
TABLE OF CONTENTS

Pages

Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

Section 00 01 10 - Table of Contents.....	3
---	---

Division 01 - GENERAL REQUIREMENTS

Section 01 11 00 - Summary of Work	4
Section 01 14 00 - Work Restrictions	2
Section 01 21 00 – Allowances.....	2
Section 01 29 00 - Payment Procedures	1
Section 01 29 01 – Method of Measurement and Payment	28
Section 01 29 83 - Payment Procedures For Testing Laboratory Services.....	1
Section 01 31 19 - Project Meetings	1
Section 01 32 16.07 - Construction Progress Schedule - Bar (Gantt) Chart.....	3
Section 01 33 00 - Submittal Procedures.....	4
Section 01 35 29 – Health, Safety, and Emergency Response Procedures.....	4
Section 01 35 43 - Environmental Procedures.....	4
Banff National Park Directive – BNP-93-17	11
Section 01 41 00 - Regulatory Requirements	1
Section 01 42 13 - Abbreviations & Acronyms.....	4
Section 01 45 00 - Quality Control	5
Section 01 51 00 - Temporary Utilities.....	3
Section 01 52 00 - Construction Facilities	8
Section 01 56 00 - Temporary Barriers And Enclosures	3
Section 01 61 00 - Common Product Requirements.....	5
Section 01 71 00 - Examination And Preparation	3
Section 01 73 00 - Execution.....	3
Section 01 74 11 - Cleaning.....	2
Section 01 74 21 – Construction/Demolition Waste Management And Disposal...5	
Section 01 77 00 - Closeout Procedures	2
Section 01 78 00 - Closeout Submittals.....	4

Division 02 - EXISTING CONDITIONS

Section 02 41 12.13 – Paving Removal	2
Section 02 62 00.01 - Hazardous Materials	4

Division 03 - CONCRETE

Section 03 10 00 - Concrete Forming And Accessories	3
Section 03 20 00 - Concrete Reinforcing.....	2
Section 03 30 00 – Cast-in-Place Concrete.....	8

Division 31 - EARTHWORK

Section 31 05 10 - Corrected Maximum Dry Density For Fill	1
Section 31 05 16 - Aggregate for Earthworks	3
Section 31 11 00 - Clearing And Grubbing	4
Section 31 14 13 - Soil Stripping And Stockpiling.....	3
Section 31 22 13 - Rough Grading	2
Section 31 22 16.13 – Roadway Subgrade Reshaping	2
Section 31 23 33 – Excavating, Trenching And Backfilling	7

Division 32 - EXTERIOR IMPROVEMENTS

Section 32 03 11 – Landscape Maintenance.....	5
Section 32 11 16.01 – Granular Sub-base.....	4
Section 32 12 13.16 - Asphalt Tack Coats.....	2
Section 32 12 13.23 - Asphalt Prime Coats	2
Section 32 12 16 - Asphalt Paving.....	10
Section 32 17 23 – Pavement Markings	5
Section 32 91 19.13 – Topsoil Placement and Grading.....	5
Section 32 92 19.13 – Mechanical Seeding	4
Section 32 92 23 – Sodding	5

Division 33 - UTILITIES

Section 33 05 16 – Maintenance Holes and Catch Basin Structures	8
Section 33 05 23B – Trenchless Pipe Bursting.....	6
Section 33 05 23.13 – Utility Horizontal Directional Drilling	9
Section 33 05 23.22 – CIPP	7
Section 33 11 16 - Site Water Utility Distribution Piping.....	14
Section 33 11 16.13 - Water Utility Distribution Piping – Cathodic Protection	2
Section 33 12 13 - Water Service Connections	3
Section 33 31 11 - Public Sanitary Sewerage Gravity Piping	11

Division G – BUILDING SITEWORK

Section G2050 – Landscape.....	3
--------------------------------	---

Appendix A

Sewer Bypass Pumping Guidelines, January 2018, City of Calgary
Lake Louise Utilities Upgrade Geotechnical Investigation Revision 4, September 2019
Lake Louise Water and Sanitary Infrastructure Upgrades – Mitigation Measures
Existing Slate Road Reservoir Connection

LIST OF DRAWINGS

OVERALL PLANS

- C100 Title Sheet & Index
- C101 Overall Site Location Plan
- C102 Underground Utilities Plan Sheet 1 of 3
- C103 Underground Utilities Plan Sheet 2 of 3
- C104 Underground Utilities Plan Sheet 3 of 3

BLOCK PROFILES

- C201 Plan Profile - From Sta 0+545 to Sta 0+870
- C202 Plan Profile - From Sta 0+840 to Sta 1+140 Along Existing Deep Utilities
- C202B Plan Profile - From Sta 0+860 to Sta 1+060 Along Proposed Deep Utilities
- C209 Plan Profile - From Sta 2+560 to Sta 2+740
- C305 Plan Profile - From Sta 1+910 to Sta 2+230
- C306 Plan Profile - From Sta 2+230 to Sta 2+540
- C307 Plan Profile - From Sta 2+520 to Sta 2+820

DETAILS

- C400 Details (Typical)
- C401 Details (Typical)
- C402 Details (Typical)
- C403 Borehole Location Plan & Borehole Logs Sheet 1 of 2
- C404 Borehole Logs Sheet 1 of 2

END OF TABLE

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:
 - Sanitary and Water Main Upgrades through the Lake Louise Inn (**Start Sept. 8, 2020 and completed in 2020**)
 - Sanitary and Water Main Upgrades through the Post Hotel (**Oct. 14, 2020 – Nov. 22, 2020**)
 - Trans Canada Highway Water Main Connector (**to be completed by June 30, 2021**)
 - Slate Road Sanitary and Water Main Upgrades (**to be completed June 30, 2021**)
 - Bow River Sanitary Crossing Upgrade (**to be completed June 30, 2021**)
 - 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.
 - .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.
 - .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 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.
- .3 Provide for personnel and vehicular traffic. Provide detours, flagging, barricades and traffic controls before beginning work.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.4 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 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. Saturdays and Sundays from 8am to 7pm.
- .6 Long weekend work to be pre-approved by the Departmental Representative otherwise, no work will be permitted from noon on the Thursday before any long weekend until 7am on the Tuesday following the long weekend. The Departmental Representative will provide a list of non-working holidays and events 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.
- .12 2020 work identified in Section 01 11 00 Summary of Work is to be completed during the 2020 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;

-
- .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 use 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 Erosion and Sediment Control
 - .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 throughout the entire project. The work includes:
 - .1 Supply and installation of erosion control 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.
- .2 Clearing and 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 possible.
 - .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 Topsoil Stripping (Haul off-site)
 - .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 Disposal includes all organic material contaminated by road gravel and salt.
 - .5 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.2 Part B – Water Mains

- .1 Remove and Replace Existing Water Main
 - .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 and depth 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 of entry, exit, and slurry containment pits, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump fees.
 - .4 Locating and protecting existing utilities and structures.
 - .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, 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 Stabilising of surface structures as required.
 - .11 Excavation and 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 Proposed Water Main
 - .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.
 - .10 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .11 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .3 Remove and Replace Existing Water Main – Pipe Bursting
 - .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 of entry, and exit pits, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump Fees.
 - .4 Locating/exposing/protecting all existing utilities to allow the proposed alignment.
 - .5 Water control and disposal.
 - .6 Temporary fencing.
 - .7 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .8 Trench or ground support system, shoring, sheeting and pit maintenance.

-
- .9 Pipe supply, installation of pipe and fittings, bedding, jointing, placing, concrete thrust blocking, cleaning, flushing and disinfecting, pressure and leakage testing.
 - .10 Stabilising of surface structures as required.
 - .11 Backfilling of all pits, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .12 No payment will be made for pipe bursting deemed unacceptable due to incorrect grade or alignment beyond the specified tolerances.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Connection to Existing 400 HDPE Reservoir Transmission Main
- .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.) connected to the existing water main.
 - .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, mechanical restraint, bedding, epoxy coating, cathodic protection, cleaning, flushing and disinfecting, pressure and leakage testing.
 - .10 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.
 - .4 Existing Reservoir connection can be seen in Existing Slate Road Reservoir Connection found in Appendix A.
- .5 Connection to Existing Water Distribution Main (All sizes)
- .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, Replacement harness and coupling, tee, reducer, valve, valve box, operating rod, concrete thrust blocking, mechanical restraint, connecting pipe, bedding, epoxy coating, cathodic protection, cleaning, flushing and disinfecting, pressure and leakage testing.
 - .10 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.
- .6 Abandon Existing Water Main in Place
- .1 Measurement shall be made on a complete unit (EA) to abandon an existing watermain in place.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) to abandon an existing watermain.
 - .3 Payment shall include the supply of all labour, material and plant to abandon an existing watermain in place. The work includes:
 - .1 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .2 Dump Fees.
 - .3 Locating and protecting existing utilities.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .7 Excavation, trench or ground support system, shoring, and sheeting.
 - .8 Modifications to the existing pipe including cutting and grouting.
 - .9 Breaking, excavation, loading, hauling and disposal of removed materials outside of Banff National Park.
 - .10 Trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .11 Cleaning, removal of debris.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.

-
- .7 Reconnect Existing Building Service to Water Main
- .1 Measurement shall be made on each (EA.) complete unit installed.
 - .2 Payment shall be made on the unit price bid per complete unit installed for all building services sizes 100mm and under.
 - .3 Payment shall include the supply of all labour, material and plant to reconnect the existing water service connection. 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 Removal of excavated material to disposal or stockpile areas.
 - .5 Connecting to watermain, tapping water service saddle, extension of pipe, and configuration of existing curb stop to suit new connection.
 - .6 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 service connection pipes and fittings.
 - .10 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .8 Extend and Reconnect Water Service for the Post Hotel
- .1 No measurement shall be taken
 - .2 Payment shall be made on lump sum (L.S.) price bid.
 - .3 Payment shall include the supply of all labour, material and plant to reconnect the existing water service connection. The work includes:
 - .1 Protecting existing utilities and structures.
 - .2 Traffic accommodations, barricades, flag men or temporary traffic control as required, including coordination to ensure access is always available to the Post Hotel.
 - .3 Excavation, trench or ground support system, shoring, sheeting.
 - .4 Removal of excavated material to disposal or stockpile areas.
 - .5 Connecting to watermain, tapping water service saddle, extension of pipe, and configuration of existing curb stop to suit new connection.
 - .6 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 service connection pipes and fittings.
 - .10 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .9 Remove and Replace Existing Hydrant, Lead and Valve
- .1 Measurement shall be made on a complete unit (EA) to remove and replace and reconnect to the new water main.

-
- .2 Payment shall be made on the unit price bid per complete unit (EA.) to remove and replace and reconnect existing hydrant.
 - .3 Payment shall include the supply of all labour, material and plant to remove and replace and reconnect the existing hydrant to the existing water main. The work includes:
 - .1 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .2 Removal and disposal of existing hydrant, lead and valve
 - .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 Supply of new of fire hydrant, valve, valve box, operating rod, connecting pipe, tee.
 - .10 The supply and installation of new concrete thrust blocking, bedding, epoxy coating and cathodic protection if necessary, cleaning, flushing and disinfecting.
 - .11 Pressure and leakage testing.
 - .12 Trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .10 Supply and Install Hydrant
 - .1 Measurement shall be made on a complete unit (EA) to supply and install and connect to the new water main.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) supply and install and connect new hydrant.
 - .3 Payment shall include the supply of all labour, material and plant to supply and install and connect hydrant to the existing water main. The work includes:
 - .1 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .2 Supply of new hydrant.
 - .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 Supply of fire hydrant, valve, valve box, operating rod, connecting pipe, tee.
 - .10 The supply and installation of new concrete thrust blocking, bedding, epoxy coating and cathodic protection if necessary, cleaning, flushing and disinfecting.
 - .11 Pressure and leakage testing.
 - .12 Trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .11 Remove Existing Drain Valve and Manhole.
- .1 No measurement shall be taken.
 - .2 Payment shall be made on lump sum (L.S.) price bid.
 - .3 Payment shall include the supply of all labour, material and plant to remove existing drain valve and manhole. The work includes:
 - .1 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .2 Locating and protecting existing utilities and structures.
 - .3 Removal and disposal of existing valve and manhole.
 - .4 Breaking, excavation, loading, hauling and disposal of old manhole outside of Banff National Park.
 - .5 Dump Fees.
 - .6 Locating and protecting existing utilities.
 - .7 Water control and disposal.
 - .8 Temporary fencing.
 - .9 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .10 Excavation, trench or ground support system, shoring, and sheeting.
 - .11 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .12 Cleaning, removal of debris.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .12 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.
- .13 Remove and Replace Existing Valve
- .1 Measurement shall be made on a complete unit (EA) to remove and replace existing valve.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) to remove and replace existing valve.
 - .3 Payment shall include the supply of all labour, material and plant to remove and replace the existing valve to the existing water main. The work includes:
 - .1 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .2 Removal and disposal of existing valve.
 - .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 Supply of new valve, valve box, operating rod, connecting pipe, tee.
 - .10 The supply and installation of new concrete thrust blocking, bedding, epoxy coating and cathodic protection if necessary, cleaning, flushing and disinfecting.
 - .11 Pressure and leakage testing.
 - .12 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .14 Install Curb Stop on Existing Building Service
- .1 Measurement shall be made on a complete unit (EA) of curb stop installed
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) of curb stop installed
 - .3 Payment shall include the supply of all labour, material and plant to install a new curb stop. The work includes:
 - .1 Excavation, trenching, and the removal of excavated material to disposal or stockpile areas.

-
- .2 Dump Fees
 - .3 Locating and protecting existing utilities.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .7 Excavation, trench or ground support system, shoring, and sheeting.
 - .8 Installation of a new curb stop.
 - .9 The supply and installation of new concrete thrust blocking, bedding, epoxy coating and cathodic protection if necessary, cleaning, flushing and disinfecting.
 - .10 Pressure and leakage testing.
 - .11 Trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming, testing and subgrade restoration.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.3 Part C – Sanitary Sewer

- .1 Remove and Replace Existing Sanitary Sewer – Pipe Bursting
 - .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 and depth specified.
 - .3 Payment shall include the supply of all labour, material and plant to install the new sewer pipe through pipe bursting to lines and grades shown on the plans. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Excavation of entry, exit, and slurry containment pits, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump fees.
 - .4 Locating and protecting existing utilities and structures.
 - .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, sheeting.
 - .9 Stabilising of surface structures as required.
 - .10 Pre-installation CCTV inspection.
 - .11 Pipe supply, installation, bedding, jointing, placing, insulation, cleaning, leakage testing, and CCTV testing.
 - .12 Excavation and backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.

-
- .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .2 Remove and Replace Existing Sanitary Sewer – Open Cut
 - .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 and depth specified.
 - .3 Payment shall include the supply of all labour, material and plant to remove and dispose of the old pipe and install the new sewer pipe 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 Wasting of materials in the pipe zone to an approved disposal site outside of Banff National Park.
 - .4 Removal and disposal of existing sanitary sewer pipe to an approved disposal site outside of Banff National Park.
 - .5 Dump fees.
 - .6 Locating and protecting existing utilities and structures.
 - .7 Water control and disposal.
 - .8 Temporary fencing.
 - .9 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .10 Excavation, trench or ground support system, shoring, sheeting.
 - .11 Pipe supply, installation, bedding, jointing, placing, insulation, cleaning, leakage testing, and CCTV testing.
 - .12 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .3 New Sanitary Sewer
 - .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 and depth specified.
 - .3 Payment shall include the supply of all labour, material and plant to install the new sewer pipe 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 and structures.
 - .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, sheeting.
 - .9 Pipe supply, installation, bedding, jointing, placing, insulation, cleaning, leakage testing, and CCTV testing.
 - .10 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .11 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Abandon Existing Sanitary Sewer in Place
- .1 Measurement shall be made on a complete unit (EA.) abandoned.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) abandoned.
 - .3 Payment shall include the supply of all labour, material and plant to abandon the sanitary sewer in place per City of Calgary guidelines. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Locating and protecting existing utilities and structures.
 - .3 Excavation and the removal of excavated material to disposal areas and ground support.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .7 Grouting, cutting, sealing ex sanitary line.
 - .8 Breaking, excavation, loading, hauling and disposal of removed materials outside of Banff National Park.
 - .9 Dump fees.
 - .10 Backfilling as detailed, compacting, grading, testing.
 - .11 Cleaning, removal of debris.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .5 Existing Manhole – Adjust Benching
- .1 Measurement shall be made on a complete unit (EA.) adjusted.
 - .2 Payment shall be made on the unit price bid per complete unit (EA.) adjusted.
 - .3 Payment shall include the supply of all labour, material and plant to jack hammer and re-bench the existing manhole. The work includes:
 - .1 Breaking, excavation, loading, hauling.
 - .2 Removal of material to an approved landfill.
 - .3 Dump fees.
 - .4 Forming and placing new concrete benching.
 - .5 Locating and protecting existing utilities and structures.
 - .6 Dewatering, water control and disposal.

-
- .7 Temporary fencing.
 - .8 Excavation, trench or ground support system, shoring, and sheeting.
 - .9 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .6 Existing Manhole – Adjust Rim
- .1 Measurement shall be made in unit price per unit (EA.)adjusted.
 - .2 Payment shall be made on the unit price bid (EA.) to adjust each manhole.
 - .3 Payment shall include the supply of all labour, material and plant to raise each manhole to the level of the existing grade. The work includes:
 - .1 Raising of manhole covers including grade rings if necessary, to make a level surface.
 - .2 Excavation and backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .3 Disposal of all removed materials to an approved dump site.
 - .4 Dump fees.
 - .5 Cleaning, removal of debris.
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .7 Manhole – New
- .1 Measurement shall be made in vertical metre (V.M.) from the lowest invert to the rim of the frame and cover of the new manhole installed.
 - .2 Payment shall be made on the vertical metre (V.M.) price bid per complete unit installed.
 - .3 Payment shall include the supply of all labour, material and plant to construct the new manhole. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Locating and protecting existing utilities and structures.
 - .3 Excavation and the removal of excavated material to disposal areas and ground support.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .7 Supply and installation of concrete manhole material as detailed.
 - .8 Concrete bedding, grouting joints, benching, cutting, patching, connecting, leakage testing.
 - .9 Supply and installation, manhole frame and cover.
 - .10 Backfilling as detailed, compacting, grading, testing.
 - .11 Cleaning, removal of debris.
 - .12 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .8 Temporary Sanitary Sewer Bypass Pumping

-
- .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 sanitary sewer bypass pumping during the installation of the sanitary sewer system. The work includes:
 - .1 Traffic accommodations, 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 pumping wastewater flows around pipe segments.
 - .3 Submit plan for implementation and sequencing of bypass pumping for review and approval by the Department Representative 4 weeks prior to installation of the bypass system.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .9 CIPP Lining of Existing 200mm Siphon – Bow River
 - .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.
 - .3 Payment shall include the supply of all labour, material and plant to install the new CIPP liner within the existing sewer pipe as shown on the plans. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Excavation of entry and exit pits, trenching, and the removal of excavated material to disposal or stockpile areas.
 - .3 Dump fees.
 - .4 Locating and protecting existing utilities and structures.
 - .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, sheeting.
 - .9 Stabilising of surface structures as required.
 - .10 Pre-installation CCTV inspection.
 - .11 Supply of CIPP liner, installation, jointing, placing, curing, pre and post cleaning, leakage testing, and CCTV testing.
 - .12 Excavation and backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .13 All incidental work and items required to complete the work for which payment is not specified elsewhere.

-
- .10 Reconnect Existing Sanitary Sewer Service in Place
- .1 Measurements shall be made in unit price per unit (EA.) reconnected
 - .2 Payment shall be made on the unit price bid (EA.) per complete unit reconnected.
 - .3 Payment shall include the supply of all labour, material and plant to reconnect the sanitary sewer in place per City of Calgary guidelines. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Locating and protecting existing utilities and structures.
 - .3 Excavation and the removal of excavated material to disposal areas and ground support.
 - .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 Grouting, cutting, sealing ex sanitary line.
 - .9 Breaking, excavation, loading, hauling and disposal of removed materials outside of Banff National Park.
 - .10 Dump fees.
 - .11 Pipe supply, installation, bedding, jointing, placing, insulation, cleaning.
 - .12 Backfilling as detailed, compacting, grading, testing.
 - .13 Cleaning, removal of debris.
 - .14 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .11 Remove Existing Parshall Flume and Replace with 5A Manhole
- .1 No measurement shall be made.
 - .2 Payment shall be made on lump sum (L.S.) upon work completed.
 - .3 Payment shall include the supply of all labour, material and plant to remove and dispose of the old Parshall flume and to construct the new manhole. The work includes:
 - .1 Construction survey, layout, setting grades.
 - .2 Locating and protecting existing utilities and structures.
 - .3 Excavation and the removal of excavated material to disposal areas and ground support.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .7 Breaking, excavation, loading, hauling and disposal of old structure outside of Banff National Park.
 - .8 Dump fees.
 - .9 Supply and installation of concrete manhole material as detailed.

-
- .10 Concrete bedding, grouting joints, benching, cutting, patching, connecting, leakage testing.
 - .11 Supply and installation, manhole frame and cover.
 - .12 Extending the existing pipes to connect to the new manhole, including all pipe and couplers.
 - .13 Backfilling as detailed, compacting, grading, testing.
 - .14 Cleaning, removal of debris.
 - .15 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .12 Additional Efforts Required to Ensure Existing Curb and Cobblestone Surface Remain Undisturbed at the Lake Louise Inn
- .1 No measurement shall be made.
 - .2 Payment shall be made on lump sum (L.S.) upon work completed.
 - .3 Payment shall include the supply of all labour, material and plant to ensure existing curb and cobblestone surface remain undisturbed at Lake Louise Inn. The work includes:
 - .1 Complete pricing for all methodologies proposed by the contractor to ensure no disturbance to the existing roundabout.
 - .2 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .13 Manhole – Remove & Replace
- .1 Measurement shall be made in vertical metre (V.M.) from the lowest invert to the rim of the frame and cover of the new manhole installed.
 - .2 Payment shall be made on the vertical metre (V.M.) price bid per complete unit installed.
 - .3 Payment shall include the supply of all labour, material and plant to remove and dispose of the old manhole and to construct the new manhole. The work includes:
 - .1 Construction survey, layout, setting grades
 - .2 Locating and protecting existing utilities and structures.
 - .3 Excavation and the removal of excavated material to disposal areas and ground support.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .7 Breaking, excavation, loading, hauling and disposal of old manhole outside of Banff National Park.
 - .8 Dump fees.
 - .9 Supply and installation of concrete manhole material as detailed.
 - .10 Concrete bedding, grouting joints, benching, cutting, patching, connecting, leakage testing.
 - .11 Supply and installation, manhole frame and cover.
 - .12 Backfilling as detailed, compacting, grading, testing.

-
- .13 Cleaning, removal of debris.
 - .14 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .14 Sanitary Sewer Insulation - Styrofoam HI40 Insulation
 - .1 Measurement shall be made in lineal metres (L.M.).
 - .2 Payment shall be made on the unit price bid per lineal metre (L.M.) for the width of insulation specified.
 - .3 Payment shall include the supply of all labour, material and plant for installation of the insulation. The work includes:
 - .1 Supply and installation of Styrofoam HI40 insulation.
 - .2 Cutting and trimming.
 - .3 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .15 Remove and Replace Manhole S201
 - .1 Measurement shall be made in vertical metre (V.M.) from the lowest invert to the rim of the frame and cover of the new manhole installed.
 - .2 Payment shall be made on the vertical metre (V.M.) price bid per complete unit installed.
 - .3 Payment shall include the supply of all labour, material and plant to remove and dispose of the old manhole and to construct the new manhole. The work includes:
 - .1 Construction survey, layout, setting grades
 - .2 Locating and protecting existing utilities and structures.
 - .3 Excavation and the removal of excavated material to disposal areas and ground support.
 - .4 Water control and disposal.
 - .5 Temporary fencing.
 - .6 Traffic accommodations, barricades, flag-person or temporary traffic control as required
 - .7 Breaking, excavation, loading, hauling and disposal of old manhole outside of Banff National Park.
 - .8 Dump fees.
 - .9 Supply and installation of concrete manhole material as detailed.
 - .10 Concrete bedding, grouting joints, benching, cutting, patching, connecting, leakage testing.
 - .11 Supply and installation, manhole frame and cover.
 - .12 Backfilling as detailed, compacting, grading, testing.
 - .13 Cleaning, removal of debris.
 - .14 All incidental work and items required to complete the work for which payment is not specified elsewhere.

-
- .16 Remove and Replace Existing Manhole Collars with Concrete Collars – 50mm
- .1 Measurement shall be made on the unit price bid per unit (EA.) removed and replace existing manhole collars.
 - .2 Payment shall be made on the unit price bid (EA.) to remove and replace existing manhole collars.
 - .3 Payment shall include the supply of all labour, material and plant to remove and replace each existing manhole collar. The work includes.
 - .1 Breaking, excavation, loading, hauling.
 - .2 Backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .3 Trench or ground support system, shoring, and sheeting.
 - .4 Disposal of all removed material to an approved dump site.
 - .5 Cleaning, removal of debris.
 - .6 Dump fees.
 - .7 Installing and securing new concrete collar including grouting.
 - .8 Locating and protecting existing utilities and structures.
 - .9 Dewatering, water control and disposal.
 - .10 Temporary fencing.
 - .11 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.4 Part D – Roadworks

- .1 Waste Excavation
- .1 Measurement shall be made in cubic metres (m3). 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 (m3).
 - .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.
 - .4 Dump Fees.
 - .5 Determination of a suitable disposal site outside the Park and providing the Department Representative with signoff of acceptance of waste material.
 - .6 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 125mm.
 - .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.
 - .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 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.
 - .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.
 - .5 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.
 - .6 Granular Base, 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.
 - .7 Prime Coat
 - .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 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.
 - .8 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.
- .9 Concrete Curb and 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.
 - .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.
- .10 Pavement Markings
- .1 Measurement shall be made in linear metres (L.M.) along the centre of the paint line regardless of width or line-gap ratio. Double center lines are to be measured as one line.
 - .2 Payment shall be made on the unit price bid per lineal metre (L.M.) for each item installed.
 - .3 Payment shall include the supply of all labour, material and plant to install the pavement markings as existing. The work includes:
 - .1 Traffic accommodations, barricades, flag-person or temporary traffic control as required.
 - .2 Survey of pre-existing pavement markings prior to their disturbance so as to ensure their ability to re-instate them accurately.
 - .3 Cleaning of surfaces, layout, grinding, supply and application of pavement markings as per specifications and protection until dry.

- .4 Repair or removal and replacement of incorrect pavement markings as directed by the Departmental Representative shall be completed at the Contractor's cost.
- .5 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures for the Work shall be incidental to the Contract and no separate payment will be made to the contractor.
- .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.5 Part E –Miscellaneous

.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 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 Owner.
 - .2 Manufacturing, supply, erection and relocation as required of all barricades, flashers and signs required for completion of the project.
 - .3 Maintenance, replacement and removal after construction completion.
 - .4 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .3 Topsoil and Seed
- .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 Payment shall include the supply of all labour, material and plant for top soil and seed. The work includes:
 - .1 Supply and hauling of topsoil.
 - .2 Shaping, spreading, trimming and final grading of topsoil 150 mm thick.
 - .3 Supply and spreading of grass seed and fertilizer
 - .4 Watering and fertilizing of seeded areas
 - .5 Re-seeding any areas that do not show signs of growth
 - .6 Regular watering and maintenance during the growing season
 - .7 All protection, maintenance and establishment for a period of 48 months.
 - .8 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Remove and Replace Existing Culverts c/w Rip Rap

-
- .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 culvert and rip rap to the lines and grades shown on the plans. 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 Removal of excavated material to disposal or stockpile areas.
 - .5 Excavation and trench backfilling, compaction, grading, supply of granular materials, spreading, placing, trimming, testing, and subgrade restoration.
 - .6 Water control and disposal.
 - .7 Temporary fencing.
 - .8 Pipe supply, installation, bedding, jointing, placing, cleaning, and leakage testing.
 - .9 Excavation and trench backfilling, compaction, supply of granular materials, grading, spreading, placing, trimming and testing.
 - .10 Supply and installation of riprap rock at both ends of each culvert.
 - .11 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .5 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:
 - .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.
 - .6 Removal of Boulders from Excavation with Imported Granular Material
 - .1 Measurement shall be made in tonnes (tonne) of imported granular fill used to backfill the removal of boulders.
 - .2 Payment shall be made on tonnage (tonne) of imported granular fill as measured by truck tickets delivered to the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material and plant to remove and dispose of the material. The work includes:
 - .1 Removal of existing boulders including over excavation, rock breaking, fitting and use of lifting aids such as chains or straps, and all other associated efforts.
 - .2 Loading and hauling to disposal area within Banff National Park and approved by Parks Canada Agency.
 - .3 Supply of all materials, transporting and placing for backfill.
 - .4 Grading, compaction, watering, aerating, compaction and testing.
 - .5 Providing photographic evidence of boulders removed until this line item
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .7 Landscape Rehabilitation - Removal and Replacing of Existing Landscape Areas including Post Hotel and Lake Louise Inn
 - .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 surrounding cobblestone and concrete liner at the Lake Louise Inn from any damage while completing work.
 - .4 Preservation of trees and brush where required.
 - .5 Removal of grass, weeds, bark mulch, fabric, insulation, soil and other deleterious material.
 - .6 Removal of surface structures and material from work areas designated for excavation including landscape retaining walls, decorative rocks and boulders, tree grates and concrete.
 - .7 Removal and replacement of existing irrigation line as needed to complete the work. Salvage existing line if possible. Contractor responsible for any damages to the line.
 - .8 Preservation of any salvageable materials shall be delivered and stockpiled in a location approved by the Departmental Representative.
 - .9 Preservation of any plaques, signs, or other erected signages already existing in the landscape area.

-
- .10 Removal and disposal of waste material to an approved disposal site outside of the National Park.
 - .11 Dump fees.
 - .12 Restore landscaping to existing or better condition, or as approved by the departmental representative and Parks Canada Agency.
 - .13 Supply and installation of as needed trees and shrubs. Species and size to be identified and approved prior to installation as outlined in Section G2050.
 - .14 Landscape Maintenance as per Section 32 03 11
 - .15 Maintain plant life immediately after planting until plants are well established. Continue until termination of warranty period or as directed by Parks Canada Agency.
 - .16 Regular weed control and watering as required
 - .17 Maintenance schedule program as submitted to Parks Canada Agency including monthly maintenance logs.
 - .18 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.

-
- .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.

-
- .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.

-
- .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.

- .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.

- .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.

**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

2.6 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.

**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

- 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.

**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

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*".

**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

- 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.

**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

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.

**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

- 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.

**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

- 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.

**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

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.

-
- .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).

-
- .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 on 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.

-
- .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.

-
- .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.

-
- .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.

-
- .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.

-
- .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 lift station and storage tanks 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.

-
- .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.

-
- .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.

-
- .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.

-
- .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 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA O121-M1978 (R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-S269.3-M92 (R2003), Concrete Formwork.
- .2 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.
- .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.
- .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 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN3-A23.3-04, Design of Concrete Structures for Buildings.
 - .3 CAN/CSA-G30.18-M92 (R2007), Billet Steel Bars for Concrete Reinforcement.

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 C260-01, Specification for Air Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Specification for Liquid Membrane Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M 05, Standard Specification for Chemical Admixtures for Concrete..
- .2 Canadian Standards Association (CSA)
 - .1 CSA A23.1/A23.2 2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-A3000-03, Cementitious Materials Compendium Consists of A3001, A3002, A3003, A3004 and A3005.
 - .3 CSA-A3001-03, Cementitious Materials for Use in Concrete.

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.

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.
 - .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.
 - .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..

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 Do cast-in-place concrete work in accordance with CAN/CSA-A23.1.
- .2 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.
- .3 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.
- .4 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .5 Finishing
- .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.

.6 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 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.

-
- .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 D698-00a, 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.

-
- .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.

-
- .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:

-
- .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 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.

1.2 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.

1.3 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.
- .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.

1.4 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.

1.5 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.

1.6 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 All products to be approved by **Parks Canada Agency** prior to use.

2.2 PEST AND DISEASE CONTROL

- .1 All products to be approved by **Parks Canada Agency** prior to use.

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 approved 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 Supply labour, hoses and equipment necessary to provide adequate watering and moisture penetration of 50 mm.
- .4 Mowing – Maintained Areas:
 - .1 Cut once per week following establishment.
 - .2 Remove clippings from pathway.
 - .3 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.
 - .4 The Department Representative shall be the “Sole Judge” for variations in mowing operations during dry or wet weather.
 - .5 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
- .3 Fertilizer
 - .1 Fertilizer type and application to be based on spring tree and shrub condition assessment and approved by Department Representative prior to application.
- .4 Watering
 - .1 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
 - .1 Ensure proper, positive identification of infestations and consult with **Department Representative** before taking corrective action.
 - .2 Determine all susceptibility of subject and adjacent plant material to damage from corrective action prior to undertaking.
 - .3 Ensure application equipment is clean and free from any residue of prior chemical applications not related to current control measures being undertaken.
 - .4 All corrective chemicals to be Organic based and Bio-degradable (such as Horticultural Vinegar) unless otherwise approved by **Department Representative**.
 - .5 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.
 - .6 Prepare and apply chemicals according to manufacturer's specifications, minimize drift at all times.
 - .7 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.
 - .8 Spray application is not permitted.
- .2 Weed Control
 - .1 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
 - .1 Inspect grassed areas and plants weekly for insect and disease infestations. Apply corrective measures as approved by **Department Representative** and **Parks Canada Agency**.
 - .2 Any damage caused by application of corrective measures to be repaired at no cost to the **Department Representative**.
 - .3 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 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.
 - .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.

-
- .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.

-
- .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.

-
- .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

	<u>Type A</u>	<u>Type B</u>	<u>Type C</u>	<u>Type M</u>
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.
 - .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.
 - .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:
 - .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 SECTION INCLUDES

- .1 Supply and installation of Pavement Markings in areas in accordance with the Contract Documents and as directed by the Departmental Representative.
- .2 The Contractor shall complete a survey of the pre-existing pavement markings prior to their disturbance to ensure their ability to re-instate them accurately.

1.1 REFERENCES

- .1 CAN/CGSB-1.5-M99 Low Flash Petroleum Spirits Thinner.
- .2 CGSB1-GP-12C-83 Standard Paint Colours.
- .3 CGSB1-GP-71-83 Method, of Testing Paints and Pigments.
- .4 CAN/CGSB 1.74-01 Alkyd Traffic Paint.
- .5 U.S. FED-STD-595B, 1989 – Colours Used in Government Procurement.
- .6 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 AT Standard Specification for Highway Construction (current edition)

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 In accordance with Section 01 35 43 - Environmental Procedures.

Part 2 Products

2.1 MATERIALS

- .1 Paint:
 - .1 To CGSB 1.74-2001-CAN/CGSB, alkyd traffic paint.
 - .2 Colour: to FED-STD-595B, yellow 33538 and white 37925.
 - .3 Upon request, Departmental Representative will supply a qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative reserves right to perform further tests.
- .2 Thinner: to CAN/CGSB-1.4-2000.
- .3 Glass beads:
 - .1 Overlay type: to CGSB1-GP-74M.

2.2 DELIVERY, STORAGE AND HANDLING

- .1 Storage and handling shall meet the requirements of Section 01 35 43 - Environmental Procedures and Section 02 81 01 - Hazardous Materials.
- .2 The Contractor shall make all arrangements for the supply and delivery of paint and glass beads and shall provide the Departmental Representative with records of all materials received and/or returned, on a daily basis.

- .3 The Contractor shall provide, maintain and reclaim all material storage sites.
- .4 No paint formulation shall be diluted or mixed with a different formulation or with any other material, without the specific approval of the Departmental Representative.
- .5 The Contractor shall take all necessary steps to prevent contamination of the materials.
- .6 Paint shall be protected from freezing.
- .7 The Contractor shall be responsible for the proper clean-up of waste or spilled material, and the proper disposition of containers.

Part 3 Execution

3.1 TEMPORARY MARKINGS

- .1 The Contractor shall supply and place temporary line markings on newly constructed hard surfaces (pavement, sealcoat, etc.) throughout the project, re-establishing centreline and all lane-dividing lines prior to being opened to traffic, and shall maintain such markings until the earlier of the Actual Completion Date or the date Permanent markings have been placed. Temporary line markings are not required for lane edge lines (fog lines) unless otherwise directed by the Departmental Representative.
- .2 Temporary line markings must be placed on an offset from the permanent lane marking and must be removed once permanent markings are in place.
- .3 Centreline of undivided highway shall be marked throughout as “no passing” unless otherwise directed by the Departmental Representative.
- .4 Painted temporary lines are not permitted on the final surface.
- .5 Pavement markings for traffic detours shall be in accordance with Part 2 Products.

3.2 PERMANENT MARKINGS

- .1 Prior to any work affecting pavement markings, the Contractor shall pick-up survey all key control points of existing markings at intersections, turn slots, exit tapers and similar features and, upon completion of the final hard surfacing, re-establish those points, unless shown otherwise in the Contract Documents or directed by the Departmental Representative.
- .2 Further to the key control pick-up, the Contractor shall also pick-up survey all Transverse and Chevron and Crosshatch Pavement Markings and upon completion of the final hard surfacing, re-establish those points, unless shown otherwise on the IFC drawings or directed by the Departmental Representative.
- .3 All layout markings shall be done with white or yellow centreline paint which will be clearly visible after exposure to all Site Conditions for a minimum period of two (2) months past the Actual Completion Date.
- .4 Key control points shall be marked at their design location within tolerances of $\pm 50\text{mm}$ transversely and $\pm 100\text{mm}$ longitudinally. Longitudinal tolerances for intermediate points, when required, are $\pm 10\text{mm}$.
- .5 Permanent pavement markings are to be reinstated within two (2) weeks of paving completion, or earlier as acceptable to the Departmental Representative.

3.3 TOLERANCE

- .1 All painted lines shall not exceed a dimensional width of 110 mm for specified 100 mm wide line. No tolerance below 100 mm is allowed for the specified 100 mm wide line.
- .2 All painted lines shall not exceed a dimensional width of 210 mm for specified 200 mm wide line. No tolerance below 200 mm is allowed for the specified 200 mm wide line.
- .3 All painted direction dividing, lane dividing or continuity lines shall not exceed a maximum dimensional length deviation of +/- 100 mm for specified 3 m length of line.
- .4 All spaces between painted direction dividing, lane dividing or continuity lines shall not exceed a maximum dimensional length deviation of +/- 100 mm for specified 6 m or 3 m length of space.
- .5 All paint shall be applied at the proper locations in accordance with the Contract Documents or as directed by the Departmental Representative.
- .6 All paint and glass beads shall be uniformly applied.
- .7 All painted lines shall be uniform in thickness and free of tire tracking, with no splatter, excessive overspray or other defects.
- .8 Remove incorrect markings as directed by the Departmental Representative at Contractor's cost.
 - .1 Blackout painting for incorrect lane marking will not be permitted. Incorrect paint work must be eradicated and re-painted by method approved by the Departmental Representative.

3.4 EQUIPMENT REQUIREMENTS

- .1 Paint applicator to be an approved pressure type mobile distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.
- .2 Distributor to be capable of applying reflective glass beads as an overlay on freshly applied paint.

3.5 CONDITION OF SURFACES

- .1 Pavement surface to be dry, free from ponded water, frost, ice, dust, oil, grease and other foreign materials.

3.6 APPLICATION

- .1 Pavement markings to be laid out by Contractor.
- .2 Apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 h.
- .3 Apply traffic paint evenly at rate of 3 L/m².
- .4 Do not thin paint.
- .5 Paint lines to be of uniform colour and density with sharp edges.
- .6 Thoroughly clean distributor tank before refilling with paint of different colour.

- .7 Apply glass beads at rate of 200 g/m² of painted area immediately after application of paint.

3.7 REMOVAL, REPAIR OR REPLACEMENT OF UNACCEPTABLE PAVEMENT MARKINGS

- .1 All painted lines that do not meet the requirements of the Contract Documents shall be removed and correctly applied or repaired by the Contractor.
- .2 In cases where the paint is "tracked" by vehicles tires, the lines may be repaired by reapplying paint and glass beads to the damaged areas.
- .3 In cases where incorrectly painted lines need to be removed, the Contractor shall use methods and equipment that will totally eliminate the pattern of the lines without damaging the integrity of the pavement surface. The methods and equipment used for such work shall be reviewed and accepted by the Departmental Representative prior to their use. Obliterating incorrectly painted lines through the sole use of paint, liquid asphalt, slurry seal or other similar materials will not be permitted.

3.8 QUALITY CONTROL

- .1 In accordance with Section 01 45 00 – Quality Control.
- .2 The Contractor is responsible for quality control inspection throughout every stage of the Work to ensure that materials and workmanship comply with the requirements of the Contract Documents.
- .3 The Contractor to include in the Quality Control Plan actions to address all the elements that affect the quality of the line painting including, but not limited to:
 - 1. Paint Application Rates.
 - 2. Glass Bead Application Rates.
 - 3. Pavement Surface and Atmospheric Conditions.
 - 4. Line Widths, Line Lengths and Space Lengths.

3.9 HIGHWAY OPERATION

- .1 Highway operation shall be in accordance with the Contractor's accepted Traffic Management Plan and shall meet the following requirements:
 - .1 General
 - .1 Painting shall be carried out in accordance with Section 01 14 00 - Work Restrictions and Section 01 35 31 - Special Procedures for Traffic Control.
 - .2 Operation of the painting truck against the flow of traffic will not be permitted.
 - .3 Loading glass beads or paint onto the painting truck is not permitted on a roadway surface.
 - .1 Operation of Companion Vehicles
 - 1. When the roadway to be painted is open to public traffic, the Contractor shall operate a crash attenuator vehicle and a pilot vehicle in conjunction

with the painting truck during the painting of all longitudinal lines. Companion vehicle operators shall not attempt to control traffic from inside the vehicle.

2. The actual operating parameters of the companion vehicles will be determined by the Contractor to safely accommodate traffic and will be based on site specific conditions such as sight distances, highway geometrics and traffic patterns and volumes. Typical operating parameters are as follows:
 - .1 The crash attenuator vehicle shall be equipped with a crash attenuator that meets National Cooperative Highway Research Program, Report 350 Test Criterion. Test Level 3 for 100 km/hr. The vehicle shall follow behind the painting truck at a distance of 50 to 400 m.
 - .2 The pilot vehicle shall be driven in the same travel lane as the paint machine, following it at a constant distance of approximately two kilometres.
 - .3 The crash attenuator vehicle, pilot truck and the painting truck are to display the same message at all times. The painting truck and the companion vehicles shall be equipped with a two-way radio for communication and overhead revolving beacon with an amber lens of a minimum 180 mm high and 180 mm wide.

3.10 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.

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.

-
- .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.

-
- .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

Part 1 General

1.1 RELATED WORK

- .1 Topsoil Placement And Grading – Section 32 91 19.13
- .2 Mechanical Seeding – Section 32 92 19.13

1.2 SUBMITTALS

- .1 Submit samples as directed by Departmental Representative.
- .2 Obtain approval of samples by Departmental Representative.

1.3 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.
- .3 Pre-Installation Meetings: Conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule sod installation to coincide with the preparation of the soil surface.
- .2 Schedule sod laying to coincide with preparation of soil surface.

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 Divert unused fertilizer 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 MATERIALS

- .1 Sod
 - .1 Sod that has been especially sown and cultivated for use as sod. Generic sod type suitable for use in Banff National Park. Contractor to provide sod type and source for approval by Departmental Representative.

-
- .2 Not more than 2 broadleaf weeds or 10 other weeds per 40 square meters.
 - .3 Density of sod sufficient so that no soil is visible from height of 1500mm when mown to height of 50mm.
 - .4 Mowing height limit: 35mm to 65mm.
 - .5 Soil portion of sod: 6mm to 15mm in thickness.
 - .2 Sod establishment support:
 - .1 Erosion control blankets: biodegradable, 25mm square mesh on all slopes exceeding 40%.
 - .2 Wooden pegs: 17 x 8 x 200mm for all slopes exceeding 33% (3 height to 1 vertical).
 - .3 Water
 - .1 Available from standpipes on site or as directed by Departmental Representative.
 - .4 Fertilizer
 - .1 To Canada "Fertilizer Act" and "Fertilizers Regulations".
 - .2 Slow release in water-insoluble form, as approved by Departmental Representative.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization.

Part 3 Execution

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 – Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered in snow, ice or standing water.
- .3 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.
- .4 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 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted.
- .2 Lay sod sections in rows, longitudinally, along contours of slopes, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES, PEGGING, AND EROSION CONTROL BLANKETS

- .1 Install and secure erosion control blankets in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1m of catch basins and within 1 m of drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 5 pegs per square metre.
 - .3 Not less than 7 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
 - .4 Drive pegs to 20mm above soil surface of sod sections.
- .4 Add Erosion Control Blankets as per manufacturer's installation instructions on all slopes that exceed 40% or as indicated on drawings.
 - .1 Pegs as per manufacturer's instructions.
 - .2 Pattern and amount of pegs as per manufacturer's instructions

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment and warranty periods to following program agreed to by Departmental Representative.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
 - .1 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
 - .2 Cut manicured sod areas to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas.
 - .3 Maintain sodded areas weed free.

- .4 Fertilize 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.

3.6 ACCEPTANCE

- .1 Sodded Commercial Grade Turfgrass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 No surface soil is visible from height of 1500mm when the grass has been cut to height of 50mm.
 - .3 Sod is free of bare or dead spots and extent of weeds.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
 - .5 Fertilizing in accordance with fertilizer program has been carried out.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.7 MAINTENANCE DURING WARRANTY PERIOD

- .1 Warranty Period shall be two weeks from date of sod installation.
- .2 Perform following operations from time of acceptance until end of warranty period:
 - .1 Water sodded areas as required. to obtain optimum soil moisture conditions to depth of 100 mm.
 - .2 Repair and re-sod dead or bare spots to satisfaction of Departmental Representative.
 - .3 Cut grass and remove clippings that will smother grass as directed by Departmental Representative:
 - .1 50mm during normal growing conditions
 - .2 Cut grass at 2 week intervals or as directed by the Departmental Representative but at intervals so that approximately one third of the growth is removed in a single cut.
 - .4 Fertilize 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 Eliminate weeds by mechanical means to extent acceptable to Departmental Representative.

3.8 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-µm (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.

-
- .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.

-
- .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 SUMMARY

- .1 Section Includes:
 - .1 Refers to those portions of the work that are unique to the supply and installation of High Density Polyethylene (HDPE) sanitary sewer or water distribution by pipe bursting. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.
- .2 Related Sections:
 - .1 Section 01 33 00 - Submittal Procedures
 - .2 Section 01 35 43 - Environmental Procedures
 - .3 Section 01 51 00 - Temporary Utilities
 - .4 Section 01 52 00 - Construction Facilities
 - .5 Section 01 35 29 – Health, Safety, and Emergency Response Procedures.
 - .6 Section 31 23 33 – Excavation, Trenching and Backfilling.
 - .7 Section 33 31 11 – Sanitary Sewers
 - .8 Section 33 11 16 – Site Water Utility Distribution Piping

1.2 MATERIAL CERTIFICATION

- .1 All materials are to conform to this specification, to the latest edition of the appropriate specifications of the American Society for Testing and Materials (ASTM) or other standards expressly specified. All provisions in ASTM and the plastic Pipe Institute Handbook or other specified standards pertaining to materials, workmanship, finish, inspection and rejection form part of these specifications as far as they are applicable and providing that they are not inconsistent with this specification. This specification takes precedence over the ASTM specifications in case of a discrepancy or conflict. Materials incorporated into the work but not specifically covered in the specifications are to be obtained from the Contractor Administrator prior to installation.
- .2 Material delivery and storage is to meet the requirements of the manufacturer. Materials damaged through transportation or handling are to be removed from the job site and replaced with new materials at the Contractors expense.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures
- .2 The contractor shall submit for approval the following information to the Contract Administrator for each section at least seven (7) days prior to the commencements of any site work:
 - .1 Proposed sequence and method of construction
 - .2 Location and dimensions of entry and exit pits including staging areas and pipe storage areas
 - .3 Method of dewatering including disposal
 - .4 Bypass pumping arrangements

- .5 Temporary water service arrangements
- .6 Method of bursting (pneumatic or static) and description of equipment including camera and software
- .7 Proof of training, certification and experience relevant and comparable to the proposed work in the proposed pipe bursting methodology and equipment
- .8 Copy of certification for fusion equipment operator listing fusion training and training organization
- .9 Proof of availability of all required equipment onsite as identified in the risk register.
- .10 HDPE pipe manufacturers recommended fusion procedures including point interfacial pressures and heater temperature
- .11 Maintenance records and pressure gauge calibration for fusion machine
- .12 Maximum permissible tensile forces on HDPE
- .13 Details of selected lubrication product
- .14 Traffic management plan
- .15 Safety procedures and certificate of satisfactory first aid training
- .16 Sediment and lubrication control details
- .17 Schedule of expected service interruptions and reconnect time
- .18 Method of construction and restoration of existing sewer to services and manhole connections
- .19 Risk register
- .20 Before and after video inspection reports and all relevant outputs from sewer inspection software including graphical representation of pipe profile

1.4 RECORDS

- .1 Provide post construction detailed record sketches, including location of pipes, bends, and appurtenances.
- .2 Provide all process information for each fusion joint and connection, including time, temperature, and pressure as an electronic file from an integral data logger, a printed file from an integral recording device or a manual recording satisfactory to the Contract Administrator.

1.5 SCHEDULING

- .1 Minimize interruptions to existing services
- .2 Observe service interruption bylaws
- .3 Observe noise restriction bylaws

1.6 INSPECTION AND TESTING

- .1 Refer to Section 01 45 00 – Quality Control.
- .2 Contractor to provide Department Representative two (2) days advance notice of butt fusion operation.

- .3 Make available installation and fusion procedures as per relevant standards and pipe manufacturer's recommendations.
- .4 Manually record pipe installation time (HH:MM:SS) at beginning and every 5m of pipe until completion.

1.7 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure all permits are in place prior to construction start up.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 – Health, Safety, and Emergency Response Procedures.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Dispose of excess material at approved disposal locations.

Part 2 Products

2.1 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

- .1 AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings 100mm through 1600mm.
- .2 HDPE pipe to conform to AWWA C906-99 standard and shall be specification PE4710 with a minimum DR-11 unless otherwise noted.
- .3 All mainline DR and diameter pipes to be as indicated on accompanying drawings with an HDB of 1600psi (11.03 MPa) at 73oF as determined by ASTM D2837.
- .4 Remove and replace sections of HDPE main with surface damage penetrating 10% or more of the pipe wall thickness.
- .5 ASTM D 3035-03 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR)
- .6 ASTM D3350 Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
- .7 ASTM F714 Standard Specification for Polyethylene (PE) Plastic (SDR-PR) Based on Outside Diameter
- .8 ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

2.2 HDPE FITTINGS

- .1 High Density Polyethylene and Associated Fittings.
 - .1 Moulded fittings shall be manufactured in accordance with ASTM D3261
 - .2 Electrofusion fittings to be manufactured in accordance with ASTM F1055 and AWWA C906

2.3 MISCELLANEOUS

- .1 Gaskets to be of suitable neoprene compound cut to fit the joint

- .2 Flanged union required carbon steel backing rings as per manufacturers specifications

2.4 LUBRICATION FLUIDS

- .1 Lubrication fluids may be used by the contractor to aid in the installation of the HDPE sewer main. Contractor to determine lubricant type to suit assessed soil conditions.

2.5 CONCRETE

- .1 Concrete mixes and materials required for bedding cradles, encasements, thrust blocks, and incidental uses: to Section 03 30 00 – Cast-in-Place Concrete.

2.6 GRANULAR PIPE BEDDING AND SURROUND MATERIAL

- .1 As shown on Contract Drawings
- .2 Refer to Section 31 05 16 – Aggregate Materials for material specifications.

2.7 BACKFILL MATERIAL

- .1 Refer to section 31 23 33.00 Excavating, Trenching & Backfilling.

Part 3 Execution

3.1 EXCAVATION, TRENCHING AND BACKFILLING

- .1 Do excavating, trenching and backfilling work to Section 31 23 33 – Excavating, Trenching, and Backfilling.

3.2 Pipe Bursting Tools

- .1 Pipe bursting shall use a pneumatic or static system capable of generating sufficient force to burst and compact the existing pipe sections into the surrounding soil as it progresses. Contractor to utilize a cutter head suitable for cutting and breaking the existing pipe and fittings. All bursting tool selections shall be in strict compliance with the manufacturers recommendations.

3.3 WINCHING AND HYDRAULIC SYSTEMS

- .1 Pneumatic and static bursting tools shall be operated in accordance with the manufacturers specified pipe size and upsizing force requirements. Any winch or hydraulic system shall provide a constant tensile force throughout the operation but in no case are the forces to exceed the limits of the pipe tensile strength.
- .2 Enough equipment for appropriate pulling power – based on existing pipe materials and length of pull

3.4 CAMERA INSPECTION AND SOFTWARE

- .1 A camera is required on the pulling side of the winch or hydraulic system to monitor pipe bursting in real time.
- .2 A camera truck shall be operated onsite with qualified personnel monitoring pipe bursting in real time. Real time monitoring will be available to the Department Representative.

- .3 Sewer inspection software to be used shall be 2017 version or newer.
- .4 Camera and associated software to have the following features and capabilities:
 - .1 Ability to automatically detect pipe diameter, deformities, locations of laterals;
 - .2 360° rotating head;
 - .3 Zoom;
 - .4 Mounted on remote control crawler;
 - .5 Output providing graphical representation of pipe profile

3.5 BYPASS PUMPING

- .1 Install temporary bypass pumping system around the designated sewer sections in accordance with plans approved by Department Representative.
- .2 Pumps and bypass lines shall be of adequate capacity to accommodate pre-determined flows.
- .3 Prevent spills to the environment or back-up of sewerage onto private property. In the event of a spill the Contractor shall undertake immediate clean-up and remediation.
- .4 The contractor shall report any spills and back-ups to the Department Representative upon occurrence.

3.6 PIPE STORAGE AND PREPARATION.

- .1 Transport, handle, and store pipe in accordance with the Plastic Pipe Institutes Handbook and pipe manufacturer's recommendations.

3.7 PIT EXCAVATIONS

- .1 Excavate in accordance with Section 31 23 33 – Excavation, Trenching, and Backfilling.
- .2 Restrict the excavation footprint to the minimum area possible in order to meet insertion requirement and complete the bursting work.
- .3 Pit locations to adhere to pre-approved locations as per submittals.
- .4 Pit to be sufficient size to accommodate a minimum of 12 times the diameter of the HDPE pipe plus 2.5 times the depth of excavation for sloping in accordance with the Plastic Pipe Institutes manual section for "Pipeline Rehabilitation by Slip-Lining with Polyethylene pipe.

3.8 PIPE JOINING

- .1 Fuse pipe lengths in accordance with ASTM D2657.
- .2 Maintain data log record of temperature, pressure, and time of each individual butt fusion and time for electro fusion performed when joining HDPE pipe on pipe diameter over 100mm
- .3 Fusion process to be carried out by personnel certified by an industry recognised training body and approved by Department Representative.
- .4 Allow reasonable time period between jointing procedures to permit physical inspection by Department Representative. All misaligned joints to be cut out and re-joined.

- .5 Pulling head to be attached to HDPE pipe in accordance with equipment and pipe manufacturer's recommendations. Attachment devices to be equally spaced to ensure even distribution of pulling and insertion forces.
- .6 Install mechanical connections as indicated in the contract documents and as per the manufacturers installation instructions.

3.9 PIPE INSTALLATION

- .1 Perform pre-installation camera inspection per section 3.4
- .2 Install HDPE pipe diameter and DR as indicated on the Contract Drawings.
- .3 Provide sufficient guides and rollers at entry pits to minimize frictional forces during the insertion process.
- .4 Fused replacement pipe continuously over the entire length between entry/exit points.
- .5 Perform real time video monitoring per section 3.4
- .6 Confirm the existing grade of the sewer and identify associated misalignments, and inconsistency at service connections.
- .7 Report anticipated alignment problems to Department Representative. Report any alignment deviations upon discovery.
- .8 Sections of HDPE pipe with scrapes and gouges greater than 10% of the wall thickness either prior to insertion or post-installation to be removed and replaced.
- .9 Avoid potential conflicts with other buried underground utilities and where necessary expose conflicting utility to relieve adverse effects of soil pressure during bursting operation.
- .10 Make good any damage incurred to other utilities and reinstate any paved surfaces.
- .11 Allow a minimum of 8-24 hour period as specified by the manufacturer or industry standards prior to connecting or attaching any appurtenances or restraining the inserted HDPE pipe.

3.10 PIPE SURROUNDING

- .1 Upon completion of the bursting process and after the Department Representative has inspected all the work in place, surround and cover the exposed HDPE in excavations in accordance with Section 31 23 33 – Excavation, Trenching and Backfilling.
- .2 Hand place bedding and initial backfill around HDPE pipe as backfill requirements, including type of material and compaction requirements, as shown on contract drawings.

3.11 Warranty

- .1 Any settlement over the installed pipe ramming 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 bursting before final acceptance.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 The “Work” means all activities associated with directional drilling and the subsequent pipeline installation.
- .2 This Work shall be carried out by a specialized contractor experienced in directional drilling.
- .3 This Specification is not intended to be all-inclusive and does not relieve the Contractor of its responsibility to supply a product capable of performing its intended service.

1.2 SUBMITTALS

- .1 The Contractor shall prepare a “Work Plan” (WP) for the pipeline. The WP shall include, but not necessarily be limited to, the following:
 - .1 List of equipment and personnel.
 - .2 Method to handle:
 - .1 Spills of hazardous and toxic waste.
 - .2 Erosion.
 - .3 Escape of drilling fluid.
 - .4 A hole blow-out.
 - .3 A quality control plan that describes the method to determine the:
 - .1 Accuracy of drill hole profile and location.
 - .2 Assurance of hole size.
 - .3 Drilling mud viscosity for specific conditions.
 - .4 Limits of pipe force to be applied and force available from equipment.
 - .4 Drilling guidance system:
 - .1 Description of guidance system.
 - .2 The expected accuracy of the down-hole guidance system.
 - .3 A description of external factors which could affect the accuracy of the proposed guidance system.
 - .4 The contingency measures to be employed in the event that inaccuracies with the guidance systems are detected.
 - .5 The stress that will be exerted on the pipe as a result of the proposed radius of curvature and the distance the pipe is to be pulled.
 - .6 The type and composition of drilling fluid and additives to be used.
 - .7 The type of solids control, cleaning equipment and re-circulation system proposed to maximize drilling fluid reuse.
 - .8 A description of the proposed method of drilling fluid disposal.
 - .9 Provide a high density polyethylene (HDPE) fusion welding quality assurance plan.

- .10 Provide certifications of training by the polyethylene pipe fusing equipment manufacturer(s) stating that the operators of polyethylene fusion equipment have been fully trained in the use of the fusion equipment used on the project.
- .11 A description of pipe section pull through including:
 - .1 Pipe section hook-up arrangement.
 - .2 Pull force monitor.
 - .3 Recognition when pipe section is stuck.
- .12 Contingency plan in event of:
 - .1 Severe pipe damage.
 - .2 Hole collapse during pull.
 - .3 Off alignment.
- .13 Schedule.
- .2 Prior to construction, the WP shall be approved by the Departmental Representative.

1.3 RESPONSIBILITIES OF PARTIES

- .1 Contractor
 - .1 The Contractor shall prepare a comprehensive WP as set out above.
 - .2 The Contractor shall conduct the Work in accordance with these Specifications and the WP.
 - .3 The Contractor shall ensure that all workers engaged in this Work are experienced and have a complete understanding of the Work and will comply with these requirements.
 - .4 The Contractor shall furnish equipment, labour and material necessary to conduct the Work as specified in this Specification.
 - .5 The Contractor shall be responsible for securing, transportation, storing and disposing of all water required for directional drilling and hydrostatic testing.
 - .6 The Contractor shall monitor the drilling path and maintain visual and audio communications with the drilling operation and to immediately cease drilling operation if a problem is identified.
 - .7 The Contractor shall provide access to Pason or WP to the Department Representative.
- .2 Departmental Representative
 - .1 The Departmental Representative will monitor and inspect the Work. The Departmental Representative's inspection does not relieve Contractor from any deficiency or non-conformance to the Contract Documents.

1.4 ENVIRONMENTAL REQUIREMENTS

- .1 The Contractor shall comply with all environmental requirements outlined in the Specifications and be fully responsible for all environmental related fines and penalties levied against the Departmental Representative as a result of the Contractor's activities.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyethylene pressure pipe:
 - .1 NPS 1/2 to NPS 6: to CSA B137.1 type PE 3406, series 160 ASTM F714, type PE 3408, series DR 11.
 - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE 1404, series 250.
 - .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 or flanged with steel aluminum ductile iron backing flanges.
 - .4 Cast iron fittings with flanged ends: to ANSI/AWWA C110/A21.10 for pipe size above NPS 4, Cement mortar lined to ANSI/AWWA C104/A21.4.
 - .5 Polyethylene fittings: to CSA B137.1, for pipe sizes NPS 4 and less.

2.2 DRILLING FLUIDS

- .1 The composition of all drilling fluids and additives shall be submitted to the Departmental Representative for approval prior to their use.
- .2 No drilling fluid or additives shall be used that do not comply with permit requirements and environmental regulations.
- .3 The Contractor shall have contingency measures and materials to handle lost circulation.
- .4 The Contractor shall provide, where required all cement, cement additives, mixing water, cement mixing and pumping equipment, and cementing tools to provide a proper cement job.

2.3 TRACER WIRE

- .1 Tracer wire shall be #7 strand RWU insulation

Part 3 Execution

3.1 INSTALLATION

- .1 General:
 - .1 Contractor shall install the pipelines by means of horizontal directional drilling as shown, specified and as recommended by the manufacturer.
 - .2 Contractor shall be responsible for his means and methods of directional drilling construction and shall ensure the safety of the work, the Contractor's employees, the public, and adjacent property, whether public or private.
 - .3 The pipe shall be installed in the location and to the line and grade designated on the drawings.

-
- .4 Provide for testing and cleanup as soon as practicable, so these operations do not lag far behind pipe installation. Perform preliminary cleanup and grading operations immediately after backfilling.
 - .5 All surfaces shall be finish graded to original contours and ground cover.
 - .6 Excavated material, which is not removed from the immediate work site, shall be stockpiled so as to cause as little inconvenience to the property owners as possible. Driveways and street crossings must be kept clear.
 - .7 Excavation for entry, recovery pits, or any other excavation shall be carried out in accordance with Specification Section 31 23 33 - Excavating, Trenching And Backfilling. Holding tanks are required to contain drilling fluids, sump pits will not be permitted.
 - .8 After completing installation of the product the work site shall be restored. All slurry should be contained to tanks. Removal and final disposition of excess slurry or spoils as the product is introduced shall be the responsibility of the Contractor.
 - .9 Excavated areas shall be restored in accordance with the Contract Documents. The cost of restoring damaged pavement, curb, sidewalk, driveways, lawns, storm drains, landscape, and other facilities is borne by the Contractor.
 - .10 If underground utilities and/or structures not shown on the Drawings are encountered, notify the Departmental Representative and do not proceed until instructions are obtained. Notify the Departmental Representative if springs or running water are encountered.

3.2 UTILITY VERIFICATION (POTHOLING)

- .1 Contractor shall conduct prior to the start of water main construction the verification of all underground utilities (potholing) that may conflict with sanitary sewer and water main construction. Cost of potholing shall be included in the cost of the pipe installation unit price.
- .2 Potholing results shall be presented to the Departmental Representative on a full set of drawings showing accurate locations of utilities. Information marked on the plans should include horizontal tie downs as well as depths related to drawing elevation.
- .3 Alignment of the proposed water main (horizontal and vertical) may be adjusted in the field upon review of potholing results by the Departmental Representative.

3.3 HANDLING PIPE

- .1 Prepare pipe on a relatively smooth surface, free of sharp rocks, sticks or debris. Utilize cribbing, pipe stands, rollers or other equipment as necessary to support the pipe.
- .2 Lift and move piping using ropes, slings or straps. Do not use unprotected chains, hooks or clamps to lift pipe.
- .3 When lifting and moving pipe, provide a minimum of two points of support. Do not support pipes at butt-fused joints.

- .4 Sections of pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and rejoined at the Contractor's expense.
- .5 Plug all pipes at end of each workday. Provide a watertight plug to prevent entry of foreign materials into the pipe.

3.4 DRILLING OPERATIONS:

- .1 Directional drilling/boring shall use techniques of creating or directing a borehole along a predetermined path to a specified target location. This must involve use of mechanical and hydraulic deviation equipment to change the boring course and must use instrumentation to monitor the location and orientation of the boring head assembly along a predetermined course.
- .2 Drilling must be accomplished with fluid assisted mechanical cutting. The spoils must be transported from the job site and be properly disposed. Under NO circumstances will the drilling spoils be permitted to be disposed into waterways, sanitary, storm, or any other public or private drainage system.
- .3 Steering shall be accomplished by the installation of an offset section of drill stem that causes the cutterhead to turn eccentrically about its centerline when it is rotating. When steering adjustments are required, the cutterhead offset section is rotated toward the desired direction of travel and the drill stem is advanced forward without rotation.

3.5 LOCATING AND TRACKING:

- .1 The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot bore/hole, measure drilling fluid flow and pressure and depth, weight on bit, ROP, rotary, differential pressure, torque, total mud and gain/loss.
- .2 The Contractor shall provide access to real time data to the Department Representative.
- .3 The Contractor shall describe the method of locating and tracking the drill head during the pilot bore. The locating and tracking system shall be capable of ensuring that the proposed installation is installed as intended. Locating and tracking system shall be walkover, wire line, and wire line with surface grid verification, or equivalent approved by the Departmental Representative. The locating and tracking system shall provide information on:
 - .1 Clock and pitch information
 - .2 Depth.
 - .3 Battery status.
 - .4 Position (x,y).
 - .5 Azimuth, where direct overhead readings (walkover) are not possible (i.e. subaqueous or limited access transportation facility.)
 - .6 Alignment readings or plot points shall be taken and recorded every three (3) meters.

- .7 Before commencement of a directional drilling operation, proper calibration of the equipment (if required) shall be undertaken.
- .4 Contractor shall provide and grant Departmental Representative access to all data and readout pertaining to the position of the bore head and fluid pressures and flows. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Departmental Representative.
- .5 All facilities shall be installed in such a way that their location can be readily determined by electronic designation after installation. For non-conductive installations this shall be accomplished by attachment of tracing wire, as buried piping identification.

3.6 JOINING PIPE

- .1 At start of each day, complete fusion weld tests in accordance with manufacturer's recommendations to verify that fusion equipment is operating properly.
- .2 Polyethylene pipe ends shall be joined using butt fusion methods. Join polyethylene pipe and polyethylene fittings using butt fusion or socket or saddle fusion methods. Fusion methods shall comply with both pipe and fusion equipment manufacturers requirements.
- .3 Joint polyethylene pipe and mechanical joint or flanged fittings in accordance with both fitting and pipe manufacturer requirements. Provide HDPE pipe stiffeners, wedge type retainer glands and clamp type joint restraint system.

3.7 REAM AND PULLBACK:

- .1 After an initial bore has been completed, a reamer will be installed at the termination/exit pit and the pipe will be pulled back to the starting/entry pit.
- .2 Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor. However, the back ream hole diameter shall be no greater than the sum of the maximum product outside diameter (OD) plus 150mm
- .3 The maximum allowable pull exerted on the HDPE pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed.
- .4 A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe.
- .5 The lead end of the pipe shall be closed during the pullback operation.
- .6 The pipelines shall be adequately supported by rollers and side booms and monitored during installations so as to prevent over stressing or buckling during the pullback operation.

- .7 Support/Rollers shall be spaced at a maximum of 20 metres on centers, and the rollers to be comprised of a non-abrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.
- .8 Install tracer cable during pullback operations. Extend tracer cable to end of pipe and secure or as directed by the Departmental Representative. Test continuity of tracer cable prior to demobilizing.

3.8 TOLERANCE

- .1 The installed pipe shall be within 1% (+/-) of design grade and within 150mm (+/-) of exit elevation.
- .2 Entry elevation shall be within 50mm of design
- .3 Alignment variation shall be 300mm (+/-) from design location.

3.9 WORK AFFECTING EXISTING PIPING

- .1 Location of Existing Piping:
 - .1 Locations of existing piping shown should be considered approximate.
 - .2 Contractor shall determine the true location of existing piping to which connections are to be made, and location of other facilities which could be disturbed during earthwork operations, or which may be affected by Contractor's Work in anyway.
- .2 Taking Existing Pipelines Out of Service:
 - .1 Do not take pipelines out of service unless approved by Departmental Representative.
 - .2 Notify Departmental Representative, in writing, at least 48 hours prior to taking pipeline out of service.

3.10 QUALITY CONTROL

- .1 A representative of the Contractor must be in control of the operation at all times. The representative must have a thorough knowledge of the equipment and the procedures to be performed, and must be present at the job site during the installation.
- .2 The Departmental Representative must be notified forty-eight (48) hours in advance of starting work. The installation shall not begin until the Departmental Representative is present at the job site and agrees that proper preparations have been made.

3.11 BACKFILL AND RESTORATION

- .1 All backfill and restoration shall be performed in accordance with the requirements of the Section 31 23 10 – Excavating, Trenching and Backfilling.

3.12 TESTING OF PIPING

- .1 Hydrostatic Testing:
 - .1 Preparation for Testing:
 - .1 For HDPE pipe, follow procedures described in ASTM F2164. Test duration, including time to pressurize, time for initial expansion, time at test pressure, and time to depressurize, shall not exceed 8 hours. If re-testing of a test section or pipeline is required, at least 8 hours shall elapse between tests.
 - .2 Prior to testing, ensure that adequate thrust protection is in place and joints are properly installed.
 - .2 Test Procedure:
 - .1 Fill pipeline slowly to minimize air entrapment and surge pressures tested.
 - .2 Expel air from pipe as required. Obtain approval of Departmental Representative prior to tapping pipe for expelling air.
 - .3 Examine exposed joints and valves, and make repairs to eliminate visible leakage.
 - .4 After filling pipeline, gradually pressurize pipe to test pressure and maintain required test pressure for three hours for pipe to expand. During expansion, add fluid to maintain required test pressure. Begin timed test period after expansion period and other requirements are met.
 - .5 Timed test period shall not begin until after pipe has been filled, exposed to required wetting period, air has been expelled, and pressure stabilized.
 - .6 Timed Test Period: After 3 hour expansion phase, reduce test pressure by 69 kPa (10 psi) and do not add liquid. Test pressure shall then remain steady for 1 hour, indicating no leakage.
 - .7 Pump from test container to maintain test pressure. Measure volume of water pumped from test container and record on test report. Record pressure at test pump at 15 minute intervals for duration of test.
 - .3 Allowable Leakage Rates: Leakage is defined as the quantity of water supplied to pipe segment being tested to maintain pressure within five psi of test pressure during timed test period. Allowable leakage rates for piping are:
 - .1 No Leakage: Pipe with flanged, welded, fused, threaded, soldered, or brazed joints.

3.13 FLUSHING

- .1 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.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

- .3 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

- .4 Time and rate of flushing to be discussed with Departmental Representative prior to any discharge to any piped system.
.5 Provide connections and pumps for flushing as required.
.6 Open and close valves, hydrants and service connections to ensure thorough flushing.

3.14 WARRANTY

- .4 Any settlement over the installed pipe ramming 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 before final acceptance.

END OF SECTION

Part 1 General

1.1 INTENT

- .1 It is the intent of this specification to provide for the rehabilitation of pipelines and conduits by the installation of a resin-impregnated flexible tube that is formed to the original conduit by use of a hydrostatic head. The resin is cured using hot water under hydrostatic pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting.

1.2 REFERENCED DOCUMENTS

- .1 This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube), ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), ASTM D790 (Test methods for flexural properties of unreinforced plastics) and ASTM D2990 (Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics), which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

1.1 SUBMITTALS

- .1 Work Plan
 - .1 The Contractor shall prepare a “Work Plan” (WP) for the CIPP installation. The WP shall include, but not necessarily be limited to, the following:
 - .1 Location and dimensions of all launch and receiving points.
 - .2 Sanitary Bypass.
 - .3 Risk Register.
- .2 Schedule
 - .1 Contractor will submit a schedule of the work including installation of CIPP, cure time, quality verification and setup and decommissioning of the sanitary bypass.
- .3 Emergency Procedures
 - .1 Contractor will submit an emergency procedures plan for identified risks including sanitary release.
- .4 Equipment
 - .1 Contractor will submit equipment specifications and capabilities to ensure that the equipment will be adequate to complete the project.
- .5 Materials
 - .1 Specifications on material to be used shall be submitted to the Departmental Representative.

- .2 Contractor shall provide manufacturer documentation of the materials reference in Part 2 of this document.

Part 2 Products

2.1 PRODUCT, MANUFACTURER/INSTALLER QUALIFICATION REQUIREMENTS

- .1 Sewer products are intended to have a 50-year design life. In order to minimize the Owner's risk, only proven products with substantial successful long term track records will be approved. All trenchless rehabilitation products and installers must be pre-approved by the Department Representative prior to construction. Products and Installers seeking approval must meet all of the following criteria to be deemed commercially proven:
 - .1 For a Product to be considered commercially proven, a minimum of 50,000 linear meters or 400 manhole-to-manhole line sections of successful wastewater collection system installations in Canada must be documented in this submittal to the satisfaction of the Owner to assure commercial viability.
 - .2 For an Installer to be considered as Commercially Proven, the Installer must satisfy all insurance, financial, and bonding requirements of the Owner, and must have previous experience in the commercial installation of the product bid. In addition, the Installer must have previous success installing the product bid in storm and wastewater collection systems. Acceptable documentation of these minimum installations must be submitted to the Department Representative.
 - .3 Sewer rehabilitation products submitted for approval must provide third party test results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Department Representative. Test samples shall be prepared to simulate installation methods and trauma of the product. No product will be approved without independent third party testing verification. All testing methods must be in accordance with ASTM D790 and D2990.
 - .4 Both the rehabilitation manufacturing and installation processes shall operate under a quality management system that is third party certified to ISO 9000 or other internationally recognized organization standards. Proof of certification shall be required for approval.

2.2 MATERIALS

- .1 Tube - The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216-07 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.
- .2 The wet-out Tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the Design thickness.
- .3 The Tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during installation. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.

- .4 The outside layer of the Tube (before wet-out) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wet-out) procedure.
- .5 The Tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.
- .6 The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.
- .7 Seams in the Tube shall be stronger than the unseamed felt.
- .8 The outside of the Tube shall be marked for distance at regular intervals along its entire length, not to exceed 1.5 meters. Such markings shall include the Manufacturers name or identifying symbol.
- .9 The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that, when properly cured within the tube composite, meets the requirements of ASTM F1216-07, ASTM F1743, the physical properties herein, and those which are to be utilized in the Design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

2.3 **STRUCTURAL REQUIREMENTS**

- .1 The CIPP shall be designed as per ASTM F1216-07, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall.
- .2 The CIPP pipe material must have undergone long-term testing for flexural creep of the CIPP. Such test results are to be used to determine the Long-term, time dependent flexural modulus to be utilized in the product design, as referenced in 2.1.1.3. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in Design.
- .3 The Enhancement Factor 'K' to be used in 'Partially Deteriorated'(PD) Design conditions shall be assigned a value not to exceed 7.
- .4 The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.
- .5 The CIPP material shall conform to the structural properties, as listed below.

MINIMUM PHYSICAL PROPERTIES

<u>Property</u>	<u>Test Method</u>	<u>Cured Composite per ASTM F1216</u>	<u>Cured Composite (Enhanced Resin)</u>
Modulus of Elasticity	ASTM D-790 (short term)	1725 MPa	2760 MPa
Flexural Stress	ASTM D-790	31.0 MPa	27.0 MPa

- .6 The required structural CIPP wall thickness shall be based as a minimum, on the physical properties in Section 1.6.5 and in accordance with the Design Equations in the appendix of ASTM F 1216, and the following design parameters (i.e.):

LINER DESIGN REQUIREMENTS:

- Design Method = Appendix XI and X2 of ASTM F1216.
- Fully Deteriorated Gravity Pipe or Partially Deteriorated (as dictated by site requirements).
- Ovality = 3% (unless a higher value is dictated otherwise by site requirements).
- Ground cover = site specific
- Water Table = 1.6m below surface
- Soil Density = 1920 kg/m³
- Soil Modulus = 6.9 MPa (1000psi)
- Traffic Loading = AASHTO HSS20(where applicable)
- Railway Loading = Cooper E-80 (where applicable)
- Enhancement Factor = 7.0 (P.D. design only)
- Design Life = 50-years (minimum)
- Retention factor = 50% (or 50% reduction as per Section 2.2.4)
- Design safety factor of 2 (minimum)
- Poisson's Ratio = 0.30 (P.D. design only)
- Minimum Pipe DR = 50 (Pipe thickness will not be less than a DR 50 for all sections).

A design for each liner segment must be submitted to the Department Representative for approval prior to the work and stamped by a Professional Engineer licensed in Alberta.

- .7 Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

Part 3 Execution

3.1 TESTING REQUIREMENTS

- .1 Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical-testing requirements.
- .2 Hydraulic Capacity - Overall, the hydraulic profile shall be maximized. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities

may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

- .3 CIPP Field Samples - When requested by the Department Representative, the Contractor shall submit test results from field installations in Canada of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in Section 2.4.6 have been achieved in previous field applications. Samples for this project shall be made and tested as described in Section 3.5.
- .4 Long term testing – The Manufacturer shall have performed long-term testing for flexural creep on fiber-reinforced laminates generally in accordance with ASTM D2990. Such testing results are necessary for the Department Representative as the results determine the long-term, time-dependent flexural modulus to be utilized in the product design. Any submissions that do not include ASTM D2990 testing results will be rejected.

3.2 **INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS**

- .1 Cleaning of Sewer Lines
 - .1 The Contractor, when required as identified by Section 3.2.3, shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The Department Representative shall also provide a dumpsite for all debris removed from the sewers during the cleaning operation. Unless stated otherwise, it is assumed this site will be at or near the sewage treatment facility to which the debris would have arrived in absence of the cleaning operation. Any hazardous waste material encountered during this project will be considered as a changed condition.
- .2 Bypassing Sewage
 - .1 The Contractor, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair per City of Calgary Sewer Bypass Pumping Guidelines.
- .3 Inspection of Pipelines
 - .1 Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by Closed-Circuit Television (C.C.T.V.). The interior of the pipeline shall be carefully inspected to determine the location of any conditions that may prevent proper installation of CIPP into the pipelines, and it shall be noted so that these conditions can be corrected. The Contractor shall provide the Department Representative a CD, DVD in mpeg, or equivalent, format and accompanying written report as proof of workmanship and for later reference.
- .4 Line Obstructions
 - .1 It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If the pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the installation process that was not evident on the pre-bid video and cannot be removed by conventional sewer cleaning equipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Department

Representative prior to the commencement of the work and shall be considered as a changed condition separate pay item.

- .5 Upon request by the Department Representative, the Contractor shall provide dye trace reports for confirmation of active services.

3.3 **INSTALLATION**

- .1 CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 1.7, with the following modifications:

.1 **Resin Impregnation**

- .1 The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process must be used. To ensure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 7 meters from the point of initial resin introduction.
- .2 After vacuum in the tube is established, a vacuum point shall be no further than 20 meters from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. Alternate methods of resin impregnation method will not be accepted.

.2 **Tube Insertion**

- .1 The wet-out tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point. If tube insertion is completed by air inversion method it will be done in strict accordance with ASTM F1216-05. The tube must remain 'inflated' during the entire inversion and curing process. No methods allowing deflation after initial inflation will be allowed. If the air inversion method to be used causes the tube to deflate at anytime during the inversion or curing process, the installation will not be conforming to ASTM F1216-05 standards. The Contractor shall be responsible for removal and any deflated liner and replacement thereof at no cost to the Owner.
- .3 Temperature gauges shall be placed inside the tube at the invert level of each end to monitor the temperatures during the cure cycle.
- .4 Curing shall be accomplished by utilizing hot water or steam under pressure in accordance with the manufacturer's recommended cure schedule.

3.4 **REINSTATEMENT OF BRANCH CONNECTIONS**

- .1 It is the intent of these specifications that branch connections to buildings be reopened without excavation utilizing a remote controlled cutting device, monitored by a video TV camera. The Contractor shall certify he has a minimum of 2 complete working cutters plus spare key components on the site before each installation. Unless otherwise directed by the Department

Representative, all laterals will be reinstated and brushed to have the reinstated lateral within 95% of its original size. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

- .2 All laterals must be fully reinstated within eight (8) hours from the completion of the installation. If laterals are not reinstated within this time period the Contractor will be considered liable for any additional costs for the home and/or business and any resulting property damage.

3.5 **INSPECTION**

- .1 CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in Table 1 of the applicable ASTM.
- .2 Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 90% of the design thickness as calculated in paragraph 2.4.6 of this document.
- .3 Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.

3.6 **CLEAN-UP**

- .1 Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

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 C207-07, 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 C500-02, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).
 - .7 ANSI/AWWA C504-06, Rubber-Seated Butterfly Valves.
 - .8 ANSI/AWWA C651-05, Disinfecting Water Mains.
 - .9 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .10 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.
- .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 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.
 - .2 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
 - .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 shall be assembled with non-toxic, water soluble, NSF-listed lubricant.

- .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.

2.2 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.

2.3 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.

2.4 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 Gaskets to be vulcanized rubber to ASTM D2000.
- .4 Robar 1516 or approved alternate.

2.5 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.

2.6 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	
<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%

2.7 CONCRETE

- .1 Concrete required for cradles, encasement, supports, thrust blocks shall have a compressive strength of not less than 20 MPa in 28 days.
- .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. .

2.8 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.
- .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.
 - .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes.
 - .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.
 - .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 ABANDONMENT

- .1 If existing pipe must be abandoned, abandonment shall be in accordance with City of Calgary standards or as directed by the Department Representative.

3.12 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.

3.13 PRESSURE AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600.
- .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.
- .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.

3.14 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.

3.15 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.
 - .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.

3.16 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.

3.17 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 test 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 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

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C111/A21.11-00, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C14M-99, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M-02, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C117-95, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C443M-02, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .6 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³)).
 - .7 ASTM D2680-01, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly-Vinyl Chloride (PVC) Composite Sewer Piping.
 - .8 ASTM D3034-00, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - .9 ASTM D3350-02, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .3 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.
- .4 Canadian Standards Association (CSA International)
 - .1 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-A5-F98, Portland Cement.
 - .2 CAN/CSA-A257 Series-M92 (R1998, Standards for Concrete Pipe.
 - .3 CSA-B70-02, Cast Iron Soil Pipe, Fittings, and Means of Joining.
 - .4 CSA B1800-02, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).

-
- .1 CSA B182.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
 - .3 CSA B182.6-02, Profile Polyethylene Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
 - .4 CSA B182.11-02, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
 - .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA)
 - .6 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)

1.2 DEFINITIONS

- .1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit complete shop drawings and construction schedule, including methods of installation.
- .3 Inform the Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- .4 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .5 Ensure certification is marked on pipe.
- .6 Submit manufacturers information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide data to produce 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.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.
- .3 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

1.7 SCHEDULING

- .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify the Departmental Representative 96 hours minimum in advance of any interruption in service.

Part 2 Products

2.1 PLASTIC PIPE

- .1 Type PSM Polyvinyl Chloride (PVC): to CSA-B182.2 and ASTM D3034.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Locked in gasket and integral bell system.
 - .3 Pipe joints to be third party tested to withstand a 345 kPa hydrostatic pressure.
 - .4 Nominal lengths: 4 m or 6 m.
- .2 Polyethylene (PE) pressure pipes: to CSA-B137.1, CGSB 41-GP-25M:
 - .1 NPS 1/2 to NPS 6: to CSA B137.1 type PE 3406, series 160 ASTM F714, type PE 3408, series DR 11.
 - .2 90 mm to 1600 mm: to CGSB 41-GP-25M, type PE 1404, series 250.
 - .3 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657 or flanged with steel aluminum ductile iron backing flanges.
 - .4 Cast iron fittings with flanged ends: to ANSI/AWWA C110/A21.10 for pipe size above NPS 4, Cement mortar lined to ANSI/AWWA C104/A21.4.
 - .5 Polyethylene fittings: to CSA B137.1, for pipe sizes NPS 4 and less.
 - .6 Size as indicated on drawings.

- .3 Fittings:
 - .1 To be flanged to AWWA C207.
 - .2 Fittings shall match pipe supplied and shall be supplied by the manufacturer of the pipe or by suppliers approved by the manufacturer.
 - .3 All fittings to be compatible in materials and dimensions with the pipe.

2.2 SERVICE CONNECTIONS

- .1 Type PSM Poly (Vinyl) Chloride: to CSA-B182.2.
 - .1 Standard Dimensional Ratio (SDR): 28.
 - .2 Locked in gasket and integral bell system.
 - .3 Nominal lengths: 4 m or 6 m.
- .2 Multi-Fitting gasketed "strap-on" Tee (or Wye) saddle with two stainless steel clamps for PVC mains.

2.3 CEMENT MORTAR

- .1 Portland cement: to CAN/CSA-A5, normal type 10.
- .2 Mix mortar one part by volume of cement to two parts of clean, sharp sand mixed dry.
 - .1 Add only sufficient water after mixing to give optimum consistency for placement.
 - .2 Do not use additives.

2.4 PIPE BEDDING AND SURROUND MATERIALS

- .1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed or screened stone or gravel consisting of hard, durable particles.
 - .2 Gradations within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.2 Table

Sieve Designation	% Passing by Mass	
	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	80-100
2.00 mm	-	50- 90

Sieve Designation	% Passing by Mass	
	Stone/Gravel	Gravel/Sand
0.425 mm	10-25	10- 50
0.180 mm	-	-
0.075 mm	0- 8	0- 10

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

2.5 BACKFILL MATERIAL

- .1 Type 3, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
- .2 Inspect materials for defects to approval of the Departmental Representative.
- .3 Remove defective materials from site as directed by the Departmental Representative.

3.2 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of the Departmental Representative prior to placing bedding material and pipe.
- .4 Do not backfill trenches until pipe grade and alignment have been checked and accepted and test results are within limits specified.

3.3 CONCRETE PLUGS

- .1 If required, do concrete work for drainage plugs in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .1 Place concrete to details as indicated or directed by the Departmental Representative.
- .2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing.

3.4 GRANULAR BEDDING

- .1 Place selected bedding materials to details indicated on the contract drawings or as directed. Do not place material in frozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating Trenching and Backfilling with compacted bedding material.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .1 Do not use blocks when bedding pipe.
- .5 Shape transverse depressions as required to suit joints.
- .6 Compact each layer full width of bed to at least 98% corrected maximum dry density.

3.5 INSTALLATION - PVC

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of the Departmental Representative
- .2 Handle pipe using methods approved by the Departmental Representative.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .6 Do not allow water to flow through pipe during construction, except as may be permitted by the Departmental Representative.
- .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .8 Install plastic pipe and fittings in accordance with CSA B182.11.
- .9 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's recommendations.

-
- .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .3 Align pipes before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
 - .6 Complete each joint before laying next length of pipe.
 - .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
 - .10 When stoppage of Work occurs, block pipes as directed by the Departmental Representative to prevent creep during down time.
 - .11 Plug lifting holes with pre-fabricated plugs approved by the Departmental Representative set in shrinkage compensating grout.
 - .12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .13 Make watertight connections to manholes and storage tanks.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
 - .14 Use prefabricated saddles or field connections approved by Engineer Consultant, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.6 INSTALLATION - HDPE

- .1 Polyethylene (PE):
 - .1 Install polyethylene pipe in strict conformance with manufacturer's recommendation for the specific pipe being installed.
 - .2 Just prior to placement in the trench, check the pipe to ensure the surface is free of debris, stones, nails, loose concrete or other material that may ultimately damage the pipe. Any gouges or cuts that are deeper than 10% of the wall thickness shall result in rejection of that section of pipe. Other defects such as kinking and ovality shall not be cause for rejection provided the sections involved are satisfactorily repaired and meet limits outlined by the pipe manufacturer.
 - .3 Any spillage of petroleum products on any polyethylene pipe material shall result in rejection of that section.

- .4 Stainless steel bolts for fittings, to the class shown on the drawings shall be used in conjunction with insulating bolt sleeves and washers to install all fittings.
- .5 The pipe shall be lifted and placed into the trench, not rolled.
- .6 Make all allowances for expansion and contraction of pipe due to temperature changes, especially when tying into rigid structures and existing lines.
- .7 Backfilling shall follow a minimum of 20 m behind the point where the pipe passes over the top of the trench. Backfilling equipment shall maintain a minimum of 1 m vertical separation above the pipe.

3.7 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after the Departmental Representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.
- .4 Compact each layer from pipe invert to mid height of pipe to at least 95% corrected maximum dry density.
- .5 Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density.
- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.8 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Compact backfill to at least 95 % corrected maximum dry density.

3.9 SEWER SERVICE PIPE INSTALLATION

- .1 Connect 100 mm service lines to main by means of:
 - .1 A saddle installed over a machined tapped (cored) hole of sizes suitable for saddle utilized.
- .2 Connect service line to main by cutting opening in main without cracking the main. Remove cuttings from main. Install saddle. Do not project spigot into main. Make joint between saddle and main watertight.
- .3 Install bends, if required, only at the following locations:

-
- .1 A 45 degree bend with wye connection or 11-¼ degree bend at tee connection.
 - .2 A 22-½ degree bend at top of riser.
 - .3 An 11-¼ degree bend at property line.
 - .4 Maintain grade for 100 mm sewer at 1 vertical to 50 horizontal (2%) unless otherwise directed.
 - .5 Place and compact granular backfill around connection to adequately support the main, saddle and service.
 - .6 Provide a "pig tail" on the end of each sewer service as detailed on the drawings.
 - .7 Install service pipe to connect to building service if existing. Remove abandoned service pipe.
 - .8 Install marker at ends of unconnected service lines. Each marker shall consist of 50 x 100 mm stake extending from pipe invert level to 0.6 m above grade.

3.10 ABANDONMENT

- .1 If existing pipe must be abandoned, abandonment shall be in accordance with City of Calgary standards or as directed by the Department Representative.

3.11 TESTING

- .2 The following shall be the minimum acceptable standard for Testing Services and Reports.
 - .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 trench 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.
- .3 Trenches shall be tested from pipe zone to finished sub-grade.
- .4 Such tests are taken adjacent to all manholes and valves from pipe zone to finished sub-grade.

3.12 FIELD TESTING GRAVITY MAINS

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by the Departmental Representative draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

-
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
 - .4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
 - .5 Do infiltration and exfiltration test to ASTM C828.
 - .6 Do infiltration and exfiltration testing as specified herein and as directed by the Departmental Representative.
 - .1 Perform tests in presence of the Departmental Representative.
 - .2 Notify the Departmental Representative 96 hours in advance of proposed tests.
 - .7 Carry out tests on each section of sewer between successive manholes including service connections.
 - .8 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
 - .9 Exfiltration test:
 - .1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.
 - .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1m above static ground water level, whichever is greater.
 - .3 Duration of exfiltration test: 2 hours.
 - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.
 - .10 Infiltration test:
 - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750mm or more above top of pipe measured at highest point in line to be used.
 - .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
 - .3 Install watertight plug at upstream end of pipeline test section.
 - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
 - .5 Prevent damage to pipe and bedding material due to flotation and erosion.
 - .6 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.
 - .11 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100m of sewer including service connections:

- .1 Exfiltration, based on 600 mm head: 0.175 L.
- .2 Infiltration: 0.150 L.
- .12 Repair and retest sewer line as required, until test results are within limits specified.
- .13 Repair visible leaks regardless of test results.
- .14 Television and photographic inspections:
 - .1 Carry out inspection of installed sewers by television camera, photographic camera or by other related means.
 - .2 Provide means of access to permit the Departmental Representative to do inspections.

3.13 SURFACE RESTORATION

- .1 After installing and backfilling over sanitary mains, restore surface to original condition as directed by the Departmental Representative.

END OF SECTION

DIVISION G
BUILDING SITEWORK

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 32 91 19.13 Topsoil Placement and Grading
- .2 Section 32 92 19.13 Mechanical Seeding

1.2 SUMMARY

- .1 Section Includes:
 - .1 Soil and Aggregate Fills:
 - .1 Soil and subsoil, excavate and fill.
 - .2 Aggregate for fill.
 - .2 Landscaping and Planting: seed.
 - .3 Site furnishings.

1.3 REFERENCES

- .1 Canadian Food Inspection Agency (CFIA) / Department of Justice.
 - .1 Canada Fertilizer's Act-2004 and Fertilizer Regulations.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 47 15 - Sustainable Requirements. Indicate VOC's during application and curing.
- .3 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Soil and Aggregate Fills Samples for Testing: none required

1.5 DESIGN AND PERFORMANCE CRITERIA

- .1 Compaction Quality Standard:
 - .1 Standard Proctor density testing.
- .2 Landscaping Quality Assurance:

- .1 Quality Standard: Standard Practices ANSI A300.
- .2 Comply with regulatory agencies for fertilizer and herbicide composition and use.

1.6 QUALITY ASSURANCE

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

1.7 WARRANTY

- .1 Plant Material Warranty Against Death or Unhealthy Conditions: 1 year to include one continuous growing season.

1.8 MAINTENANCE SERVICE

- .1 Maintain plant life immediately after planting until plants are well established. Continue until termination of warranty period. Regular weed control and watering as required. Contractor to provide maintenance schedule program and ensure site meets Parks standard prior to commencement of FAC process. Contractor to provide monthly maintenance slips as a requirement of FAC.

Part 2 Products

2.1 SOIL AND AGGREGATE FILLS

- .1 Products:
 - .1 Topsoil: to be accessed from onsite stockpile and screened as per Section 32 91 19.13 Topsoil Placement and Grading.
 - .2 Subsoil: reusable excavated material.

2.2 LANDSCAPING AND PLANTING

- .1 Products:
 - .1 Topsoil: excavated from site, screened to remove all debris and stones greater than 15 mm and reused.
 - .2 Trees, Plants, and Ground Cover: species and size to be identified in a Plant Schedule.
 - .3 Grass and Planting:
 - .1 Refer to Section 32 92 19.13 Mechanical Seeding.
 - .4 Fertilizer: to Canada "Fertilizer's Act" and "Fertilizer Regulations".

Part 3 Execution

3.1 SOIL AND AGGREGATE FILLS

- .1 Place excavated material or imported material, consolidate and compact.

3.2 BACKFILLING

- .1 Topsoil:
 - .1 Place topsoil in areas where seeding, is required.
- .2 Site Grading:
 - .1 Cut, grade, fill, and compact the site for site structures, building pads and amenities pads.
 - .2 Place fill in continuous layers and compact.
 - .3 Slope grade away from building.
 - .4 Make grade changes gradual; blend slope into level areas.

3.3 LANDSCAPING AND PLANTING

- .1 Top Soil Application:
 - .1 Spread topsoil to a depth to promote growth as indicated.
- .2 Grass Application:
 - .1 Refer to section: 32 92 19.13 Mechanical Seeding

3.4 SITE FURNISHINGS

- .1 Installation:
 - .1 Install and secure as indicated.

3.5 QUALITY CONTROL

- .1 Field Tests: not required.
- .2 Field Inspection: required.

END OF SECTION

APPENDIX A

Calgary



Sewer Bypass Pumping Guidelines

January 2018

Table of Contents

1.0 SCOPE.....	2
2.0 SUBMISSION REQUIREMENTS	2
3.0 DESIGN REQUIREMENTS	4
A. PUMP SIZING	5
B. OVERALL SYSTEM DESIGN	6
C. SUBMERSIBLE PUMPS.....	7
4.0 EQUIPMENT AND PIPING	7
5.0 EXECUTION	7
6.0 REMOVAL, CLEANUP AND RESTORATION.....	8

List of Appendices:

APPENDIX A – SUCTION MANHOLE DETAIL.....	9
APPENDIX B – DESIGN AND SUBMISSION CHECKLIST.....	10
APPENDIX C – RISK AND MITIGATION PLAN EXAMPLE	11
APPENDIX D – LINK TO SPECIFIED REGULATORY REQUIREMENTS	12

Sewer Bypass Pumping Guidelines

1.0 SCOPE

Work covered in this document consists of bypass pumping design, installation and operation of existing City sewer systems that require temporary diversion of flow to provide adequate and reliable sewer services at all times during any construction-related activities.

Pursuant to the Alberta Environmental Protection and Enhancement Act, the bypass system shall meet all applicable regulatory requirements such as *AR 117/1993 Release Reporting Regulation* and *AR 119/1993 Wastewater and Storm Drainage Regulation*. In addition, the bypass system shall comply with the current edition of the following documents:

1. Standard Specifications, Sewer Construction
2. Standard Specifications, Waterworks Construction
3. Wastewater Bylaw #14M2012, Part VI, Section 20
4. Drainage Bylaw #37M2005
5. Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems (Part 3)

2.0 SUBMISSION REQUIREMENTS

The Contractor engaged by the Owner shall prepare and submit a Bypass Pumping Plan (BPP) to Water Services at least 6 weeks prior to starting any portion of the proposed scope of work. The plan must be approved by The City prior to mobilization of any equipment for use in the bypass operation.

A pre-design meeting with stakeholders is recommended 6 weeks prior to submission of BPP application to discuss preliminary design information such as project background, site condition, pump placements, flow rates and allowable manhole surcharge levels. Contact the *Team Lead, Operations Engineering, Water Services*, to arrange for a kick-off meeting and for any BPP application questions.

Submission requirements are outlined below to guide applicants with The City's minimum requirements and other regulatory compliance requisites.

The following must be submitted as part of the BPP:

- a. Coverletter with the following information:
 - Project name, location and detailed description of the planned bypass pumping work to be performed
 - Name and address of Contractor / Consultant

- Name and contact information of Project Manager
 - Emergency contact information (name, cell phone number and title of person(s) onsite responsible for bypass pumping operation)
- b. Detailed plan, design and description of the proposed pumping system:
- Detail drawing showing suction pipe depth, plug and pump connections (See Appendix A)
 - Locations and sizes of temporary pipe supports, thrust blocks and restraints
 - Redundancy plan (Back-up pump, power and piping equipment)
 - Calculations of static lift, friction losses, TDH and flow velocity
 - Calculations for selection of bypass pumps and piping sizes
 - Pump curves showing pump operating range (capacity, head, power, $NPSH_A$ and $NPSH_R$ values)
 - Design plans and access to bypass pumping locations
 - Method of noise control for each pump and/or generator
 - Methods to protect suction/discharge manholes and other structures such as existing interior drop from being damaged due to bypass operations
 - Schedule for installation and maintenance of bypass pumping lines
 - Procedures to monitor upstream mains for back-up impacts
 - Procedures for setting-up and dismantling pumping operations

Note: Design plans and calculations must be reviewed and signed by a Professional Engineer registered in the Province of Alberta.

- c. Description of the minimum and maximum amount of sanitary sewer flows to be bypassed and how flow conditions will be monitored during operations. All flow measurement devices, calculations, equipment and other data sources must be included in the report.

Note: For storm bypass systems, design flow shall be based on the 1:2 year storm event or at the discretion of the Design Engineer.

- d. Descriptions of all proposed bypass pumping components to be used
- Bypass pump sizes, capacity, number of each size to be on site and power requirements
 - Capacity of suction and discharge piping
 - Size, depth and location of manhole or access points for suction and discharge piping
 - Plugging method and type of plugs to be used

- Method of establishing flow rates (flow metered, modeled flow or physically measured flow depths)
 - Flowmeter installation locations
- e. Suction and discharge piping material(s) and capacity to be used for the bypass pumping operation including material(s) used for any bends and valves
 - f. Indicate the date and time the bypass pumping is expected to begin and be completed
 - g. Drawings showing location of pump(s) and route of the suction and discharge piping complete with legible dimensions. Manholes to be used for suction and discharge shall be clearly labelled including names of streets and major intersections in the area
 - h. A site specific Emergency Spill Response Plan detailing procedures to be followed in the event of pump failures, sewer overflows, service backups and sewage spillage which include:
 - Plan for containing the spill and addressing the source of the spill
 - Plan for preventing public exposure to the spill including procedures for redirecting pedestrians and traffic away from the impacted area
 - Identification of any service connections, storm drains, watercourses or other infrastructure that can be negatively impacted by the spill
 - Measures to be taken to avoid or mitigate the adverse effects of the spill on the environment

The contractor will maintain a copy of emergency/spill response plan on site for the duration of project
 - i. Environmental Risk Assessment and Mitigation Plan (Appendix C)
 - j. Traffic Control Plan (when applicable) that pertains mainly to the bypass pumping operation which include all required permits, pedestrian and vehicular access
 - k. Submit a checklist (Appendix B) confirming that all items required on this section are included in the application package.

3.0 DESIGN REQUIREMENTS

The following are essential factors to be considered when designing bypass pump systems for both storm and sanitary sewer lines.

a. Pump Sizing

Centrifugal pumps are commonly used in most bypass pumping systems. It allows suction pipes to be managed through most manhole openings and can be installed in parallel for larger flows or in series for higher heads. The following are information required to adequately size centrifugal pumps:

1. Peak flow rate (l/s) – Provided by Water Services or measured in the field
2. Total suction lift (m) = Suction lift + Friction losses
3. Total discharge head (m) = Discharge head + Friction losses
4. Total Dynamic Head (TDH) = Total suction lift + Total discharge head
5. Net Positive Suction Head Available (NPSH_A)
6. Net Positive Suction Head Required (NPSH_R)
7. Net Positive Suction Head (NPSH)

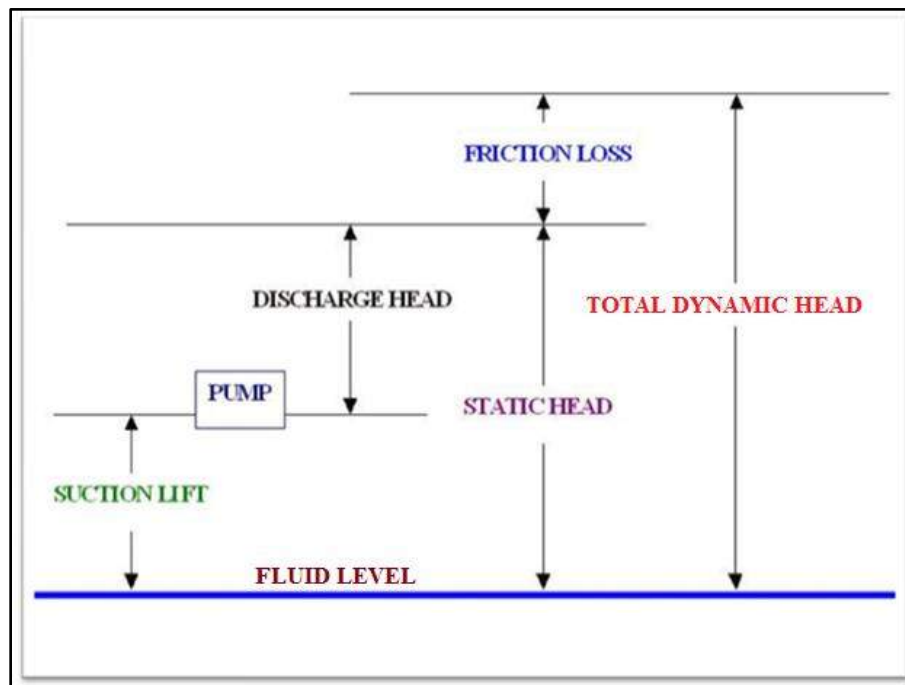


Figure 1: Calculating Total Dynamic Head on Suction Lift Applications

Pumps are sized primarily to accommodate the required flow in l/s (or gpm) and the TDH of the system. Another key factor to be considered is the system's **NPSH** value to prevent cavitation.

Pump cavitation occurs when the pressure at the pump inlet drops below the liquid's vapor pressure creating vapor bubbles. The bubbles trigger shockwaves causing premature wear and ultimately leading to its failure. Cavitation is depicted by:

- Loud noise often described as marble sounds in the pump
- Loss of capacity because bubbles are now taking up space instead of liquid
- Pitting damage to parts as material is removed by the collapsing bubbles

$$\text{NPSH} = \text{NPSH}_A - \text{NPSH}_R$$

Minimum NPSH value required is 0.9m (3').

NPSH_A = Static head + surface pressure head – liquid vapor pressure – friction losses in the piping, valves and fittings.

NPSH_R – The required pressure head acting on a liquid as it enters the pump impeller to avoid excessive cavitation and degradation of pump performance.

NPSH_A must be calculated as a function of the bypass system, whereas NPSH_R is a function of the pump and must be provided by the pump manufacturer. NPSH_A must be greater than NPSH_R for the pump to operate efficiently, in other words, the system must have more suction pressure available than the pump requires.

b. Overall System Design

Suction Manhole Depth: The construction or repair area must be isolated from the suction and discharge locations. The plug must be installed at least one manhole upstream. Lift is a key component in the assessment of pumping systems therefore selection of the suction manhole is critical. Suction lift determines the type of pump the system requires.

Allowable Manhole Surge: The allowable surge in a specific manhole will vary. Once the manhole is plugged it is important to determine how high the level in that specific manhole can be reached before negatively impacting surrounding properties.

Distance between Manhole and Pump: This horizontal distance is significant in determining friction losses as it will add distance to the fluid travelling through the system. The additional suction/discharge distance will increase the time that the pump needs to self-prime as there is more air to evacuate with the additional line added.

Pressure at Discharge Point: A bypass system will have to reach a certain TDH to pump to a physical location. Once pumped to a certain location the fluid may only have to exit the end of the pipe and be influenced by gravity down into the receiving manhole.

Redundancy or Pump Back-up: Include a 100% redundant bypass pumping capacity to allow continuous flow in case of emergencies due to clogging or pump failure. Clogging indicators include fluid level starting to rise in the suction manhole or when the pump begins to shake because the suction bin is clogged and the pump impeller is not receiving enough liquid.

Pumps in Parallel: Peak flows can easily exceed the capacity of any single pump therefore multiple pumps operating in parallel may be necessary. This system enables two or more pumps to take suction from a common structure and discharge into one destination but operating against the same discharge head. The combination of pump head-capacity curve is determined by adding the respective flow rates of each pump with specific head values.

c. Submersible Pumps

Submersibles are centrifugal pumps attached directly to a motor and the entire assembly is submerged in the fluid to be pumped. This pump type is recommended on bypass operations with suction lifts of greater than 4m (13 ft.) as this reduces the likelihood of cavitation. Submersible pumps push fluid to the discharge port while suction pumps have to pull the fluids then be able to release. Most common are electric motor-driven and hydraulically driven.

Though not published on most pump manufacturer's curves, submersibles require a specific amount of submergence in order to operate properly and for motor cooling characteristics. Submersible pumps therefore also need NPSHA but not as critical as it is for above-ground centrifugal pumps.

4.0 EQUIPMENT and PIPING

Plugs must be in good condition and shall not have any visible damage such as cracks, holes, tears, cuts, abrasions, loose or damaged fittings; selected and installed according to the size of the line to be plugged. They must be adequately secured and anchored to prevent plug movement.

All pumps must be either automatic self-priming or prime-assisted units that do not require the use of foot-valves or vacuum pumps in the priming system. They can be electric or diesel powered. Each pump must have the Stop/Start control.

Piping shall be homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, or other deleterious faults. Piping shall be assembled and joined onsite using couplings, flanges or butt-fusion method to provide leak proof joint.

Flexible hose, couplings and connectors shall be abrasive resistant and rated for external and internal loads anticipated including test pressure. External load design shall incorporate anticipated traffic loadings.

All rigid or hard piping shall be constructed with positive restrained joints.

5.0 EXECUTION

It is the Contractor's responsibility to protect the environment, public and private properties from any damage during the construction, operation and removal of the bypass system. All provisions stated in the BPP must be followed throughout the course of any bypass operations.

Contractor is responsible for locating any existing utilities in the area selected to place the bypass operation and for obtaining any approvals for placement of temporary pipelines from other regulatory agencies.

- a. Prior to actual operation, Contractor shall perform leakage and pressure testing of the discharge line to withstand at least twice the maximum system pressure based on the approved BPP for a period of 2 hours.
- b. The Contractor shall have full time (24-hour), onsite qualified pump personnel including supervision for monitoring the entire bypass installation while it is in operation. The entire length shall be inspected hourly to check for leaks. Contractor shall provide all necessary monitoring devices to notify crews of any pump failure.
- c. Prior to installing any plugs, the Contractor must inspect the existing pipe for any flaws that might cause plug damage or not being able to seal properly. Always provide a secondary plug in the event the primary plug fails. Sanitary odors shall be minimized by using snug lids and shroud covers.
- d. When the bypass pipeline crosses local streets and private driveways, use roadway ramps or place the pipe in trenches and cover with temporary pavement or other protective means of pipe crossing.
- e. Contractor must protect all components of the bypass operation from vandalism and vehicular damage by securing the site.
- f. Use low noise pumps and generators on residential areas or places where excessive noise levels can create disturbance while in operation. Implement sound attenuation measures such as soundproof canopy if necessary.

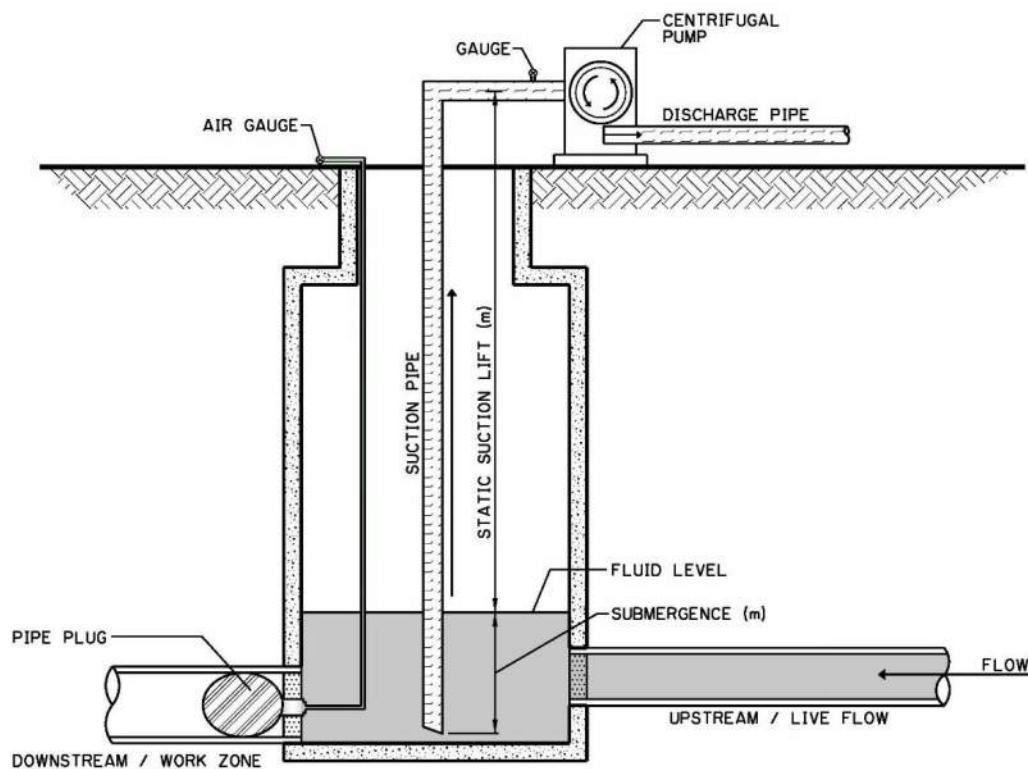
6.0 REMOVAL, CLEANUP and RESTORATION

Ensure all sewage from the bypass pipes, pumps and fittings are discharged to the specified sanitary or storm sewer system. Flush the bypass line before removal.

When a plug is no longer needed, remove it gradually to allow flow to return gradually to the normal flow condition.

Upon completion of the bypass pumping operations, Contractor shall remove all piping, restore all properties at least equal to pre-bypass condition including restoration of pavement and opening of roadways to normal traffic.

Appendix A – Suction Manhole Detail



TYPICAL SUCTION MANHOLE CROSS SECTION

SUCTION MANHOLE DETAILS		
ITEM	VALUES	NOTES
PIPE SIZE	mm	
PIPE LENGTH	m	
SUBMERGENCE	m	
STATIC SUCTION LIFT	m	
MAX. FLUID SURCHARGE LEVEL IN MH		
NPSH _a	m	
NPSH _r	m	
NPSH	m	
PUMP SIZE		
SUBMERGENCE REQUIRED BY PUMP	m	

Appendix B – Design and Submission Checklist

Project Name and Location: _____

Contractor: _____

YES NO

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. Cover Letter |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Site Details |
| | | <ul style="list-style-type: none"> • Site location indicated on the development map showing street names and major intersections in the affected area • Location and access of pumps and suction/discharge manholes • Route of piping with flow direction arrows complete with dimensions |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Design Considerations |
| | | <ul style="list-style-type: none"> • Calculations of static lift, friction losses, TDH, velocity, air valves, etc. • Calculations for pump size selection and piping sizes • Anchorage design (pipe supports, thrust blocks, restraints) • Methods of noise control for pumps and generators |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. Suction Manhole Detail |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. Pump Curves and System Information (Capacity, Head, Model, Power, Voltage, Amperage, $NPSH_A$ and $NPSH_R$ values) |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Piping information (diameter, material, length, pressure rating, etc.) |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Redundancy Plan |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Emergency Spill Response Plan |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. Risk Assessment and Mitigation Plan |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Bypass Pumping Schedule (set-up, operation, maintenance and removal) |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. Methods to protect suction/discharge manholes and appurtenances |
| <input type="checkbox"/> | <input type="checkbox"/> | 12. Traffic Control Plan (if applicable) |
| <input type="checkbox"/> | <input type="checkbox"/> | 13. Others, please specify _____ |

Appendix C – Risk and Mitigation Plan Example

(Excerpt from ECO Plan – Potential Environmental Impacts and Controls)

Construction Activity	Potential Environmental Impact(s)	Environmental Mitigation Measures
Bypass pumping	Sewage release	<p>Predesign</p> <ul style="list-style-type: none"> - Identify proximity to water courses, catch basins and other water related structures. Alberta Water Act approval may be required. - Use of jointless pipe in proximity to water courses to mitigate leakage from joints - Plug or provide protection for catch basins - Provide 100% redundancy in pumping design to accommodate potential pump failure or unexpected flows - Protect system from traffic impacts by putting barricades, fencing, road ramps, etc. <p>Setup</p> <ul style="list-style-type: none"> - Pressure test system with clean water to identify leaks - Place pumps in drip trays <p>Preconstruction</p> <ul style="list-style-type: none"> - Perform a 24-hr. system test to monitor system performance <p>Operation</p> <ul style="list-style-type: none"> - Have spill kits on hand - Have back-up plugs on hand - Have spare gaskets and parts on hand - Have monitoring and release response plan <p>Decommission</p> <ul style="list-style-type: none"> - Flush/purge piping with clean water prior to removal
	Gasoline spill when fueling equipment (also a safety hazard)	<p>Have a spill kit available and workers trained in its use in case of a spill</p> <p>No smoking allowed or use of electronic devices such as cell phones while fuelling, as spark could cause ignition</p> <p>Ensure a fire extinguisher is available in the fuelling station</p> <p>Ensure fuelling stations are setup in a well-ventilated areas</p> <p>Provide health and safety training to refueling staff to understand potential risks and to ensure correct machinery operation (total shutoff) when refueling</p> <p>Fuel Storage Tanks</p> <ul style="list-style-type: none"> - Locate in areas with sufficient space for vehicles to manoeuvre easily reducing the chances of hitting storage tanks - Ensure storage facilities are maintained and inspected regularly to prevent fuel leakage

Appendix D – Link to Specified Regulatory Requirements

- <http://www.calgary.ca/UEP/Water/Pages/Specifications/Submission-for-approval-/Development-Approvals-Submissions.aspx#spec>
- <https://www.calgary.ca/CA/city-clerks/Documents/Legislative-services/Bylaws/14M2012-Wastewater.pdf?noredirect=1>
- <https://www.calgary.ca/CA/city-clerks/Documents/Legislative-services/Bylaws/37m2005-Drainage.pdf?noredirect=1>
- <http://www.calgary.ca/UEP/ESM/Documents/ESM-Documents/ECO-Plan-Framework.pdf>
- http://www.qp.alberta.ca/documents/Regs/1993_117.pdf
- http://www.qp.alberta.ca/documents/Regs/1993_119.pdf
- <http://aep.alberta.ca/water/programs-and-services/drinking-water/legislation/documents/Part3-WastewaterSystemsStandards-2013.pdf>

PARKS CANADA

LAKE LOUISE UTILITIES UPGRADE GEOTECHNICAL INVESTIGATION REVISION 4 LAKE LOUISE, ALBERTA

SEPTEMBER 4, 2019

CONFIDENTIAL

WSP CANADA INC.
3300, 237 – 4 AVENUE SW
CALGARY, ALBERTA
T2P 4K3 CANADA

TEL: +1 403-271-4442
WSP.COM

WSP PROJECT NO. 181-13597-14



SIGNATURES

PREPARED BY



Stephen Bernier, P.Eng.
Geotechnical Engineer

REVIEWED BY


2019-09-04

Jerry Leung, P.Eng.
Geotechnical Engineer

APEGA Permit to Practice Number: P07641

PREPARED FOR:

Parks Canada
P.O. Box 900
Banff, Alberta T1L 1K2

WSP prepared this report solely for the use of the intended recipient, Parks Canada, in accordance with the professional services agreement. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

The original of this digital file will be conserved by WSP for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP, its integrity cannot be assured. As such, WSP does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.



TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	SITE AND PROJECT DESCRIPTION	1
2.1	Published Geological Information	1
3	METHODOLOGY.....	2
3.1	Field Investigation	2
3.2	Laboratory Testing	3
4	SUBSURFACE CONDITIONS.....	3
4.1	Topsoil.....	3
4.2	Asphalt	3
4.3	Fill	3
4.4	Sand.....	4
4.5	Gravel	4
4.6	Inferred Cobbles and Boulders.....	5
4.7	Weathered Bedrock.....	5
4.8	Groundwater and Sloughing Conditions	5
5	GEOTECHNICAL COMMENTS AND RECOMMENDATIONS.....	6
5.1	Frost Penetration Depth	6
5.2	Guided Pipe Ramming	6
5.3	Temporary Excavations.....	7
5.3.1	Open Cut Pipe Installation	8
5.3.2	Engineered Fill.....	8
5.4	Pipe Buoyancy	8
5.5	Seismic Site Classification	8
5.6	Water Soluble Sulphate	9

6 CLOSURE.....9

LIST OF TABLES

Table 1	Borehole Details	2
Table 2	Laboratory Test Results for Sand	4
Table 3	Laboratory Test Results for Gravel	4
Table 4	Groundwater Observations	5

APPENDICES

A	Terms of Reference
B	Site Plan and Borehole Logs

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



TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC.

1. STANDARD OF CARE

WSP Canada Inc. ("WSP") prepared and issued this geotechnical report (the "Report") for its client (the "Client") in accordance with generally-accepted engineering consulting practices for the geotechnical discipline. No other warranty, expressed or implied, is made. Unless specifically stated in the Report, the Report does not address environmental issues.

The terms of reference for geotechnical reports issued by WSP (the "Terms of Reference") contained in the present document provide additional information and caution related to standard of care and the use of the Report. The Client should read and familiarize itself with these Terms of Reference.

2. COMPLETENESS OF THE REPORT

All documents, records, drawings, correspondence, data, files and deliverables, whether hard copy, electronic or otherwise, generated as part of the services for the Client are inherent components of the Report and, collectively, form the instruments of professional services (the "Instruments of Professional Services"). The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, the communications between WSP and the Client, and to any other reports, writings, proposals or documents prepared by WSP for the Client relative to the specific site described in the Report, all of which constitute the Report.

TO PROPERLY UNDERSTAND THE INFORMATION, OBSERVATIONS, FINDINGS, SUGGESTIONS, RECOMMENDATIONS AND OPINIONS CONTAINED IN THE REPORT, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WSP CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT AND ITS VARIOUS COMPONENTS.

3. BASIS OF THE REPORT

WSP prepared the Report for the Client for the specific site, development, building, design or building assessment objectives and purpose that the Client described to WSP. The applicability and reliability of any of the information, observations, findings, suggestions, recommendations and opinions contained in the Report are only valid to the extent that there was no material alteration to or variation from any of the said descriptions provided by the Client to WSP unless the Client specifically requested WSP to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information, observations, findings, suggestions, recommendations and opinions contained in the Report, or any component forming the Report, are for the sole use and benefit of the Client and the team of consultants selected by the Client for the specific project that the Report was provided. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION OR COMPONENT WITHOUT THE WRITTEN CONSENT OF WSP. WSP will consent to any reasonable request by the Client to approve the use of this Report by other parties designated by the Client as the "Approved Users". As a condition for the consent of WSP to approve the use of the Report by an Approved User, the Client must provide a copy of these Terms of Reference to that Approved User and the Client must obtain written confirmation from that Approved User that the Approved User will comply with these Terms of Reference, such written confirmation to be provided separately by each Approved User prior to beginning use of the Report. The Client will provide WSP with a copy of the written confirmation from an Approved User when it becomes available to the Client, and in any case, within two weeks of the Client receiving such written confirmation.

The Report and all its components remain the copyright property of WSP and WSP authorises only the Client and the Approved Users to make copies of the Report, but only in such quantities as are reasonably necessary for the use of the Report by the Client and the Approved Users. The Client and the Approved Users may not give, lend, sell or otherwise disseminate or make the Report, or any portion thereof, available to any party without the written permission of WSP. Any use which a third party makes of the Report, or any portion of the Report, is the sole responsibility of such third parties. WSP accepts no responsibility for damages suffered by any third party resulting from the use of the Report. The Client and the Approved Users acknowledge and agree to indemnify and hold harmless WSP, its officers, directors, employees, agents, representatives or sub-consultants, or any or all of them, against any claim of any nature whatsoever brought against WSP by any third parties, whether in contract or in tort, arising or related to the use of contents of the Report.

TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC. (continued)

5. INTERPRETATION OF THE REPORT

- a. **Nature and Exactness of Descriptions:** The classification and identification of soils, rocks and geological units, as well as engineering assessments and estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1 above. The classification and identification of these items are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations or assessments utilizing the standards of Paragraph 1 involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to changes over time and the parties making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or when the Client has special considerations or requirements, the Client must disclose them to WSP so that additional or special investigations may be undertaken, which would not otherwise be within the scope of investigations made by WSP or the purposes of the Report.
- b. **Reliance on information:** The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site investigation and field review and on the basis of information provided to WSP. WSP has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, WSP cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.
- c. **Additional Involvement by WSP:** To avoid misunderstandings, WSP should be retained to assist other professionals to explain relevant engineering findings and to review the geotechnical aspects of the plans, drawings and specifications of other professionals relative to the engineering issues pertaining to the geotechnical consulting services provided by WSP. To ensure compliance and consistency with the applicable building codes, legislation, regulations, guidelines and generally-accepted practices, WSP should also be retained to provide field review services during the performance of any related work. Where applicable, it is understood that such field review services must meet or exceed the minimum necessary requirements to ascertain that the work being carried out is in general conformity with the recommendations made by WSP. Any reduction from the level of services recommended by WSP will result in WSP providing qualified opinions regarding adequacy of the work.

6. ALTERNATE REPORT FORMAT

When WSP submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon WSP. The hard copy versions submitted by WSP shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by WSP shall be deemed to be the overall originals for the Project.


The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except WSP. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by WSP.

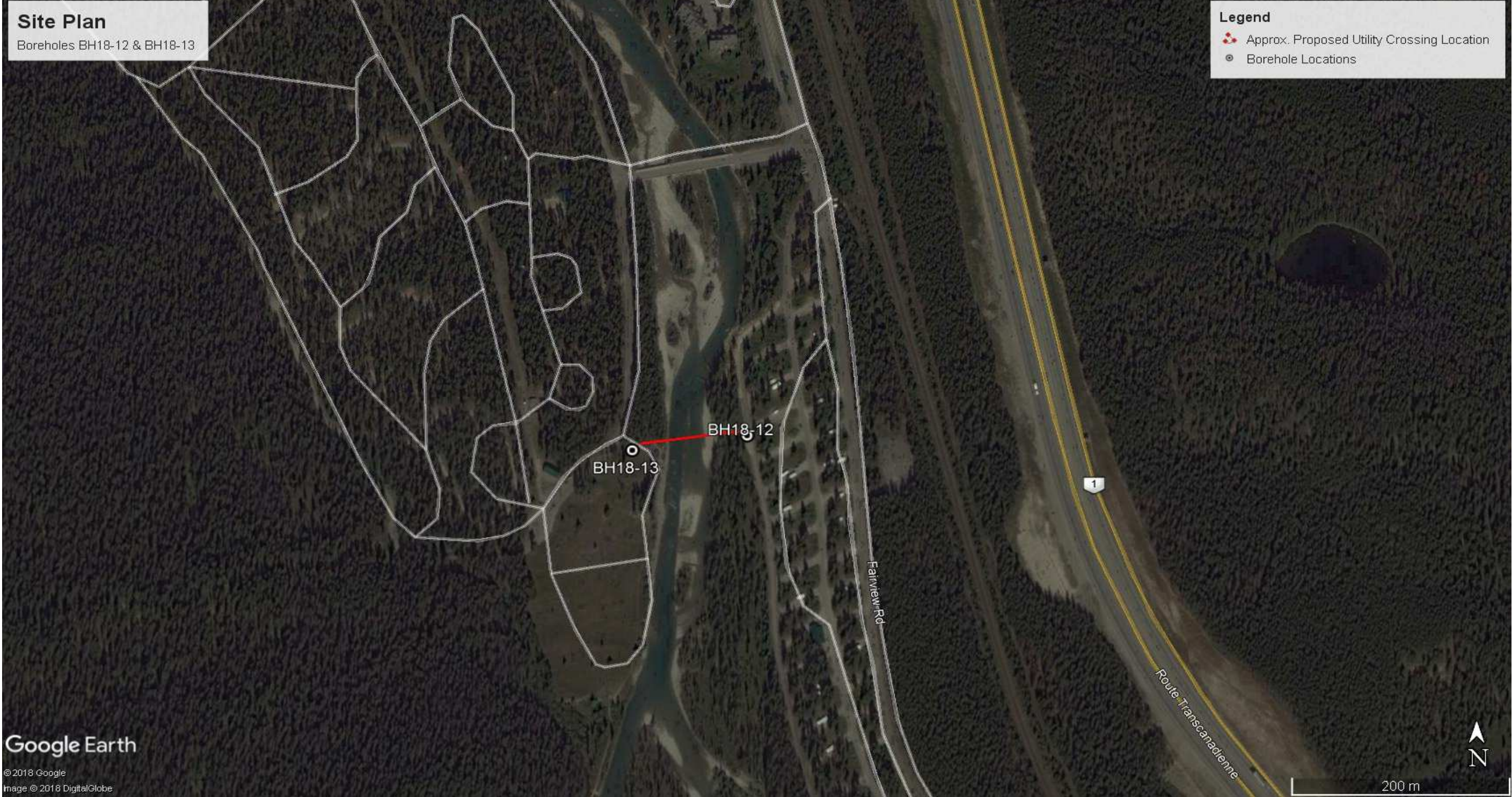
The Client recognizes and agrees that WSP prepared and submitted electronic files using specific software or hardware systems, or both. WSP makes no representation about the compatibility of these files with the current or future software and hardware systems of the Client, the Approved Users or any other party. The Client further agrees that WSP is under no obligation, unless otherwise expressly specified, to provide the Client, the Approved Users and any other party, or any or all of them, with specific software and hardware systems that are compatible with any electronic submitted by WSP. The Client further agrees that should the Client, an Approved User or a third party require WSP to provide specific software or hardware systems, or both, compatible with the electronic files prepared and submitted by WSP, for any reason whatsoever included but not restricted to an order from a court, then the Client will pay WSP for all reasonable costs related to the provision of the specific software or hardware systems, or both. The Client further agrees to indemnify and hold harmless WSP, its officers, directors, employees, agents, representative or sub-consultant, or any or all of them, against any claim or any nature whatsoever brought against WSP, whether in contract or in tort, arising or related to the provision or use of any specific software or hardware provided by WSP.


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	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. -	DATE 09/01/2019	SCALE -
FIGURE NUMBER Figure 2			REV. 0	



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

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																
35																5015
12																5010
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.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

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											
	at 2.3 m - 0.074% sulphate based on lab test		8												
	at 2.3 m - 13.7% gravel, 46.5% sand & 39.8% silt/clay based on lab test		7	G											5035
10			8												
			9	G											5034
4			8												
			9	G											5030
15	at 4.3 m - compact		9												
			11												
			19	G											5032
			18												
			21	G											5025
6	from 5.5 m - compact to loose		19												
20			7												
			7	G											
			6												
	at 6.9 m - water seepage, very dense		50 for 25 mm	G											5020
25															5030
8	at 7.6 m - coarse grained gravel, inferred cobbles			G											
				G											5015
30															
				G											5018
	End of borehole at 9.1 m. Borehole dry at drilling completion.														5028
10															5010
35															5026
															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)
 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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

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)
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.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

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
																5020
30																530
																5015
10																528
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)

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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

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											
6					G											5035
20					G											534
					G											5030
25					G											532
8					G											5025
					G											530
30					G											5020
10					G											5015
35					G											
12					G											528
40					G											
	End of borehole at 12.2 m. Borehole dry at drilling completion. Piezometer was dry 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:

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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-08




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																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		●									
	from 4.9 m - light grey, very dense, inferred cobbles				G		●									5030
6					G		●									
20					G		●									
	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															532
																5025
25																
8																530
																5020
30																
10																5015
																528
35																
																5010
12																
40																526

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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-09




Pg 1 of 1

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	from 1.5 m - dynamic cone penetration testing started and continued at 12 inch (300 mm) intervals			5	G											5040
				6												536
				17	G											
				15												
10				26												
				44	G											5035
				51												
4				56	G											534
				90												
15	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles			50 for 150 mm	G											5030
					G											
6					G											532
20	End of borehole at 6.1 m. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															5025
25																
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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

BH18-10




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												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												
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

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB

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											
	light grey, BOULDER , very slow drill head advancement, inferred singular boulder or group of cobbles				G											5035
10	at 2.3 m - 0.068% sulphate based on lab test				G											
	very dense, light brown, GRAVEL , and sand, trace silt, trace clay, moist, inferred cobbles				G											5034
4					G											5030
15					G											
	End of borehole at 4.6 m due to refusal. Borehole dry at drilling completion. Piezometer was dry on April 11, 2019.															5032
																5025
6																
																5020
25																5015
8																5010
																5005
30																
10																
35																
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.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

Lake Louise Utilities Upgrade 18-19
Parks Canada
Lake Louise, AB




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.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.



WSP Canada Inc.
#203 - 6919 32nd Avenue NW
Calgary, AB T3B 0K6
Tel: +1 403-247-1813
Fax: +1 403-247-1814
www.wspgroup.com

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:

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN
FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

THIS LOG IS FOR GEOTECHNICAL PURPOSES ONLY
THIS LOG IS THE SOLE PROPERTY OF WSP CANADA INC.
AND CANNOT BE USED OR DUPLICATED IN
ANY WAY WITHOUT EXPRESS WRITTEN PERMISSION.

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.



