the Operation and Maintenance Manual, specified in Division 01 and Section 26 05 00 - Common Work Results for Electrical.
- .3 Shop Drawings:
 - .1 Show fabrication and installation details and include calculations for the following:
 - .1 Trapeze hangers. Include Product Data for components.
 - .2 Steel slotted channel systems.
 - .3 Non-metallic slotted channel systems.
 - .4 Equipment Supports.

Part 2 Products

2.1 SUPPORTING DEVICES

- .1 Provide metal brackets, frames, hinges, clamps and related types of supporting devices and support systems adequate for weight of equipment and raceways, including wiring which they carry.
- .2 Straps: galvanized steel.
- .3 Channels: 42 mm x 42 mm.
- .4 Rod Hangers: 9.5 mm.
- .5 Finishes:
 - .1 Outdoors and wet locations: Hot dipped galvanized steel.
 - .2 Indoors: Galvanized where available. Prime painted where approved by Consultant.
 - .3 Nuts, bolts, machine screws: Cadmium plated.

2.2 CONCRETE AND MASONARY ANCHORS

- .1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. All anchor bolts must be galvanized.
- .2 Components: Non-drilling anchors for use in pre-drilled holes, sized to safely support the applied load with a minimum safety factor of four (4).

2.3 NON-METALLIC ANCHORS

- .1 Material: Plastic anchors for sheet metal screws.

Part 3 Execution

3.1 INSTALLATION

- .1 Install supporting devices to maintain headroom, neat mechanical appearance and to support required equipment loads.
- .2 Except where otherwise indicated, support equipment, conduit, and cables using clips, spring-loaded bolts, or cable clamps designed as accessories to base channel members.
- .3 Do not fasten supports to piping, ductwork, mechanical equipment or conduit.
- .4 Attach hanging and support provisions to structural steel with beam clamps. Weld hanging and support provisions to structural steel only where approved by Consultant.
- .5 Do not cut or drill beams, joists or structural steel unless written permission of the Structural Consultant is obtained.
- .6 Inserts, anchors, and fasteners:
 - .1 Explosive powder-actuated fasteners are not permitted without specific written approval for their use and type has been obtained from Consultant.
 - .2 Accurately and properly set concrete inserts in concrete framework. Where multiple type inserts are used, space same to suit requirements of smallest conduit in group.
 - .3 Fasten hanger and support provisions to masonry with expansion shields and machine bolts. Plugs and screws may be used for light loads.
 - .4 Use two (2) wing toggles in drywall or plaster. Provide steel anchor plates with two (2) or more toggles to spread load for heavy loads.
- .7 Support for raceway and cable:
 - .1 Do not use ceiling suspension hangers or grids for suspension of raceway and conductors. Install supports to permanent structure of building, limited to areas that will not damage structural stability.
 - .2 Fasten conduit and cables to building construction or support system.
 - .1 50 mm and smaller: One-hole steel straps.
 - .2 Larger than 50 mm: Two-hole steel straps.

- .3 Exposed conduit:
 - .1 Support using hangers, clamps or clips.
 - .2 Support on each side of bends and spaced in accordance with Canadian Electrical Code.
 - .3 Where three (3) or more conduits run parallel, install conduit on conduit rack. Size conduit racks to provide 25% spare capacity.
- .4 Support riser conduit at each floor level with clamp hangers.
- .5 Provide channel support with fittings for vertical runs of raceway and cables.
- .6 Independently support raceway and cables dropped vertically to equipment where there is no wall support.
- .8 Support for cabinets and panelboards:
 - .1 Install surface-mounted cabinets and panelboards with minimum four (4) anchors. Provide steel channel supports to stand cabinet 25 mm clear of wall.
 - .2 Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

END OF SECTION

1.0 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

2.0 PRODUCTS

2.1 CONCRETE HANDHOLES

- .1 Handhole types for splices, pulls and junction applications:
 - .1 Cast-in-place concrete handholes;
 - .2 Pre-cast concrete handholes;
 - .3 Pre-fabricated handholes made of semi-concrete or non-concrete materials polymer concrete.
- .2 Handholes to be CSA approved and in accordance with following, as applicable:
 - .1 OPSS 602;
 - .2 ASTM C857;
 - .3 ANSI/SCTE 77.
- .3 Concrete to be in accordance with CSA A23.1 and CSA A23.2. Minimum compressive strength to be of 32MPa (4600 psi), 6-8% air entrainment, and be suitable for installation and use through a temperature range of minus 40°C to 70°C. (-40°F to 158°F).
- .4 Polymer concrete to consist of aggregates in combination with polymer resin, and reinforced with fibreglass. Non-conductive and non-flammable. Stable under freeze / thaw conditions.
- .5 Enclosures to be designed and installed to withstand loads likely to be imposed and be of size, with wiring/duct entries, covers and bottoms (as noted) and of type to suit specific applications.
- .6 Steel Handhole Cover:
 - .1 Galvanized steel according to CAN/CSA-G40.20/G40.21 and CAN/CSA-G164M92 (R2003);
 - .2 Checkered tread on top side for skid resistance;
 - .3 Tamper-proof, stainless steel head bolts recessed into cover;
 - .4 Area for logo;
 - .5 Flush mounted with gaskets to prevent ingress of water;
 - .6 Minimum thickness of cover is 10 mm (3/8").

- .7 Polymer Concrete Cover:
 - .1 Flush mounted with gaskets to prevent ingress of water;
 - .2 Skid resistant;
 - .3 Tamper-proof, stainless steel head bolts recessed into cover;
 - .4 Area for logo;
 - .5 Minimum thickness of cover is 20 mm (3/4").
- .8 Cable termination hardware to accommodate cables and required grounding hardware. Hardware to be corrosion resistant and in accordance with code requirements.
- .9 Provide PVC seals on cable entry openings.
- .10 Identification:
 - .1 Identification markings on each handhole embedded on outside vertical surface of handhole, showing manufacturer's name or trademark, and date of manufacture.
 - .2 Top surface of handhole cover permanently marked, showing manufacturer's name or trademark, and date of manufacture; this marking embedded into top surface of handhole cover, or embedded into a corrosion-resistant metal plate securely cemented to top surface of handhole cover.
- .11 Refer to drawings for handhole dimensions.
- .12 Acceptable manufacturers are:
 - .1 Armtex Ltd (Brooklin Concrete);
 - .2 Industrial Cast Stone Ltd.;
 - .3 Utility Structures Inc.;
 - .4 Hanson Pipe and Pre-cast;
 - .5 Hubbell.

2.2 PRECAST CABINET BASE

- .1 As indicated on drawings.
- .2 Install in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 WORK INCLUDED

- .1 Provide a complete system of boxes for the installation of wiring and equipment.

1.2 RELATED SECTIONS

- .1 Electrical General Requirements Section 26 05 00
- .2 Wiring Devices Section 26 27 26

1.3 REFERENCES

- .1 CSA C22.1-Canadian Electrical Codes, Part 1.

Part 2 Products

2.1 SHEET METAL BOXES

- .1 All octagon boxes shall be hot dipped galvanized steel, minimum 100 mm in diameter #54151. All 100 mm square boxes shall be minimum 40 mm deep #52151. Deep boxes #52171 shall be installed where specified and where six or more conductors enter the box.
- .2 Device boxes shall be minimum 64 mm deep (#1104).

2.2 CAST BOXES

- .1 All exterior outlet boxes shall be cast aluminum with female threaded hubs suitable for surface or recessed mounting as shown and required. (Crouse Hinds FS series)

2.3 PVC BOXES

- .1 PVC outlet boxes shall be CSA approved, two (2) gang with gaskets cover unless otherwise stated. Size and quantity of knockouts shall be coordinated with conduit entrances.
- .2 PVC boxes and fittings to: CSA C22.2 No. 85.

2.4 MATERIAL

- .1 Interior Boxes: Provide galvanized sheet steel boxes, blanked for conduit, attached lugs for locating.
- .2 Exterior Boxes: Cast aluminum deep type boxes, FA series with threaded hubs.
- .3 Masonry Boxes: 90 mm deep, conduit knockouts for mounting in masonry walls.
- .4 Combination boxes with barriers where outlets for more than one system are grouped.

2.5 COMPONENTS

- .1 Wall boxes, concealed in concrete or masonry: for one (1) and two (2) gang applications shall be 101 mm square, 54 mm deep, 52171 series complete with suitable 52-C-49 series square cornered raised tile wall cover for proper device and wall surface application. Masonry boxes may be used for line voltage switching.
- .2 Wall outlets, surface, exposed mounting or used for outdoor outlets: one (1) or more gang, Crouse-Hinds FS series or FD series, conduit.
- .3 Covers: Unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.

2.6 OUTLET BOXES FOR RIGID PVC CONDUIT

- .1 Materials:
 - .1 Rigid PVC boxes and fittings: NEMA 4 minimum.

2.7 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.8 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.9 CONDUIT BOXES

- .1 Cast ferroalloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.10 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two (2) double clamps to take non-metallic sheathed cables.

Part 3 Execution

3.1 INSTALLATION

- .1 All outlet boxes to be flush mounted in all areas except mechanical rooms, electrical rooms, above removable ceiling and crawl spaces.
- .2 Support boxes independently of connecting conduits. Secure outlet boxes to building structure.
- .3 No sectional, gangable or handy boxes are to be used.

-
- .4 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
 - .5 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
 - .6 Provide correct size of openings in boxes for conduit or cable connections. Reducing washers are not allowed.
 - .7 Outlet boxes shall not be mounted back-to-back within the same stud space (separate by at least one stud).
 - .8 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. Coordinate location of outlet boxes in masonry walls, so that the outlet box is centred between masonry block course lines. All cutting of masonry for installation of electrical equipment shall be completed using rotary cutting equipment.
 - .9 Extension rings shall **not** be utilized to accommodate conductor fill requirements.
 - .10 Where 25 mm conduit is utilized, outlet boxes must be minimum 119 mm (4 11/16") square.
 - .11 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.
 - .12 Provide boxes sized as required by the Canadian Electrical Code. All boxes are to be the deep type as a minimum.
 - .13 Outlets installed in party walls to be offset by a minimum of one stud space.
 - .14 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.
 - .15 For outlets mounted above counters or in millwork coordinate location and mounting heights prior to installation. Refer to architectural details
 - .16 Adjust height of outlets above heating cabinets. Coordinate with mechanical contractor.
 - .17 Where devices are located adjacent to one another they shall be grouped in a multi gang outlet box. Provide and install barriers where required.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section describes conduit and conduit fittings. Drawings do not indicate all necessary conduit runs, offsets, bends, or configurations. Provide a complete system of conduit and fittings for installation of wiring.

1.2 COORDINATION

- .1 Coordinate installation of conduit:
 - .1 That penetrates fire rated walls, floors or ceilings with firestopping work specified in Section 26 05 00 - Common Work Results for Electrical.

Part 2 Products

2.1 METALLIC CONDUIT

- .1 Electrical Metallic Tubing (EMT):
 - .1 Standard: CSA C22.2 No. 83.
 - .2 Fittings:
 - .1 Material: Zinc-coated steel, or zinc alloy for conduits 25 mm and smaller.
 - .2 Type: Compression or set screw. Liquid tight for wet or damp areas.
- .2 Flexible Metal Conduit:
 - .1 Standard: CSA C22.2 No. 56.
 - .2 Types:
 - .1 Flexible metal conduit:
 - .1 Spirally wound, interlocked zinc-coated strip steel.
 - .2 Minimum 10 mm diameter.
 - .2 Liquid-tight flexible metal conduit:
 - .1 Continuous interlocked and double-wrapped steel, zinc-coated inside and outside.
 - .2 Coated with liquid-tight jacket of flexible PVC.
 - .3 Minimum 12 mm diameter.
 - .3 Fittings:
 - .1 Flexible metal conduit: Threadless hinged clamp type;
 - .2 Liquid-tight flexible metal conduit: Cadmium-plated, malleable iron with compression type steel ferrule and neoprene gasket sealing rings.

2.2 NON-METALLIC CONDUIT

- .1 Rigid type EB1 PVC conduit: to CSA C22.2 No. 211.1.
- .2 Flexible non-metallic tubing: to CSA C22.2 No. 227.3.

Part 3 Execution

3.1 INSTALLATION - GENERAL

- .1 Install all wiring in conduit, except where otherwise indicated in the Specifications or Drawings. All conduit is to be 21 mm minimum.
- .2 Refer to "Conduit Installation Schedule" for permitted applications for each conduit type. Obtain approval from Consultant prior to using conduit in an application not listed.
- .3 Install all conduit concealed, except where otherwise indicated. Conduit may be exposed in the following locations:
 - .1 Mechanical, electrical, and service rooms;
 - .2 Unfinished areas;
 - .3 Above accessible ceilings.
- .4 Workmanship:
 - .1 Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
 - .2 Do not include more than equivalent of two (2) 90° bends in any run of conduit without a suitable intermediary access point. Provide conduit fittings, pullboxes and junction boxes where necessary. Do not use pulling elbows without prior approval by the Consultant.
 - .3 Cut conduit straight. Ream ends of conduits to ensure a smooth interior finish that will not damage wire insulation.
 - .4 Fasten conduit terminations in sheet metal enclosures with locknuts installed inside and outside enclosure.
 - .5 Bushings:
 - .1 Use insulated non-metallic bushings on all conduit terminations 25 mm and larger.
 - .2 Provide bushing at end of conduit stub-ups into accessible ceiling space.
 - .6 Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
 - .7 Plug exposed conduit ends during construction to prevent entry of dirt and moisture. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

- .8 Install a 90 lb. test line in all conduits left empty, including those in which others will pull cables.
- .9 Installed conduit is to be free from dents, bruises and other damage. Replace damaged conduit.
- .5 Conduit penetrations:
 - .1 Do not install conduit through structural elements without prior approval from Structural Consultant.
 - .2 Seal conduit with duct seal compound where conduit leaves heated area and enters unheated area.
 - .3 Seal openings where conduits pierce fire separations. Refer to Section 26 05 00 - Common Work Results for Electrical.
 - .4 Provide necessary flashing and pitch pockets, making watertight joints where conduit passes through roof or watertight membranes.
 - .5 Install expansion fittings complete with grounding jumper where conduit crosses building expansion joints. Utilize fitting to suit type of conduit used.
- .6 Identify systems and equipment as per Section 26 05 53 - Identification for Electrical Systems.
- .7 All redundant conduits to be removed in any renovated area.

3.2 INSTALLATION OF EXPOSED CONDUIT

- .1 Run parallel to building lines.
- .2 Where conduits are grouped (two (2) or more), space evenly, make bends concentric and mount on racks.
 - .1 Size racks to provide at least 25% future capacity.
- .3 Lay out conduit to conserve headroom and avoid interference with other work.
 - .1 Install conduit so as not to interfere with or impede maintenance access to mechanical and electrical equipment.
 - .2 Maintain a minimum clearance of 150 mm from steam or hot water piping, vents, etc.
 - .3 Coordinate routing to avoid structural obstructions, keeping crossovers to a minimum.
- .4 Exposed conduits in finished areas are to be free of unnecessary labels and trademarks. Paint conduits where directed.
- .5 For vertical runs, use unistrut channels.

3.3 CONDUIT INSTALLATION SCHEDULE

Application	Conduit Type
Final connections to luminaires	• Flexible metal
Final connections to equipment in damp locations	• Liquid-tight flexible metal
Final connections to control devices	• Flexible metal
All other applications (where permitted by Canadian Electrical Code)	• EMT

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Refer to Division 01 and Section 26 05 00 - Common Work Results for Electrical for general requirements pertaining to submittals and submittal procedures.
- .2 Submittals shall be included in the Operation and Maintenance Manual, specified in Division 01 and Section 26 05 00 - Common Work Results for Electrical.

Part 2 Products

2.1 BOXES

- .1 Device boxes and box accessories to CAN/CSA-C22.2 No. 18. Non-metallic device boxes to CAN/CSA-C22.2 No. 85. Pull and junction boxes to CAN/CSA-C22.2 No. 40.
- .2 Device boxes for interior general use:
 - .1 Material: Hot dipped galvanized sheet steel.
 - .2 Mounting: Recessed, gangable.
 - .3 Depth: 64 mm (2-1/2") minimum.
 - .4 Standard of acceptance: Iberville #1104.
 - .5 Special requirements:
 - .1 347V outlet boxes for 347V switching devices. Standard of acceptance: Iberville #1104-HV.
 - .6 Sectional boxes shall not be used.
- .3 Octagon and square boxes:
 - .1 Material: Hot dipped galvanized sheet steel.
 - .2 Dimensions: Minimum 101 mm (4") diameter.
 - .3 Depth: 38 mm (1-1/2") standard box. 54 mm (2-1/8") deep box.
 - .4 Standard of acceptance: Iberville #52151, #52171, #54151, #54171.
- .4 Non-metallic boxes:
 - .1 Same as steel boxes except of rigid PVC.

2.2 BOX ACCESSORIES

- .1 Bushings, knockout closures and locknuts: Corrosion resistant.
- .2 Air/vapor hats: Polyethylene, minimum 0.40 mm thick with minimum 25 mm wide flanges.

Part 3 Execution

3.1 GENERAL

- .1 Provide a device box for each luminaire, wiring device, structured wiring and low-tension outlet, fire alarm field device, and each other such outlet.
 - .1 Use galvanized sheet steel boxes for interior work connected to EMT conduit, recessed in stud walls.
 - .2 Use cast aluminum boxes for exterior work, surface-mount interior work, and recessed interior work connected to rigid steel conduit.
 - .3 Use rigid PVC boxes for interior work connected to rigid PVC conduit.
 - .4 Use masonry boxes for work in masonry walls and concrete floors.
 - .5 Use 347V boxes for 347V switching devices.
- .2 Use combination boxes with barriers where:
 - .1 Power and low-tension/communication devices are grouped.
 - .2 Devices fed from different voltages are grouped.
 - .3 Devices fed from normal and emergency distribution are grouped.
- .3 Provide a pullbox whenever shown on the Drawings, and whenever necessary to facilitate conductor installations. Conduit runs exceeding 30m in length, or with more than two (2) 90° bends are to be equipped with a pullbox installed at a convenient and accessible intermediate location.
- .4 Identify systems and equipment as per Section 26 05 53 - Identification for Electrical Systems.

3.2 INSTALLATION OF BOXES

- .1 Size boxes to accommodate devices and bending radii of installed cables.
 - .1 Provide deep boxes where six (6) or more conductors enter the box.
- .2 Provide a multi-gang device box for devices located adjacent to each other. Provide barriers where required.

- .3 Mounting of boxes:
 - .1 Secure boxes to building structure, independently of connecting conduits.
 - .2 Mount device boxes at height indicated. Refer to Section 26 05 00 - Common Work Results for Electrical.
 - .3 Mount device boxes in masonry walls centered between masonry course lines.
 - .4 Mount device boxes in metal stud walls so they are solidly anchored on two sides to ensure box does not move within wall.
 - .5 Do not install boxes back-to-back in same stud space in walls and partitions to minimize noise transmission and maintain integrity of fire separation, when applicable.
 - .6 Support boxes mounted in suspended ceilings from T-bar grid with "Caddy" type supports.
- .4 Fill boxes with paper to prevent entry of construction material.
- .5 Provide correct size of openings in boxes for conduit or cable connections. Do not use reducing washers.
- .6 Provide air/vapor hat around boxes in walls where insulation and vapor barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .7 Provide blank cover plates on boxes left empty for future boxes and boxes made obsolete in renovation.
- .8 Ensure pull boxes and junction boxes are accessible after work is completed.
- .9 Accurately identify location of concealed boxes on record drawing mark-ups.

END OF SECTION

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 74 11 - Cleaning
- .2 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-[98(R2003)], Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-[M1981(R2003)], Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-[04], Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-[M1985(R2003)], Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-[M1984(R2003)], Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-[05], Non-metallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

2.0 PRODUCTS

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.
- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.
- .4 Reel and mark shielded cables rated [2,001] volts and above.

2.2 CONDUITS

- .1 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .3 Rigid pvc conduit: To CSA C22.2 No. 211.2.
- .4 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.3 CONDUIT FASTENINGS

- .2 One (1) hole malleable steel straps to secure surface conduits [NPS 2] [50 mm] and smaller.
 - .1 Two (2) hole steel straps for conduits larger than [NPS 2] [50 mm].
- .3 Beam clamps to secure conduits to exposed steel work.
- .4 Channel type supports for two (2) or more conduits.
- .5 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Watertight connectors and couplings for EMT.
 - .1 Set-screws are not acceptable.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 All underground conduits shall have weatherproof expansion fittings with internal bonding assembly suitable for 200 mm linear expansion at distances in accordance with manufactures requirements. Expansion fittings shall be inspected and photographed prior to backfill.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene.

3.0 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Surface mount conduits.
- .3 Use electrical metallic tubing (EMT) [except in cast concrete] [above 2.4 m not subject to mechanical injury].
- .4 Use rigid pvc conduit for underground installations.
- .5 Install expansion joints for underground PVC conduit installations in accordance with manufacturers requirements.
- .6 Minimum conduit size for lighting and power circuits: 19 mm.
- .7 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.

- .11 Run 2-[NPS 1] [25 mm] spare conduits up to ceiling space and 2-[NPS 1] [25 mm] spare conduits down to ceiling space from each flush panel.
 - .1 Terminate these conduits in [152 x 152 x 102 mm] junction boxes in ceiling space or in case of an exposed concrete slab, terminate each conduit in [flush concrete] [surface] type box.
- .12 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on [suspended] [surface] channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONDUITS IN CAST-IN-PLACE CONCRETE

- .1 Locate to suit reinforcing steel.
 - .1 Install in centre one third of slab.
- .2 Protect conduits from damage where they stub out of concrete.
- .3 Install sleeves where conduits pass through slab or wall.
- .4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed.
 - .1 Use cold mastic between sleeve and conduit.
- .5 Conduits in slabs: minimum slab thickness 4 times conduit diameter.
- .6 Encase conduits completely in concrete with minimum 25 mm concrete cover.
- .7 Organize conduits in slab to minimize cross-overs.

3.5 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits below slab and encase in 75 mm concrete envelope.
- .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.6 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.

3.7 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

1.0 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 - Cleaning
- .3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal
- .4 Section 31 23 33.00 - Excavating, Trenching and Backfilling

1.2 REFERENCES

- .1 CSA International
 - .1 CAN/CSA-Z809-16, Sustainable Forest Management.
- .2 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-(latest edition), FSC Principle and Criteria for Forest Stewardship.
- .3 Insulated Cable Engineers Association, Inc. (ICEA)
- .4 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2014 Standard.

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 cables and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Wood Certification: submit vendor's and manufacturer's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

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 Store and protect cables from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.

.4 Develop Waste Reduction Workplan related to Work of this Section.

.5 Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials as specified in Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

2.0 PRODUCTS

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated with clear, coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.
- .2 Cedar post type markers: to CAN/CSA-Z809 or FSC or SFI 89 x 89 mm, 1.5 m long, pressure treated with clear, coloured, or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing cable or conduit to indicate depth and direction of duct and cable runs.
 - .1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words Cable, Joint or Conduit with arrows to indicate change in direction.

3.0 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Parks Canada Representative.
 - .2 Inform Parks Canada 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 Parks Canada Representative.

3.2 DIRECT BURIAL OF CABLES

- .1 After sand bed in accordance with Section 31 23 33.00 - Excavating, Trenching and Backfilling, is in place, lay cables maintaining a minimum 75 mm clearance from each side of trench to nearest cable.
 - .1 Do not pull cable into trench.
- .2 Include offsets for thermal action and minor earth movements.
 - .1 Offset cables 150 mm minimum for each 60m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 0.6 m minimum of surplus cable in each direction.
 - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Cable separation:
 - .1 Maintain 75 mm minimum separation between cables of different circuits.
 - .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
 - .3 When low-voltage cables cross high voltage cables maintain 300 mm vertical separation with low-voltage cables in upper position.
 - .4 At crossover, maintain 75 mm minimum vertical separation between low-voltage cables and 150 mm between high voltage cables.
 - .5 Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other cables, with fire alarm and control cables in upper position.
 - .6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.
- .7 After sand protective cover specified in Section 31 23 33.01 - Excavating, Trenching and Backfilling, is in place, install continuous row of overlapping 38 x 140 pressure treated planks as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

- .1 Mark cable every 150 m along cable runs and changes in direction.
- .2 Mark underground splices.
- .3 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .4 Install concrete cable markers within 180 m from each side of runway centreline; 45 m from each side of taxi way centreline; 50 m from edge of taxi ramps or aprons.
- .5 Install cedar post type markers.
- .6 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.

- .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
- .6 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing to original factory test voltage in accordance with manufacturer's recommendations.
 - .4 Leakage Current Testing:
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer for type of cable being tested.
 - .2 Hold maximum voltage specified time period by manufacturer.
 - .3 Record leakage current at each step.
 - .7 Provide Parks Canada Representative a list of test results showing location at which each test was made, circuit tested and result of each test.
 - .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

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 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 Identification for electrical systems, equipment, conduit and related components.

1.2 REFERENCE STANDARDS

- .1 Federal Standard 595C – Colours.

Part 2 Products

2.1 IDENTIFICATION MATERIALS

- .1 Lamicoid Nameplates: 3 mm thick plastic engraving sheet, black face, white core, mechanically attached, sizes as follows:
 - .1 Size 1: 12 mm high with 5 mm high letters.
 - .2 Size 2: 20 mm high with 8 mm high letters.
 - .3 Size 3: 25 mm high with 12 mm high letters.
- .2 Printed Labels: Self-adhesive, permanent labels, letter size as per Lamicoid.
 - .1 Standard of Acceptance: Brother "P-Touch".
- .3 Wire Identification Materials: Use one of the following:
 - .1 Heat shrink sleeves, blank.
 - .2 Clear plastic tape wrap-on strips with white writing section.
 - .3 Wrap-on strips, pre-numbered.
 - .4 Slip-on identification bead markers or sleeves, blank or pre-numbered.
- .4 Colour Banding Tape: 25 mm wide adhesive backed plastic tape, integrally coloured.

Part 3 Execution

3.1 COLOUR IDENTIFICATION OF EQUIPMENT

- .1 Electrical equipment shall be prefinished in coded colours designating voltage or system, as indicated.
- .2 All switchgear, distribution centre, panel boards, motor control cabinets, disconnect switches, contractor cabinets, relay cabinets, transformers, termination cabinets, splitter boxes, etc., are to be colour coded as per the same identification as per site; however, if there are no known colours, provide the following:

Voltage	Colour
.1 347/600 V:	Sand
.2 120/208 V:	Grey
.3 Emergency Power:	Associated Voltage Colour
.4 Fire Alarm and Fire Phone:	Red
.5 Security/Intrusion/Surveillance:	Green
.6 Low-Voltage Switching:	Black
.7 Annunciator Cabinets:	Black
.8 Data/Telephone Cabinets:	Blue
.9 Backboards:	Grey

- .3 All pull boxes, junction boxes, covers, and conduit banding shall be finished in the following colours:

System	Colour
.1 Emergency Power:	Red/Grey
.2 347/600 V:	Sand
.3 277/480 V:	Bronze
.4 120/208 V:	Grey
.5 Fire Alarm and Fire Phone:	Dark Red
.6 Security/Intrusion/Surveillance:	Green
.7 Telephone:	Dark Green
.8 Door Security:	Pink
.9 Data:	Dark blue

Note: All cover markings are to be in "Black" lettering with the exception of Low-Voltage Switching – Emergency that is to be marked with "White" lettering.

- .4 Where impracticable to obtain equipment prefinished in coded colours, equipment may be site painted in coded colours.

3.2 NAMEPLATE IDENTIFICATION OF EQUIPMENT

- .1 Except where indicated elsewhere, identify equipment with lamicoid nameplates.

3.3 PANELBOARD DIRECTORIES

- .1 Identify loads controlled by each overcurrent protective device in each panelboard, by means of a typewritten panelboard directory. Update existing directories with new over current protective devices that have been added or removed.

3.4 COMMUNICATIONS CABLE AND EQUIPMENT LABELLING

- .1 Label communication outlets, panels and ports with lamicaid nameplates as specified in Equipment Identification Schedule.
- .2 Label each of cables with other ends address using Wire Identification Materials.
- .3 Label outlets with labels vertically aligned in each row.
- .4 Position panel labels in the same position on each panel.

3.5 INTERMITTENT COLOUR CODING OF CONDUIT AND CABLE

- .1 Apply colour banding (tape or paint) in required colours for each voltage or system in 25 mm wide bands all around conduit or cable as follows:
 - .1 At least once in each 10 m of conduit or cable run.
 - .2 Where conduit or cable enters inaccessible ceiling, wall and floor spaces.
 - .3 At least once in each room or area through which a conduit or cable passes.
- .2 Apply colour banding on electrical conduit and cable in the following locations:
 - .1 Exposed in service areas.
 - .2 Exposed in unfinished areas.
 - .3 Semi-concealed spaces.
 - .4 Exposed to exterior.

3.6 IDENTIFICATION OF PULL AND JUNCTION BOXES

- .1 Identify pull and junction boxes over 100 mm size as follows:
 - .1 Use boxes which are prefinished in coded colours, or spray paint inside and outside of boxes prior to installation, in coded colours designating voltage or system.
 - .2 Apply size 2 lamicaid nameplate to cover of each box. Identify system name. Where sequence identification is required, identify system name and number.
- .2 Identify pull and junction boxes 100 mm or less in size as follows:
 - .1 Spray paint inside of boxes and box cover in coded colours designating voltage or system.
 - .2 Apply permanent identifying markings directly to box covers designating Panel and circuit number using indelible black ink.

3.7 COLOUR IDENTIFICATION OF WIRING

- .1 Identify No. 4/0 AWG wiring and smaller by continuous insulation colour.
- .2 Identify wiring larger than No. 4/0 AWG by continuous insulation colour or by colour banding tape applied at each end and at splices.
- .3 Colour coding shall be in accordance with Canadian Electrical Code, and as follows:

Voltage	Colour
.1 Grounding Conductors	Green
.2 Neutral Conductors	White
.3 120/208V, Normal Power:	Red, black and blue
.4 120/208V Emergency Power:	Red, black and blue with yellow tracer
.5 347/600V Normal Power:	Orange, brown and yellow
.6 347/600V Emergency Power:	Orange, brown and yellow with red tracer

- .4 Where multi-conductor cables are used, use same colour coding system for identification of wiring throughout each system.
- .5 Maintain phase sequence and colour coding throughout each system.

3.8 NAME/NUMBER IDENTIFICATION OF WIRING

- .1 Identify No. 8 AWG wiring and smaller using one of the wire identification materials specified in IDENTIFICATION MATERIALS.
- .2 Type or print on blank wire identification materials using indelible black ink.
- .3 Identify wiring at all pull boxes, junction boxes, and outlet boxes for all systems.
- .4 Identify each conductor as to panel and circuit, terminal, terminal numbers, system number scheme, and polarization, as applicable.

3.9 IDENTIFICATION OF RECEPTACLES

- .1 Provide lamicaid nametag with 6 mm high white lettering on black background (red background for emergency receptacles). Locate on wall above cover plate.
 - .1 Standard duplex receptacles: Indicate circuit and panel designation.
 - .2 Other receptacles: Indicate voltage, phase, amps, circuit and panel designation.

3.10 IDENTIFICATION OF SWITCHES FOR HEALTH CARE FACILITIES

- .1 Provide lamicaid nametag with 6 mm high white lettering on black background above all lighting and dimmer switches at patient bedside and nurses' stations.
- .2 Nametag is to describe function of switch, such as "Exam Light", "General Lighting", etc. Three-position switches are to also indicate all positions, such as "High/Off/Low", "Night/Off/General", etc.

3.11 EQUIPMENT IDENTIFICATION SCHEDULE

Equipment	Colour	Nameplate Identification	Lamicaid Nameplate Size
Distribution Centers	Voltage Colour	<ul style="list-style-type: none"> • Distribution center designation, amperage, voltage • Loads controlled by each overcurrent protective device 	2 1
Panelboards	Voltage Colour	• Panelboard designation	2
Ground Bus	N/A	• System Ground	1
On/Off Switches	N/A	• Load Controlled	1
Disconnect Switches,	Voltage Colour	• Voltage and equipment controlled	2
Line-Voltage Cabinets and Enclosures	Voltage Colour	• Designation and voltage	2
Low-Voltage Cabinets and Enclosures	System Colour	<ul style="list-style-type: none"> • System name; system name and number if more than one cabinet or enclosure • Major components within cabinets and enclosures 	2 1
Communication Outlet and Outlet Assemblies	N/A	• Outlet Designation	1

3.12 COLOUR SCHEDULE

<u>Electrical Colours</u>	<u>Federal Standard 595C Colour Numbers</u>
Blue	15052
Green	14449
Brown	10115
Sand	12516
Grey	16307 or ASA61 Grey
Black	17038
Bronze	13275
Purple	17100
Orange	12473
Yellow	13655
Red	11350

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 NEMA ST-20: Dry-Type Transformers for General Applications.
- .2 NEMA TP-1: Guide for Determining Energy Efficiency for Distribution Transformers.
- .3 CAN/CSA C802.2: Minimum Efficiency Values for Dry-Type Transformers.
- .4 CSA C9: Dry-Type Transformers.
- .5 EEMAC GL1-3: Power Transformer and Reactor Bushings.

1.2 SUBMITTALS

- .1 Refer to Division 01 and Section 26 05 00 - Common Work Results for Electrical for general requirements pertaining to submittals and submittal procedures.
- .2 Submittals shall be included in the Operation and Maintenance Manual, specified in Division 01 and Section 26 05 00 - Common Work Results for Electrical.
- .3 Shop Drawings:
 - .1 Provide manufacturer's literature including applicable reference standards, performance and test data for the following:
 - .1 All transformers:
 - .1 kVA rating, primary and secondary voltages, phase, frequency;
 - .2 Polarity or angular displacement;
 - .3 Full load efficiency;
 - .4 Regulation at unity power factor;
 - .5 Basic Impulse Level (BIL);
 - .6 Insulation type;
 - .7 Sound rating.
 - .2 K-rated transformers:
 - .1 Linear load efficiency at 35%, 50%, 65%, 75%, 100% of name plate rating;
 - .2 Efficiency under load profile at 50%, 65%, 75%, 100% of name plate rating.
- .4 Testing and Factory Inspection Reports:
 - .1 Submit on-site testing reports.

.5 Training and Maintenance Materials:

.1 Operation and Maintenance instructions to include:

- .1 Changing Tap settings;
- .2 Recommended environmental conditions;
- .3 Recommended periodic inspection and maintenance;
- .4 Bushing replacement.

1.3 QUALITY ASSURANCE

- .1 Transformers to be NEMA TP-1 Energy Star and CSA C802.2 labelled.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from potential damage from weather and construction operations. Store so condensation will not form on or in the transformer housing and if necessary, apply temporary heat where required to obtain suitable service conditions.
- .2 Handle transformers using proper equipment for lifting and handling. Use lifting eye and/or brackets provided for that purpose when necessary.

Part 2 Products

2.1 GENERAL REQUIREMENTS FOR TRANSFORMERS

- .1 Transformers are to be designed, constructed, and rated and approved in accordance with ULC, CSA, and NEMA standards.
- .2 Provide ground bar kit and neutral to ground bond jumper terminated at ground bar. Provide mechanical lugs mounted on the ground bar for input ground bond, output ground bond, and external ground
- .3 Transformers are to be matched with overcurrent protection on primary side to ensure overcurrent device can carry twelve (12) times rated primary full-load current for 0.1 seconds. Refer to Section 26 28 16 - Moulded Case Circuit Breakers.

2.2 GENERAL DUTY TRANSFORMERS

- .1 Cooling Class: ANN.
- .2 kVA Rating: As specified on Drawings.
- .3 Primary voltage, phase: As specified on Drawings.
- .4 Secondary voltage, phase: As specified on Drawings.
- .5 System frequency: 60 Hz.

- .6 220 insulation system class, 150°C temperature rise.
- .7 Impedance: Standard.
- .8 Primary winding: 208V Single Phase.
- .9 Secondary winding: 240V Single phase, 2 wire, low resistance effectively grounded.
- .10 Efficiency: Meet or exceed minimum efficiency levels as per NEMA TP-1.
- .11 No load losses not to exceed 1.4% of kVA rating.
- .12 Full load losses not to exceed 1.4% of kVA rating.
- .13 Sound level: to meet NEMA ST-20.
- .14 Voltage Taps: Standard. Taps located at front of coils for accessibility.
- .15 Tap Changer: Bolted-link type.
- .16 Primary and secondary coils:
 - .1 Copper;
 - .2 Open.

2.3 TRANSFORMER ENCLOSURES

- .1 Construction: Sheet steel, with bolted removable panels for access to tap connections, enclosed terminals.
- .2 Mounting: Designed for wall mounting;
- .3 Enclosure type:
 - .1 Indoor, ventilated:
 - .1 Temperature of exposed metal parts not to exceed 65°C rise.

Part 3 Execution

3.1 GENERAL

- .1 Identify systems and equipment as per Section 26 05 53 - Identification for Electrical Systems.

3.2 INSTALLATION OF TRANSFORMERS

- .1 Locate, install and ground transformers in accordance with manufacturer's instructions.
- .2 Mounting:
 - .1 Set and secure transformers in place, rigid plumb and square. Make sure that the transformer is level.
 - .2 Mount transformer on factory supplied suitable isolation pad to minimize vibrations.
 - .3 Floor-mounted transformers: provide 100mm high concrete housekeeping pad.
 - .4 Wall-mounted transformers: provide all steel supports (platform), including independent support from structure above.
- .3 Connections:
 - .1 Connect primary terminals to primary voltage circuit.
 - .2 Connect secondary terminals to secondary cables.
 - .3 Use flexible conduit to make connections to transformer.
 - .4 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.
- .4 Check for damage and loose connections.
- .5 Energize transformers and check secondary no-load voltage.
 - .1 Adjust primary taps as necessary to produce rated secondary voltage at no-load.

3.3 TESTING

- .1 Perform testing as per Section 26 05 00 - Common Work Results for Electrical.
- .2 Factory Testing:
 - .1 Provide type test of transformers, proving the performance of the units to provide capacities as listed in these specifications. Factory type tests to include:
 - .1 Resistance measurements of all windings;
 - .2 Ratio test at rated connection and on all taps;
 - .3 Polarity and phase relation tests;
 - .4 Audible sound level tests;
 - .5 No load loss at rated voltage and losses at 25%, 50%, 75% and 100% load;
 - .6 Exciting current at rated voltage;
 - .7 Laboratory test of insulating liquid;
 - .8 Impedance;

-
- .9 Applied potential test;
 - .10 Induced potential test;
 - .11 Hi-pot test;
 - .12 Heat run, temperature rise tests on each transformer.
- .3 Site Testing:
- .1 After the transformers have been set in place, prior to energizing, verify in writing that the transformers have been installed and tested in accordance with recommended practice and are suitable for energizing and use. Without limiting the foregoing, the work shall, as a minimum, include the following:
 - .1 Prior to connecting, the Electrical Contractor is to inspect visually and conduct the following tests.
 - .1 Megger test: Megger high voltage to ground with the secondary grounded for the duration of the test. Megger low voltage to ground with the primary grounded for the duration of the test.
 - .2 Electrical centers test on high voltage off-load tap changer switch.
 - .3 Ratio test for all transformer tap positions.
 - .4 Moisture test using a capacitance bridge.
 - .5 Verify the shipping braces and shipping shims have been removed.
 - .2 After the connection of line, load, control and alarm wiring, but prior to energizing, inspect the installation and confirm the following:
 - .1 Transformer has been properly cleaned, is dry and free of foreign materials and contaminants and otherwise is suited for energizing.
 - .2 All bus and connector bolts have been installed, tightened, and torqued properly. Uninsulated surfaces of connectors and buses have been taped.
 - .3 Transformer taps have been set to provide the secondary voltage required.
 - .4 All insulators are in perfect condition, without cracks, chips or surface contaminants.
 - .5 Core, coil, terminal boards, tap changers, bushings and all insulated surfaces have not been damaged.
 - .3 Any other tests or inspections deemed necessary or appropriate by the manufacturer.

END OF SECTION

1.0 GENERAL

1.1 SUBMITTALS

- .1 Panel boards are existing Submittals are not required.

2.0 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- .1 Panelboards are existing. Circuit breakers shall match existing types.
- .2 Acceptable manufacturers AC Dandy including panel interior by:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (I-Line Series);
 - .3 Siemens Electric Ltd.

END OF SECTION

Part 1 General

1.1 REQUIREMENTS

- .1 Provide a complete system of wiring to mechanical apparatus (including static heating systems) and controls as specified herein, as shown on the drawings and in accordance with Urecon installation methods and instructions.
- .2 Unless specifically noted otherwise, wire and leave in operation all electrically operated equipment supplied under all contracts related to this project. Examine the drawings and shop drawings of all Divisions for the extent of electrically operated equipment supplied under other contracts.
- .3 All control wiring diagrams shown on the drawings illustrate typical control circuits applicable to the equipment. Control circuits may vary with different manufacturers of equipment. Verify all control circuits with the suppliers of the equipment and make any corrections that may be required.
- .4 Unless specifically noted otherwise, supply all pushbuttons, relays, starters, etc., necessary for the operation of equipment. Check all starters, relay coils and thermal elements to ensure that they provide the necessary protection for motors.
- .5 Do not operate motors and controls until approval is obtained from the trade providing equipment.
- .6 Examine drawings and shop drawings of other Divisions to obtain exact location of motors and equipment shown on drawings. Where necessary, obtain conduit locations from other trades' drawings and shop drawings.
- .7 Assist in placing in operation all mechanical equipment having electrical connections.
- .8 Provide all power wiring for all motors and control wiring as indicated on the drawings.
- .9 In general, wiring for freezestats, firestats, E.P. switches, P.E. switches, dampers, temperature controllers, flow switches, solenoid valves, etc., for heating ventilating and air conditioning equipment will be under a separate contract. Provide terminations in starters and MCC's for control wiring so that starter control circuits may be extended. Where 120 volt power is required for mechanical equipment, i.e. roll type filters, refrigerated aftercoolers, control cabinets, etc. wiring to the equipment terminals is the work of this Division.
- .10 Some specific definitions of equipment wiring responsibilities are as follows:
 - .1 Urecon Heat Trace Systems
 - .1 Provide 240V power and connection of RTDs to vendor supplied control panels (AKA Thermostat).

Part 2 Products

2.1 208 AND 240 VOLT, 1 PHASE MOTOR DISCONNECT SWITCHES

- .1 Provide means of locking and tagging out heat trace system at the Urecon heat trace controller (AKA Thermostat).

Part 3 Execution

3.1 INSTALLATION

- .1 Provide disconnect switches adjacent to all systems.
- .2 Provide all wiring between all force flow and unit heaters and their thermostats. Install wiring between all flow switches and valve monitors and the fire alarm panel.
- .3 Do control wiring as indicated on the drawings and the motor control schedules.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section describes materials and methods used in the provision of line voltage switches and dimmers, receptacles, timers and control devices, and associated equipment.

1.2 COORDINATION

- .1 Coordinate installation of wiring devices and cover plates with site painting and finishing work specified in Division 09.

1.3 SUBMITTALS

- .1 Refer to Division 01 and Section 26 05 00 - Common Work Results for Electrical for general requirements pertaining to submittals and submittal procedures.
- .2 Submittals shall be included in the Operation and Maintenance Manual, specified in Section 26 05 00.
- .3 Product Data:
 - .1 Provide manufacturer's literature including applicable reference standards, performance and test data for products specified in this section.
 - .1 Indicate dimensions, colour, etc.
- .4 Shop Drawings:
 - .1 For all areas covered by occupancy sensors, provide layout drawing indicating sensor location(s), and areas of coverage, demonstrating complete coverage.

Part 2 Products

2.1 GENERAL PRODUCT REQUIREMENTS

- .1 All wiring devices are to be CSA approved.
- .2 Products of the same type are to be from one manufacturer.

2.2 SWITCHES AND DIMMERS

- .1 Manually operated line-voltage switches:
 - .1 Rating: as required based on circuit rating.
 - .2 Configuration: Single pole, three-way or four-way as indicated on Drawings.
 - .3 Grade: Commercial/Specification
 - .4 Terminals: Back or side mounting, approved for #10 AWG wire.
 - .5 Contacts: Silver alloy.
 - .6 Toggle switch: Rectangular rocker-type ("decorator" style).

2.3 RECEPTACLES

- .1 Standard receptacles:
 - .1 Rating:
 - .1 15A, 125V, 2-pole 3-wire grounding, CSA Type 5-15R.
 - .2 20A T-slot, 125V, 2-pole 3-wire grounding, CSA Type 5-20R.
 - .3 Other CSA configurations based on amperage, voltage and phase of connected equipment, and as indicated on Drawings.
 - .2 Configuration: Single or duplex, as indicated on Drawings.
 - .3 Grade: Commercial/Specification
 - .4 Terminals: Back or side mounting, approved for #10 AWG wire.
 - .5 Construction: Nylon face and base, galvanized steel straps, break-off tabs for split receptacle.
 - .6 Colour:
 - .1 Isolated ground type: Orange.
 - .2 All other locations: White or as indicated on Drawings.
 - .7 Standard of acceptance: Hubbell, Leviton, or approved equivalent.
- .2 Special Receptacles:
 - .1 To be same as standard receptacles with following features:
 - .1 Ground fault circuit interrupter: Class A type, solid state ground fault sensing with 5 mA ground fault trip level and integrated reset button.
 - .2 Weather resistant.
 - .3 Tamper resistant.
 - .4 Isolated ground: Ground contact isolated from mounting strap to establish a separate pure ground path.
 - .5 Locking type: L5-15R and L5-20R configuration.

2.4 COVERPLATES

- .1 Mounting: For flush or surface boxes as required.
- .2 Types:
 - .1 Galvanized steel.
 - .2 Weatherproof: Cast metal gasketed, complete with spring-loaded gasketed doors.

2.5 TIMERS AND CONTROLLERS

- .1 Heat Trace Controller (AKA Thermostat):
 - .1 Supplied by Urecon: obtain technical literature from Urecon prior to installation.
 - .2 Outdoor rated, supply weatherproof fittings.

Part 3 Execution

3.1 GENERAL

- .1 Install wiring devices in boxes specified in Section 26 05 33.16 - Boxes for Electrical Systems.
- .2 Install wiring devices in gang-type boxes when more than one device is required in one location.
- .3 Clean device boxes prior to installing wiring devices.
- .4 Install wiring devices and cover plates flush and level.
- .5 Identify systems and equipment as per Section 26 05 53 - Identification for Electrical Systems.

3.2 INSTALLATION OF SWITCHES

- .1 Install single-throw switches with toggle in the "UP" position when switch closed.
- .2 Mount switches on latch side of door. Where this not possible, mount switch as close as possible to door but visible when door is open.
- .3 Provide a separate neutral conductor from branch circuit panel to each dimmer.

3.3 INSTALLATION OF SENSORS & CONTROLLERS

- .1 Position sensors based on manufacturer's recommendations.
 - .1 Provide quantity of sensors and locate as required to provide complete coverage over area controlled. Sensors shown on Drawings are diagrammatic to indicate how area is to be controlled and do not accurately represent required quantity or optimum location.
 - .2 Ensure occupancy sensors are not activated by movement outside area of coverage.

3.4 INSTALLATION OF RECEPTACLES

- .1 Mount split receptacles vertically and switch upper portion.
- .2 Provide special receptacles as shown on Drawings and as indicated here:
 - .1 GFCI receptacles:
 - .1 Outdoors
 - .2 Weather resistant receptacles: outdoors and in wet or damp locations, lockable where indicated.

3.5 INSTALLATION OF COVER PLATES

- .1 Provide cover plates for all equipment installed in device boxes, including but not limited to switches, sensors, receptacles, communication and TV outlets, and sound system components.
 - .1 Use weatherproof cover plates in exterior locations, when installed in wet or damp areas, where subject to splashing water, and where indicated on Drawings.
 - .2 Use galvanized steel cover plates in service areas, above accessible ceilings, in unfinished areas, and on surface-mount boxes.
 - .3 Use nylon cover plates in residential suites.
 - .4 Use stainless steel cover plates in all other locations.
- .2 Provide common cover plates where wiring devices are grouped.
- .3 Provide blank cover plates on empty boxes, including existing boxes left empty in renovation.
- .4 Do not use cover plates for flush-mount boxes on surface-mount boxes.
- .5 Protect cover plate finish with paper or plastic film until all construction and painting work is finished. Remove paper.

1.1 TESTING

- .1 Perform testing as per Section 26 05 00 - Common Work Results for Electrical.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA International

- .1 CSA C22.2 No. 5, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

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 circuit breakers and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Include time-current characteristic curves for breakers with ampacity of 100A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

- .4 Certificates:

- .1 Prior to installation of circuit breakers in either new or existing installation, the Consultant reserves the right to request from the Contractor to submit three (3) copies of a production certificate of origin from the manufacturer. Production certificate of origin must be duly signed by factory and local manufacturer's representative certifying that circuit breakers come from this manufacturer and are new and meet standards and regulations.

- .1 Prior to installation, the Contractor shall contact the Consultant for confirmation if the request for the certificates is required to review.

- .2 Production certificate of origin must be submitted to Consultant for approval.

- .2 Delay in submitting production of certificate of origin will not justify any extension of contract and additional compensation.

- .3 Any work of manufacturing, assembly or installation to begin only after acceptance of production certificate of origin by Consultant. Unless complying with this requirement, Consultant reserves the right to mandate manufacturer listed on circuit breakers to authenticate new circuit breakers under the contract, and to Contractor's expense.

- .4 Production certificate of origin must contain:
 - .1 Manufacturer's name and address and person responsible for authentication. Person responsible must sign and date certificate.
 - .2 Licensed dealer's name and address and person of distributor responsible for Contractor's account.
 - .3 Contractor's name and address and person responsible for project.
 - .4 Local manufacturer's representative name and address. Local manufacturer's representative must sign and date certificate.
 - .5 Name and address of building where circuit breakers will be installed:
 - .1 List of circuit breakers.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 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 circuit breakers indoors, in a dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 BREAKERS GENERAL

- .1 Match breakers to existing panel types.
- .2 Moulded-case circuit breakers and ground-fault circuit-interrupters to CSA C22.2 No. 5.
- .3 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .4 Common-trip breakers: with single handle for multi-pole applications.
- .5 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

- .6 Circuit breakers with interchangeable trips as indicated.
- .7 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating.
- .8 Ground-fault circuit breakers as indicated on drawings.

2.2 THERMAL MAGNETIC BREAKERS

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS

- .1 Thermal magnetic breakers with current limiters.
 - .1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.
 - .2 Coordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.
- .2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.
 - .1 Breakers applied following manufacturer's guidelines and accepted best practice.

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 installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 INSTALLATION

- .1 Install circuit breakers in existing panels as indicated.

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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1.0 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products of this Section, and on Schedule of Luminaires on drawings.
- .2 For exterior site areas or parking areas, where luminaires are proposed that are not from based specified manufacturer, provide luminaire manufacturer's computer prepared detailed photometric layout drawings with complete photometry showing performance levels of proposed luminaires. Clearly identify lighting levels, quantity, locations, mounting heights, etc. Identify variances from base design.

1.2 WARRANTY

- .1 Warranty requirements are as follows:
 - .1 Permanent luminaires shall be re-installed after pipe and earthwork is complete. Contractor shall warranty the installation of new raceways and concrete pole bases.

2.0 PRODUCTS

2.1 LUMINAIRES

- .1 Provide luminaires in accordance with Schedule of Luminaires. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Some luminaires as noted or directed by Parks Canada Representative or identified in other Division documents may be supplied by Owner or under another Division of Work. Include in Bid, Work and materials to accommodate such fixtures, including:
 - .1 receiving and inspecting fixtures;
 - .2 complete installation;
 - .3 providing basic installation hardware not supplied by luminaire manufacturer;
 - .4 aiming and connecting;
 - .5 providing power feeders and conduit/boxes;
 - .6 cleaning, adjusting and testing;
 - .7 providing lamps where documented or as scheduled, unless otherwise noted or directed by Parks Canada Representative or supplied with fixture by fixture manufacturer;
 - .8 provide required power connections and where luminaires are controlled via remote low voltage controller;
 - .9 include for installation of controller and providing required low voltage wiring in conduit and necessary connections;
 - .10 coordination of exact requirements with supplier of fixtures and Parks Canada Representative prior to installation.

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- .3 Provide neoprene or silicone gasketting, barriers and stops where required to prevent light leaks or water/water vapour penetration.
 - .4 Fabricate housings to allow for easy accessibility and replacement of parts.
 - .5 Luminaires to be factory assembled and tested prior to delivery on site.
 - .6 Exposed parts and hardware of luminaires located in non-climate controlled areas to be corrosion resistant and weather resistant. Hardware to be tamper-proof. Manufacturer exterior luminaire poles with corrosion resistant finish and construction.
 - .7 Confirm exact colours and finishes of luminaires with Parks Canada Representative after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
 - .8 Products of same specified type to be of same manufacturer.

2.2 LEDS AND DRIVERS

- .1 General features include:
 - .1 CSA approved, ULC listed and labelled;
 - .2 Operating temperature:
 - .1 Luminaires for applications in non-climate controlled area: operating temperature range through -40°C (-40°F) to 60°C (140°F);
 - .2 Luminaires for applications in climate controlled area: operating temperature range through -20°C (-4°F) to 50°C (122°F);
 - .3 With rapid and changing development of LED technology, provide most technically proven and most advanced and successfully tested LED technology at time of installation;
 - .4 Specification standards to meet requirements of IES LM 79 and LM-80.

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- .2 Light emitting diodes (LEDs) features to include:
 - .1 LEDs to be selected from same colour bin size for consistency in chromaticity and meet ANSI C78 377A as a minimum;
 - .2 generally, colour temperature range to be from 2700 K to 6500 K; specific temperature requirements to be identified on Schedule of Luminaires;
 - .3 minimum CRI of 80;
 - .4 rated life (based on 70% lumen depreciation level) from 50,000 to 70,000 hours.
 - .3 Driver (ballast) features to include:
 - .1 Operate from 60 Hz input source of 120 VAC with sustained variations of $\pm 10\%$ (voltage and frequency) with no damage to driver;
 - .2 Output regulated to $\pm 5\%$ across load range;
 - .3 Power factor greater than 0.90;
 - .4 Total harmonic distortion less than 20%;
 - .5 Class A sound rating;
 - .6 Comply with ANSI C62.41 Category A for transient protection.
 - .4 Acceptable manufacturers to be as recommended by luminaire manufacturers.

2.3 LIGHTING POLES

- .1 Steel poles: Contractor is to re-use existing poles.
- .2 Temporary wood poles: as per drawings.

3.0 EXECUTION

3.1 INSTALLATION

- .1 Install poles true and plumb in accordance with manufacturer's instructions.
- .2 Install temporary luminaires on pole. Re-install permanent lamps on permanent (if required).
- .3 Check luminaire orientation, level and tilt.
- .4 Connect luminaire to lighting circuit.
- .5 Provide luminaires as required. Install products in accordance with manufacturer's instructions to suit specific installation requirements.
- .6 Before placing luminaire orders:
 - .1 verify quantity requirements;

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- .2 thoroughly review ceiling types, finishes and construction details; verify ceiling types with latest Architectural Drawings; order luminaires to suit correct ceiling type;
 - .3 ensure that required mounting assemblies, frames, rings and similar features are included;
 - .4 confirm colours and finishes with Parks Canada Representative.
 - .7 Include for assembly and mounting of luminaires and lamps, complete with:
 - .1 wiring and connections;
 - .2 fittings and hangers;
 - .3 aligners;
 - .4 box covers;
 - .5 other accessories required for a complete, safe and fully operational assembly.
 - .8 Where outlet boxes locations are shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
 - .9 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.
 - .10 Support luminaires directly by ceiling structure and not to formed ceiling hangers, ductwork, piping, cable trays, etc.
 - .11 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.
 - .12 Use cloth gloves when handling reflector cones, louvers, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
 - .13 Coordinate luminaire installation with work of other trades to ensure that necessary recessing depths and mounting spaces are provided.
 - .14 Install luminaires in accordance with applicable architectural drawing reflected ceiling plans and/or wall elevations and/or field instructions issued by Parks Canada Representative. Confirm luminaire locations prior to roughing-in. In equipment rooms, shafts and similar secondary areas, install luminaires after mechanical and other major work is roughed in and adjust luminaire locations as required.
 - .15 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to lamps specified.
 - .16 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.
 - .17 Connect luminaires to power circuits and controls as required. Refer to drawings notes and schedules.

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- .18 Notify Parks Canada Representative immediately and relocate if necessary as directed by Parks Canada Representative, if:
 - .1 fixture placement is in conflict with a structural beam, mechanical duct, plumbing pipe, etc.;
 - .2 space above ceiling is not sufficient;
 - .3 any reason that a fixture cannot be located where it is dimensioned or shown on construction documents.
 - .19 Provide seismic restraints to suspended luminaires, in accordance with latest local governing building code requirements.
 - .20 Ground and bond luminaires as per local governing electrical code requirements.
 - .21 Prior to turn over of Work to Parks Canada, clean luminaires in manner recommended by manufacturer and to satisfaction of Parks Canada Representative.
 - .22 Lamps to be new and intact when project is complete and ready for acceptance.
 - .23 Include a full lamp listing in Operating and Maintenance Instruction Manuals.
 - .24 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

DIVISION 31
EARTHWORK

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C127-04, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - .2 ASTM D698-00a1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
 - .3 ASTM D1557-02e1, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
 - .4 ASTM D4253-00, 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 $D = D1 \times D2 / (F1 \times D2) + (F2 \times D1)$
 - .2 $D = (F1 \times D1) + (0.9 \times D2 \times F2)$
 - .3 Where: D = corrected maximum dry density kg/m³.
 - .1 F1 = fraction (decimal) of total field sample passing 19 4.75 mm sieve
 - .2 F2 = fraction (decimal) of total field sample retained on 19 4.75 mm sieve (equal to 1.00 - F1)
 - .3 D1 = maximum dry density, kg/m³ of material passing 19 4.75 mm sieve determined in accordance with Method A C of ASTM D698 ASTM D1557.
 - .4 D2 = bulk density, kg/m³, of material retained on 19 4.75 mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.
 - .4 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 dry method wet method when directed by Departmental Representative.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.2 SAMPLES

- .1 Submit sieve/sampling/testing analysis for approval.
- .2 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Allow continual sampling by Departmental Representative during production.
- .4 Provide Departmental Representative with access to source and processed material for sampling.
- .5 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.
- .6 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .7 Provide water, electric power and propane to Contractor laboratory trailer at production site.

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, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand
 - .2 Manufactured sand
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .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

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least four (4) weeks prior to commencing production.
- .2 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Departmental Representative four (4) weeks 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.

Part 3 Execution

3.1 PREPARATION

- .1 Handling
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 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 forty-eight (48) hours of rejection.

- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.5 m for coarse aggregate and base course materials
 - .2 Max 1.5 m for fine aggregate and sub-base materials
 - .3 Max 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.

3.2 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.
- .3 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Alberta Environmental Protection
 - .1 Storm Water Management Guidelines for the Province of Alberta, 1999.
- .2 Canada National Parks Act.
- .3 Canadian Environmental Assessment Act.

1.2 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3 Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5 Grubbing consists of excavation and disposal of stumps and roots to not less than specified depth below existing ground surface.
- .6 All clearing and grubbing to be done according to the Canadian Environmental Assessment Act and Canada National Parks Act as well. Where the above Acts and this specification disagrees, the above Acts will govern.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Samples:
 - .1 Submit 3 samples of each material listed below for approval prior to delivery of materials to project site.
 - .2 Tree wound paint: one litre can with manufacturer's label.
- .3 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Safety Requirements: worker protection.
 - .1 Workers must wear gloves, eye protection and protective clothing.
 - .2 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

1.5 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, bench marks, existing buildings, utility lines, root systems of trees which are to remain.
 - .1 Repair damaged items to approval of the Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by the Departmental Representative.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
 - .1 Stockpile adjacent to site.

Part 2 Products

2.1 MATERIALS

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reused.

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 PREPARATION

- .1 Inspect site and verify with the Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify the Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify the Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

- .1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.4 CLEARING

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Clear as directed by the Departmental Representative, by cutting at height of not more than 300mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 300mm above ground surface.
- .3 Cut off unsound branches on trees designated to remain as directed by the Departmental Representative.
- .4 Do not cut Douglas Fir trees for any reason whatsoever.

3.5 CLOSE CUT CLEARING

- .1 Close cut clearing to ground level.

3.6 ISOLATED TREES

- .1 Cut off isolated trees as directed by the Departmental Representative at height of not more than 300mm above ground surface.
- .2 Grub out isolated tree stumps.

3.7 UNDERBRUSH CLEARING

- .1 Clear underbrush from areas as indicated at ground level.

3.8 GRUBBING

- .1 Remove and dispose of roots larger than 5cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300mm in greatest dimension, but less than 0.25m³.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.9 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site and as designated by Departmental Representative.
- .2 Cleared Trees shall be mulched and delivered to Lake Louise Waste Water Treatment Plant (WWTP) between the hours of 9am and 4pm. The Contractor must attend a site orientation with WWTP Operations staff prior to stockpiling. Stockpiled timber becomes property of Parks Canada.

3.10 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations to approval of the Departmental Representative.

3.11 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 Alberta Environmental Protection
- .1 Storm Water Management Guidelines for the Province of Alberta, 1999.
- .2 Canada National Parks Act.
- .3 Canadian Environmental Assessment Act.

1.2 EXISTING CONDITIONS

- .1 Refer to Geotechnical Report in Appendix “A” for site details.

Part 2 Products

2.1 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 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 Ensure that procedures are conducted in accordance with applicable Parks Canada, Municipal and other Federal 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 outside the park.
- .5 Remove brush from targeted area by non-chemical means and dispose outside the park.

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- .6 Strip topsoil to depths as directed by the Departmental Representative.
 - .1 Avoid mixing topsoil with subsoil.
 - .7 Pile topsoil in berms in locations as directed by the Departmental Representative.
 - .1 Stockpile height not to exceed 2.5 m.
 - .8 Stripped topsoil shall not be destroyed.
 - .9 All stockpiled soil must be salvaged for re-use.
 - .10 Dispose of unused topsoil off-site as directed by Departmental Representative.
 - .11 Protect stockpiles from contamination and compaction.
 - .12 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.
 - .13 All topsoil imported from outside of the campground has to be approved by the Environmental Department. Supply a sample as per Section 01 33 00 to be approved by Parks Canada.

3.3 PREPARATION OF GRADE

- .1 Verify that grades are correct and notify the Departmental Representative if discrepancies occur. Do not begin work until instructed by the 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 the Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 150mm, 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 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 American Society for Testing and Materials (ASTM)
 - .1 ASTM D698-00a¹, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).

1.2 EXISTING CONDITIONS

- .1 Visit the site and note all characteristics and irregularities affecting the work of this section.
- .2 Refer to dewatering in Section 31 23 33 - Excavating Trenching and Backfilling.

1.3 PROTECTION

- .1 Protect and/or transplant existing fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by the Parks Canada Representative. If damaged, restore to original or better condition unless directed otherwise.

Part 2 Products

2.1 MATERIALS

- .1 Fill material: Excavated material - Type 3 in accordance with of Section 31 23 33 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
 - .1 100 mm for grassed areas.
 - .2 Bottom of subgrade for roads.
- .3 Slope rough grade away from lift station, storage tanks, parking pad and access road at 2.00% minimum.
- .4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .5 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove and dispose of soil contaminated with calcium chloride, toxic materials and petroleum products as per applicable guidelines and standards. Remove debris which protrudes more than 75 mm above surface.

- .6 Compact filled and disturbed areas to corrected maximum dry density, as follows:
 - .1 95% under landscaped areas.
 - .2 98 % under paved and gravel areas.
 - .3 98% under the landscape islands
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM D698-00a, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).

1.2 DEFINITIONS

- .1 Reshaping subgrade: scarifying, pulverizing, blading, reshaping and recompacting existing subgrade surface.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 SCARIFYING AND RESHAPING

- .1 Scarify subgrade to full width as indicated and to minimum depth of 150 mm.
- .2 Pulverize and break down scarified material to 150 mm maximum soil clod size, except that stones larger than this size may be left intact as directed by Departmental Representative.
- .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. Blade excess material over shoulder and trim.

3.2 COMPACTING

- .1 Compact to density not less than 100% corrected maximum dry density in accordance with ASTM D698.
- .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 a value not greater than 98% moisture above optimum value for compaction in accordance with ASTM D698.

3.3 SITE TOLERANCES

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

3.4 PROTECTION

- .1 Maintain reshaped surface in condition conforming to this section until succeeding material is applied or until Departmental Representative's acceptance.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117-03, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-632002, Standard Test Method for Particle Size Analysis of Soils.
 - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600 kN-m/m³.
 - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 2,700 kN-m/m³.
 - .6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CAN/CSA-A23.1/A23.2-00 (August 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: any solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. 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 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .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 approved by Parks Canada to meet requirements of fill areas. Submit material samples to Departmental Representative for testing and approval.

- .6 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials.
 - .3 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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 clearance record from utility authority location plan of relocated and abandoned services, as required
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures
 - .2 Complete quality control testing in accordance with Section 01 45 00 – Quality Control.

1.4 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where a qualified Professional Engineer is an employee of the Contractor, submit proof that Work by the Engineer is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified Professional Engineer registered or licensed in Province of Alberta, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified Professional Engineer who is registered or licensed in Province of Alberta, Canada in which Work is to be carried out to design and inspect shoring, bracing and underpinning required for Work.
- .7 Do not use soil material until written report of soil test results are reviewed by Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection:

-
- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
 - .2 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Confirm locations of buried utilities by careful soil hydrovac methods.
 - .3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
 - .4 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .5 Record location of maintained, re-routed and abandoned underground lines.
 - .6 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, 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.
 - .2 Construction/Demolition Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - .3 Place materials defined as hazardous or toxic in designated containers.
 - .4 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
 - .5 Ensure emptied containers are sealed and stored safely.

1.6 EXISTING CONDITIONS

- .1 Refer to Geotechnical Report in Appendix "A" for site details.

Part 2 Products

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within the following limits:

Sieve Designation	% Passing		
	Type 1	Type 2	Type 4
75 mm	-	100	
50 mm	-	-	
37.5 mm	-	-	
25 mm	100	-	
19 mm	75-100	-	
12.5 mm	-	-	
9.5 mm	50-100	-	100
4.75 mm	30-70	22-85	90-100
2.00 mm	20-45	-	
0.425 mm	10-25	5-30	
0.180 mm	-	-	20
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 200 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Type 4 fill: clean sand, or free draining granular fill, free from clay, friable materials, and other deleterious materials.

Part 3 Execution

3.1 SITE PREPARATION

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

3.2 SOIL STRIPPING AND STOCKPILING

- .1 Perform in accordance with Section 31 14 13 – Soil Stripping and Stockpiling.

3.3 SHORING AND BRACING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with the Health and Safety Act for the Province of Alberta.
- .2 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.

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- .3 When sheeting is required to remain in place, cut off tops at elevations as indicated by the Departmental Representative.
 - .4 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as indicated and as directed by Departmental Representative.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative's review 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 accordance with Section 01 35 43 - Environmental Procedures to approved collection areas and 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.

3.5 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken. Provide schedule of excavation to Departmental Representative.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Dispose of surplus and unsuitable excavated material off site, as directed by the Departmental Representative.
- .5 Do not obstruct flow of surface drainage or natural watercourses.
- .6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .7 Notify Departmental Representative when bottom of excavation is reached.
- .8 Obtain Departmental Representative approval of completed excavation.

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- .9 Correct unauthorized over excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 98% of corrected Standard Proctor maximum dry density.
 - .10 Hand trim, make firm and remove loose material and debris from excavations.
 - .11 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .12 Open trenches shall not be more than 30 m in length.
 - .1 Open trenches shall be fenced overnight for public and wildlife protection.

3.6 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.
- .2 Exterior side of pre-cast concrete storage tanks: use Type 4 fill within 450 mm from wall and Type 3 fill to sub-grade level. Do not compact soil adjacent to the pre-cast concrete storage tanks.
 - .1 Under exterior concrete slabs and aprons: provide 150mm compacted thickness base course of Type 1 fill topped with 50 mm Type 4 fill to underside of slab. Compact base course to 100%.
 - .2 Under exterior pre-cast concrete storage tank: provide 150mm compacted thickness base course of Type 1 fill.

3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved of construction below finish grade.
 - .2 Inspection, testing, approval, and recording location of underground utilities.
 - .3 Removal of concrete formwork.
 - .4 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 250mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Install drainage system in backfill as indicated.

3.8 TESTING

- .1 The following shall be the minimum acceptable standard for backfill testing:

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- .1 Tests are taken within 24 hours of the backfill being placed in the trench or cut. Reports indicate date when the backfill was placed and testing completed.
 - .2 Soil density and moisture content tests are taken on each 150mm of depth for a maximum of 75 meters of trench length or as directed by the Departmental Representative.
 - .3 Tests shall be so distributed that they are representative of the entire area of the backfill operations.
- .2 Trenches shall be tested from pipe zone to finished sub-grade.
 - .3 Such tests are taken adjacent to the wet well, storage tanks, manholes and valves from pipe zone to finished sub-grade.

3.9 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 Rebuild damaged road sections to drawing detail prior to execution of Work. Edges of asphalt on damaged roads are to be saw cut prior to remediation.
- .5 Clean and reinstate areas affected by Work as directed by Departmental Representative.

3.10 TRENCH SETTLEMENT DURING WARRANTY PERIOD

- .1 During the warranty period, the Contractor shall replace material and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls.
- .2 Trenches in which backfill settles shall be refilled with the specified backfill material. Paved surfaces that are adjacent to trenches or on trench backfill, which fail during the period, shall be replaced or repaired in an approved manner.
- .3 Replacement or materials and rectification of failures that occur as a result of settlement of trench backfill or collapse of trench walls is entirely the responsibility of the Contractor and such repairs work shall be done at the Contractor's expense.

END OF SECTION

DIVISION 32
EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.1 REGULATORY REQUIREMENTS

- .1 Provide **Department Representative** with copies of permits and licenses required by regulatory authorities, including applicator's current chemical license number.

1.2 REFERENCE STANDARDS

- .1 Pruning methods: Pruning Manual, 1984 Edition, by APWSS.
- .2 Alberta horticultural Guide: Alberta Agriculture Agdex 200/01.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store fertilizer and seed in waterproof bags showing mass, analysis and name of manufacturer.
- .2 Provide storage space for material and equipment at location approved by **Department Representative**.

1.4 DAMAGE TO PROPERTY

- .1 The landscaper shall repair and pay for damages caused by **Contractor's** personnel and equipment during the term of the Contract.
- .2 The **Contractor** shall report damages immediately to the **Department Representative**.
- .3 Obtain approval by **Department Representative** for repairs and replacements. Return grass areas, plant materials, equipment and buildings to their original condition prior to damage. Scalping of turf and mechanical damage to trees including tearing of bark shall be considered damage.
- .4 Complete repairs and replacements within seven days from date of approval given for repair or replacement.

1.5 MAINTENANCE PERIOD

- .1 Maintain all material planted from the time of installation until the issuance of the Final Acceptance Certificate or as otherwise defined in the General Conditions of the Contract.
- .2 The Contractor shall note that the maintenance period for which separate payment for Maintenance shall be made, will commence only following the issuance of Construction Completion Certificates for the work of this contract. Maintenance of the site and all plant material from the time of installation and until the issuance of certificates of substantial completion shall be the responsibility of the Contractor and shall be incidental to the work of the contract.
- .3 Maintenance shall include all measures necessary to establish and maintain plant materials in a vigorous, healthy, growing condition as determined by the Department Representative.
- .4 Maintain all plant and tree accessories, such as tree wrappings, tree guys, stakes, turnbuckles, rodent protection, flagging, etc. from time of installation until end of guarantee period.

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- .5 Adjust turnbuckles to keep guys taut at all times. Repair or replace accessories when necessary.
 - .6 At time of final inspection, all plants and trees shall be completely free of diseases and/or insect infestations. All planting beds and tree saucers shall be freshly cultivated, free of weeds, free of debris, wood mulch shall be topped up as specified. All vegetation must show new growth but sucker or water spout growth will not be accepted as new growth.
 - .7 Following the final inspection but as a condition of the issuance of Final Acceptance Certificate by the Department Representative, all tree stakes guys and accessories shall be removed.

1.6 HOURS OF WORK

- .1 Perform maintenance work during regular working hours of 07:30 to 21:30, Monday to Friday.
- .2 Obtain **Department Representative's** approval to undertake maintenance outside of regular working hours.
- .3 The **Contractor** shall provide **Department Representative** with a weekly maintenance schedule upon acceptance of exterior landscape works and prior to commencement of landscape maintenance. Include in Schedule: detail of all maintenance activities, areas in which activities will occur and approximate time for start –up and completion of activity.
- .4 The **Contractor** shall provide **Department Representative** minimum three days notification of intent to spray for weed and insect control.

1.7 MAINTENANCE LOG

- .1 A maintenance log shall be kept throughout the contract.
- .2 Submit log to **Department Representative** with submission of progress claim.
- .3 Include in Log: detail of all maintenance activities, areas in which activities were carried out and approximate time for start –up and completion of activity.
- .4 Detail applications of chemicals in Log. Include target weed or insect, mode/type/application rate of chemical and date/time/weather conditions. Also, document success of application on the target weed or insect.

1.8 ACCEPTANCE

- .1 Upon completion of specified Maintenance Period, notify **Department Representative** and arrange for inspection.
- .2 Plant pits and beds shall be freshly cultivated, free of weeds, leaves, broken branches and rubbish, in neat and tidy condition.
- .3 Plants shall be alive and healthy and in satisfactory growing condition.
- .4 Project shall be turned over to **Department Representative** after written notification of acceptance of completion of all specified maintenance requirements.

PART 2 PRODUCTS

2.1 FERTILIZER

- .1 Do not use "Weed and Feed" fertilizer.
- .2 Fertilizer shall be standard commercial grade with guaranteed chemical analysis.
- .3 Fertilizer shall be water soluble granular type.
- .4 Soil Supplements: According to results of soils test.

2.2 PEST AND DISEASE CONTROL

- .1 Chemicals: All chemical types for weed and insect control to be approved by **Parks Canada Agency** prior to use and acceptable to the **Department Representative**.

PART 3 EXECUTION

3.1 GENERAL WORKMANSHIP

- .1 Schedule timing of operations to growth, weather conditions and use of site.
- .2 Do each operation continuously and complete within time period indicated on schedule.
- .3 Provide equipment and material necessary for maintenance to acceptable horticultural standards.
- .4 Co-ordinate all maintenance practices with **Department Representative**. Maintenance schedules may be altered to deal with site activities of the **Department Representative**.
- .5 Collect and dispose of excess material and debris to municipal disposal site as required. Disposal site to be approved by **Department Representative**.

3.2 SPRING CLEAN-UP

- .1 Complete spring clean-up as soon as working conditions are favourable and must be completed by May 15th
- .2 Collect and dispose of sand, gravel, salt and debris accumulated during winter months and dispose of at approved Parks disposal site.
- .3 All turf areas to be raked to remove dead vegetation, leaves and debris. Areas of snow mould to be raked as directed by **Department Representative**. All turf areas lifted due to frost action to be lightly rolled as directed by **Department Representative**.
- .4 All planting beds to be cleaned of debris and dead plant material. Loosen and lightly cultivate soil without disturbing roots and permanent plantings.
- .5 Remove and dispose of protective coverings and mulch used in winter protection

3.3 FERTILIZER AND WATERING

- .1 Fertilizer
 - .1 Coniferous Plant Material
 - 1 Fertilizer content requirements:
30% Total Nitrogen

10% Available Phosphoric Acid

10% Potash

- 2 Apply according to manufacturer's instruction.
- 3 Application rates to be approved by **Department Representative** prior to application
- 4 Apply RX30, Muracid as per manufacturer's recommendations.

.2 Deciduous Plant Material

- 1 Fertilizer shall be slow release coated fertilizer (Apex, Nutraccoat, Osmicoat) with a release period of 3-4 months.
- 2 Fertilizer content requirements:
 - 21% Total Nitrogen
 - 5% Available Phosphoric Acid
 - 6% Potash

.2 Watering:

- .1 Areas not equipped with underground irrigation systems: supply labour, hoses and sprinkler equipment necessary to provide adequate watering.
- .2 Areas where water is supplied by **Contractor**: Supply labour, water truck, pumps, portable sprinkler systems and water necessary to provide adequate watering.
- .3 Apply watering minimum once per week as approved by **Department Representative**. Each application to obtain moisture penetration of 75mm.

3.4 TURF MAINTENANCE

.1 Topdressing and Reseeding

- .1 Spread topsoil, filling in all low and eroded areas and bare spots.
- .2 Overseed areas with seed mixture as specified in section 32 92 22. Seed at a rate of 3 kg/100 m².

.2 Fertilizing

- .1 Use only mechanical equipment suited to the purpose. Check calibration of spreader to ensure that specified rate is used.
- .2 Apply 11-51-0 fertilizer at a rate of 3 kg/100m², in early spring as soon as frost is out of the ground prior to May 31st.
- .3 Apply 16-20-0 fertilizer at a rate of 3 kg/100m² during the last two weeks of August.

.3 Watering

- .1 Keep all plants well watered from time of planting until acceptance.
- .2 Water all turf areas within the MR parcels seeded with Urban B seed mix. Supply labour, hoses and equipment necessary to provide adequate watering and moisture penetration of 50 mm.

.4 Mowing – Maintained Areas:

- .1 Mow and maintain turf areas within the MR parcels seeded with Urban B seed mix.
- .2 Cut once per week following establishment.
- .3 Remove clippings from pathway.

- .4 If growth of turf has exceed 60 mm, raise mower blades so that not more than 30% of grass blade will be cut at one time.
- .5 The Department Representative shall be the “Sole Judge” for variations in mowing operations during dry or wet weather.
- .6 Edge along pathway surface once monthly during the growing season.

3.5 TREE AND SHRUB MAINTENANCE

- .1 Planting Beds
 - .1 Add approved mulch to ensure consistent 100mm depth throughout.
 - .2 Remove weeds every two weeks including entire root system.
 - .3 Do not damage plant roots during maintenance operations.
 - .4 Collect and dispose of paper, refuse and dead plants.
- .2 Pruning
 - .1 Obtain pruning Manual from APWSS.
 - .2 Prune, when required or directed in accordance with manual
- .5 Fertilizer
 - .3 Fertilizer type and application to be based on spring tree and shrub condition assessment and approved by **Department Representative** prior to application.
- .6 Watering
 - .4 Test moisture levels with moisture meter for individual tree and shrub species and provide adequate water supply

3.6 WEED, INSECT AND DISEASE CONTROL

- .1 General Conditions
 - .5 Ensure proper, positive identification of infestations and consult with **Department Representative** before taking corrective action.
 - .6 Determine all susceptibility of subject and adjacent plant material to damage from corrective action prior to undertaking.
 - .7 Ensure application equipment is clean and free from any residue of prior chemical applications not related to current control measures being undertaken.
 - .8 All corrective chemicals to be Organic based and Bio-degradable (such as Horticultural Vinegar) unless otherwise approved by **Department Representative**.
 - .9 All disease, weed and pest control to adhere to Provincial Chemical Application Regulations for specific chemicals if required. **Department Representative** to be notified minimum of three days prior to any corrective measures being undertaken.
 - .10 Prepare and apply chemicals according to manufacturer’s specifications, minimize drift at all times.
 - .11 Carry out corrective measures with due regard to climatic conditions, effect on surrounding context including building and plants and occupants of school and adjacent buildings.
 - .12 Spray application is not permitted.
- .2 Weed Control
 - .13 Eradicate weeds in areas of driveways, walkways, fences, storage compounds, and parking lots within the site boundary. Weeds to be hand pulled.
- .3 Insect and Disease Control

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- .14 Inspect grassed areas and plants weekly for insect and disease infestations. Apply corrective measures as approved by **Department Representative** and **Parks Canada Agency**.
 - .15 Any damage caused by application of corrective measures to be repaired at no cost to the **Department Representative**.
 - .16 Effectiveness of treatment to be assessed by **Department Representative** and **Parks Canada Agency**.

3.7 AUTUMN PREPARATION

- .1 Rake leaves from site and use on tree and shrub planting beds as winter protection.
- .2 Deep water trees and shrubs between October 1 to 15th.

3.8 CLEANLINESS OF GROUNDS

- .1 Grounds to be kept in a neat and tidy condition throughout the specified Maintenance Period.
- .2 Garbage Containers to be emptied weekly and garbage disposed of at approved municipal disposal site.
- .3 Clean hard surface areas, walkways and driveways as required, minimum once per week.
- .4 Any and all vandalism to be reported to **Department Representative** and **Parks Canada Agency** immediately.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D422-63 (1998), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .6 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/m³).
 - .7 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
 - .8 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

Part 2 Products

2.1 MATERIALS

- .1 Pit Run Gravel: River sand and gravel free from silt, clay, loam, friable or soluble materials, vegetative matter and conforming to the following grading:
 - .1 Gradation to be within the following limits when tested to ASTM C136-06 and ASTM C117-04 and giving a smooth curve without sharp breaks when plotted on a semi-log chart.

Sieve Sizes (Square Openings)	Percent Passing by Weight
200 mm	100 of Total Sample
150 mm	96 – 100 of Total Sample
75 mm	60 – 80 of Total Sample
25 mm	70 – 100 of Material Passing 75 mm Sieve
4.75 mm	25 – 63 of Material passing 75 mm Sieve
1.18 mm	14 – 41 of Material Passing 75 mm Sieve
0.6 mm	7 – 30 of Material Passing 75 mm Sieve
0.15 mm	3 – 18 of Material Passing 75 mm Sieve

	0.075 mm	2 – 9 of Material Passing 75 mm Sieve
.2	Any grading variation from the above is at the discretion of the Departmental Representative, however, the percent of material passing 0.075 mm sieve shall not exceed 2/3 of the material passing the 0.6 mm sieve.	
.3	The pit run gravel shall be free from any form of coating.	
.4	Pit run gravel containing clay, loam or other deleterious materials will be rejected.	
.5	No oversize material is tolerated.	

Part 3

Execution

3.1

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 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) 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.

3.2

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.

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- .4 Compact to density of not less than 98% corrected maximum dry density in accordance with ASTM D698 and ASTM D1557.
 - .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.

3.3 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 maximum.
- .2 Obtain approval from Departmental Representative to use non-standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated. If 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 sub-base and subgrade material to depth and extent as directed by Departmental Representative.
 - .2 Backfill excavated subgrade with common 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.

3.4 SITE TOLERANCES

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

3.5 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 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D140-01, Standard Practice for Sampling Bituminous Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.2 QUALITY ASSURANCE

- .1 Upon request by Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this section.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with ASTM D140.
- .2 Provide, maintain and restore asphalt storage area.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused asphalt from landfill to facility capable of recycling materials.

Part 2 Products

2.1 MATERIALS

- .1 Anionic emulsified asphalt: to CAN/CGSB-16.2, grade: SS-1.
- .2 Water: clean, potable, free from foreign matter.

Part 3 Execution

3.1 APPLICATION

- .1 Obtain Departmental Representative approval of surface before applying asphalt tack coat.
- .2 Apply asphalt tack coat only on clean and dry surface.
- .3 Dilute asphalt emulsion with water at 1: 1 ratio for application.
 - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .4 Apply asphalt tack coat evenly to pavement surface at rate as directed by Departmental Representative, between 0.20 and 0.40 L/m² but not to exceed 0.5 L/m².

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- .5 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
 - .6 Do not apply asphalt tack coat when air temperature is less than 5 degrees C or when rain is forecast within 2 hours of application.
 - .7 Apply asphalt tack coat only on unfrozen surface.
 - .8 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
 - .9 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
 - .10 Keep traffic off tacked areas until asphalt tack coat has set.
 - .11 Re-tack contaminated or disturbed areas as directed by Departmental Representative.
 - .12 Permit asphalt tack coat to set before placing asphalt pavement.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D140-01, Standard Practice for Sampling Bituminous Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.2-M89, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.2 QUALITY ASSURANCE

- .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section in accordance with Section 01 33 00 - Submittal Procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials to ASTM D140.
- .2 Provide, maintain and restore asphalt storage area.

Part 2 Products

2.1 MATERIAL

- .1 Asphalt material: CAN/CGSB-16.2 grade: SS-1.
- .2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.
- .3 Water: clean, potable, free from foreign matter.

Part 3 Execution

3.1 APPLICATION

- .1 Obtain Departmental Representative's approval of granular base surface before applying asphalt prime.
- .2 Cutback asphalt:
 - .1 Heat asphalt prime to between 121 and 163 degrees C for pumping and spraying.
 - .2 Apply asphalt prime to granular base at rate as directed by Departmental Representative, between 0.20 and 0.50 L/m² but not to exceed 2 L/m².
 - .3 Apply on dry surface unless otherwise directed by Departmental Representative.
- .3 Anionic emulsified asphalt:
 - .1 Dilute asphalt emulsion with clean water at 2 parts SS-1 emulsion to 1 part water.

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- .2 Mix thoroughly by pumping or other method approved by Departmental Representative.
 - .3 Apply diluted asphalt emulsion at rate directed by Departmental Representative, between 0.27 and 0.45 L/m² but do not exceed 2 L/m².
 - .4 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.
 - .4 Apply asphalt prime only on unfrozen surface.
 - .5 Do not apply prime when air temperature is less than 5 degrees C or when rain is forecast within two (2) hours.
 - .6 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt prime material.
 - .7 Where traffic is to be maintained, treat no more than one-half width of surface in one application.
 - .8 Prevent overlap at junction of applications.
 - .9 Do not prime surfaces that will be visible when paving is complete.
 - .10 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.
 - .11 Keep traffic off primed areas until asphalt prime has cured/set.
 - .12 Permit prime to cure/set before placing asphalt paving.

3.2 USE OF SAND BLOTTER

- .1 If asphalt prime fails to penetrate within 24 hours, spread sand blotter material in amounts required to absorb excess material.
- .2 Allow sufficient time for excess prime to be absorbed as directed by the Departmental Representative.
- .3 Apply second application of sand blotter as required.
- .4 Sweep and remove excess blotter material.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 This section specifies the requirements for construction of all roadwork and asphalt patching required under this contract.

1.2 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320 - Current Edition, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29- Current Edition, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245- Current Edition, Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.
- .2 Asphalt Institute (AI)
 - .1 AI MS2- Current Edition Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C123- Current Edition, Standard Test Method for Lightweight Particles in Aggregate.
 - .2 ASTM C127- Current Edition, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .3 ASTM C128- Current Edition, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .4 ASTM C131- Current Edition, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .5 ASTM C136- Current Edition, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .6 ASTM D3203- Current Edition, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .7 ASTM D4791- Current Edition, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2- Current Edition, Sieves Testing, Woven Wire, Metric.
 - .2 CAN/CGSB-16.3- Current Edition, Asphalt Cements for Road Purposes.

1.3 PRODUCT DATA

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

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- .2 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 degrees C at least 4 weeks prior to beginning Work.
 - .3 Submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.
 - .4 The Contractor shall submit to the Departmental Representative, at least 7 working days prior to the commencement of field paving, a proposed job mix formula in writing for the asphalt mixture to be supplied.
 - .5 The job mix formula so submitted shall list the following information:
 - .1 The sieve analysis of the combined aggregate in the mix.
 - .2 The sieve analysis of aggregate in each bin separation to be used.
 - .3 The weight of the material to be used from each bin for one batch of mix.
 - .4 The weight of asphalt to be used in each batch.
 - .5 The mixing temperature of the asphalt as determined from the temperature-viscosity relationship for the asphalt.
 - .6 The formula shall be posted in a conspicuous place within sight of the plant operator. Any subsequent changes must be approved by the Departmental Representative in writing.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Handle all aggregate in a manner that will prevent segregation and intrusion of foreign materials.
- .2 Submit to Departmental Representative copies of freight and waybills for asphalt cement as shipments are received. Departmental Representative reserves right to check weights as material is received.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert unused asphalt to facility capable of recycling materials.

1.6 REGULATIONS

- .1 Abide by the bylaws and regulations of the Province of Alberta or Municipality in which the work is located.
- .2 Obtain permission from the Local or Highway Authority for haul routes and abide by the regulations with respect to their maintenance.

1.7 QUALITY ASSURANCE

- .1 Refer to Section 01 45 00 - Quality Control.

1.8 SITE EXAMINATION

- .1 Examine all existing structures and protect them from damage during paving operations.
- .2 Ascertain that the base course is properly compacted and prepared for placement of the surface course.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt Cement
 - .1 Asphalt cement: to CAN/CGSB-16.3, Grade 150/200, Group: A.

<u>Property</u>	<u>CGSB Specification</u>	<u>Test Method</u>
Flash Point (C.O.C.), °C	205 Minimum	ASTM D 92
Penetration at 25°C, 100 g/5 s, 0.1 mm	150 Minimum, 200 Maximum	ASTM D 5
Viscosity at 60°C, Pa.s	50 minimum	ASTM D 2171
Viscosity at 135°C, cSt	185 minimum	ASTM D 2170
Solubility in Trichloroethylene, % by Mass	99.0 minimum	ASTM D 2042
Ductility at 25°C, 5 cm/min, cm (4)	100 minimum	ASTM D 113
Thin Film Oven Test:		ASTM D 1754
% Loss in Mass	1.3 maximum	
% of Original Penetration at 25°C	40 minimum	
Ratio of Absolute Viscosity of residue to Original	4.0 maximum	

- .2 Asphalt shall be prepared by the refining of petroleum.
 - .3 Asphalt shall be uniform in character and shall not foam when heated to 177°C.
 - .4 Delivery temperature shall be between 135°C and 177°C.
- .2 Aggregates: in accordance with Section 31 05 16 - Aggregate for Earthworks and the following requirements:
 - .1 25mm Road Crush Gravel.
 - .2 Gradations: within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table

Sieve Size (mm)	Percent Passing			
	Type A	Type B	Type C	Type M
25	100			
20	95-83		100	
16	90-74	100	100-97	
12.5	80-64	100-95	95-80	100
10	72-56	95-85	85-70	100-97
5	58-40	75-60	70-55	
2.5	46-30	60-45	55-36	
1.25	40-22	45-28	45-26	
0.630	33-15	26-20	38-18	
0.315	27-10	28-15	28-12	
0.160	18-8.0	18-6.0	16-8.0	
0.080	8.0-4.0	8.0-4.0	8.0-4.0	8.0-4.0

- .4 For crushed aggregate not less than 60 percent of the material retained on the 4.75 mm sieve shall be crushed particles. The ratio of the percentage passing the 4.75 mm sieve to the ratio passing the 425 micro-m sieve shall not exceed two-thirds and preferably not less than one half.

2.2 MINIMUM QUALITY CONTROL TEST FREQUENCIES

- .1 The following frequencies of testing are the minimum required. The Contractor shall perform as many tests as are necessary to ensure that the Work conforms to the requirements of the Contract regardless of the minimum number specified.
- .1 Crushed Gravel
- .1 One sieve analysis for every 500 m3 of crushed gravel.
 - .2 One field density for every 2000 m2 of compacted layers.
- .2 Asphalt
- .1 Submit a certified laboratory analysis to the Departmental Representative for each shipment of asphalt cement.
 - .2 Provide test data (re: the temperature viscosity relationship).
 - .3 Submit one copy of results of each of the following control tests, for each class of aggregate to be used:
 - .1 Los Angeles Abrasion Test - ASTM-C 131.
 - .2 Crushed Fragments.
 - .3 Specified Gravity and Absorption ASTM-C127 and ASTM C128.
 - .4 Material passing 75 micro-m sieve - ASTM-C117.
 - .4 Combined aggregate tests shall be taken prior to the aggregate being combined with asphalt.
 - .1 Sieve analysis (ASTM-C136) will be taken daily.
 - .2 Moisture contents of dried aggregates will be taken daily.

- .5 The testing agency shall sample asphalt mixtures daily and in accordance with ASTM-D1559 method. Subject the samples to a density, air voids and an asphalt content determination.
- .6 A stability value shall be established at least once in each five days of mixing.
- .7 Density determination and air void contents will shall be taken by the Contractor's Testing Agency at a rate of one test for each layer at each site; and at least one each day during placing operations.
- .8 Nuclear density determinations will be in accordance with ASTM D2950 and one test will be taken at each paving site at a minimum.
- .9 Cores will be measured and tested to provide the following information.
 - .1 Thickness
 - .2 Asphalt content
 - .3 Density
 - .4 Sieve analysis
 - .5 Percentage air voids: ASTM-D3203

2.3 MIX DESIGN

- .1 The Contractor shall pay for and submit duplicate copies of a design mix as recommended by a testing agency employed by the Contractor. The design mix shall satisfy the following criteria based on the Standard Marshall Test Procedure (ASTM-D1559).

- .1 Compaction blows on each face of test specimens: 75.
- .2 Mixture physical properties:

<u>Property</u>	<u>Mix Type</u>			
	<u>Type A</u>	<u>Type B</u>	<u>Type C</u>	<u>Type M</u>
Marshall Stability (kN)	10 min.	8 min.	12 min.	6 min.
Marshall Flow (mm)	2.0-4.0	2.0-4.0	2.0-4.0	2.0-4.0
Air Voids (%)	4.3-4.7	3.3-3.7	3.8-4.2	2.8-3.2
VMA (%)	12 min.	14 min.	13.5min	15 min.
VFA (%)	60-70	70-80	65-80	70-85
Film Thickness(μm)	6.0 min.	7.0 min.	7.0 min.	7.0 min.
Tensile Strength Ratio (%)	70 min.	75 min.	75 min.	-

- .2 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula will be provided to Departmental Representative for review.

Part 3 Execution

3.1 PREPARATION

- .1 Apply prime coat and tack coat in accordance with Section 32 12 13.23 - Asphalt Prime Coats and Section 32 12 13.16 - Asphalt Tack Coats prior to paving.
- .2 Prior to laying mix, clean surfaces of loose and foreign material.

3.2 TRANSPORTATION OF MIX

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with limewater, soap or detergent solution, or non-petroleum based commercial product, at least daily or as required. Elevate truck bed and thoroughly drain. No excess solution to remain in truck bed.
- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.
- .4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.
- .5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.
- .6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within 10°C of the temperature specified by the Departmental Representative.

3.3 PLACING

- .1 Obtain Departmental Representative approval prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as indicated or as directed by Departmental Representative.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5 degrees C.
 - .2 When temperature of surface on which material is to be placed falls below 10 degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness as indicated.
- .5 Where possible do tapering and levelling where required in lower lifts.
- .6 Spread and strike off mixture with self-propelled mechanical finisher.

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- .1 Construct longitudinal joints and edges true to line markings. Position and operate paver to follow established line closely.
 - .2 Maintain constant head of mix in auger chamber of paver during placing.
 - .3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
 - .4 Correct irregularities in alignment left by paver by trimming directly behind machine.
 - .5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
 - .6 Do not throw surplus material on freshly screeded surfaces.
 - .7 When hand spreading is used:
 - .1 In small areas where the use of mechanical finishing equipment is not practical, the mix may be spread and finished by hand, if so directed by the Departmental Representative.
 - .2 Use approved wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .3 Distribute material uniformly. Do not broadcast material.
 - .4 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
 - .5 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .6 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.4 COMPACTING

- .1 General:
 - .1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one roller must be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.
 - .4 Use static compaction for levelling course less than 25 mm thick.
 - .5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.
 - .6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.

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- .7 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
 - .10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side. Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.
 - .11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
 - .12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
 - .2 Breakdown rolling:
 - .1 Begin breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine.
 - .4 Use only experienced roller operators.
 - .3 Intermediate rolling:
 - .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
 - .4 Finish rolling:
 - .1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks. Conduct rolling operations in close sequence.
 - .5 Density
 - .1 Minimum in place densities after second rolling shall be:
 - .1 Prior to September 1 - 96% of the laboratory design density
 - .2 After September 1 - 98% of the laboratory design density.
 - .2 Mixes that tend to move unduly under a roller and show excessive cracking shall be modified to correct this problem.

3.5 JOINTS

- .1 General:

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- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
 - .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
 - .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.
 - .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

3.6 FINISH TOLERANCES

- .1 Finish the surface smooth, uniform and true to the lines of the specified grade.
- .2 Finished asphalt surface to be within 5mm of design elevation but not uniformly high or low.
- .3 Finished asphalt surface not to have irregularities exceeding 5mm when checked with 4.5m straight edge placed in any direction.
- .4 Uneven surfaces shall be corrected by loosening the surface and adding new material or removing high areas.

3.7 SAMPLING AND TESTING FREQUENCY

- .1 A minimum of one test sample shall be taken at each road crossing requiring rehabilitation or as directed by the Departmental Representative.
- .2 Minimum Marshall Test sampling size is 10 Kg or as directed by the Departmental Representative.

3.8 THICKNESS TOLERANCE

- .1 Pavement found to be deficient in thickness by more than 13 mm shall be removed and replaced by pavement of sufficient thickness, at the Contractor's expense.

3.9 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 10 00 - Concrete Forms and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.
- .3 Section 03 30 00 - Cast-in-Place Concrete.
- .4 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .5 Section 32 11 23 – Aggregate Base Courses.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA).
 - .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.2, Boiled Linseed Oil.
 - .2 CAN/CGSB-3.3, Kerosene.
- .3 American Society for Testing and Materials (ASTM).
 - .1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).

1.3 TESTING

- .1 Testing of concrete to CAN3-A23.1 and requirements of Section 03 30 00 – Cast-in- Place Concrete.

1.4 ENVIRONMENTAL CONDITIONS

- .1 If temperature is below 5°C or if **Consultant** anticipates a temperature drop below this value within the next 24 hours, take all necessary measures to protect concrete from freezing.
- .2 Do not place concrete on frozen base.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Concrete mixes and materials: to Section 03 30 00 - Cast-in-Place Concrete, mix designed to produce a minimum compressive strength at 28 days of 32 MPa and containing 19 mm maximum size, 6 mm minimum size course aggregate, with water/cement ratio to CAN3-A23.1, Table 7 for Class C-2 exposure and 60 mm slump at time and point of deposit, air entrainment to CAN3-A23.1, Table 9.
- .2 Reinforcing steel: to Section 03 20 00 - Concrete Reinforcing.
- .3 Joint filler to Section 03 30 00 - Cast-in-Place Concrete, 20 mm preformed, non-extruding, resilient bituminous type.

- .4 Granular base: to Section 32 11 23 – Aggregate Base Courses and to Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water soluble soap.
- .6 Fill material: to Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .7 Clear, polyethylene film to ASTM C171, minimum thickness 0.10 mm.

PART 3 EXECUTION

3.1 GRADE PREPARATION

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials. Dispose of surplus and unsuitable excavated material off site.
- .3 Place fill in maximum 150 mm layers and compact to at least 95% of maximum density to ASTM D698.
- .4 Ensure that Sub Grade, Granular Sub Base and Granular Base preparation has been inspected and approved by **Consultant** before commencing work.

3.2 GRANULAR SUB BASE

- .1 Obtain **Consultant's** approval of subgrade before placing granular sub base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular sub base to at least 100% of maximum dry density to ASTM D698.

3.3 FORMING

- .1 Form vertical surfaces to full depth using forming material that will not deform under loading by plastic concrete.
- .2 Securely position forms to required lines and grades.
- .3 Coat forms with form release agent.
- .4 Obtain approval of forms before placing concrete.
- .5 Install metal fabrication as required.

3.4 CONCRETE

- .1 Obtain **Consultant's** approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Finish exposed surface to a smooth, uniform finish, free of open texturing and exposed aggregate. Do not work more mortar to the surface than required. Do not use neat cement as a dryer to facilitate finishing.
- .4 Wood float finish surface to provide no-skid texture.

- .5 Immediately after floating, give sidewalk surface uniform finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to centre line.
- .6 Provide edging as indicated with 10 mm radius edging tool.
- .7 Cure and protect concrete in accordance with CAN3-A23.1.

3.5 TOLERANCES

- .1 Finish surfaces to within 3mm in 3m as measured with 3m straightedge placed on surface.

3.6 EXPANSION AND CONTRACTION JOINTS

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 1.5 m.
- .2 Install expansion joints at intervals of 6 m.
- .3 Install expansion joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .4 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- .5 Install joint filler in expansion joints as indicated.

3.7 ISOLATION JOINTS

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Install joint filler in isolation joints as indicated.

3.8 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CAN/CSA-A23.1, to exposed finished surfaces for at least 1 day after placing.
- .2 Where polyethylene sheets are used for moist curing, place polyethylene over sufficiently hardened concrete to prevent drainage. Overlap adjacent edges 150 mm and tightly seal with sand or wood planks. Weigh sheets down to maintain close contact with concrete during the entire curing period.
- .3 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.

3.9 BACKFILL

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material approved by **Consultant**. Compact and shape to required contours as indicated or as directed by **Consultant**.

END OF SECTION

Part 1 General

1.1 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-[2005], 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.

1.2 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) (50)), and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.3 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.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.

- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 TOPSOIL

- .1 Topsoil to be stripped and salvaged during excavation and redistributed upon completion. No topsoil is to be imported onto site.
- .2 Topsoil for seeded areas and planting beds: 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 consist of a fertile, friable, natural loam, containing not less than 4% organic matter for clay loams and not less than 2% organic matter for sandy loam to a maximum of 15%, and capable of sustaining vigorous plant growth, free of rocks of 50mm in diameter and over, subsoil contamination, roots and weeds (as determined by the Departmental Representative) and having a pH ranging from 7.0 to 8.5.
 - .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 TOP SOIL TESTING AND AMENDMENTS

- .1 Contractor will arrange and pay for services of accredited testing laboratory, approved by the Departmental Representative, to perform complete soil quality analysis on imported topsoil(s). Provide adequate tests from all sources of topsoil and submit copy of analysis to Departmental Representative.
- .2 Where stockpiled topsoil exists on site, Departmental Representative will perform soil tests.
- .3 Conduct soils test on three separate soil samples, taken as directed by Departmental Representative. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing.
- .4 Testing of soil shall be done within three weeks prior to soil placement.
- .5 Testing laboratory shall be approved by Departmental Representative prior to submitting samples.
- .6 Inform approved testing laboratory that soil tests are for growing native grasses and shrubs. Analysis and recommendations from laboratory should be specific for growing native grasses and shrubs.

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- .7 Test specifically for the following: Nitrogen, Phosphorous, and Potassium. The analysis should also include measurement of percent sand, fines, (silt and clay), and organic matter to total 100%; soil pH; recommendation on quantity of lime required to achieve pH 6.5; water soluble salts; total carbon to total nitrogen ratio; total nitrogen and available levels of calcium and magnesium; and herbicide content.
 - .8 Submit to the Departmental Representative 1 copy of the soils test analysis report from the testing laboratory. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the Contractor.
 - .9 The analysis report shall include laboratory's recommendations for amendments, fertilizer and other required modifications to make the proposed growing medium meet the requirements of this specification and should clearly state the type, quantity and application procedure that is to be used.
 - .10 At the discretion of the Departmental Representative, submit up to two additional soil samples for testing at intervals outlined by the Departmental Representative. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Departmental Representative for review.
 - .11 Failure to satisfy these contractual requirements could result in the Contractor being required to remove unacceptable growing medium at their expense.

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 as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as indicated.
 - .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 3m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Departmental Representative.
- .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 as indicated to following minimum depths after settlement.

.1 100 mm for seeded areas.

.2 100 mm for sodded areas.

.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 material except topsoil not required where Departmental Representative off site.

3.8 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide product data for:
 - .1 Seed.
 - .2 Fertilizer.

1.2 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 SCHEDULING

- .1 Schedule seeding to coincide with topsoil installation work.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

Part 2 Products

2.1 GRASS SEED

- .1 Grass seed shall be certified Canada No. 1 grade to Government of Canada Seeds Regulations and having minimum germination of 75% and minimum purity of 97% and consist of:
 - .1 100%: Seed at 60kg per hectare
 - .2 40% Agrostis scabra Tickle grass.
 - .3 40% Poa palustris Fowl bluegrass.
 - .4 20% Agropyron trachycaulus var. subsecundus *Awne d wheat grass.

- .2 If Grass Seed Mixture is unavailable due to a demand shortage, a generic Western Canada Parks Seed Mixture is acceptable. Departmental Representative to approve the alternative seed mixture at the time of initial start-up meeting.

2.2 WATER

- .1 Free of impurities that would inhibit germination and growth.
- .2 Available from standpipes on site or as directed by Departmental Representative.

2.3 FERTILIZER

- .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
- .2 Complete synthetic fertilizer with guaranteed minimum analysis as specified.

Part 3 Execution

3.1 QUALITY OF WORK

- .1 Do not perform work under adverse field conditions as determined by Departmental Representative.
- .2 Remove and dispose of weeds, debris, stones 50mm in diameter and larger, soil contaminated by oil, gasoline and other deleterious materials, outside of Banff National Park, as directed by Departmental Representative.

3.2 SEED BED PREPARATION

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Fine grade surface free of humps and hollows to smooth, even grade, to contours and elevations indicated, to tolerance of plus or minus 15mm, surface to drain naturally.
- .3 Cultivate fine grade approved by Departmental Representative to 25 mm depth immediately prior to seeding.

3.3 SEED PLACEMENT

- .1 For mechanical seeding:
 - .1 Use "Brillion" type mechanical landscape seeder which accurately places seed at specified depth and rate and rolls in single operation.
 - .2 Use equipment and method acceptable to Departmental Representative.
- .2 For manual seeding:
 - .1 Use "Cyclone" type manually operated seeder.

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- .2 Use manually operated, water ballast, landscaping type, smooth steel drum roller. Ballast as directed by Departmental Representative.
 - .3 Use equipment and method acceptable to Departmental Representative.
 - .3 On cultivated surfaces, sow seed uniformly at rate of:
 - .1 1.0 kg/ 100m²
 - .4 Blend applications 150 mm into adjacent grass areas to form uniform surfaces.
 - .5 Sow half of required amount of seed in one direction and remainder at right angles as applicable.
 - .6 Incorporate seed by light raking in cross directions.
 - .7 Consolidate mechanically seeded areas by rolling area if soil conditions warrant or if directed by Departmental Representative with equipment approved by Departmental Representative immediately after seeding.

3.4 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of seed application until acceptance by Departmental Representative:
 - .1 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.
 - .2 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
 - .3 Cut grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass as directed by Departmental Representative.
 - .4 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 and water in well.
 - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

3.5 FINAL ACCEPTANCE

- .1 Seeded areas will be accepted by Departmental Representative provided that:
 - .1 Areas are uniformly established and turf is free of rutted, eroded, bare or dead spots and free of weeds.
 - .2 Areas have been cut at least twice.
 - .3 Areas have been fertilized.
- .2 Areas seeded in fall will be accepted in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.6 MAINTENANCE DURING WARRANTY PERIOD

- .1 Perform following operations from time of acceptance until end of warranty period.
 - .1 Water seeded area to maintain optimum soil moisture level for continued growth of grass. Control watering to prevent washouts.
 - .2 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
 - .3 Cut grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass as directed by Departmental Representative.
 - .4 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.
 - .5 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.

3.7 CLEANING

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

END OF SECTION

DIVISION 33

UTILITIES

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A48/A48M-03 (2016), Standard Specification for Gray Iron Castings.
 - .2 ASTM C117-04, Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C139-17, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .5 ASTM C478M-18, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .6 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
- .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 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-03 (R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CSA-A3002-03, Masonry and Mortar Cement.
 - .3 CAN/CSA-A165 Series-04, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
 - .4 CAN/CSA-G30.18-M92 (R2002), Billet Steel Bars for Concrete Reinforcement.
 - .5 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

Part 2 Products

2.1 MATERIALS

- .1 Cast-in-place concrete:
 - .1 In accordance with Section 03 30 00 - Cast-in-Place Concrete.
 - .2 Cement: to CAN/CSA-A3001, Type HS.

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- .3 Concrete mix design to produce 28 MPa minimum compressive strength at 28 days and containing 25 mm maximum size coarse aggregate, with water/cement ratio to CAN/CSA-A23.1.
 - .1 Air entrainment to CAN/CSA-A23.1, Table 8 for Class A exposure.
 - .2 Concrete reinforcement: in accordance with Section 03 20 00 - Concrete Reinforcing.
 - .3 Precast maintenance hole units: to ASTM C478M, circular.
 - .1 Top sections flat slab top type with opening offset for vertical ladder installation.
 - .2 Pre-cast concrete rings to be used for adjustment of the frame and cover.
 - .3 Maintenance hole bases
 - .1 Maintenance hole bases to be pre-benched for all pipes 450mm in diameter and smaller.
 - .4 Pre-cast catch basin sections: to ASTM C139 and ASTM C478M.
 - .5 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement, cement mortar or approved alternative.
 - .6 Mortar:
 - .1 Aggregate: Clear, sharp sand
 - .2 Masonry Cement: to CAN/CSA-A3002 or Type V to ASTM C150.
 - .7 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164, or aluminium rungs.
 - .1 Rungs to be safety pattern (drop step type).
 - .2 Ladder rungs to be cast into maintenance hole sections.
 - .8 Adjusting rings: to ASTM C478M.
 - .9 Concrete Brick: to CAN3-A165 Series.
 - .10 Drop maintenance hole pipe: same as sewer pipe, if required.
 - .11 Frames, gratings, and covers to dimensions as indicated and following requirements:
 - .1 All cast iron, cast steel and ductile iron maintenance hole components shall be coated with asphalt varnish
 - .2 All metal gratings and covers to bear evenly on frames and machined for a non-rocking fit. Frame with grating or cover to constitute one unit.
 - .3 Standard Maintenance Hole Cover
 - .1 Grey cast iron conforming to ASTM A48 (Gray Iron Castings) Class 20
 - .4 Grated Maintenance Hole Cover
 - .1 Cast steel to ASTM A148 (High Strength Steel Casting for Structural Purposes) Grade 90-60 or Ductile iron conforming to ASTM A536 (Ductile Iron Casting) Grade 60-40-18

- .5 Standard Maintenance Hole Frame – Standard and 150mm Shallow Maintenance Hole Frame
 - .1 Grey cast iron conforming to ASTM A48 (Gray Iron Castings) Class 20
- .6 150mm Shallow Maintenance Hole Frame
 - .1 Grey cast iron conforming to ASTM A48 (Gray Iron Castings) Class 20
- .7 90mm Shallow Maintenance Hole Frame and Maintenance Hole Frame Riser
 - .1 Ductile iron conforming to ASTM A536 (Ductile Iron Casting) Grade 60-40-18
- .8 Maintenance hole frames and covers: 600mm sized opening.
- .9 Catch basin frames and covers: to City of Calgary, Type C, Type K2 and or K-3.
- .10 Maintenance hole frames and covers: to be heavy duty municipal type for road service. Norwood Foundry NF-49 or approved equal.
- .12 Granular bedding and backfill: in accordance with Section 31 05 16 – Aggregates for Earthworks and following requirements:
 - .1 Crushed gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.SPEC NOTE: If Canadian metric sieve standard CAN/CGSB-8.2 is chosen use Table below and edit to suit project.
 - .3 Table:

Sieve Designation	% Passing	
	Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10

- .4 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .13 Unshrinkable fill: in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of the Departmental Representative before installing outfall structures, maintenance holes or catch basins.

3.3 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Position metal inserts in accordance with dimensions and details as indicated.

3.4 INSTALLATION FOR MAINTENANCE HOLES

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses.
- .3 Pump excavation free of standing water and remove soft and foreign material before placing concrete base.
- .4 Cast-in-place maintenance hole bases shall be constructed directly on undisturbed ground or approved backfill compacted to a minimum 95% S.P.D.
- .5 Pre-cast maintenance hole bases shall be installed on a granular bedding compacted to a minimum 95% S.P.D. The bedding shall be shaped to support the bottom of the base.
- .6 Openings made for connections into the maintenance hole barrel shall not be greater than the outer diameter of the pipe by more than 50 mm in any direction.
- .7 For connecting PVC pipe to maintenance holes, the following approved methods may be used:
 - .1 Approved maintenance hole coupling and gasket shall be placed at the pipe maintenance hole junction. Mortar shall be then place between the maintenance hole coupling and the maintenance hole barrel.

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- .2 3-O ring rubber gaskets placed around the PVC pipe. The O ring shall be of the size that when placed on the PVC pipe a snug fit is achieved between the gasket and the PVC pipe. The two outer rings shall be placed 2.5 cm away from the centre ring. All three rings shall be positioned in the opening within the maintenance hole barrel. Mortar shall then be placed between the PVC pipe and the maintenance hole barrel.
 - .8 Where the pipe enters the maintenance hole, the pipe shall be made flush with the inside of the maintenance hole barrel and the opening shall be mortared flush with the pipe and inside maintenance hole wall.
 - .9 All pre-cast sanitary sewer maintenance hole bases shall be constructed with rubber gaskets or an approved equivalent Sealant material.
 - .10 Plug lifting holes with pre-cast concrete plugs set in cement mortar or mastic compound.
 - .11 Where possible the ladder shall be oriented such that the person exiting the maintenance hole would face the traffic.
 - .12 Maintenance hole slab top, collars, and frames shall be set level and true, and shall not rock when stacked. A layer of mortar, not exceeding 1.0 cm in thickness, shall be placed between the slab top, all collar, and the frame as a bedding and leveling course.
 - .13 Place maintenance hole frame and cover on top section to elevation as indicated. All frames to be installed on a minimum of one 50mm precast concrete collar. Maximum height of collars, including mortar shall not exceed 305mm. If additional height is required, an additional maintenance hole barrel shall be installed. During setting and adjustment, collar thickness shall be maximized to reduce the number joints between collars.
 - .14 Where the height of adjustment does not permit the use of a full precast collar, or the frame must be on an angle to suit the surface grade, one of the following shall apply
 - .1 Use iron or steel wedges, brick, or a combination of wedges and bricks to support the frame. Once the correct height and grade has been confirmed, the full width of the space under the frame shall be filled with mortar, or mortar and brick, depending on the space required to be filled. The amount of mortar shall be minimized.
 - .2 Use a mechanical adjustment ring (Trojan or approved equal). The adjustment ring must be installed in accordance with the manufacturer's recommendations.
 - .15 Parge all maintenance hole joints and rings smooth.
 - .16 Bench to provide a smooth U-shaped channel. Side height of channel to be the full diameter of the sewer. Slope adjacent floor at 1 on 10. Curve channels smoothly. Slope invert to establish sewer grade.
 - .17 In all cases, the outgoing pipe shall be extended to the back wall of the maintenance hole. All other leads entering the maintenance hole shall have the pipe form the invert through the benching from the inside wall of the maintenance hole barrel to the centre line of the outgoing pipe.

3.5 INSTALLATION FOR CATCH BASINS

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses.
- .3 Pump excavation free of standing water and remove soft and foreign material before placing concrete base.
- .4 Set catch basin barrel on undisturbed soil or on a maximum of 150 mm of 25 mm course gravel thoroughly compacted.
- .5 All catch basins must have a poured concrete base slab a minimum of 100 mm thick inside the catch basin well.
- .6 Where the catch basin lead enters the catch basin well, it must be sealed with mortar and be flush with the inside face of the well.
- .7 The bottom of the well is raised with concrete so that it is flush with the invert of the catch basin lead and slopes with a minimum gradient of 10% toward the invert lead.
- .8 The catch basin benching must have a trowelled surface finish.
- .9 Catch basins placed in lanes, swales or ditches that do not have an ACP surface, shall not be benched and shall contain a sump of not less than 600 mm in depth.
- .10 Catch basin precast collars shall be smooth and level and shall not rock when stacked. Collars must be in good condition. Mortar must completely fill any spaces between collars, and the top slab and frame, in order to provide a continuous bearing surface. Mortar must be trowelled smooth with the inside of the collars, Mortar must not be applied to the inside of the collars.
- .11 Collars and bricks must be installed in vertical alignment. The chimney must maintain a round or square configuration matching the inside of the frame. Off-setting the chimney due to misalignment of the maintenance hole or catch basin barrel is not permitted.
- .12 Bonding of surfaces with mortar is required. Where it is absolutely necessary to raise frames and side inlets above the slab top in order to meet the curb and gutter grade, the adjustments shall maintain the standard vertical distance of 165 mm from the top of the side inlet to the top of the grate next to the face of curb and an allowable tolerance of 25 mm. These adjustments are made by:
 - .1 For adjustments of 12 to 25 mm the frame or inlet shall be supported by iron or steel wedges on all corners, with mortar or concrete placed in the space or gap created by the adjustment. The mortar or concrete may be placed at the time of adjustment or cast-in-place prior to placement of the frame
 - .2 For adjustments from 25 mm to 75 mm, the frame or inlet shall be adjusted by:
 - .1 using cast-in-place mortar or concrete collar placed prior to the placement of the frame

- .2 using iron wedges, brick or a combination of wedges and brick on all corners of the frame of inlet with mortar or concrete compacted in the adjusted space at the time of adjustment
- .3 using precast spacer and iron wedges with mortaring as in a) above.
- .4 using a single course of brick embedded in mortar; the brick shall be placed with the length perpendicular to the barrel.
- .3 For adjustments of 75 mm to 134 mm use the same procedures as in .4 above except that a maximum of two courses of brick laid plus wedges may also be used.
- .4 For adjustment greater than 134 mm use a catch basin ring or on top of the existing barrel.
- .13 All catch basin barrels shall be installed with three (3) - 75 mm diameter weeper holes equally spaced at 120 degrees located 400 mm below the top of the barrel. A 500 mm wide strip of non-woven geotextile fabric (minimum 200 gm/m²) shall be wrapped around the exterior of the barrel, centred on the weeper holes and overlapped at the ends a distance of 300 mm.
- .14 Backfill should be clay below and granular above the lowest weeper hole invert.
- .15 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.6 ADJUSTING TOPS OF EXISTING UNITS

- .1 Remove existing gratings and frames and store for re-use at locations designated by the Departmental Representative.
- .2 Sectional units:
 - .1 Raise or lower straight walled sectional units by adding or removing pre-cast sections as required.
- .3 Frames and Covers.
 - .1 Follow 3.4.13 or 3.5.12
- .4 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

3.7 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.

3.1 ABANDONMENT

- .1 If existing manholes must be abandoned, abandonment shall be in accordance with City of Calgary standards or as directed by the Department Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-04, Hypochlorites.
 - .2 ANSI/AWWA B303-05, Sodium Chlorite.
 - .3 ANSI/AWWA C203-02, Coal Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied. (Includes Addendum C203a-99).
 - .4 ANSI/AWWA C207-18-, Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
 - .5 ANSI/AWWA C208-07, Dimensions for Fabricated Steel Water Pipe Fittings.
 - .6 ANSI/AWWA C220-17, Stainless-Steel Pipe, 1/2 In. (13mm) and Larger
 - .7 AWWA C221-18, Fabricated Steel Mechanical Slip-Type Expansion Joints.
 - .8 ANSI/AWWA C500-02, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
 - .9 ANSI/AWWA C504-06, Rubber-Seated Butterfly Valves.
 - .10 AWWA C606-15, Grooved and Shouldered Joints.
 - .11 ANSI/AWWA C651-05, Disinfecting Water Mains.
 - .12 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .13 ANSI/AWWA C900-07, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A307-02, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .2 ASTM C117-95, Standard Test Method for Material Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C478M-97, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .5 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3)
 - .6 ASTM D2657-97, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
 - .7 ASTM F714-01, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
 - .8 NSF International Standard / American National Standards Institute / National Standard of Canada, (NSF/ANSI/CAN)

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- .9 NSF/ANSI/CAN 61-2019, Drinking Water Systems Components - Health Effects.
 - .3 American Water Works Association (AWWA)/Manual of Practice
 - .1 AWWA M17-1989, Installation, Field Testing, and Maintenance of Fire Hydrants.
 - .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
 - .2 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.
 - .5 Canadian Standards Association (CSA International)
 - .1 NSF/ANSI/CAN
 - .2 CAN/CSA-A3000-98 (April 2001), Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
 - .1 CAN/CSA-A8-98, Masonry Cement.
 - .3 CSA B137 Series-02, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CSA B137.1-02, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 - .2 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .6 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)
 - .8 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S520-1991, Hydrants.
 - .2 CAN4-S543-1984, Internal-Lug, Quick Connect Couplings for Fire Hose.

1.2 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform the Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
- .3 Pipe certification to be stamped on pipe.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.4 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to the Departmental Representative for approval and adhere to interruption schedule as approved by the Departmental Representative.
- .3 Notify the Departmental Representative minimum of 24 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

Part 2 Products

2.1 PIPE AND FITTINGS

- .1 Polyvinyl Chloride Pressure Pipe
 - .1 Blue Brute pipe shall conform to AWWA C900-07 and be certified to CSA B137.3.
 - .2 Blue Brute DR18 pipe shall have a pressure class of 1034 kPa.
 - .3 Blue Brute pipe shall be made from clean, 12454B PVC compound to ASTM resin specification D1784. Clean, reworked material generated from the manufacturers own pipe production may be used.
 - .4 Pipe shall be suitable for use at a maximum hydrostatic pressure equal to the class designation at 23oC. Laying lengths shall be 6.1 metres. Pipe shall have cast iron outside diameters. Every length must be proof tested at four times the pressure.
 - .5 Pipe shall be colour coded blue.
- .2 Polyvinyl Chloride Fittings

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- .1 Blue Brute fittings shall conform to AWWA C907-04 and be certified to CSA B137.2. They shall also be UL Listed and FM approved.
 - .3 Blue Brute fittings shall be made of PVC compound 12454B (ASTM D1794) and have a hydrostatic design basis of 27.6 MPa. The compound shall be listed with the National Sanitation Foundation.
 - .4 Fabricated fittings shall be made from segments of AWWA C900-07 Class 150 (DR18) PVC pipe bonded together and overwrapped with fibreglass reinforced polyester. The pressure ratings must match the pipe. The fittings must meet the requirements of CSA B137.3.
 - .5 All fittings assembled with non-toxic, water soluble, NSF-listed lubricant. Excess lubricant avoided. Apply at manufacturer's recommended quantities only.
 - .6 PVC fittings shall be colour coded blue.
 - .7 All cast-iron fittings shall be epoxy coated as per the City of Calgary, Current Year Specifications.
 - .8 Five-degree sweeps shall be polyvinyl chloride extruded fittings, Class 150, DR18 conforming to AWWA C900-07.
 - .9 In addition to the above PVC pipe requirements, integral PVC joint restraint pipe shall have:
 - .1 Spline locked joints in connectors or;
 - .2 Plastic pin lock joints.
 - .10 Steel pipe shall be 316 stainless steel meeting AWWA C220-17 requirements for potable water. Pipe schedule on Contract Drawings.
 - .11 All stainless steel pipe and fittings to be cleaned, pickled and passivated and flushed of all chemicals once passivation is complete. Seal ends during transit and on site to avoid contamination.
 - .12 All flanges to be Class D, AWWA C207-18 standard.

2.2 PIPE INSULATION

- .1 Pipe insulation shall be factory applied rigid polyurethane foam.
- .2 Foam insulation shall be covered with an HDPE jacket, minimum 1.90mm (75mils), UV inhibited, specially formulated for superior cold weather properties.
 - .1 For tape wrap: modified butyl rubber and resin sealant designed to adhere to foam insulation; minimum elongation, ASTM D 1000, 300% for 6 month test; tensile strength, ASTM D 1000, 6.83 kg/cm wide.
 - .2 For extruded jacket: bimodal polyethylene.
 - .3 UV inhibited with a minimum of 2% finely divided carbon black to ISO 9001-2001 Quality Management Program.

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- .3 The minimum rated pipe, foam and jacket shall be 410 kPa.
 - .4 Integral heat tape cable conduits to be installed prior to factory applied insulation. All conduits to be extruded molded and shall be checked after insulating to ensure they are free of obstruction. The ends shall be sealed prior to and during shipping to avoid contamination.
 - .5 All fittings, flanges and other appurtenances shall be covered in with equivalent depth of foam as the main pipe. Foam on fittings shall either be insulating half shells or prefabricated kits designed for the specific component. All gaps to be filled with expanding foam equivalent to the main pipe insulation. Foam shall be tape wrapped or heat shrunk to provide a continuous outer jacket equal to the main pipe.
 - .6 All anchor points shall be insulated as per insulation manufacturer recommendations.
 - .7 Bends to be thrust blocked are to be factory insulated.
 - .8 In addition to the above PVC pipe requirements, integral PVC joint restraint pipe shall have:
 - .1 Spline locked joints in connectors or;
 - .2 Plastic pin lock joints.
 - .9 Steel pipe shall be 316 stainless steel seamless meeting AWWA requirements for potable water with schedule as noted on the drawings.
 - .10 All flanges to be 150 pound AWWA C20707 standard.

2.3 PIPE INSULATION

- .1 Pipe insulation shall be factory applied rigid polyurethane foam.
- .2 Foam insulation shall be covered with an HDPE jacket, minimum 1.90mm (75mils), UV inhibited, specially formulated for superior cold weather properties.
 - .1 For tape wrap: modified butyl rubber and resin sealant designed to adhere to foam insulation; minimum elongation, ASTM D 1000, 300% for 6 month test; tensile strength, ASTM D 1000, 6.83 kg/cm wide.
 - .2 For extruded jacket: bimodal polyethylene.
 - .3 UV inhibited with a minimum of 2% finely divided carbon black to ISO 9001-2001 Quality Management Program.
- .3 The minimum rated pipe, foam and jacket shall be 410 kPa.
- .4 Integral heat tape cable conduits to be installed prior to factory applied insulation. All conduits to be extruded molded and shall be checked after insulating to ensure they are free of obstruction. The ends shall be sealed prior to and during shipping to avoid contamination.
- .5 All fittings, flanges and other appurtenances shall be covered in with equivalent depth of foam as the main pipe. Foam on fittings shall either be insulating half shells or

prefabricated kits designed for the specific component. All gaps to be filled with expanding foam equivalent to the main pipe insulation. Foam shall be tape wrapped or heat shrunk to provide a continuous outer jacket equal to the main pipe.

- .6 All anchor points shall be insulated with prefabricated kits.
- .7 Bends to be thrust blocked are to be factory insulated.

2.4 VALVES AND VALVE BOXES

- .1 Gate valves: to AWWA C500-02, standard body, bronze mounted wedge valves with non-rising stems, suitable for 1.4 MPa (200 psi) for valves 300mm and smaller or 1 MPa (150 psi) for valves 400mm and larger, with push-on grooved type coupling joints, unless specified otherwise. Valves to be manufactured by Mueller or approved alternate.
- .2 Valves to open counter clockwise.
- .3 Cast iron valve boxes: adjustable over a minimum of 450 mm complete with valve operating extension rod, 30 mm minimum diameter, 25 x 25 mm cross-section, of such length that when set on valve operating nut top of rod will not be more than 150 mm below cover. Base to be large round type with a minimum diameter of 300 mm. Top of box to be marked "V" and to sit on rubber disk.
- .4 All buried boxes and irregular surfaces shall be coated with factory applied coating in accordance with City of Calgary, Current Year Specifications and have cathodic protection.
- .5 All valves shall be epoxy coated as per City of Calgary, Current Year Specifications.
- .6 Valves for isolation of air - vacuum release valves shall be manually actuated, full port ball valves, stainless steel body and component construction. Valves shall be rated NSF 61 for potable water, 1034 kPa (150 psi) minimum pressure rating.
- .7 Air - vacuum release valves shall provide full 50mm (2") port throughout the valve to NSF/ANSI 61 & 372 and AWWA C512 standards. Valve bodies shall be stainless steel 316 with EPDM diaphragm. Internal float shall be polypropylene or stainless steel. The outlet / inlet shall be fully screened. Valves shall release small amounts of air during operation, release large volumes of air during filling and admit air during vacuum conditions.
- .8 Valves for isolation of air - vacuum release valves shall be manually actuated, full port ball valves, stainless steel body and component construction. Valves shall be rated NSF 61 for potable water, 1034 kPa (150 psi) minimum pressure rating.
- .9 Air - vacuum release valves shall provide full 50mm (2") port throughout the valve to NSF/ANSI 61 & 372 and AWWA C512 standards. Valve bodies shall be stainless steel 316 with EPDM diaphragm. Internal float shall be polypropylene or stainless steel. The outlet / inlet shall be fully screened. Valves shall release small amounts of air during operation, release large volumes of air during filling and admit air during vacuum conditions.

2.5 HYDRANTS

- .1 Hydrants: shall be ULC and FM approved and conforming to AWWA C502-05. Hydrants to open counter clockwise.
- .2 Hydrants must be free draining. The hydrant drains shall be plugged if the hydrants are being installed in high groundwater table areas. Non-draining hydrants shall have top and caps painted red and be clearly marked with a disk labelled "Fire Service Only" installed on the hose port; the disk shall be installed when the hydrant is installed
- .3 All hydrants shall include:
 - .1 A 150 mm dry barrel with one 100 mm diameter "Storz" pumper connection and two 65 mm threaded hose connections at 180°
 - .2 Threaded hose connections shall be 4 tpi conforming to the Alberta Mutual Aid (AMA) standards
- .4 The exterior of the hydrant above and 300 mm below the gradeline flange shall be coated in accordance with the City of Calgary, Standard Specifications, Waterworks Construction (current year), Section 505.01.00 (Type C) in the following colours:
 - .1 Red, equal to C.I.L. #22370, Riley PM2506 or approved equal
 - .2 Black caps
 - .3 Red top
- .5 All hydrants are to be separated from the distribution system by a valve located 1.0 metre from the main.
- .6 Mueller or McAvity (Clow Brigadier M-series) unless otherwise approved by the Departmental Representative.

2.6 COUPLINGS

- .1 Bolted sleeve-type couplings shall conform to AWWA C219-06.
- .2 Couplings to be Robar couplings designed to 1 MPa working pressure.
- .3 Vulcanized rubber gaskets to ASTM D2000.
- .4 Fasteners 304 or 316 stainless steel.
- .5 Robar 1507x series or approved alternate for non-restrained application.
- .6 Couplings to provide integral cathodic protection.
- .7 Couplings without integral cathodic protection come with crimp or lug anode bond wire connections.
- .8 Expansion joints to be Blair-Smith 611 with limit rods or approved equal.

- .9 Grooved couplings to AWWA C605-15, gasket material designed for Sodium hypochlorite, calcium hypochlorite and chloramine disinfectant.

2.7 EPOXY COATING

- .1 Apply epoxy coatings in plant by manufacturer or specialized coating applicator.
- .2 Sandblast surfaces to white metal prior to coating. Do not sandblast newly cast objects if not contaminated with soil, oil, grease, etc. and if coated within four hours of casting.
- .3 Apply one of the following coatings in strict conformance to coating manufacturer's specifications:
- .1 Type A: 100% solid thermosetting, fusion bonded, dry powder, epoxy resin, to AWWA C213-01; Scotchkote 206N, 3M Scotchkote 134 or Valspar D 1003 LD. Apply to pre-heated surface by fluidized bed method or electrostatic power spray gun method to a minimum film thickness of 0.50 mm (15 mils) and a maximum film thickness of 0.64 mm (20 mils).
 - .2 Type B: one coat two component liquid Zinc Chromate Epoxy (50% min. solids) primer, Valspar 13-R-159 or Carboline 893 followed by two coats two component liquid High Build Epoxy (55% min. solids), Valspar 89 Series or Carboline 890. Minimum film thickness-primer 0.05 mm (2 mils), top coat 0.30 mm (12 mils). Maximum film thickness-primer 0.08 mm (3 mils), top coat 0.80 mm (30 mils).
 - .3 Type C: apply one coat Valspar M&F Enamel 20 Series, Carboline Admiral GP-62 Finish or Carboline 139 over Type B coating system to a minimum thickness of 0.05 mm (2 mils).
- .4 Test coating with a wet sponge holiday detector set at 7 volts. Repair all pinholes and retest. Coating to be pinhole free.
- .5 Do not exothermic cadweld bond wires to epoxy coated fittings.

2.8 PIPE ZONE MATERIALS

- .1 The pipe zone material consisting of bedding, haunching and backfill shall be clean, sound, non-compressible, free from all deleterious matter and shall conform to one of the following gradations.
- .1 Class IA – Manufactured Aggregate; open graded clean, conforming to the following gradation:

For Pipe 375mm and Smaller	For Pipe Larger than 375mm
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<u>Sieve Size</u>	<u>% Passing by Mass</u>	<u>Sieve Size</u>	<u>% Passing by Mass</u>
20.0 mm	100%	40.0 mm	100%
4.75 mm (#4)	< 10%	4.75 mm (#4)	< 10%
2.5 mm (#8)	< 5%	2.5 mm (#8)	< 5%
0.075 mm (#200)	< 5%	0.075 mm (#200)	< 5%

- .2 Class IB – Manufactured, Processed Aggregate; dense graded clean, conforming to the following gradation:

For Pipe 375mm and Smaller		For Pipe Larger than 375mm	
<u>Sieve Size</u>	<u>% Passing by Mass</u>	<u>Sieve Size</u>	<u>% Passing by Mass</u>
20.0 mm	100%	40.0 mm	100%
4.75 mm (#4)	10%-50%	4.75 mm (#4)	10%-50%
2.5 mm (#8)	< 5%	2.5 mm (#8)	< 5%
0.075 mm (#200)	< 5%	0.075 mm (#200)	< 5%

- .3 Class II – Course-Grained Soils, clean or borderline clean w/fines, conforming to the following gradation:

For Pipe 375mm and Smaller		For Pipe Larger than 375mm	
<u>Sieve Size</u>	<u>% Passing by Mass</u>	<u>Sieve Size</u>	<u>% Passing by Mass</u>
20.0 mm	100%	40.0 mm	100%
4.75 mm (#4)	Varies	4.75 mm (#4)	Varies
0.075 mm (#200)	0%-12%	0.075 mm (#200)	0%-12%

- .4 Class III – Course-Grained soils with fines, conforming to the following gradation:

For Pipe 375mm and Smaller		For Pipe Larger than 375mm	
<u>Sieve Size</u>	<u>% Passing by Mass</u>	<u>Sieve Size</u>	<u>% Passing by Mass</u>
20.0 mm	100%	40.0 mm	100%
4.75 mm (#4)	Varies	4.75 mm (#4)	Varies
0.075 mm (#200)	0%-50%	0.075 mm (#200)	0%-50%

2.9

CONCRETE

- .1 Concrete required for cradles, encasement, supports, thrust blocks shall have a compressive strength of not less than 20 MPa in 28 days.

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- .2 Concrete shall be manufactured from sulphate resistant cement Type HS (Type 50) in accordance with CSA A3001 or Type V in accordance with ASTM C150.
 - .3 Where concrete is exposed to the surface, air entrainment to CAN3-A23.1, Table 9

2.10 PIPE DISINFECTION

- .1 Sodium hypochlorite or calcium hypochlorite to AWWA B300-04 to disinfect water mains.

Part 3 Execution

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 - Excavating Trenching and Backfilling.
- .2 Do not backfill trenches until pipe grade and alignment have been checked and accepted, and test results are within limits specified.
- .3 Trench alignment and depth require the Departmental Representative's approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10- Excavating Trenching and Backfilling with compacted type 3 fill.

3.4 PIPE INSTALLATION

- .1 Lay pipes to manufacturer's standard instructions and specifications.
- .2 Join pipes in accordance with manufacturer's recommendations.

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- .3 Bevel or taper ends of PVC pipe to match fittings.
 - .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
 - .5 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3m.
 - .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .7 Unless otherwise specified, the amount of pipe deflection at joints and couplings shall not exceed with that recommended by the pipe manufacturer.
 - .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .9 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .11 Align pipes before jointing.
 - .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
 - .14 Complete each joint before laying next length of pipe.
 - .15 Minimize deflection after joint has been made.
 - .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations. Over inserted joints must be removed and re-inserted to the correct depth. Insertion depth lines to be provided on all spigot ends prior to assembly as per manufacturers recommendations.
 - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.

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- .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
 - .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
 - .20 Do not lay pipe on frozen bedding.
 - .21 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
 - .22 Backfill remainder of trench.

3.5 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of concrete located between valve and solid ground. Valves not to be supported by pipe.
- .3 Each valve shall be provided with a valve box, which shall be installed plumb and centred over the key nut of the valve. The valve box shall be set such that traffic loads are not transmitted to the valve. Valve box covers shall be set flush with the existing road surface, finished ground elevation or as otherwise designated by the Departmental Representative. Valve boxes shall provide for adjustment of the cover to a level 150 mm higher or 150 mm lower than the installed level for future adjustment of the road or ground surface. Backfill around the box shall be backfilled to prevent excess settlement and displacement by traffic.
- .4 The top operating nut and rock disk shall be within 300 mm of the finished ground elevation.
- .5 Hydrant valves shall be tied back to the main using redi-rod.

3.6 UNDERCROSSING

- .1 Excavate working pit outside right-of-way to be crossed.
- .2 Excavate working pit to not less than 0.6m below lowest invert of pipe.
- .3 Dewater excavation.
- .4 Dewater area of undercrossing.
- .5 Install heavy timber backstop.
- .6 Use approved blocking method to guide water main in true alignment.
- .7 Join water main one length at time. Push water main into position.

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- .8 Couplings of water main shall not rest on levelling pad when water main is in position.

3.7 HYDRANTS

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with AWWA M17.
- .3 Install gate valve and cast iron valve box on hydrant service leads as indicated. The distance between the valve and the fire hydrant shall be 1.0 metre
- .4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
- .5 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
- .6 To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
- .7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.8 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as directed by Departmental Representative.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by the Departmental Representative.

3.9 PIPE SURROUND

- .1 Upon completion of pipe laying and after the Departmental Representative has inspected the Work in place, surround and cover pipes as indicated.
- .2 Place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.

- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.

3.10 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 98% corrected maximum dry density.

3.11 PRELIMINARY FLUSHING OF MAINS

- .1 Notify the Departmental Representative at least 4 days in advance of proposed date when preliminary flushing operations will begin.
- .2 The Contractor shall notify the Departmental Representative at least 24 hours in advance of any proposed flushing operations to ensure there are no conflicts with system operation and maintenance. Comply with any special procedures required by the Departmental Representative.
- .3 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within the pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

- .4 Flushing flows as follows:

<u>Pipe Size (mm)</u>	<u>Flow (L/s) Minimum</u>
150 and below	38
200	75
250	115
300	150

- .5 Time and rate of flushing to be discussed with Departmental Representative prior to any discharge to any piped system. The rate of disposal to a sanitary sewer shall not exceed the available capacity of the sewer or lift station. Disposal to a sanitary sewer may be restricted to low flow periods or to maximum rates established by the Departmental Representative.
- .6 Provide connections and pumps for flushing as required.
- .7 Open and close valves, hydrants and service connections to ensure thorough flushing.

3.12 PRESSURE AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.

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- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
 - .3 Notify the Departmental Representative at least 48 hours in advance of proposed tests.
 - .1 Perform tests in presence of the Departmental Representative.
 - .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
 - .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Departmental Representative.
 - .6 Upon completion of pipe laying and after the Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated as directed by the Departmental Representative.
 - .7 Leave hydrants, valves, joints and fittings exposed.
 - .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
 - .9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
 - .10 Open valves.
 - .11 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
 - .12 Thoroughly examine exposed parts and correct for leakage as necessary.
 - .13 Apply hydrostatic test pressure of 150% of the normal operating pressure or 1 MPa (150 psi), whichever is greater at the lowest elevation and not less than 125% of the normal working pressure or 860 kPa (125 psi) whichever is greater at the highest elevation. The test pressure shall not exceed the manufacturer's recommended maximum test pressure, for period of 2 hours.
 - .14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
 - .15 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
 - .16 Repeat pressure test until defects have been corrected.
 - .17 The Departmental Representative may, at his discretion, stop the test after one hour, if the leakage is well below the allowable.

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- .18 Apply leakage test pressure of 1 MPa (150 psi) after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
 - .19 Leakage is defined as amount of water that must be supplied from water storage tank in order to maintain test pressure within 35 kPa (5 psi) of the specified test pressure.
 - .20 No pipe installation will be accepted until the leakage is equal to or less than the number of litres per hour as determined by the formula.

$$Q_m = \frac{LD(P)^{1/2}}{795,000} \quad \text{for PVC Pipe}$$

In which

- Q_m = Allowable makeup in litres per hour.
- L = Length of main tested in metres (including fittings)
- D = Nominal diameter of the main in millimetres
- P = Hydrostatic pressure in kilopascals

- .21 Locate and repair defects if leakage is greater than amount specified.
- .22 Repeat test until leakage is within specified allowance for full length of water main.

3.13 HYDRANT FLOW TESTS

- .1 A hydrant flow test is required for every hydrant installed. Flow testing shall be performed in accordance with the AWWA manual "Installation, Field Testing, and Maintenance of Fire Hydrants (M17)." Test results shall be submitted to the Departmental Representative.

3.14 DISINFECTING AND FINAL FLUSHING

- .1 After the hydrostatic and leakage testing is completed, all distribution mains and services larger than 50mm shall be disinfected
- .2 Notify the Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .3 The Contractor shall notify the Departmental Representative at least 24 hours in advance of any proposed disinfecting operations to ensure there are no conflicts with system operation and maintenance. Comply with any special procedures required by the Departmental Representative.
- .4 Disinfection water mains to AWWA C651-05.
- .5 Rate of chlorine application to be proportional to rate of water entering pipe. A solution of calcium hypochlorite shall be injected while sufficient water is being discharged through the main to bring the chlorine content to a concentration of not less than 25 ppm.

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- .6 Chlorine application to be close to point of filling water main and the discharge point(s) shall be near the extremities of the system. Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
 - .7 Once chlorine residual of 25 ppm has reached the extremities of the system, the intake and discharge valves shall be closed and the leave system charged with chlorine solution for 24 hours unless otherwise directed by the Departmental Representative. During this period, proper precautions are to be taken to prevent this chlorinated water from flowing back into the existing system.
 - .8 Operate valves, hydrants and appurtenances while main contains chlorine solution.
 - .9 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
 - .10 Following the chlorination period, all lines shall be flushed to remove chlorine solution.
 - .11 All super-chlorinated water must be de-chlorinated. Super-chlorinated water must be neutralized to a concentration of 5 ppm or free chlorine or less PRIOR to discharge into the sanitary sewer system. Chlorinated water released to storm sewers or water courses shall not exceed 0.002 ppm of free chlorine and requires all pertinent approvals from governing agencies.

3.15 BACTERIOLOGICAL ANALYSES

- .1 Perform bacteriological tests on water main after the chlorine solution has been flushed out.
- .2 Bacteriological sampling shall be made by the Contractor's competent person(s) in full accordance with AWWA C651 and under the supervision of the Departmental Representative. Sampling consists of two consecutive samples, taken at least 24 hours apart.
- .3 Contractor to submit samples for analysis. All results shall be provided to the Departmental Representative for review.
- .4 Failure of any one of bacteriological test samples shall require re-chlorination and retesting by the Contractor.
- .5 The Contractor shall not put mains into service without the approval of the Departmental Representative.

3.16 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 This section refers to the supply and installation of a cathodic protection system for all buried ductile iron pipe and fittings, valves and hydrants.

Part 2 Products

2.1 SACRIFICIAL ANODES - GENERAL

- .1 The anode lead wire shall be a minimum of 3 metres in length and shall consist of #12 solid copper insulated wire type TW (blue for Mg anodes, white for zinc anodes). The lead wire shall be connected to the core with silver solder or approved equal. The connection shall be insulated by filling the recess and any voids in the lead wire core connection with an electrical potting compound.
- .2 The anode shall be packaged in a permeable cloth bag or cardboard tube containing a backfill mixture of the following composition:
- Ground Hydrated Gypsum 60% min.
 - Powdered Wyoming Bentonite 20% \pm 5%
 - Anhydrous Sodium Sulphate 5% \pm 2%
 - Quartz, Calcite, Dolomite Remainder
- .3 Backfill shall have a grain size so that 100% is capable of passing through a 20 mesh screen and 50% will be retained by a 100 mesh screen. The mixture shall be firmly packaged around the anode within the cloth bag or cardboard tube by means of adequate vibration. Backfill material shall be of sufficient quantity to cover all parts of the anode to a minimum thickness of 25 mm.
- .4 All anodes shall carry a label identifying the Manufacturer's name, type of anode, and the net weight of the anode. Anode packaged in cloth bags shall be shipped in a watertight plastic bag of sufficient mil thickness to permit normal handling without tearing. Cardboard tubes when used to package anodes shall have sufficient strength to permit normal shipping and handling without failure.
- .5 Manufacturers of sacrificial anodes shall have their anodes tested on a regular basis by an independent testing laboratory to ensure compliance to these Specifications. The Manufacturers shall furnish, when requested by the Engineer, an "Affidavit of Compliance" and text results prepared by an independent testing laboratory verifying compliance of these Specifications.

2.2 MAGNESIUM ANODES

- .1 Magnesium anodes shall be cast with a perforated galvanized steel core. The weight of the core shall not exceed 0.15 kg per metre. One end of the anode shall be recessed so that one end of the core is accessible for the lead wire connection. Magnesium anodes shall conform to the following composition:

- Al - 0.02% maximum

- Mn - 0.80 to 1.50%
- Fe - 0.03% maximum
- Ni - 0.002% maximum
- Cu - 0.003% maximum
- Zinc - 0.02% maximum
- Other - 0.02% maximum
- Magnesium - Remainder

2.3 ZINC ANODES

.1 Zinc anodes shall conform to ASTM B418-01 and shall have the following composition:

- Aluminium - 0.005% maximum
- Cadmium - 0.003% maximum
- Iron - 0.0014% maximum
- Lead - 0.003% maximum
- Copper - 0.002% maximum
- Zinc - Remainder

Part 3 Execution

3.1 CATHODIC PROTECTION FOR A NON-METALLIC PIPE SYSTEM

- .1 Connect 2.3 kg zinc sacrificial anode (without a test point) to each valve, fitting and coupling.
- .2 Connect 5.0 kg zinc sacrificial anode (without a test point) to each hydrant.
- .3 The Contractor may at his option install and connect a single 5.0 kg zinc sacrificial anode to one valve and one adjacent metallic fitting.

3.2 CATHODIC PROTECTION FOR AN EXISTING METALLIC PIPE SYSTEM

- .1 Whenever an existing metallic distribution system is exposed for the purpose of performing a tie-in, repair or service kill; the Contractor shall supply and install a 14.5 kg magnesium anode to protect the existing system.
- .2 If the tie-in requires the replacement of more than 5 m of existing uncoated pipe, then two 14.5 kg magnesium anodes shall be installed to protect the existing system.
- .3 If the tie-in is made to an existing coated pipe, then the size of the anodes may be reduced to 7.7 kg.
- .4 Electrical continuity shall be maintained in the existing system.
- .5 Test points are not required for these anode installations.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section specifies the requirements for the supply and installation of casing pipe.

1.2 CASING PIPE INSTALLATION METHOD

.1 Definitions

- .1 A casing pipe is a conduit into which a product pipe or utility is inserted, and serves to protect that pipe or utility from future damage, supports soil loadings, and protects structures and utilities external to the casing.
- .2 A product pipe conveys the fluid/gas integral to the purpose of the installation.

1.3 WORK CONTENT

- .1 Include all construction services, plant, labour, and material, for all of the following:
 - .1 Preparation of the site including removal of vegetation, location of all existing utilities along the proposed path, exposure of all utility crossings, and excavation of entry and exit pits if installed below grade.
 - .2 Installation of casing pipe by pipe ramming method, boring or placed on supports above ground.
 - .3 Testing of installed section and restoration of all affected surfaces to their pre-construction conditions.
 - .4 Dewatering and/or water handling methods and equipment.

1.4 CONSTRAINTS

- .1 Schedule Work to minimize interruption to existing services and local traffic.
- .2 Obtain all necessary permits or authorizations to conduct construction activities and to disturb ground near or across all existing buried utilities, pipelines, services, and conduits.
- .3 Submit for approval proposed methods to control, collect, transport, and dispose of lubricating fluids and spoils.

1.5 SUBMITTALS

- .1 Provide within twenty-five (25) working days of the award of the Contract:
 - .1 A detailed description of the pipe ramming, case boring or above ground procedure including construction techniques to provide the access required to install pipe in conformance with the Contract Document.
 - .2 Drawings and description indicating limits of launch and exit pits, and method of ground support to be utilized.

-
- .3 Method and timing of spoil removal.
 - .4 Casing pipe joining method and details.
 - .5 Methodology to handle and dispose of water that may accumulate in the launch and exit pits, and water that may flow through the casing pipe during installation.
 - .6 Crane details and confirmation of bridge loading safety calculations for above ground installations.
 - .7 Manufacturer confirmation of materials for casing pipe support fitment, spacing and installation details.
 - .8 Manufacturer confirmation of materials for product pipe support fitment, spacing and installation details.
 - .9 Casing end sealing details including all proposed materials and suitability statement from manufacturer.
 - .10 Risk register.

Part 2 Part 2 Products

2.1 CASING PIPE

- .1 Pipe material shall be steel.
- .2 Steel casing pipe shall be new, smooth wall carbon steel pipe which conforms to ASTM Specifications A139, Grade B or ASTM A252. Hydrostatic testing will not be required.
- .3 Steel casing pipe shall have a minimum yield strength of 240 MPa (35,000 psi) for pipe ramming. Other installation methods, refer to Contract Drawings.
- .4 Final required casing diameter is listed on Contract Drawings.
- .5 Pipe wall thickness to be a minimum of 19.05 mm for pipe ramming. Contractor to determine if indicated wall thickness is suitable for ramming operations, and increase wall thickness if required to ensure casing pipe is not damaged during installation.
- .6 Pipe wall thickness for other installation methods listed on Contract Drawings.
- .7 Steel pipe joints shall be of pressure fit or welded type.
- .8 All steel casing pipe shall be square cut – with bevelled ends for welding if required.
- .9 Steel casing pipe shall have a roundness such that the difference between the major and minor outside diameters do not exceed 1% of the specified nominal outside diameter or 7 mm, whichever is less.
- .10 Steel casing pipe shall have a minimum allowable straightness deviation in any 3 m length of 3 mm.
- .11 Curve steel casing pipe to the radius listed on Contract Drawings. All curve radii to be confirmed by field measure and shown on shop drawings.

-
- .12 Installation steel casing pipe to curve direction on Contract Drawings.

Part 3 Part 3 Execution

3.1 PRE-COMMENCEMENT

- .1 All subsurface utilities within 25 m of the proposed alignment must be identified and location marked on the surface. Owners of subsurface utilities within 25 m of the proposed alignment must be notified of the impending work through the one-call program or directly if not a member of the service.
- .2 All utility crossings shall be exposed using hand excavation or another approved method to confirm depth. Contractor must acquire appropriate permits to cross, expose, and backfill existing utilities.
- .3 The proposed alignment shall be determined and documented, including its horizontal and vertical alignments and the location of buried utilities and subsurface structures along the path.
- .4 Launch and Retrieval pits should be delineated using traffic cones, barricades, construction taping, flagging, or by some combination of these. If necessary, warning signs should be placed to indicate open excavation.
- .5 Launch and Retrieval pits shall be constructed to prevent or mitigate excessive water ingress, and Contractor to have a methodology in place to remove and dispose of any water entering the pits.
- .6 Location must be identified for casing pipe layout, as well as suitable space for pipe welding or coupling. This area may require delineation depending on level of pedestrian and vehicular traffic at the discretion of the Departmental Representative.
- .7 Lane closures for cranes or other lifting equipment must be approved by Departmental Representative.

3.2 PITS

- .1 Excavation methods to provide access for pipe ramming or casing boring to ensure the safety of the work.
- .2 Final dimensions of access pits selected by the Contractor shall conform as a minimum with dimensions required to permit installation of the Work.
- .3 Contractor shall be required to properly support all excavations and to prevent all movement of the soil, pavement, utilities, or structures outside of the excavation.
- .4 Construct pits to accommodate the installation of pipe casings and ramming or boring device. Install seals in the pit walls as required to control ground movement where the casings enter and exit the ground.

- .5 All Work of excavating shoring and bracing, and pipe ramming shall be so executed that settlement is minimized, the in-place casing shall have full bearing against earth, and no voids or pockets are left in any portion of the Work.

3.3 **PIPE RAMMING**

- .1 Only a fully trained and experienced operator shall be permitted to operate the ramming equipment. While operating the ramming equipment, the manufacturer's operating instructions and safety practices shall always be followed.
- .2 The Contractor shall be responsible for the pipe ramming method and equipment. The Contractor shall confirm that the equipment utilized will be of sufficient capacity to successfully complete the installation taking into consideration the installation length, casing pipe diameter, and ground and ground water conditions that can be reasonably foreseen.
- .3 Each pipe section shall be rammed forward as the excavation progresses in such a way that provides complete and adequate ground support at all times. Lubrication shall be applied to the external surface of the pipe to reduce skin friction. A hammer frame shall be positioned to develop a uniform distribution of ramming forces around the periphery of the pipe.
- .4 Casing to be installed such that the product pipe may be installed to the line and grade as shown on the Drawings.
- .5 Contractor shall monitor ground movements associated with the work, and make suitable changes in construction method to control ground movements.
- .6 All excavated material from the pipe ramming shall be disposed of off-site by the Contractor.
- .7 A lubrication system shall be provided that injects an approved lubricant on the inside and outside of the pipe to lower the friction developed on the sides of the pipe during ramming.
- .8 Contractor shall reinforce the leading edge of the casing pipe as required to ensure integrity of the pipe as installation progresses in the expected soil conditions.
- .9 The overcut created by the reinforced leading edge of the pipe shall not exceed 25 mm without prior approval of the Departmental Representative. The annular space created by the overcut shall be filled with lubricant that has been proved suitable for the particular soil conditions.
- .10 Amount of overcut shall be compatible with the soil conditions, stiffness characteristics of the selected pipe, and joint system at the designed maximum ramming loads.
- .11 Casing pipe shall extend 1.0m into the sending and receiving pits or long enough to facilitate future excavation of the casing at using safe trench slopes.

-
- .12 A soil plug of suitable length shall be left in the casing pipe at all times during installation, unless otherwise approved by the Departmental Representative. Contractor to maintain soil plug to assist in prevention of surface subsidence and water ingress into the launch pit.
 - .13 If a rammed crossing must be abandoned for what ever reason, the casing shall be removed or filled with grout as directed by the Departmental Representative.
 - .14 If Telescopic Pipe Ramming methods are utilized, the Contractor is responsible for determining initial and any intermediate casing sizes required to install the final casing size specified on the Contract Drawings. The supply and installation of any initial and intermediate casings will be considered integral to the project and must be installed as per the Pipe Ramming Specifications.

3.4 **CASING SPACERS AND PIPE RESTRAINTS**

- .1 14 ga metal band with shop coat.
- .2 Band compatible with pipe coating and / or insulation cover.
- .3 10 ga risers mig welded to the band when runner height extension required.
- .4 Glass reinforced polyester runner. Minimum compressive strength 124 Mpa.
- .5 Spacer runner height shall be sufficient to elevate the pipe bell and to prevent pipe bell contact to the casing in the event that the casing pipe rolls during insertion.
- .6 All components in contact with casing and carrier pipe shall be non-metallic non-conductive material to ensure carrier and casing pipe are electrically isolated.
- .7 Final position of carrier pipe within casing to be centered and restrained, unless specifically detailed otherwise on Contract Drawings..
- .8 All spacer fasteners to be 304 stainless steel nuts and bolts.
- .9 Contractor to ensure that casing spacers will fit properly within the casing prior to ordering.
- .10 Pipe runners shall be evenly spaced around the carrier pipe as per manufacturer's recommendations. Maximum spacing between pipe runners longitudinally along pipe is 1,800 mm, or less, based on manufacturers recommendations for carrier pipe support requirements.
- .11 Acceptable product:
 - .1 Casing spacers: Per drawing package, shop drawings to be submitted for approval.
- .12 Do not fill annular space between casing and carrier pipe with grout.

3.5 **CASING SUPPORTS – ABOVE GRADE**

- .1 Roller supports and anchor supports to provide electrical isolation of casing pipe from supports.
- .2 Isolation materials to be compatible with load requirements.
- .3 Casing supports to meet load requirements on Contract Drawings.
- .4 Sliding supports to be supplied by Taylor Pipe Supports or approved equal.
- .5 All steel components to meet product requirements as outlined in Section 05 12 33 – Structural Steel for Bridges.
- .6 All shop drawings to be approved by Departmental Representative prior to material orders.

3.6 **END SEALS**

- .1 Acceptable product: CCI End Seals from Pipeline Supply International or approved alternate.
- .2 End seals on above ground installations to be UV protected.

3.7 **RECORD OF CONSTRUCTION**

- .1 Contractor shall indicate any horizontal or vertical deviations between the designed alignment and the actual installation. Contractor to provide a set of as-built Drawings including both alignment and profile constructed from actual field readings.
- .2 A log book must be kept for all installations. As a minimum the log shall consist of the following:
 - .1 The position of the pipe in relation to the design line and grade.
 - .2 The date, the starting time, and the finish time of each pipe installation.
 - .3 Inclination.
 - .4 Advance rates.
 - .5 Hammer strokes per minute.
 - .6 Quantity of and type of pipe lubrication utilized.
- .3 Logs must be legible and accurate, and copies submitted to Departmental Representative with the as-built Drawings.

3.8 **WARRANTY**

- .1 Any settlement over the installed pipe casing shall be monitored during the warranty period by the contractor and reported to the Department Representative. The contractor is responsible to remediate any observed settlement during the warranty period over the installed pipe ramming or case boring before final acceptance.

3.9

ACCEPTANCE

- .1 Product pipe shall be installed within the pre-specified alignment and grade tolerance as shown on the Drawings and provided in the project Specifications.
- .2 Insulation and jacket is undamaged and continuous per Contract Drawings.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C110/A21.10-98, Ductile Iron and Gray Iron Fittings, 3 inch through 48 inch for Water and Other Liquids.
 - .2 ANSI/AWWA C111/A21.11-00, Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A307-00, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- .3 Manufacturer's Standardization Society of the Valve and Fittings Industry
 - .1 MSS-SP-70-1998, Cast Iron Gate Valves, Flanged and Threaded Ends.

1.2 PRODUCT DATA

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

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

- .1 Water Service Pipe
 - .1 High Density Polyethylene Pipe (HDPE) Series 160 Municipal Tubing (Copper, Tubing Size), Conforming to AWWA C901-02.
 - .2 Pex Pipe (Cross-Linked Polyethylene), Minimum SDR9, to AWWA C-904, ASTM F876/877, CSA B137.5
- .2 Corporation Stops
 - .1 Corporation Stops: to ASTM B62-02, red brass.
 - .2 Inlet Thread: tapered to AWWA C800-05.
 - .3 Outlet: compression type ends.
 - .4 Ford pack joint, EMCO Successor, Mueller, Cambridge Brass, or equal.
- .3 Water Service Saddles
 - .1 Service Saddle: waterworks bronze saddle body tapped for AWWA tapered thread, T304 stainless steel straps, bolts and nuts, Buna S rubber gasket under saddle body.

-
- .2 Use double strap saddles for taps larger than 25 mm in diameter.
 - .3 Robar 2706 or equal.
 - .4 Curb Stop and Service Box
 - .1 Curb Stop: bronze ball type or O-ring plug type, without drain.
 - .2 Joints: Compression type ends.
 - .3 Ford Series B44, EMCO Century Ball Valve, Mueller-Oriseal, or equal.
 - .4 Service Box and Extension Spindles: epoxy coated with solid stainless steel rod as detailed in the drawings and in the Standard Specification of the City of Calgary Waterworks Construction.

Part 3 Execution

3.1 PREPARATION

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

3.2 TRENCHING AND BACKFILLING

- .1 Do trenching and backfill work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .2 Trench depth to provide minimum cover over water service pipe of 2.75 m from finished grade.
- .3 Install services at right angles to main, unless otherwise specified or shown.
- .4 Lay up to 50 mm water service in same trench as sanitary sewer where applicable. Excavate trench for 300 mm separation between pipes.
- .5 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .6 Fill any excavation below level of bottom of specified bedding with crush stone and compact.
- .7 Bench trench when one service pipe is lower than the other. Support higher service pipe(s) with compacted backfill or granular backfill if benching not possible to prevent settlement or dislocation.
- .8 Lay sanitary sewer to left hand side of water pipe and storm sewer to right hand side of water pipe when viewed from the main to the property.
- .9 Do not backfill trenches until installed work has been checked by the Departmental Representative and hydrostatic and leakage test results are within limits specified.

3.3 WATER SERVICE PIPE INSTALLATION

- .1 Drill and tap main under pressure with a tapping machine capable of inserting corporation stop into main or saddle.
- .2 Tap PVC pipe with one of the following core cutters and tap (do not use auger or twist bits):
- .3 Footage Tools Main Line tap machine.
- .4 Modified Mueller B, Mueller B100 or Hays B1.
- .5 Tapping shall conform to the following requirements:

Pipe Diameter (mm)	Maximum Size Tap Without Saddle (mm)			Maximum Size Tap With Saddle (mm)
	CI & DI	AC	PVC	
100	25	20	Not Permitted	25
150	25	20	25	50
200	25	25	25	50
250	25	25	25	50
300	25	Not Permitted	25	50

- .6 Tapping of PVC DR 25, Class 100 Pipe, without a Saddle is not permitted.
- .7 Tap mains at 3:00 o'clock or 9:00 o'clock position and not closer than 0.6 m to a joint.
- .8 Attach service pipe and form a goose neck horizontally from corporation stop.
- .9 All copper services must be continuous from main to curb stop and from curb stop to end of service with no couplings joining short lengths of pipe.
- .10 Set curb stop on treated 50 x 150 x 200 mm wooden block. Install and maintain service box in plumb position during backfilling.
- .11 Open corporation stop, flush service line, check operation of curb stop and check all joints for leaks prior to backfilling.
- .12 Set top service box to proper elevation.
- .13 Provide a "pig tail" on the end of each water service as detailed on the drawings.

END OF SECTION

APPENDIX A

PARKS CANADA

LAKE LOUISE UTILITIES UPGRADE GEOTECHNICAL INVESTIGATION REVISION 4 LAKE LOUISE, ALBERTA

SEPTEMBER 4, 2019

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1 INTRODUCTION

Parks Canada retained WSP Canada Inc. (WSP) to complete a geotechnical investigation for the proposed utility upgrades within the town of Lake Louise, Alberta. The scope of work was completed in accordance with WSP's proposal dated September 25, 2018, and included the following:

- Thirteen geotechnical boreholes
- Laboratory testing
- Geotechnical report

This document is "Revision 4" of the geotechnical report. The objectives of this geotechnical investigation were to assess the subsoil conditions and to provide recommendations for engineering design parameters for the proposed developments on site.

A Technical Memo, CP Crossing Settlement Assessment Rev 2 is also submitted. The memo is dated September 4, 2019.

The use of this report is subject to the Terms of Reference (Appendix A).

2 SITE AND PROJECT DESCRIPTION

The purpose of the geotechnical investigation is to characterize the soil at the multiple proposed underground crossing locations for the proposed underground utilities on site. The proposed underground utilities will be added onto the existing Lake Louise system and will consist of both water and sanitary utilities. The approximate locations of the crossings are shown on the site plan in Appendix B. The crossings are located throughout the town of Lake Louise, Alberta.

The utility crossing will be constructed using guided pipe ramming technology. The size and the buried depth of the utility has not been determined at the time of this report prepared.

2.1 Published Geological Information

Based on a review of available surficial geology mapping¹ fluvial, eolian and moraine glacial till deposits are present on site. The composition is generally coarse grained (i.e. sand, gravel, cobbles etc.) with minor fine grained (i.e. silt and clay) components.

¹ Fenton, M.M., Waters, E.J., Pawley, S.M., Atkinson, N., Utting, D.J. and McKay, K. (2013): Surficial geology of Alberta; Alberta Energy Regulator, AER/AGS Map 601, scale 1:1 000 000.

3 METHODOLOGY

3.1 Field Investigation

WSP oversaw the drilling of 13 geotechnical boreholes from November 26 to 29, 2018. The boreholes were drilled by Earth Drilling Co. Ltd. using a truck-mounted drill rig and ODEX drilling technology. Borehole details are provided in Table 1. The boreholes were advanced on either side of the proposed crossing locations. The boreholes were drilled nearby or on the local roads or parking lots in Lake Louise. A site plan showing the borehole locations is provided in Appendix B.

Table 1 Borehole Details

Borehole #	Completion Date	Depth (mbgs)	Latitude	Longitude	Elevation (mASL)
BH18-01	November 29, 2018	6.1	51.43293	-116.1888	1539.8
BH18-02	November 26, 2018	9.1	51.43213	-116.19000	1537.2
BH18-03	November 29, 2018	6.1	51.42962	-116.18694	1539.6
BH18-04	November 29, 2018	4.6 (Refusal)	51.42880	-116.18812	1538.8
BH18-05	November 27, 2018	6.1	51.42839	-116.18167	1541.3
BH18-06	November 28, 2018	6.1	51.42766	-116.18159	1540.5
BH18-07	November 28, 2018	12.2	51.42700	-116.17926	1540.8
BH18-08	November 26, 2018	6.1	51.42588	-116.18150	1538.4
BH18-09	November 28, 2018	6.1	51.42484	-116.18182	1538.0
BH18-10	November 28, 2018	6.1	51.42473	-116.18135	1537.7
BH18-11	November 29, 2018	4.6 (Refusal)	51.42450	-116.18082	1537.6
BH18-12	November 27, 2018	11.6 (Refusal)	51.41451	-116.17398	1526.2
BH18-13	November 26, 2018	12.2	51.41438	-116.17549	1529.0

Notes: mbgs – meters below ground surface

mASL – meters above sea level

Drilling machine refusal occurred in BH18-04, BH18-11 and BH18-12; the drill head was making little to no advancement so the borehole was terminated.

Standard Penetration Tests (SPTs) and Dynamic Cone Penetration Tests (DCPTs) were performed at selected depth intervals and soil samples were obtained from the split-spoon sampler. Piezometers were installed in all boreholes except BH18-02. The borehole logs which describe soil stratigraphy, sampling sequences, and the field and laboratory test results are included in Appendix B.

3.2 Laboratory Testing

The following laboratory tests were completed on soil samples collected on site:

- 118 moisture content tests
- 6 grain size analysis tests (granular soils only)
- 7 soluble sulphate content tests

The laboratory test results are discussed in Section 4. The test results are shown in the borehole logs (Appendix B).

4 SUBSURFACE CONDITIONS

The soil profile encountered at the borehole locations generally consisted of either gravel or sand beneath surficial fill material or topsoil. Native materials (i.e. gravel or sand) started at depths ranging from 0.1 to 4.3 mbgs. ODEX drilling technology was required to advance through the gravelly materials; however, this drilling technology breaks aggregate apart into smaller pieces as the drill head advances. Thus, it is not possible to estimate how much large aggregate exists on site; however, it is likely that cobbles and boulders are common within the subsurface profile.

Groundwater conditions are summarised in Section 4.8. A description of the subsurface soil strata is provided in the following sub-sections.

4.1 Topsoil

The surficial topsoil was encountered in BH18-01 to BH18-04 and BH18-13 and ranged from 100 to 200 mm thick. The topsoil consisted generally of brown sandy silt with roots and was dry.

4.2 Asphalt

Surficial asphalt was encountered in BH18-05 to BH18-11 and ranged from 100 to 150 mm thick.

4.3 Fill

Some combination of fill materials in the form of sand fill, gravel fill (road base), and gravel fill (sub base), were encountered near the surface in all boreholes except for BH18-02, BH18-03 and BH18-13. Native materials (i.e. gravel or sand) were encountered immediately below the fill at depths ranging from 0.1 to 4.3 mbgs.

In general, the road base and sub base fill was a sandy gravel with variable amounts of silt and trace clay that was placed as part of the construction of the local roads. The sand fill was encountered in BH18-01 below the topsoil and extended to 0.6 mbgs. The sand fill was light brown, gravelly, with some silt and trace clay and dry.

Moisture contents of nine samples of fill ranged from 3 to 10% indicating dry to moist condition.

4.4 Sand

Sand was encountered in BH18-01 below the fill and in BH18-02 below the topsoil and extended until borehole termination depth. The sand was generally brown with more than 35% gravel and silty with trace clay.

Moisture contents of 21 samples of sand ranged from 1 to 20% indicating dry to wet condition.

A total of 32 SPTs or DCPTs completed within the sand had “N” values ranging from 7 blows per 300 mm of penetration to refusal (i.e., greater than 50 blows per 150 mm of penetration), which indicates loose to very dense sand. In general, the sand was in the compact range.

The laboratory testing completed on the sand is summarized in Table 2.

Table 2 Laboratory Test Results for Sand

Borehole Number	Sample Depth (mbgs)	Grain Size Analysis			Soluble Sulphate (%)
		Gravel (%)	Sand (%)	Silt/Clay (%)	
BH18-02	2.3	13.7	46.5	39.8	0.074

4.5 Gravel

Gravel was encountered in BH18-03 to BH18-13 below the fill or topsoil and extended until borehole termination depth except in BH18-04 and BH18-12 which encountered weathered bedrock prior to termination depth. The gravel was generally brown with more than 35% sand, with trace silt and trace clay.

Moisture contents of 84 samples of gravel ranged from 1 to 18% indicating dry to wet condition.

A total of 39 SPTs or DCPTs completed within the sand had “N” values ranging from 19 blows per 300 mm of penetration to refusal (i.e., greater than 50 blows per 150 mm of penetration), which indicates compact to very dense gravel. In general, the gravel was in the very dense range.

The laboratory testing completed on the gravel is summarized in Table 3.

Table 3 Laboratory Test Results for Gravel

Borehole Number	Sample Depth (mbgs)	Grain Size Analysis			Soluble Sulphate (%)
		Gravel (%)	Sand (%)	Silt/Clay (%)	
BH18-04	2.3	55.3	41.8	2.9	0.086
BH18-05	2.3	49.7	43.8	6.6	0.064
BH18-07	2.3	51.9	35.5	12.7	0.038
BH18-08	2.3	34.5	46.7	18.8	0.030
BH18-11	2.3	N-A	-	-	0.068
BH18-12	2.3	52.1	44.2	3.7	0.064

4.6 Inferred Cobbles and Boulders

Since ODEX drilling technology was required to advance the boreholes to the target depths (see comment in Section 4); it was not possible to visually confirm or take samples of intact cobble or boulder material. The presence of cobbles and boulders throughout the site is very likely. The presence of cobbles and boulders is inferred on the borehole logs throughout the native materials on site. An inferred boulder was encountered in 2.1 to 3.0 mbgs in BH18-11.

4.7 Weathered Bedrock

Weathered sedimentary sandstone bedrock was encountered in BH18-04 from 2.9 mbgs until borehole termination depth and in BH18-12 from 11.3 mbgs until borehole termination depth. The ODEX sample did not yield a good sample of the bedrock; however, the bedrock was inferred to be weathered and extremely weak in terms of rock classification.

Moisture contents of four samples of bedrock ranged from 1 to 15% indicating dry to moist condition.

4.8 Groundwater and Sloughing Conditions

The boreholes on site were advanced using temporary casing, therefore, borehole sloughing conditions could not be observed. However, the granular soils on site are expected to slough.

Groundwater observations are summarized in Table 4.

Table 4 Groundwater Observations

Borehole #	Drilled Depth (mbgs)	Water Seepage During Drilling (mbgs)	Water Level at Drilling Completion (mbgs)	Water Level on April 11, 2019 (mbgs)
BH18-01	6.1	None	None	Dry
BH18-02	9.1	6.9	None	Piezometer not installed
BH18-03	6.1	None	None	Dry
BH18-04	4.6	None	None	Dry
BH18-05	6.1	None	None	Dry
BH18-06	6.1	None	None	Dry
BH18-07	12.2	None	None	Dry
BH18-08	6.1	None	None	Dry
BH18-09	6.1	None	None	Dry
BH18-10	6.1	None	None	Dry
BH18-11	4.6	None	None	Dry
BH18-12	11.6	4.6	8.5	3.2
BH18-13	12.2	6.9	None	*

Notes: *The piezometer for borehole BH18-13 could not be located.

Groundwater levels were observed during drilling and at drilling completion. Groundwater levels are prone to fluctuations and may be affected by seasonal fluctuations, recent rainfall, surface drainage, and infiltration, etc.

5 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

This section provides geotechnical design parameters based on WSP's interpretation of the field and laboratory testing information. The geotechnical parameters provided are intended as preliminary guidance for planning and design by qualified engineers and architects. Where comments are made on construction, they are provided to highlight aspects of construction that could affect the implementation of the project. Parties requiring information beyond the scope or purpose of this report must contact WSP or make their own interpretation of the information provided.

5.1 Frost Penetration Depth

The near surface soils on site are considered to be low to medium (i.e. category F2 – gravels and sands) frost susceptible. The maximum seasonal frost penetration depth was calculated for the near-surface soils using the procedure described in Canadian Foundation Engineering Manual (CFEM)². A mean freezing index of 1,600°C days based on a 30-year return period was used for the site. The maximum seasonal frost penetration depth is estimated to be 2.6 mbgs. The estimated frost penetration depth assumes a uniform soil type without snow cover. Buried utilities should be buried at least 2.6 mbgs in order to avoid the affects of frost action.

5.2 Guided Pipe Ramming

WSP understands that the proposed utility crossings will be installed using guided pipe ramming completed by a specialty contractor.

Guided pipe ramming is a trenchless method for installation of casings, in which a pneumatic tool is used to hammer the casing through the ground while the excess soil from creating the holes is removed to the surface. An open-ended casing can be used. The spoil can be removed by compressed air, hand or water.

In general, guided pipe ramming can be applied in a wide variety of soil, except at intact bedrock area. Compact to very dense gravel and weathered bedrock are expected to be encountered at the crossing areas. Based on the subsurface conditions, guided pipe ramming method is considered to be the suitable installation method.

During the ramming operations, the maximum size of cobbles/boulders that can be ingested is roughly equivalent to the inner diameter of the casing. The percussive nature of the operation would either displace these obstructions to the outside or inside of the casing or break up the cobbles and boulders.

The casing leading edge design may allow slight overcut of the hole to create a small soil clearance around the casing. Overcut can be designed on the outside of the casing to reduce external friction between the casing and soil.

² Canadian Geotechnical Society. 2006. Canadian Foundation Engineering Manual, Fourth Edition.

Some (but not all) issues that the guided pipe ramming contractor should consider are as follows:

- The fill extends to 4.3 mbgs in BH18-09; the buried utilities should be buried below 4.3 mbgs in the native materials at this area. As such, guided pipe ramming in this area may need to extend below the fill and into the native material in this area.
- The guided pipe ramming would be within gravel, sand, and weathered bedrock deposits. The transitioning between various soil types should be considered by the contractor.
- The groundwater and sloughing observations in Section 4.8 should be considered. The contractor should be prepared to deal with water seepage issues as they arise.
- Presence of inconsistent materials encountered within zones of fill material.
- Difficult excavation and drilling conditions should be expected due to the presence of very dense sand/ gravel, bedrock and the presence of cobbles and boulders.

In order to reduce the potential for heave or settlement, the utility should be installed at least 3 times their respective diameter below the ground surface at the crossing area. The diameter of the casing pipes should be sufficient to install the utility to the specified line and grade.

Settlement at the ground surface may occur during the trenchless installation provided the standard practices of trenchless tunnelling are followed during construction. The estimated settlement is based on the empirical method proposed by Snežana Maraš-Dragojević (2012) and an assumed ground loss of 0.5 to 2% during the trenchless installation. The settlement is expected to be at its maximum above the crown of the trenchless installation and gradually decrease to near zero at an estimated lateral distance of 4.5 m to 6.5 m from the centre line of the trenchless installation on both sides (based on installation depth of 2.6m). The ground movement and settlement potential is related to the installation methods and the type of soil at the depth of installation. The contractor should further assess and confirm the amount of ground settlement and ground loss/disturbance based on the subsurface conditions, the proposed construction trenchless methods, and the amount of over-excavation. In general, calculation of the settlement pattern is complex and difficult without knowledge of the exact construction method, construction sequences, and encountered subsurface conditions. The estimated settlement can be provided by the contractor based on the method of tunnelling and construction/installation methods.

5.3 Temporary Excavations

If temporary excavation on site are required, then they should be sloped or shored for worker protection. Construction must conform to good practice and comply with regulations, such as the Alberta Construction Safety Regulations. According to the Occupational Health and Safety Code Part 32³, the soil is to be classified as “soft, sandy or loose”; therefore, excavation walls must be sloped at an angle of not less than 45 degrees from the bottom of the excavation. Excavations on site are not anticipated to be deeper than 3 mbgs.

If steeper or deeper excavations with shoring are required, then the contractor can consider using trench boxes as temporary shoring. The trench boxes should be designed by the contractor. WSP can review the proposed excavation layout and to provide further guidance, if required.

Excavations must be protected from rain, snow, or any ingress of free water. Prolonged exposure of excavated areas should be avoided to prevent deterioration of exposed soil with resultant slope instability. Similarly,

³ Occupational Health and Safety Act, Occupational Health and Safety Code 2009, Government of Alberta, 2009

excavated materials should be stockpiled away from the excavations to avoid any slope instability and to prevent materials from falling into excavations. Temporary surcharge loads, such as stock of material or heavy equipment, should be kept back from excavation faces a distance equal to at least one-half the excavation depth.

Based on conditions encountered during drilling and the measured groundwater levels, seepage is not anticipated in excavations up to 3.0 m in depth at most locations; however, seepage may be present in areas near BH18-02 (see Table 4) which is close to the river. Seepage should be expected in excavation near the river. The contractor should be prepared to deal with water issues as they arise. Dewatering of excavations will be dependent upon weather conditions and the time of year of construction. If seepage is encountered during construction, groundwater may be controlled by sump and pumping methods. The groundwater level should be maintained a minimum of 0.5 m below excavation grade at all times.

5.3.1 Open Cut Pipe Installation

WSP anticipates that some open cut pipe installation will be required. All underground pipes must be placed on competent ground. Any soft, loose, organic, or otherwise deleterious soil existing below the pipes must be over-excavated and replaced with well-compacted material. The subgrade soil and bedding soil beneath the pipes should not be allowed to freeze.

In the event of significant groundwater seepage or wet base conditions, additional measures may be required. Typically, these measures include placement of a working mat of free draining gravel and filter cloth after lowering of the water table and removal of disturbed soils. This layer of gravel is intended to be a safe working base and the thickness required will be based on keeping groundwater below the working surface.

5.3.2 Engineered Fill

The excavation can be restored to grade using engineered fill. Engineered fill may consist of the native granular soils provided that they are free of organics, aggregate larger than 100 mm, frozen soils and/or other unsuitable materials. The engineered fill should be placed in loose lift thickness not exceeding 200 mm, depending on compaction equipment used, and be compacted to minimum 100% Standard Proctor Maximum Dry Density (SPMDD). The moisture content at placement should be within -3% to +1% of its Optimum Moisture Content (OMC) for compaction purposes.

5.4 Pipe Buoyancy

The potential for pipe flotation under design flood conditions, or conditions where the pipe may not be full, should be assessed. Under static conditions, it may be assumed that the moist unit weight of granular overburden above the water table is 20 kN/m³, the buoyant unit weight below the water table is 10 kN/m³, and that the unit weight for water displaced by the pipe is 9.8 kN/m³.

5.5 Seismic Site Classification

Available information was reviewed to assess the seismic classification of the project site. The reviewed information included the borehole logs, the National Building Code of Canada (NBCC)⁴ and CFEM.

The site classification for Seismic Site Response is provided in Sections 4.1.8.4 of NBCC and in Chapter 6 of CFEM and is determined using the expected shear wave velocity, Standard Penetration Resistance N-value and

⁴ National Research Council; 2015; National Building Code of Canada

undrained shear strength within the top 30 m. Based on the available information, the average ground properties in the upper 30 m at the site are inferred to stiff soil, corresponding to Class C as per Table 6.1A, CFEM.

5.6 Water Soluble Sulphate

The results from the soluble sulphate content laboratory tests are summarized in Table 2 and Table 3.

The test results indicate negligible degree of exposure to sulphate attack on concrete in contact with the soil as per degree CSA A23.1-14⁵. Any imported soils should be tested for water soluble sulphate concentration and associated sulphate exposure classification.

Concrete properties should be specified by the structural engineer to meet structural requirements and exposure to freeze and thawing and/or chlorides.

6 CLOSURE

This report has been prepared for the sole benefit of Parks Canada and is not intended for use by others. This report may not be reproduced without the prior written consent of WSP. Contractors undertaking the work must draw their own interpretations of the factual information provided in this report as they affect the construction costs, procedures, and scheduling.

As boreholes are a localized representation of the total study area, subsurface conditions may vary between and/or beyond the borehole locations. If conditions encountered at the site vary significantly from that reported herein, WSP should be notified immediately so that our interpretation and recommendations can be reviewed and revised, if necessary.

⁵ Canadian Standards Association; 2014; Concrete Materials and Methods of Concrete Construction, Canadian Standards Association International; CSA A23.1-14

APPENDIX

A TERMS OF REFERENCE



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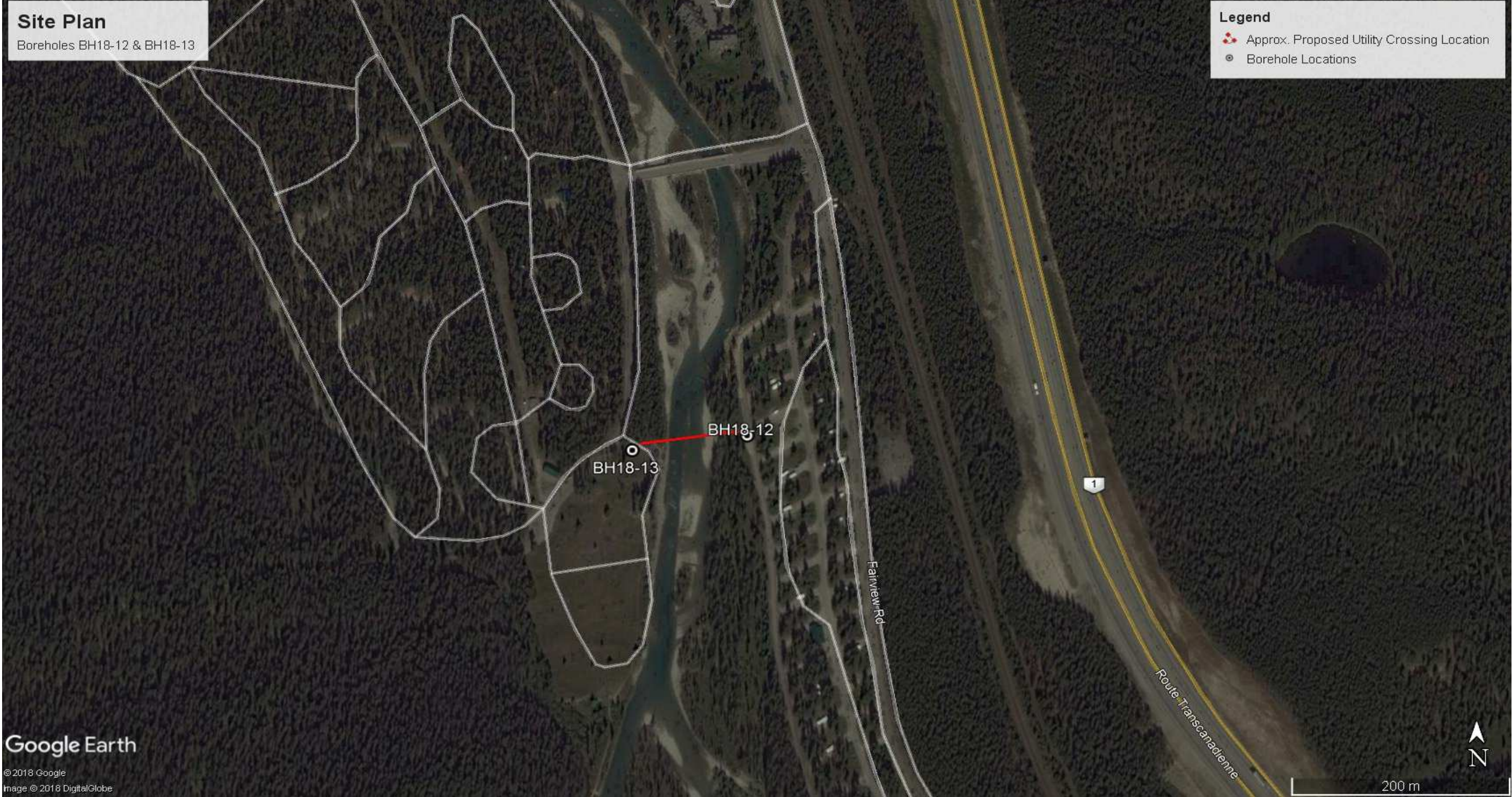
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APPENDIX

B SITE PLAN AND BOREHOLE LOGS



		Site Plan Lake Louise Utilities Upgrade 18-19 Geotechnical Investigation Lake Louise, AB	
SOURCE Google Earth		CLIENT NAME Parks Canada	PROJECT NUMBER 181-13597-14
DRAWN SB	CHECK JL	APPR. -	DATE 09/01/2019
EPSP -	SCALE -	FIGURE NUMBER Figure 1	REV. 0



		Site Plan Lake Louise Utilities Upgrade 18-19 Geotechnical Investigation Lake Louise, AB			
SOURCE Google Earth		CLIENT NAME Parks Canada		PROJECT NUMBER 181-13597-14	
DRAWN SB	CHECK JL	APPR -	EPSC -	DATE 09/01/2019	SCALE -
FIGURE NUMBER Figure 2				REV. 0	



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Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-01

Pg 1 of 1
Project No: 181-13597-14
Lat: 51.43293 Long: -116.18880

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1539.8m																Elev. 1539.8m
	dark brown, TOPSOIL (150 mm thick) , silt, sandy, some gravel, roots, dry															
	light brown, SAND FILL , medium grain, gravelly, some silt, trace clay, dry				G											5050
5	loose to compact, light brown, SAND , medium grain, gravelly, silty, trace clay, moist			7	G											5045
2	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			9												
	at 2.1 m - some gravel			7	G											
				10												
10				9												
	at 3.0 m - coarse grained gravel			12	G											5040
				13												
4				11	G											5036
				10												
15				13												
				9	G											5035
				13												
				11	G											
6				12												5034
				10	G											
20																
	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															5030
25																5025
8																
30																5020
10																
																5015
35																
																5010
12																
40																

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)
Pocket Penetrometer
(compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method: ODEX
Date Drilled: 29/11/2018
Logged by: PC
Checked by: SB

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

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Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-02

Pg 1 of 1

Project No: 181-13597-14
Lat: 51.43213 Long: -116.19000

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1537.2m															Elev. 1537.2m
	brown, TOPSOIL (200 mm thick) , silt, sandy, gravelly, roots, dry		19	SPT											
	loose to compact, brown, SAND , medium grain, some gravel, silty, trace clay, moist			G											5040
5															536
2	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals		7	G											
			8												
	at 2.3 m - 0.074% sulphate based on lab test		7	G											5035
			8												
10	at 2.3 m - 13.7% gravel, 46.5% sand & 39.8% silt/clay based on lab test		8												5034
			9	G											
			8												
4			9	G											5030
	at 4.3 m - compact		9												
15			11												
			19	G											5025
			18												
	from 5.5 m - compact to loose		21	G											5025
			19												
6			7												
			7	G											
			6												
	at 6.9 m - water seepage, very dense		50 for 25 mm	G											5020
															5020
25															
	at 7.6 m - coarse grained gravel, inferred cobbles			G											
8															
				G											5015
30				G											5015
	End of borehole at 9.1 m. Borehole dry at drilling completion.														528
10															5010
35															5005
															526
															5005
12															
40															

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

▼ Ground Water Level
∞ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

Drill Method: ODEX

Date Drilled: 26/11/2018

Logged by: PC

Checked by: SB

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Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-03

Pg 1 of 1

Project No: 181-13597-14

Lat: 51.42962 Long: -116.18694

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1539.6m																Elev. 1539.6m
	dark brown, TOPSOIL (100 mm thick) ,silty, sandy, trace clay, roots, dry															
5	very dense, light brown, GRAVEL and sand, trace silt, trace clay, dry to moist, inferred cobbles				G											5050
2					G											5045
10					G											5040
4					G											5036
15					G											5035
6					G											5034
20					G											5030
	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															5030
25																5025
8																5020
30																5015
10																5010
35																
12																
40																

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

▼ Ground Water Level
∞ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method:
ODEX
Date Drilled: 29/11/2018
Logged by: PC
Checked by: SB

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

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STANDARD PENETRATION TEST



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Lake Louise, AB

BH18-04

Pg 1 of 1

Project No: 181-13597-14
Lat: 51.42880 Long: -116.18812

Depth (m) (ft)	Description	Well 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1538.8m																Elev. 1538.8m
	dark brown, TOPSOIL (150 mm thick) silty, sandy, trace clay, roots, dry															
	light brown, GRAVEL FILL (road base) sandy, silty, trace clay, moist				G											538
5	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, dry to moist, inferred cobbles			47	G											5045
2	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			78												
	at 2.3 m - 0.086% sulphate based on lab test			79	G											5040
10	at 2.3 m - 55.3% gravel, 41.8% sand & 2.9% silt/clay based on lab test			88 50 for 125 mm												536
	extremely weak (i.e. very dense soil like behaviour), completely weathered, light grey, SANDSTONE (Bedrock) , dry				G											
4					G											5035
15					G											534
	End of borehole at 4.6 m due to refusal. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															530
6																532
20																5025
25																530
8																5020
30																5015
10																528
35																5010
12																526
40																

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)
Pocket Penetrometer
(compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method:
ODEX
Date Drilled: 29/11/2018
Logged by: PC
Checked by: SB

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Lake Louise, AB




BH18-05

Pg 1 of 1

Project No: 181-13597-14
Lat: 51.42839 Long: -116.18167

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1541.3m																Elev. 1541.3m
	ASPHALT (100 mm thick)															
	light brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist															5055
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G			●								5040
5	very dense, brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles			41	G			●								5050
2	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			81	G			●								
	at 2.3 m - 0.064% sulphate based on lab test			85	G			●								
10	at 2.3 m - 49.7% gravel, 43.8% sand & 6.6% silt/clay based on lab test			50 for 150 mm 50 for 125 mm	G			●								5038
					G			●								5045
4					G			●								
15					G			●								5040
					G			●								5036
6					G			●								
20					G			●								5035
	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															5034
																5030
8																5032
																5025
30																5020
																5030
10																5020
35																5015
12																
40																

C: Condition of Sample

Good 
Disturbed 
No Recovery 

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

STANDARD PENETRATION TEST

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

▼ Ground Water Level
∞ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method: ODEX
Date Drilled: 27/11/2018
Logged by: PC
Checked by: SB

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BH18-06




Pg 1 of 1

Project No: 181-13597-14

Lat: 51.42766 Long: -116.18159

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1540.5m																Elev. 1540.5m
	ASPHALT (150 mm thick)															
	brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist															540
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G											5050
5																
2	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			54	G											5050
				89												
				60	G											538
				38												5045
10				83												
				88	G											
				93												
4				87	G											5040
				77 50 for 100 mm												536
15					G											
					G											5035
6					G											
20	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															534
																5030
25																532
8																5025
30																5020
10																530
35																5015
12																528
40																

C: Condition of Sample

Good 
Disturbed 
No Recovery 

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)

Pocket Penetrometer
(compressive strength in kPa)

Shear strength in kPa (Unconfined)

Shear strength in kPa (Field vane)

Remolded strength in kPa

Percent Passing # 200 sieve

Bentonite/Grout Plug

Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method:

ODEX

Date Drilled: 28/11/2018

Logged by: PC

Checked by: SB

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BH18-07

Pg 1 of 1

Project No: 181-13597-14

Lat: 51.42700 Long: -116.17926

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1540.8m																Elev. 1540.8m
	ASPHALT (125 mm thick)															
	brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist															
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G											540
5																5050
2	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			62	G											
				84												
				82	G											538
10	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles			62												5045
	at 2.3 m - 0.038% sulphate based on lab test			75												
	at 2.3 m - 51.9% gravel, 35.5% sand & 12.7% silt/clay based on lab test			91	G											
4				50 for 150 mm	G											5040
15				50 for 150 mm	G											536
				50 for 50 mm	G											5035
6					G											534
20					G											5030
					G											532
25					G											5025
8					G											530
					G											5020
30					G											5015
10					G											
35					G											
12					G											
40					G											
	End of borehole at 12.2 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															528

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)
Pocket Penetrometer
(compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method: ODEX

Date Drilled: 28/11/2018

Logged by: PC

Checked by: SB

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Pg 1 of 1

Project No: 181-13597-14

Lat: 51.42588 Long: -116.18150

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1538.4m																Elev. 1538.4m
	ASPHALT (125 mm thick)															
	brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist				G											538
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G											5045
5					G											
2					G											5040
	at 2.3 m - 0.038% sulphate based on lab test			19	SPT											536
	at 2.3 m - 34.5% gravel, 46.7% sand & 18.8% silt/clay based on lab test				G											
10	compact, light brown, GRAVEL , and sand, trace silt, trace clay, moist				G											5035
4					G											534
15					G											5030
	from 4.9 m - light grey, very dense, inferred cobbles				G											5030
6					G											5025
20	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															532
																5025
25																530
8																5020
30																5015
10																528
35																5010
12																5026
40																

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)

Pocket Penetrometer
(compressive strength in kPa)

Shear strength in kPa (Unconfined)

Shear strength in kPa (Field vane)

Remolded strength in kPa

Percent Passing # 200 sieve

Bentonite/Grout Plug

Solid Pipe

Cuttings

Slotted Pipe

Sand/Pea-Gravel

Drill Method:

ODEX

Date Drilled: 26/11/2018

Logged by: PC

Checked by: SB

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Project No: 181-13597-14

Lat: 51.42484 Long: -116.18182

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1538.0m																Elev. 1538.0m
	ASPHALT (150 mm thick)															5045
	brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist															
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G											
5																
2																5040
	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			5	G											536
				6												
				17	G											
				15												
10				26												
				44	G											5035
				51												
4				56	G											534
				90												
15				50 for 150 mm	G											5030
	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles				G											
					G											
6					G											532
20																5025
	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															
25																5020
8																530
30																5015
10																528
35																5010
12																526
40																5005

C: Condition of Sample

Good 
Disturbed 
No Recovery 

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

▼ Ground Water Level
∞ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
X Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method:
ODEX
Date Drilled: 28/11/2018
Logged by: PC
Checked by: SB

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Pg 1 of 1

Project No: 181-13597-14

Lat: 51.42473 Long: -116.18135

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1537.7m																Elev. 1537.7m
	ASPHALT (150 mm thick)															
	brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist															
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G											
5				8	G											5040
2				10	G											536
	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			11	G											
				25												
10				82												5035
	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles			95	G											
				50 for 150 mm	G											5034
4				50 for 125 mm	G											
15				50 for 50 mm	G											5030
					G											
					G											5032
6					G											5025
20	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															
25																5020
8																
30																5015
10																5010
35																
12																5005
40																

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

STANDARD PENETRATION TEST

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)
Pocket Penetrometer
(compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method: ODEX

Date Drilled: 28/11/2018

Logged by: PC

Checked by: SB

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BH18-11

Pg 1 of 1

Project No: 181-13597-14

Lat: 51.42450 Long: -116.18082

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1537.6m																Elev. 1537.6m
	ASPHALT (150 mm thick)															
	brown, GRAVEL FILL (road base) , sandy, silty, trace clay, moist															
	brown, GRAVEL FILL (sub base) , sandy, some silt, trace clay, moist				G		●									5040
5					G		●									5036
2					G		●									5035
	light grey, BOULDER , very slow drill head advancement, inferred singular boulder or group of cobbles at 2.3 m - 0.068% sulphate based on lab test				G		●									5034
10					G		●									5030
	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles				G		●									5025
4					G		●									5020
15					G		●									5015
	End of borehole at 4.6 m due to refusal. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															5010
																5005
6																
20																
25																
8																
30																
10																
35																
40																
12																

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)
Ground Water Level
Shear strength in kPa (Torvane)
Pocket Penetrometer
(compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Bentonite/Grout Plug
Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method:
ODEX
Date Drilled: 29/11/2018
Logged by: PC
Checked by: SB

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STANDARD PENETRATION TEST



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BH18-12

Pg 1 of 1

Project No: 181-13597-14
Lat: 51.41451 Long: -116.17398

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1526.2m																Elev. 1526.2m
	brown, GRAVEL FILL (road base; 300 mm thick) , sandy, silty, trace clay, moist															526
	compact, light brown, GRAVEL , and sand, trace silt, trace clay, moist				G											5005
5																
2	at 1.5 m - very dense, inferred cobbles from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			83	G											524
	at 2.3 m - 0.064% sulphate based on lab test			50 for 75 mm	G											5000
	at 2.3 m - 52.1% gravel, 44.2% sand & 3.7% silt/clay based on lab test			67	G											
10				55												
				47												
4				43	G											4995
				75												
				75	G											522
15				94												
	at 4.6 m - water seepage			94	G											4990
				50 for 150 mm	G											
6					G											520
					G											4985
25					G											
8					G											518
					G											4980
30					G											
					G											4975
10					G											516
35					G											
	extremely weak (i.e. very dense soil like behaviour), completely weathered, light grey, SANDSTONE (Bedrock) , dry				G											4970
12	End of borehole at 11.6 m due to refusal.															514
40	Water level at 8.5 m at drilling completion. Water level in piezometer was at 3.2 mbgs on April 11, 2019.															

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)

Ground Water Level

Shear strength in kPa (Torvane)

Pocket Penetrometer (compressive strength in kPa)

Shear strength in kPa (Unconfined)

Shear strength in kPa (Field vane)

Remolded strength in kPa

Percent Passing # 200 sieve

Bentonite/Grout Plug

Solid Pipe

Cuttings

Slotted Pipe

Sand/Pea-Gravel

Drill Method:

ODEX

Date Drilled: 27/11/2018

Logged by: PC

Checked by: SB

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

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Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-13

Pg 1 of 1

Project No: 181-13597-14

Lat: 51.41438 Long: -116.17549

Depth (m) (ft)	Description	Piezo 1	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90	Elevation (m) (ft)
Elev. 1529.0m																Elev. 1529.0m
	dark brown, TOPSOIL (200 mm thick) , silt, sandy, some gravel, roots, dry				G											5015
	dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles				G											5028
5				50 for 125 mm	SPT											5010
2	from 1.5 m - very dense				G											5026
10				50 for 50 mm	SPT											5005
4	at 3.7 m - very slow drill head advancement				G											5000
15					G											5024
6					G											4995
20	at 6.9 m - water seepage				G											5022
25					G											4990
8					G											5020
30					G											4985
10					G											5018
35					G											4980
12					G											4975
40	End of borehole at 12.2 m. Borehole dry at drilling completion. Piezometer could not be located on April 11, 2019.				G											

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

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STANDARD PENETRATION TEST

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)

Ground Water Level
Shear strength in kPa (Torvane)
Pocket Penetrometer
(compressive strength in kPa)
Shear strength in kPa (Unconfined)
Shear strength in kPa (Field vane)
Remolded strength in kPa
Percent Passing # 200 sieve

Bentonite/Grout Plug

Solid Pipe
Cuttings
Slotted Pipe
Sand/Pea-Gravel

Drill Method: ODEX

Date Drilled: 26/11/2018

Logged by: PC

Checked by: SB

LAKE LOUISE WATER & SANITARY INFRASTRUCTURE UPGRADES:

LAKE LOUISE UTILITIES – VILLAGE ROAD, SENTINEL ROAD, LL INN AND POST HOTEL, HIGHWAY RAILWAY AND RIVER CROSSING

A Basic Impact Analysis (BIA) will be provided to the successful proponent, mitigation requirements for the Lake Louise Utility Replacement project are detailed below.

MITIGATION MEASURES

GENERAL MITIGATIONS

1. Environmental Protection Plan

Before initiation of construction, the contractor will prepare an Environmental Protection Plan (EPP) prepared and certified by a Qualified Environmental Professional (QEP) (i.e. a person who has training, expertise, and experience in a discipline relevant to the field of practice required and who is registered with the appropriate professional organization, is acting under that organizations code of ethics, and is subject to disciplinary action by that organization) and in accordance with Parks Canada Environmental Procedures. At least 7 days prior to work beginning, the EPP must be submitted to Parks Canada for approval by the LLYK Field Unit Environmental Surveillance Officer (ESO). The EPP will include, but not be limited to;

- Details on how the work limits will be marked and procedures to ensure operations will remain within the clearing boundaries to minimize damage to vegetation and soil. Site access shall also be identified and parking, materials and equipment storage, and project footprint should be clearly identified on the site.
- An overall site **Erosion and Sedimentation Control (ESC) Management Plan** which outlines areas where erosion and sedimentation are likely to occur and the means by which the Contractor proposes to control these issues. Specification of materials available to be deployed on-site and the specifications for installation will be included in this plan and subject to the approval of the LLYK ESO. If site specific ESC issues are noted, a localised ESC plan which directs specific mitigation for a specific location (e.g. near watercourse construction) may be required during construction at the discretion of the Departmental Representative, or the ESO.
- **A Drilling Plan.** For directional drilling operations, a drilling plan will be developed by the contractor, addressing mud systems and handling, and contingency measures for circulation losses or dewatering of excavations. All mud containment structures must be situated outside the Riparian Zone. All drill mud must be disposed of appropriately off site. Drill mud containment and frac-out response materials and equipment must be available on site during operations (e.g., vacuum truck, sandbags, spill response equipment).

- **A Drainage Plan** for ground water or surface water management shall be created to outline specific plans and mitigations implemented when water is encountered during trenching. Identified in the Aquatics Mitigation section, areas with a high water table areas will be need to be de-watered in such a manner that soil will not erode and will not be mobilized by watercourses or surface flow and have impacts on water quality.

- **A Frac-Out Prevention and Response Plan.** The chance of frac-out affecting the water quality of any of the nearby water bodies is low for this project due to the locations of the drill pits and drill paths. The drill pits will not be within 30 m of any waterbody and drilling will not occur below any watercourse. The Frac-Out Mitigation Plan will be followed to reduce the risk to water bodies in the project area. Environmentally friendly drill mud will be used for the duration of the project. A vac-truck and other spill response equipment will be kept on site and ready to mobilize at all times in the event of a frac-out. The frac-out response plan will be reviewed with the crew at the project kick off meeting. If frac-out occurs, drilling will cease and Parks Canada will be notified immediately. Parks Canada will approve all clean-up measures prior to the continuation of drilling.

- **A Spill Response Plan (SRP)** that details the containment and storage, security, handling, use and disposal of empty containers, surplus fuels, or other hydrocarbon products to the satisfaction of the Departmental Representative and the LLYK Field Unit Environmental Surveillance Officer (ESO) and in accordance with all applicable federal and provincial legislation. The SRP will include a list of products and materials to be used or brought on site that are considered or defined as hazardous or toxic to the environment. Such products may include, but are not limited to, fuels and lubricants. The Material Safety Data Sheets (MSDS) for all chemicals used will be made available on-site. Appropriately sized and stocked spill kits will be on site capable of handling 110% of the largest potential spill. Unique spill response requirements and disposal of empty containers, surplus product or waste generated in the application of these products shall be presented in the EPP. All contractor's staff will be made aware of their location(s) on site and will be trained on spill response procedures.

- A site specific **Restoration Plan** will be included for all areas of disturbances including remediation work at frac-out locations and entry and exit pits.

2. All Contractor personnel working on site will be required to attend an on-site environmental briefing conducted by the LLYK ESO. The first briefing will occur at the start of construction and will be provided at later dates as new personnel arrive on site.
3. Equipment fueling will only take place at an impermeable roadside area away from watercourses, or at staging areas with spill catchment countermeasures in place. Refueling and servicing of vehicles and equipment will only take place at least 30 m from the stable top of any banks, and in an area that drains away from any watercourse.
4. Tanks, hoses and connections will be inspected prior to use. All hose connections will be wrapped and secured with absorbent pads during fuel/oil transfers. All hoses, valves and equipment are to be kept in a containment area whenever possible. Hose length and the number of connections shall be minimized, and dripless connections will be used if possible. Gravity-fed systems are not permitted within the Parks, so manual or electric pump delivery systems shall be used.

5. Prior to use on the Project sites and daily during use, equipment, propane storage and fuel lines will be inspected for leaks and structural integrity, and inspections will be recorded. Any detected leaks will be addressed immediately, and spills over 5 L or any spill quantity in water will be reported to Banff Dispatch and the ESO immediately. Equipment stored overnight in staging areas will be stored on tarps with appropriate containment and with drip trays and/or pans under fuel tanks, if required.
6. All spills (e.g. hydraulic fluids) will be responded to immediately according to the Contractor's Spill Response Plan. In the event of any fluid spills or leaks exceeding 5 L or any spill quantity in or near water, the Spill Response Plan will be followed, including immediate containment, cleanup/mitigation, and immediate reporting to Banff Dispatch and the ESO. Any absorbent materials used in the clean-up or soils contaminated by the spill will be disposed of in the appropriate facilities and transported in accordance with the federal Transportation of Dangerous Goods Regulations. All spills, regardless of size or location, will be reported to the ESO.
7. Hazardous or toxic products (fuels, lubricants, etc.) will be stored no closer than 100 m from any drainage, wetland, watercourse, and water body. This will prevent/minimize deleterious materials from entering drainages, wetlands, watercourses and water bodies that would result in damage to aquatic and riparian habitat.
8. Special care will be taken in storage and application of patching and sealing compounds, concrete, grout and chemical surface sealants and none of these will be disposed of within the National Parks.
9. No garbage or debris of any kind will be left onsite. Garbage and/or food attractants will be kept inside vehicles, or in bear-safe garbage bins if they can be arranged for the site, and not kept out in the open, to minimize the risk of wildlife encounters.

AIR QUALITY AND NOISE

10. Dust generated by Project activities, both on Project site and access roads will be controlled as necessary by watering down surfaces and ongoing cleanup/maintenance. Dust-generating activities will be minimized as much as possible during windy periods.
11. Stationary emission sources such as portable diesel generators, compressors, etc. will only be used when necessary.
12. No equipment (motor vehicle or construction equipment) motor will idle when not in use, unless required under normal operating procedures or extenuating circumstances, and efficient use of vehicles will be encouraged to reduce air emissions and noise pollution.
13. All equipment, vehicles and stationary emission sources will be well maintained and used at optimal loads for minimal noise and air emissions.

WILDLIFE RESOURCES

14. Staging areas will be selected in consultation with the LLYK Field Unit to reduce the potential for impacts to wildlife species and their habitats.
15. Construction vehicles shall yield to wildlife.

16. Food and food waste will be securely stored to avoid access by animals. Daily off-site disposal of food wastes and other wildlife attractants are mandatory.
17. Contractor lunches will be stored and eaten inside vehicles to minimize wildlife attractants.
18. Feeding, harassment, or destruction of wildlife is strictly prohibited. Any wildlife encountered within or near the Project area will be allowed to passively disperse without harassment.
19. The Contractor is required to report large carnivore sightings or incidents and other emergencies to the Banff Dispatch Non-Emergency Line at 403-762-1473. Banff Dispatch will be notified immediately if a human-wildlife encounter occurs with a bear, wolf, cougar, wolverine, or any wildlife species of management concern. A written record of the wildlife sighting must be submitted to the Parks Canada ESO within 24 hours of the sighting.
20. The contractor will consult with the LLYK Field Unit to determine whether there are reports of wildlife in the immediate vicinity of the Project area.
21. If removal of vegetation must occur within the restricted activity period (April 20 to August 17) due to Project scheduling demands, pre-clearance bird nest/bat roost surveys will be conducted by a Qualified Environmental Professional with an appropriate level of experience identifying birds/bats and conducting nest sweeps/roost surveys. Should active nests/roosts or evidence of nesting/roosting (singing birds, alarm calls, distraction displays, birds carrying food, nesting or fecal material) be detected during surveys, consultation will occur with LLYK Field Unit staff to determine the appropriate course of action which may include species-specific setback distances until nestlings have fledged. Most migratory birds, their nests and eggs are protected under the MBCA (Government of Canada 1994). Little brown bats (myotis) are listed as *Endangered* under Schedule 1 of the *Species at Risk Act*.
22. If any active nests, roosts, or dens of species protected by SARA or the Migratory Birds Convention Act (MBCA; Government of Canada, 1994) are identified during construction, the contractor will immediately consult with the LLYK Field Unit to determine appropriate mitigation measures.

SPECIES AT RISK

23. If removal of vegetation must occur within the restricted activity period (April 20 to August 17), pre-clearance bird nest/bat roost surveys will be conducted by a Qualified Environmental Professional (See mitigation 21).

VEGETATION

24. Efforts will be made to ensure the minimum amount of vegetation is cleared or disturbed. The area to be cleared will be visibly delineated to avoid unnecessary vegetation removal. Such area will be clearly marked with highly visible materials such as flagging tape to inform equipment operators of the area they are to work in. Equipment operators will take extra caution to make sure no mechanical damage is caused to trees and other vegetation outside the designated clearing area.
25. Minimize full removal, phase vegetation removal, and retain vegetation when possible to reduce erosion.
26. Prior to accessing Banff National Park, contractors will make sure that construction equipment is clean to prevent introduction of invasive species, noxious weeds and soils from off-site.
27. To minimize migration of invasive species from the Project site:

- Prior to entry onto new segments of the Project area, all equipment that came into contact with soil at previous segments (i.e. clearing, grading, decompaction, or restoration equipment) must be cleaned (blow down/scrape down), and approved by the LLYK Field Unit, where possible and appropriate.
 - Construction staff and others will be required to scrape mud off their boots and brush seeds and dirt from their clothing before leaving the Project site.
 - Discussion will take place between the Contractor and the LLYK Field Unit before work commences to make sure special attention is paid for proper control of the invasive species.
28. Consider sod salvage in areas where native vegetation will have to be re-established (sensitive sites), and may not have grass as the dominant vegetation type. Generally the top 15cm of vegetation and topsoil can be salvaged in blocks of varying sizes using hand tools or an excavator with a finishing bucket, and can be stored for up to 72 hours prior to replacement.
 29. Any incidental disturbance to vegetation in areas temporarily disturbed by heavy equipment and other construction-phase related activities (including lay-down sites, temporary work sites, and material stock pile sites) will be restored as quickly as possible by planting grass seed or hydro-seeding (using seed mixtures approved by the LLYK ESO at an appropriate time of year).
 30. Vegetation reclamation and rehabilitation shall be submitted to the LLYK ESO in the EPP or at least 14 days before planned implementation. Ensure restoration plans, equipment, methodology, and supplies are approved prior to purchasing or mobilizing to the site.
 31. All vegetation debris will be managed following the contract specifications and using the BFU/LLYK Woody/Vegetated Debris Management Guidelines
 32. During the grubbing component, stumps, roots, imbedded logs and other non-soil debris shall be pulled and shaken free of loose soil and rocks.
 33. Clear vegetation areas with non-native vegetation in spring and early summer to avoid further spread and development of the non-native seed bank.
 34. Clearing activities shall be avoided during nesting seasons for birds, bats reptiles and amphibian species in the project area.
 35. Retain 30 metre vegetated buffer around water bodies, and where disturbance is necessary and unavoidable restoration is required.
 36. Debris will not be deposited in water bodies.

SOILS AND LANDFORMS

37. Project activities will be planned and scheduled for dry weather whenever possible. If significant wet weather is encountered, additional measures will be taken to minimize erosion potential.
38. Construction and equipment travel will be minimized during periods of heavy precipitation and excavation activities halted during heavy rainfall events.
39. Contingency plans for isolating worksites during high precipitation, high wind and runoff events will be identified in the EPP.
40. The area of exposed soil at any given time will be minimized by using techniques such as phased construction activities, retaining vegetation as much as possible, and, following construction works completion, stabilizing the exposed soils as soon as possible using temporary measures (e.g. mulch,

biodegradable erosion sediment control blankets, hydro-seeding, plastic sheeting, planting long-term vegetation, etc.).

41. Erosion- and sediment-control materials will be readily available on-site. Materials may include but are not limited to rock, gravel, mulch, biodegradable erosion sediment control blankets, grass seed (Seed Mix B provided in *Seed Mixes and Reclamation Strategies for Projects in the LLYK Field Unit of Banff, Kootenay and Yoho National Parks: FINAL*), sediment fencing, staking, and polyethylene sheeting.
42. Slope stabilization methods including, but not limited to, catchment and wire netting and grading will be used if appropriate, to help reduce any potential slope failures.
43. To minimize soil compaction, all equipment will be stored either on the road or on previously disturbed or hardened surfaces.
44. All topsoil will be salvaged at all excavation sites for reclamation purposes and whenever possible stripping done under dry conditions only.
45. Topsoil separation from spoil/mineral soils will be maintained by a horizontal distance of at least 1m or will have separation maintained through a barrier.

AQUATIC RESOURCES

46. The Erosion and Sediment Control Management Plan that was included with the EPP will be implemented by the successful Contractor. All components will be regularly maintained to ensure effectiveness and a maintenance schedule and responsible personnel (position) will be identified in the EPP.
47. Project activities will be planned for dry weather to allow easier control of contaminated runoff and sediment. However, if any scheduled activity requires working in wet conditions, the area of work will be isolated and appropriate sediment controls installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters. Special care will be taken for surface repair works requiring the cast in place concrete pouring activities, application of grout, epoxy, paint, patching and sealing compounds, and chemical surface sealants.
48. Fuels, gases, or other deleterious substances will be contained within the appropriate and approved containers. Secondary containment large enough to hold 110% of the volume of the containers will be used.
49. Fuel storage and fueling locations will be identified and approved by the Parks Canada Departmental Representative or the LLYK ESO. Fuels, gases, or other deleterious substances will be transported according to the federal Transportation of Dangerous Goods Regulations.
50. In the event of a frac-out, spills or release of deleterious substances drilling will cease and Parks Canada will be notified immediately. Parks will approve all clean-up measures prior to the continuation of drilling;
51. All material and equipment needed to contain and clean up drilling mud releases will be kept onsite, in good working order, and readily accessible in the event of a frac-out

DRAINAGE

52. Water encountered in the trench excavations and entry and exit pits will need to be isolated and managed to ensure no sediment laden water contaminates local watercourses.
53. The locations and site specific drainage plans will need to be approved by the Parks Canada ESO or Departmental Representative in the field prior to being implemented.

CULTURAL RESOURCES

54. Accidental Finds Protocol. There may be cultural resources present in the project area that have not yet been discovered (even after an archaeological assessment has been carried out or no assessment was deemed necessary for the project). If staff observe any significant cultural resources while working, they must stop work in the immediate area, and contact the project manager, or a Parks Canada archaeologist or cultural resource advisor, to discuss any protective measures that might be needed.
55. Significant resources that could be considered grounds for work stoppage include, but are not limited to, human remains, unique or diagnostic artifacts, and/or artifacts directly associated with known sites and/or unidentified sites in the area. In all cases, cultural managers must be made aware of the finds, and these finds must be communicated back to Parks Archaeologists.

VISITOR AND RESIDENT SAFETY/EXPERIENCE

56. The LLYK Field Unit will be kept apprised of timelines, work periods and construction activities so that their staff (e.g. visitor centre and media) can provide information to the public to prevent additional safety risks for recreational users in the vicinity of the Project site during construction.
57. Work will be restricted to daytime hours (7:00-19:00) unless otherwise requested and appropriately permitted.
58. The contractor will post road signage (e.g. road closed, trucks turning, reduced speed) to improve public safety. All signage will be in English and French.
59. Aesthetically displeasing visual impacts of the work site and staging areas will be reduced by minimizing clearing of vegetation to the extent possible (i.e. only what is necessary to maintain stable slopes and a safe work environment). Construction staging and materials stockpiling will ideally be confined to areas physically and visually obstructed from the public.
60. Work will be scheduled to avoid early morning, late evening, and after-sundown periods.

CONSTRUCTION MITIGATIONS

REFERENCE DOCUMENT: PARKS CANADA NATIONAL BEST MANAGEMENT PRACTICES FOR ROADWAY, HIGHWAY, PARKWAY AND RELATED INFRASTRUCTURE

1. EXCAVATIONS, SOIL STRIPPING AND OVERBURDEN REMOVAL MITIGATIONS MODULE

Construction projects often involve excavations. To successfully complete reclamation of disturbed areas, and protect areas from erosion proper soil handling and backfilling procedures must be followed. Post excavation and stripping soil and vegetation restoration mitigations should be applied and the approved Restoration Plan should be implemented.

Timing of Works

- 1.1. Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.
- 1.2. If the work schedule requires working in the rain, appropriate sediment controls must be installed to prevent the release of sediment-laden water or any other deleterious substances into surface waters.

EXCAVATION

- 1.3. Materials shall be placed at storage sites or on the grade without spillage outside the working limits. Any material inadvertently falling outside the work limits is to be removed promptly in a manner that does not damage trees or vegetation.
- 1.4. All sediment control measures must be in place before starting work in the vicinity of rivers, water bodies, watercourses, and wetlands.
- 1.5. Special precautions may have to be taken during excavation in the vicinity of intermittent or active drainage channels.
- 1.6. Excavation plans must be compared to local archaeological resource inventories, if available.
- 1.7. If cultural resources (e.g. archaeological resources) are discovered, immediately cease work, and alert ESO.
- 1.8. Minimize changes to the ground surface that affects its infiltration and runoff characteristics and maintain/re-establish effective surface drainage on completion of the project
- 1.9. Backfill and compact excavations as soon as possible. Optimize degree of compaction to minimize erosion and allow for re-vegetation.
- 1.10. All trenches or ditches left unattended overnight must be fenced or covered to prevent wildlife entrapment.

SOIL STRIPPING

- 1.11. Strip topsoil under dry conditions, whenever possible.
- 1.12. No stripping shall occur outside of the delineated work area or within 1 metre of the drip line of existing forest.

- 1.13. In the event of a work program shutdown during inclement weather (e.g. winter conditions unfavourable for construction, heavy rain events, construction delays, etc.) erosion control of bared soils or excavated material stockpiles is required.
- 1.14. Stripping close to any watercourse, water body or wetland shall employ methods to ensure materials are not pushed, do not fall or erode into the water or wetlands.
- 1.15. Work within a 100 metre buffer from the high water mark of waterways or wetlands will require a site specific sediment and erosion control plan.
- 1.16. An erosion control plan is also needed to control dust generated from the construction site.

TOPSOIL SALVAGE

- 1.17. Salvage topsoil at all excavation sites for reclamation purposes.
- 1.18. Usually the upper 15 cm of soil, below the sod layer if present, is considered topsoil, where depths exceed 15cm salvage the entire depth of topsoil.
- 1.19. Remove stumps and woody debris from topsoil, wherever possible.

EXCAVATED MATERIAL STORAGE

- 1.20. Allow space for separate storage of topsoil and spoil; where space is available separate stored topsoil from spoil by at least 1 m. Use appropriate material (e.g., geo-textile) to separate soil components where space is limited.
- 1.21. Topsoil may be stored on hardened surfaces, geo-textile material or directly on undisturbed vegetation. If storage occurs on vegetation, material recovery by hand may be required.
- 1.22. Cover all stockpiled material with heavy-duty plastic or filter cloth to prevent erosion during precipitation events.
- 1.23. Topsoil should be stockpiled on the uphill side of the disturbance on sloped terrain.
- 1.24. Construct barricades to prevent losses on steep terrain (>18°, 3:1) and within 100m of watercourses.

EXCESS MATERIALS AND WASTE (OVERBURDEN REMOVAL)

- 1.25. Remove excess excavated material from site where it cannot be used for the final grading of the area. Site specific arrangements must be made for disposal locations and procedures of overburden.
- 1.26. Surplus excavated material may be used to fill depressions around the project site providing topsoil is stripped before filling, with approval from SO.

2. CONCRETE HANDLING MITIGATIONS MODULE

Concrete is a common construction material used in transportation infrastructure. Its use ensures longevity of the infrastructure and safety for public use. One litre of concrete wash water or leachate in 1000L of water will kill fish. Cement-based products including grouts and concrete are lethal to fish and many other aquatic organisms. Raw product or leachate entering a watercourse will alter water chemistry, making it more basic or alkaline.

ONSITE TEMPORARY CONCRETE WASHOUT FACILITY

- 2.1. Temporary concrete washout facilities shall be located a minimum of 30m from storm drain inlets, open drainage facilities, and watercourses. Washout facilities will be identified and approved by the Parks Canada Departmental representative or the ESO.

- 2.2. Temporary concrete washout facilities shall be temporary pit or bermed areas constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
- 2.3. Straw bales, wood stakes, and sandbag materials can be used to construct temporary containment walls or “barriers”.
- 2.4. Plastic lining material shall be a minimum of 10-mil polyethylene sheeting and shall be free of holes, tears or other defects that compromise the impermeability of the material.
- 2.5. The soil base shall be prepared free of rocks or other debris that may cause tears or holes in the plastic lining material.
- 2.6. Perform washout of concrete mixer trucks in designated areas only.
- 2.7. Wash concrete from mixer truck chutes into approved concrete washout facility or collect in an impermeable bag for disposal.
- 2.8. Pump excess concrete in concrete pump bin back into concrete mixer truck.
- 2.9. Concrete washout from concrete pumper bins can be washed into concrete pumper trucks and discharged into designated washout area or properly disposed offsite. Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of per federal and provincial regulations.

MAINTENANCE AND INSPECTION OF TEMPORARY CONCRETE WASHOUT FACILITIES

- 2.10. Temporary concrete washout facilities shall be maintained to provide adequate holding capacity with a minimum freeboard of 100 mm (4 inches) for above grade facilities and 300 mm (12 inches) for below grade facilities.
- 2.11. Maintaining temporary concrete washout facilities shall include removing and disposing of hardened concrete and returning the facilities to a functional condition.
- 2.12. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is 75% full.
- 2.13. Temporary concrete washout facilities shall be inspected for damage (i.e. tears in PVC liner, missing sand bags, etc.).
- 2.14. Onsite concrete waste storage and disposal procedures will be monitored at least weekly or as directed by the ESO.
- 2.15. Holes, depressions or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and restored.

ON SITE CONCRETE MANAGEMENT

- 2.16. Water contaminated in the placing of cement and curing of concrete shall be contained and removed from the site to an approved disposal facility.
- 2.17. The concrete batching plant (if applicable) must be operated pursuant to applicable dust, air emission, and water quality control regulations.
- 2.18. Waste, solidified concrete from rolling concrete mixers in amounts less than 1 cubic meter and waste solidified concrete from construction pour shall be buried in the grade within 48 hours of the pour, subject to approval and direction from the Departmental Representative, or disposed of in a waste container.

