

**Pê Sâkâstêw Centre,
Maskwacis, Alberta,
Vocational Facility**

Issued for Tender

**Maskwacis, Alberta
Project No. R.072604.001**

Client:

**Public Works and Government
Services Canada**

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END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

Work of this Contract, identified as project R.072604.001 Pê Sâkâstêw Centre, Maskwacis, Alberta comprises general construction of the Vocational Facility.

1.2 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Departmental Representative's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Departmental Representative Occupancy during construction.
- .3 Maintain fire access/control.

1.3 CONTRACTOR USE OF PREMISES

- .1 Departmental Representative to have unlimited access to site.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work.
- .5 At completion of operations the condition is to be equal to or better than that which existed before new work started.

1.4 DEPARTMENTAL REPRESENTATIVE OCCUPANCY

- .1 Departmental Representative will be available for meetings, inspections, and the execution of the normal operations during the construction period.
- .2 Co-operate with Departmental Representative operations to minimize conflict and to facilitate usage off adjacent spaces.

1.5 EXISTING SERVICES

- .1 Notify, Departmental Representative of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian.
- .3 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

- .4 Provide temporary services to maintain critical building and tenant systems.
- .5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

1.6 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 Corporate and Site Specific Health and Safety Plan and Site Specific Other Safety Related Documents.
 - .11 WHMIS data sheets.
 - .12 Other documents as specified.

END OF SECTION

Part 1 General

1.1 PURPOSE

- .1 To ensure that both the construction project and the institutional operations may proceed without undue disruption or hindrance and that the security of the Institution is maintained at all times.

1.2 DEFINITIONS

- .1 "Contraband" means:
 - .1 an intoxicant, including alcoholic beverages, drugs and narcotics,
 - .2 a weapon or a component thereof, ammunition for a weapon, and anything that is designed to kill, injure or disable a person or that is altered so as to be capable of killing, injuring or disabling a person, when possessed without prior authorization,
 - .3 an explosive or a bomb or a component thereof,
 - .4 currency over any applicable prescribed limit \$50.00, and
 - .5 any item not described in paragraphs (1) to (4) that could jeopardize the security of a Penitentiary or the safety of persons, when that item is possessed without prior authorization
- .2 "Unauthorized Smoking and related Items" means all smoking items including, but not limited to, cigarettes, cigars, tobacco, chewing tobacco, cigarette making machines, matches and lighters.
- .3 "Commercial Vehicle" means any motor vehicle used for the shipment of material, equipment and tools required for the construction project.
- .4 "CSC" means Correctional Service Canada.
- .5 "Director" means Departmental Representative, Warden or Superintendent of the Institution as applicable.
- .6 "Construction employees" means persons working for the general contractor, the sub-contractors, equipment operators, material suppliers, testing and inspection companies and regulatory agencies.
- .7 "Departmental Representative" means the project manager from Public Works and Government Services Canada.
- .8 "Perimeter" means the fenced or walled area of the institution that restrains the movement of the inmates.
- .9 "Construction limits" means the area as shown on the contract drawings that the contractor will be allowed to work. This area may or may not be isolated from the security area of the institution. These are the immediate areas in and around the concrete pads under construction.

1.3 PRELIMINARY PROCEEDINGS

- .1 Prior to the commencement of work, the Contractor will meet with the Departmental Representative or his representative to:
 - .1 Discuss the nature and extent of all activities involved in the Project.
 - .2 Establish mutually acceptable security procedures in accordance with this instruction and the institution's particular requirements.
- .2 The Contractor will:
 - .1 Ensure that all construction employees are aware of the security requirements.
 - .2 Ensure that a copy of the security requirements is always prominently on display at the job site.
 - .3 Co-operate with institutional personnel in ensuring that security requirements are observed by all construction employees.

1.4 CONSTRUCTION EMPLOYEES

- .1 Submit to the Correctional Services Canada (CSC): Jason Kremp: Email: Jason.Kremp@CSC-SCC.GC.CA . Phone: 403-227-8150. Fax: 403-227-8151. List the names with date of birth of all construction employees to be employed on the construction site and a security clearance and request form for each employee. Contact information could change without prior notice. Please contact the Departmental Representative prior to sending for confirmation.
- .2 Allow two (2) weeks for processing of security clearances. Employees will not be admitted to the Institution without a valid security clearance in place and a recent picture identification such as a provincial driver's license. Security clearances obtained from other CSC institutions are not valid at this institution.
- .3 The Departmental Representative may require that facial photographs may be taken of construction employees and these photographs may be displayed at appropriate locations in the institution or in an electronic database for identification purposes. The Departmental Representative may require that Photo ID cards be provided for all construction workers. ID cards will then be left at the designated entrance to be picked up on arrival at the institution and shall be displayed prominently on the construction employees clothing at all time while employees are in the institution.
- .4 Entry to Institutional Property will be refused to any person there may be reason to believe may be a security risk.
- .5 Any person employed on the construction site will be subject to immediate removal from Institutional Property if they:
 - .1 appear to be under the influence of alcohol, drugs or narcotics.
 - .2 behave in an unusual or disorderly manner.
 - .3 are in possession of contraband.

1.5 VEHICLES

- .1 All unattended vehicles on CSC property shall have windows closed; doors and trunks shall be locked and keys removed. The keys shall be securely in the possession of the Departmental Representative or an employee of the company that owns the vehicle. The Institution requires lockable gas caps on all vehicles and motorized equipment used in the construction area.
- .2 The Departmental Representative may limit at any time the number and type of vehicles allowed within the Institution.
- .3 Drivers of delivery vehicles for material required by the project will not require security clearances but must remain with their vehicle the entire time that the vehicle is in the Institution. The Departmental Representative may require that these vehicles be escorted by Institutional staff or Commissionaires while in the Institution.

1.6 PARKING

- .1 The parking area(s) to be used by construction employees will be designated by the Departmental Representative. Parking in other locations will be prohibited and vehicles may be subject to removal.

1.7 SHIPMENTS

- .1 All shipments of project material, equipment and tools shall be addressed in the Contractor's name to avoid confusion with the institution's own shipments. The contractor must have his own employees on site to receive any deliveries or shipments. CSC staff will NOT accept receipt of deliveries or shipments of any material equipment or tools.

1.8 TELEPHONES

- .1 There will be no installation of telephones, Facsimile machines and computers with Internet connections permitted within the perimeter of the institution unless prior approval of the Departmental Representative is received.
- .2 Wireless cellular and digital telephones, including but not limited to devices for telephone messaging, pagers, cell phones, telephone used as 2-way radios, are not permitted within the perimeter of the Institution unless approved by the Departmental Representative. If wireless cellular telephones are permitted, the user will not permit their use by any inmate, will not take pictures of any person, will submit to a search of all photos, and must obtain a camera/phone pass daily.
- .3 The Departmental Representative may approve but limit the use of two way radios.

1.9 WORK HOURS

- .1 Work hours within the Institution are: Monday to Friday 8:00 a.m. (0800hrs.) to 4:00 p.m. (1600 hrs).

- .2 Work will not be permitted during weekends and statutory holidays without the permission of the Departmental Representative. A minimum of seven days advance notice will be required to obtain the required permission. In case of emergencies or other special circumstances, this advance notice may be waived or period shortened by the Departmental Representative.

1.10 OVERTIME WORK

- .1 No overtime work will be allowed without permission of the Departmental Representative. Give a minimum forty-eight (48) hours advance notice when overtime work on the construction project is necessary and approved. If overtime work is required because of an emergency such the completion of a concrete pour or work to make the construction safe and secure, the contractor will advise the Departmental Representative as soon as this condition is known and follow the directions given by the Departmental Representative. Costs to the Crown for such events may be attributed to the contractor.
- .2 When overtime work, weekend statutory holiday work is required and approved by the Departmental Representative, extra staff members may be posted by the Departmental Representative or his designate, to maintain the security surveillance. The Departmental Representative may post extra staff for inspection of construction activities. The actual cost of this extra staff may be subject to reclamation by the Crown.

1.11 SECURITY HARDWARE

- .1 Turn over all removed security hardware to the Departmental Representative of the Institution for disposal or for safekeeping until required for re-installation.

1.12 PRESCRIPTION DRUGS

- .1 Employees of the contractor who are required to take prescription drugs during the workday shall obtain approval of the Departmental Representative to bring a one day supply only into the Institution.

1.13 SMOKING RESTRICTIONS

- .1 Contractors and construction employees are not permitted to smoke inside correctional facilities or outdoors within the perimeter of a correctional facility and must not possess unauthorized smoking items within the perimeter of a correctional facility.
- .2 Contractors and construction employees who are in violation of this policy will be requested to immediately cease smoking or dispose of any unauthorized smoking items and, if they persist, will be directed to leave the institution.
- .3 Smoking is only permitted outside the perimeter of a correctional facility in an area to be designated by the Departmental Representative.
- .4 Smoking arrangements are to be made with the Departmental Representative.

1.14 CONTRABAND

- .1 Weapons, ammunition, explosives, alcoholic beverages, drugs and narcotics are prohibited on institutional property.
- .2 The discovery of contraband on the construction site and the identification of the person(s) responsible for the contraband shall be reported immediately to the Departmental Representative.
- .3 Contractors should be vigilant with both their staff and the staff of their sub-contractors and suppliers. The discovery of contraband may result in cancellation of the security clearance of the affected employee. Serious infractions may result in the removal of the company from the Institution for the duration of the construction.

1.15 SEARCHES

- .1 All vehicles and persons entering institutional property may be subject to search.
- .2 When the Departmental Representative suspects, on reasonable grounds, that an employee of the Contractor is in possession of contraband or unauthorized items, he may order that person to be searched.
- .3 All employees entering the Institution may be subject to screening of personal effects for traces of contraband drug residue.

1.16 ACCESS TO AND FROM INSTITUTIONAL PROPERTY

- .1 Construction personnel and commercial vehicles will not be admitted to the institution after normal working hours, unless approved by the Departmental Representative.

1.17 MOVEMENT OF VEHICLES

- .1 Escorted commercial vehicles will be allowed to enter or leave the institution through the vehicle access gate during the following hours:
 - .1 08:00 a.m. to 0:400 p.m.(or within approved hours of work).
- .2 The contractor shall advise the Departmental Representative twenty four (24) hours in advance to the arrival on the site of heavy equipment such as concrete trucks, cranes, etc.
- .3 Vehicles being loaded with soil or other debris, or any vehicle considered impossible to search, must be under continuous supervision by CSC staff or Commissionaires working under the authority of the Departmental Representative.
- .4 Commercial vehicles will only be allowed access to institutional property when their contents are certified by the Contractor or his representative as being strictly necessary to the execution of the construction project.
- .5 Vehicles shall be refused access to institutional property if, in the opinion of the Departmental Representative, they contain any article which may jeopardize the

security of the institution.

- .6 Private vehicles of construction employees will not be allowed within the security wall or fence of medium or maximum security institutions without the permission of the Departmental Representative.
- .7. With prior approval of the Departmental Representative, a vehicle may be used in the morning and evening to transport a group of employees to the work site. This vehicle will not remain within the Institution the remainder of the day.
- .8. With the approval of the Departmental Representative, certain equipment may be permitted to remain on the construction site overnight or over the weekend. This equipment must be securely locked, with the battery removed. The Departmental Representative may require that the equipment be secured with a chain and padlock to another solid object.

1.18 MOVEMENT OF CONSTRUCTION EMPLOYEES ON INSTITUTIONAL PROPERTY

- .1 Subject to the requirements of good security, the Departmental Representative will permit the Contractor and his employees as much freedom of action and movement as is possible.
- .2 However, notwithstanding paragraph above, the Departmental Representative may:
 - .1 Prohibit or restrict access to any part of the institution.
 - .2 Require that in certain areas of the institution, either during the entire construction project or at certain intervals, construction employees only be allowed access when accompanied by a member of the CSC security staff.
- .3 During the lunch and coffee/health breaks, all employees will remain within the construction site. Employees are not permitted to eat in the officer's lounge and dining room.

1.19 SURVEILLANCE AND INSPECTION

- .1 Construction activities and all related movement of personnel and vehicles will be subject to surveillance and inspection by CSC security staff members to ensure that established security requirements are met.
- .2 CSC staff members will ensure that an understanding of the need to carry out surveillance and inspections, as specified above, is established among construction employees and maintained throughout the construction project.

1.20 STOPPAGE OF WORK

- .1 The Departmental Representative may request at any time that the contractor, his employees, sub-contractors and their employees not enter or leave the work site immediately due to a security situation occurring within the Institution. The contractor's site supervisor shall note the name of the staff member making the request and the time of the request and obey the order as quickly as possible.

- .2 The contractor shall advise the Departmental Representative within 24 hours of this delay to the progress of the work.

1.21 CONTACT WITH INMATES

- .1 Unless specifically authorized, it is forbidden to come into contact with inmates, to talk with them, to receive objects from them or to give them objects. Any employee doing any of the above will be removed from the site and his security clearance revoked.
- .2 It is forbidden to take pictures of inmates, of CSC staff members or of any part of the Institution other than those required as part of this contract.

1.22 COMPLETION OF CONSTRUCTION PROJECT

- .1 Upon completion of the construction project or, when applicable, the takeover of a facility, the Contractor shall remove all remaining construction material, tools and equipment that are not specified to remain in the Institution as part of the construction contract.

END OF SECTION

Part 1 General

1.1 APPLICATIONS FOR PROGRESS PAYMENT

- .1 Submit to Departmental Representative, at least 14 days before first application for payment, Cost Breakdown, in detail as directed by Departmental Representative, for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment and predicted cash flow. After approval by Departmental Representative, Cost Breakdown will be used as basis for progress payments.
- .2 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.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Schedule and administer project meetings throughout the progress of the work at the call of Departmental Representative.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting four days in advance of meeting date to Departmental Representative.
- .4 Preside at meetings.
- .5 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .6 Reproduce and distribute copies of minutes within three days after meetings and transmit to meeting participants.
- .7 Representative of Contractor, Subcontractor and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Site meetings are to be held at the Contractor's Site Office.
- .2 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .3 Senior representatives of, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
- .4 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16.07 - Construction Progress Schedule - Gantt Bar Chart.
 - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
 - .4 Requirements for temporary storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .6 Departmental Representative provided products.
 - .7 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.

- .8 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Monthly progress claims, administrative procedures, photographs, hold backs.
- .11 Appointment of inspection and testing agencies or firms.
- .12 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

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

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: Monday to Friday, inclusive, will provide five day work week and 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 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative within working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

- .1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).
- .2 Departmental Representative will review and return revised schedules within 5 working days.
- .3 Revise impractical schedule and resubmit within 5 working days.
- .4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

- .1 Develop detailed Project Schedule derived from Master Plan.
- .2 Ensure detailed Project Schedule includes a minimum milestone and activity types.

1.6 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule on weekly 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.

1.7 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.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit shop drawings bearing stamp and signature of qualified professional Engineer registered or licensed in Province of Alberta, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

- .4 Allow 7 days for Departmental Representative's review of each submission.
- .5 Adjustments made on shop drawings as Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing on a separate document clearly identified as a proposal to change. Submit this document to the Departmental Representative with the submitted shop drawing for review.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Provide shop drawings that are within the scope of the contract.
- .8 Provide alternate shop drawings only after shop drawings within scope, are submitted.
- .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.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.

- .7 Operating weight.
- .8 Wiring diagrams.
- .9 Single line and schematic diagrams.
- .10 Relationship to adjacent work.
- .11 After Departmental Representative's review, distribute copies.
- .12 Submit one digital and 1 hard copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .13 Submit digital copies and 2 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.
- .14 Submit digital copies and 2 copies of test reports for requirements requested in specification Sections and as requested by 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.
 - .2 Testing must have been within 3 years of date of contract award for project.
- .15 Submit digital copies and 2 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of project contract complete with project name.
- .16 Submit digital copies and 2 copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .17 Submit digital copies and 2 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

- .18 Submit digital copies and 2 copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .19 Supplement standard information to provide details applicable to project.
- .20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, digital or hard copy will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 SAMPLES

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

1.4 CERTIFICATES AND TRANSCRIPTS

- .1 Submit transcription of insurance to the Contracting Officer and the Departmental Representative immediately after the award of Contract.

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; unfavourably 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.

1.2 FIRES

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

1.3 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site unless approved by Departmental Representative.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.4 DRAINAGE

- .1 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.

1.5 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.

- .3 Protect roots of designated trees to dripline 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 Departmental Representative.

1.6 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.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.7 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, and permits.
- .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.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

- .1 Perform Work in accordance with National Building Code of Canada 2010 (NBC) including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

1.2 HAZARDOUS MATERIAL DISCOVERY

- .1 Asbestos: demolition of spray or trowel-applied asbestos is hazardous to health. Stop work immediately when material resembling spray or trowel-applied asbestos is encountered during demolition work. Notify Departmental Representative.
- .2 PCB: Polychlorinated Biphenyl: stop work immediately when material resembling Polychlorinated Biphenyl is encountered during demolition work. Notify Departmental Representative.
- .3 Mould: stop work immediately when material resembling mould is encountered during demolition work. Notify Departmental Representative.

1.3 BUILDING SMOKING ENVIRONMENT

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

END OF SECTION

Part 1 General

1.1 INSPECTION

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

1.2 ACCESS TO WORK

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

1.3 PROCEDURES

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

1.4 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.

- .3 If in opinion of Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Departmental Representative.

1.5 REPORTS

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

1.6 TESTS AND MIX DESIGNS

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121-M1978(R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.
 - .4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Indicate use of supplemental or other staging area.
- .2 Provide construction facilities in order to execute work expeditiously.
- .3 Remove from site all such work after use.
- .4 The stage and storage areas will be located in minimum security area.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding.
 - .1 Scaffolding to be erected in a manner that will not comprise the facility security.

1.5 HOISTING

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

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 Area to be assigned by Departmental Representative.

1.8 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.
- .3 Locate storage facilities as directed by Departmental Representative.
- .4 Staging and lay-down areas will be designated by the Departmental Representative in areas non-adjacent to the Administration Building.
- .5 All storage will be located in the minimum security area.

1.9 SANITARY FACILITIES

- .1 Contractor to provide portable sanitary facilities with lockable doors to meet Institutional requirements.

1.10 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 all others are the responsibility of the Contractor for removal from site and disposal.
- .4 Construction debris, waste materials and packing material to be removed by means of waste disposal vehicles or waste bins must conform to Security Restrictions Section 01 14 10 of this specification.
- .5 Waste bins must be locked and secured to meet Institutional security requirements.

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 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.

1.4 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.5 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 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Waste bins must be locked and secured to meet Institutional security requirements.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Within text of each specifications 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, 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 Departmental Representative in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, unless determined in Contract Documents, 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 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.
- .3 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

- .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Departmental Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

- .2 In event of failure to notify Departmental Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Departmental Representative reserves right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

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

1.5 TRANSPORTATION

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

1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative will establish course of action.

- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.7 QUALITY OF WORK

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

1.8 CO-ORDINATION

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

1.9 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 Departmental Representative of conflicting installation. Install as directed.

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 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.

END OF SECTION

Part 1 General

1.1 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.

1.2 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 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 Departmental Representative.

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 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 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 request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

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; all work to ensure occupants of building will not be affected or work routines altered due to contract work. Contract states winter construction plan as such.
- .6 Maintain work 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 Remove samples of installed Work for testing.
- .6 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .7 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .8 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .9 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .10 Restore work with new products in accordance with requirements of Contract Documents.
- .11 Fit Work airtight/watertight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

1.5 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, including that caused by Departmental Representative or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 Clear snow and ice from access to building, 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 location to co-ordinated and approved by Departmental Representative containers for collection of waste materials and debris.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

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 Departmental Representative or other Contractors.

- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Remove dirt and other disfiguration from exterior surfaces.
- .10 Sweep and wash clean paved areas.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Waste bins must be locked and secured to meet Institutional security requirements.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PWGSC's Waste Management Plan and Goals.
- .2 PWGSC's Waste Management Goal maximum amount of Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.

1.2 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 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.
- .3 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .4 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .5 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.
- .6 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.
- .7 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .8 Separate Condition: refers to waste sorted into individual types.
- .9 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 SUBMITTALS

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

- .2 Prepare and submit following prior to project start-up:
 - .1 2 copies of Materials Source Separation Program (MSSP) description.

1.4 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 Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship materials to site operating under Certificate of Approval.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.5 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.
- .2 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .3 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.
- .4 Protect surface drainage.
- .5 Separate and store materials produced during dismantling of structures in designated areas.
- .6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.
 - .2 Remove co-mingled materials to off-site processing facility for separation.

1.6 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste into waterways, storm, or sanitary sewers.
- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

1.7 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.

1.8 SCHEDULING

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 SELECTIVE DEMOLITION

- .1 Reuse of Building Elements: this project has been designed to result in end of project rates for reuse of building elements as follows: do not demolish building elements beyond what is indicated on Drawings without approval by Departmental Representative's.

3.2 APPLICATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.3 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.

3.4 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by 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 recovered materials is not permitted.

**3.5 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF
RESPONSIBILITY FOR THE ENVIRONMENT**

.1 Schedule E - Government Chief Responsibility for the Environment:

Province	Address	General Inquires	Fax
Alberta	Alberta Environmental Protection Petroleum Plaza, South Tower 9915 - 108 th Street Edmonton AB T5K 2G8	403-427-2739	
	Alberta Special Waste Management Corporation Pacific Plaza, Suite 610 10909 Jasper Avenue NW Edmonton AB T5J 3L9	403-422-5029	403-428-9627

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

- .1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to intent of Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Departmental Representative Review.
- .2 Departmental Representative Review: Departmental Representative and Contractor will perform review of Work to identify obvious defects or deficiencies. 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 are fully operational.
 - .4 Operation of systems have been demonstrated to Departmental Representative's personnel.
 - .5 Work is complete and ready for final inspection.
- .4 Final Review: when items noted above are completed, request final review of Work by Departmental Representative, and Contractor. If Work is deemed incomplete by Departmental Representative, complete outstanding items and request another review.
- .5 Declaration of Substantial Performance: when Departmental Representative consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

1.2 CLEANING

- .1 In accordance with Section 01 74 11 - Cleaning.
- .2 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.

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 review, with 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 copies of operating and maintenance manuals in English.
- .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.
- .10 Provide 3 hard copies and 1 electronic version of the O&M Manuals.

1.2 FORMAT

- .1 Organize data as instructional manual.
- .2 Submit PDF copies of Closeout Submittal and hard copies.
- .3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .4 When multiple binders are used correlate data into related consistent groupings. Identify contents of each binder on spine.
- .5 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .6 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .8 Text: manufacturer's printed data, or typewritten data.
- .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

- .10 Provide 1:1 scaled CAD files in dxf format on CD.
- .11 Electronic copy of all final documents to be delivered as completed.
- .12 Operations and Maintenance Manual format:

Cover and Binder Edge
Identify each binder with:

Operation & Maintenance Manual
Project: PWxxxxxx and Title
City, Prov/Terr
Date

Table of Contents

TAB A - Warranty information

Letter on letterhead providing one year warranty on installation from date of substantial completion

- Dated and signed.
- Project project name, number and building / location.
- Starting point of warranty period.
- Duration of overall warranty period.
- List of equipment that is covered by extended warranty as well as duration.
- Organization, names and phone numbers of persons to call for warranty service

TAB B - List of Project Participants

- Company names, addresses, telephone numbers and email addresses of Department Representative and Contractor with name of responsible parties.

TAB C - Reports

- Your site photographs showing before and after views of the project

TAB D - Permits

- Construction / Installation Permits and Inspection Certificates.

TAB E - Equipment and Systems information

- Approved "as-built" drawings
- Copy of approved project shop-drawings

- Include Manufacturer's data / brochures and recommendations relating: product information, installation, commissioning, start-up, O&M, shutdown and training materials for equipment installed on this project.

TAB F - Include supporting documentation and miscellaneous items

- Health and safety submittals including site specific hazard assessment, Safety Manual TOC and company safety policy, MSDS sheets if applicable, signed site orientations for workers, copy of first aid certificate, copy of emergency plan and muster location.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
 - .2 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O M staff.
- .2 Contractor assists in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown per discipline.

- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .6 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Departmental Representative, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.
 - .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.

- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Submit no later than 4 weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Departmental Representative for changes to submittals and obtain written approval at least 8 weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Departmental Representative not specified and obtain written approval at least 8 weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Departmental Representative.

1.8 COMMISSIONING DOCUMENTATION

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms for requirements and instructions for use].
- .2 Departmental Representative to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Departmental Representative.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANNT) Chart.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16.07 - Construction Progress Schedules - Bar (GANNT) Chart and as specified herein.

- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart. Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Departmental Representative who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:

- .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
- .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.

- .3 Signed installation/start-up check lists.
- .4 Start-up reports,
- .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.

- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

1.22 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.23 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.24 EXTENT OF VERIFICATION

- .1 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.25 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.26 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.27 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.28 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.29 TRAINING

- .1 In accordance with Section 01 91 41 - Commissioning (Cx) - Training.

1.30 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.31 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.32 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.33 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10% of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.

- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2% of recorded values.

1.34 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.

1.2 REFERENCES

- .1 American Water Works Association (AWWA)
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA-13-02, Installation of Sprinkler Systems Handbook.
 - .2 NFPA-14-02, Automatic Sprinkler Systems Handbook.
 - .3 NFPA-20-03, Standard for the Installation of Stationary Fire Pumps for Fire Protection.
- .3 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 –latest edition.
- .4 Underwriters' Laboratories of Canada (ULC)
- .5 CSA-Z320-11, Building Commissioning Standard and Check Sheets.

1.3 GENERAL

- .1 Provide a fully functional facility:
 - .1 Systems, equipment and components meet user's functional requirements before date of acceptance, and operate consistently at peak efficiencies and within specified energy budgets under normal loads.
 - .2 Facility user and O&M personnel have been fully trained in aspects of installed systems.
 - .3 Optimized life cycle costs.
 - .4 Complete documentation relating to installed equipment and systems.
- .2 Term "Cx" in this section means "Commissioning".
- .3 Use this Cx Plan as master planning document for Cx:
 - .1 Outlines organization, scheduling, allocation of resources, documentation, pertaining to implementation of Cx.
 - .2 Communicates responsibilities of team members involved in Cx Scheduling, documentation requirements, and verification procedures.
 - .3 Sets out deliverables relating to O M, process and administration of Cx.
 - .4 Describes process of verification of how built works meet design requirements.
 - .5 Produces a complete functional system prior to issuance of Certificate of Occupancy.

- .6 Management tool that sets out scope, standards, roles and responsibilities, expectations, deliverables, and provides:
 - .1 Overview of Cx.
 - .2 General description of elements that make up Cx Plan.
 - .3 Process and methodology for successful Cx.
- .4 Acronyms:
 - .1 Cx - Commissioning.
 - .2 BMM - Building Management Manual.
 - .3 EMCS - Energy Monitoring and Control Systems.
 - .4 MSDS - Material Safety Data Sheets.
 - .5 PI - Product Information.
 - .6 PV - Performance Verification.
 - .7 TAB - Testing, Adjusting and Balancing.
 - .8 WHMIS - Workplace Hazardous Materials Information System.
- .5 Commissioning terms used in this Section:
 - .1 Bumping: short term start-up to prove ability to start and prove correct rotation.
 - .2 Deferred Cx - Cx activities delayed for reasons beyond Contractor's control due to lack of occupancy, weather conditions, need for heating/cooling loads.

1.4 DEVELOPMENT OF 100% CX PLAN

- .1 Cx Plan to be 95% completed by the Departmental Representative and transmit to Contractor.
- .2 Cx Plan to be 100% completed within 8 weeks of award of contract to take into account:
 - .1 Approved shop drawings and product data.
 - .2 Approved changes to contract.
 - .3 Contractor's project schedule.
 - .4 Cx schedule.
 - .5 Contractor's, sub-contractor's, suppliers' requirements.
 - .6 Project construction team's and Cx team's requirements.
- .3 Submit after 100% completed Cx Plan to Departmental Representative and obtain written approval.

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 6 weeks during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.

- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC Quality Assurance Commissioning Manager: ensure Cx processes and Cx forms and checklists are developed in the Cx plan by the consultant deliver a fully functional and operational project.
 - .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities, training, and developing of Cx documentation.
 - .3 Work closely with member of Cx team.
 - .4 Witnessing, certifying accuracy of reported results.
 - .5 Witnessing and certifying TAB and other tests.
 - .6 Developing BMM.
 - .7 Ensuring implementation of final Cx Plan.
 - .8 Performing verification of performance of installed systems and equipment.
 - .9 Implementation of Training Plan.
 - .10 Review for performance, reliability, durability of operation efficiency under condition of operation.
 - .4 Construction Team: contractor, sub-contractors, suppliers and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
 - .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
 - .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.

.2 Day-To-Day operation and maintenance of facility.

1.7 CX PARTICIPANTS

- .1 Employ the following Cx participants to verify performance of equipment and systems:
 - .1 Installation contractor/subcontractor:
 - .1 Equipment and systems except as noted.
 - .2 Equipment manufacturer: equipment specified to be installed and started by manufacturer.
 - .1 To include performance verification.
 - .3 Specialist subcontractor: equipment and systems supplied and installed by specialist subcontractor.
 - .4 Specialist Cx agency:
 - .1 Possessing specialist qualifications and installations providing environments essential to client's program but are outside scope or expertise of Cx specialists on this project.
 - .5 Client: responsible for intrusion and access security systems.
 - .6 Ensure that Cx participant:
 - .1 Could complete work within scheduled time frame.
 - .2 Available for emergency and troubleshooting service during first year of occupancy by user for adjustments and modifications outside responsibility of O M personnel, including:
 - .1 Modify ventilation rates to meet changes in off-gassing.
 - .2 Changes to heating or cooling loads beyond scope of EMCS.
 - .3 Changes to EMCS control strategies beyond level of training provided to O M personnel.
 - .4 Redistribution of electrical services.
 - .7 Provide names of participants to Departmental Representative and details of instruments and procedures to be followed for Cx 3 months prior to starting date of Cx for review and approval.

1.8 EXTENT OF CX

- .1 Cx Structural and Architectural Systems:
 - .1 Architectural and structural:
 - .1 Doors, windows, and related hardware.
 - .2 Foundation Work
 - .3 Pre-Engineered Building.
 - .2 Commission mechanical systems and associated equipment:
 - .1 Plumbing systems:
 - .1 Domestic water system.
 - .2 Regular sanitary waste systems.

- .2 HVAC and exhaust systems:
 - .1 HVAC systems.
 - .2 General exhaust systems.
- .3 Fire and life safety systems:
 - .1 Fire extinguishers.
- .3 Commission electrical systems and equipment:
 - .1 Voltage:
 - .1 Voltage switch gear and transformation equipment.
 - .2 Voltage distribution systems.
 - .2 Lighting systems:
 - .1 Lighting equipment.
 - .2 Distribution systems.
 - .3 Fire alarm systems, equipment:
 - .1 Annunciators.
 - .2 Control panels.

1.9 DELIVERABLES RELATING TO O M PERSPECTIVES

- .1 General requirements:
 - .1 Compile English documentation.
 - .2 Documentation to be computer-compatible format ready for inputting for data management.
- .2 Provide deliverables:
 - .1 As-built drawings for all disciplines and manufacturers cut sheets.
 - .2 Warranties.
 - .3 Project record documentation.
 - .4 Inventory of spare parts, special tools and maintenance materials.
 - .5 Maintenance Management System (MMS) identification system used.
 - .6 WHMIS information.
 - .7 MSDS data sheets.
 - .8 Electrical Panel inventory containing detailed inventory of electrical circuitry for each panel board. Duplicate of inventory inside each panel.

1.10 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.

- .2 Factory inspections and performance verification tests.
- .3 Xc issues/resolution log, test procedures and test data report.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Tests of following witnessed by PWGSC Design Quality Review Team:
 - .10 Tests performed by Departmental Representative.
 - .11 Training Plans.
 - .12 Cx Reports.
 - .13 Prescribed activities during warranty period.
 - .14 Cx issues/resolution log and test data report.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor all of these pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Departmental Representative will monitor some of these inspections and tests.
 - .7 Include completed documentation in Cx report.
- .2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:
 - .1 Slab and beam deflection test: test after removal of temporary supports and concrete has cured to ensure adequacy for slabs.
 - .2 Doors, windows, related hardware:
 - .1 Overhead doors.
 - .2 Man doors.

- .3 Door and window hardware.
- .3 Pre-engineered building.
- .3 Pre-Cx activities - MECHANICAL:
 - .1 Plumbing systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .2 HVAC equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 At this time, complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.
- .4 Pre-Cx activities - LIFE SAFETY SYSTEMS
 - .1 Include equipment and systems identified above.
 - .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.
- .5 Pre-Cx activities - ELECTRICAL:
 - .1 High and low voltage distribution systems over 750 V.
 - .2 Lighting systems.
 - .3 Fire alarm systems: test after other safety and security systems are completed. Testing to include a complete verification in accordance with ULC requirements. Departmental Representative has witnessed and certified report, demonstrate devices and zones to Departmental Representative.
 - .4 Security, surveillance and intrusion alarm systems: to include verification by Departmental Representative.

1.12 START-UP

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction.
- .3 Departmental Representative to monitor all of these start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.

- .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
- .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
- .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
- .6 Failure of randomly selected item shall result in rejection of PV report or report of system startup and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Perform Cx by specified Cx agency using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Departmental Representative to monitor Cx activities.
- .3 Upon satisfactory completion, Cx agency performing tests to prepare Cx Report using approved PV forms.
- .4 Departmental Representative to witness, certify reported results of, Cx activities and forward to Departmental Representative.
- .5 Departmental Representative reserves right to verify a percentage of reported results at no cost to contract.

1.14 INSTALLATION CHECK LISTS (ICL)

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.15 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.16 PERFORMANCE VERIFICATION (PV) REPORT

- .1 Refer to Section 01 91 33 - Commissioning (Cx) Forms: Installation Check Lists and Product Information (PI) / Performance Verification (PV) Forms.

1.17 DELIVERABLES RELATING TO ADMINISTRATION OF CX

- .1 General:
 - .1 Because of risk assessment, complete Cx of occupancy, weather and seasonal-sensitive equipment and systems in these areas before building is occupied.

1.18 CX SCHEDULES

- .1 Prepare detailed critical path Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule.

1.19 CX REPORTS

- .1 Contractor's to submit reports of tests, witnessed and certified by Departmental Representative who will verify reported results.

- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.
- .4 Static and operational verification forms, test reports for integrated systems and test reports provided by manufacturers on their own forms.

1.20 ACTIVITIES DURING WARRANTY PERIOD

- .1 Cx activities must be completed before issuance of Interim Certificate, it is anticipated that certain Cx activities may be necessary during Warranty Period, including:
 - .1 Fine tuning of HVAC systems.
 - .2 Adjustment of ventilation rates to promote good indoor air quality and reduce deleterious effects of VOCs generated by off-gassing from construction materials and furnishings.
 - .3 Full-scale emergency evacuation exercises.

1.21 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project.

1.22 TRAINING PLANS

- .1 Refer to Section 01 91 41 - Commissioning (Cx) - Training.

1.23 FINAL SETTINGS

- .1 Upon completion of Cx to satisfaction of Departmental Representative lock control devices in their final positions, indelibly mark settings marked and include in Cx Reports.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.

1.2 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks.
 - .2 Special procedures as specified in relevant technical sections.
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation.
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made, indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed check lists to Departmental Representative. Check lists will be required during Commissioning and will be included in Building Maintenance Manual (BMM) at completion of project.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment. This documentation is included in the BMM at completion of work.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain Departmental Representative's approval.

1.4 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.

- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain Departmental Representative's approval.

1.5 SAMPLES OF COMMISSIONING FORMS

- .1 Departmental Representative will develop and provide to Contractor required project-specific Commissioning forms in electronic format complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.
- .3 Samples of Commissioning forms and a complete index of produced to date will be provided to Contractor when construction commences.

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from Departmental Representative develop appropriate verification forms and submit to Departmental Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by Departmental Representative.

1.7 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Departmental Representative provides Contractor project-specific Commissioning forms with Specification data included.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by Departmental Representative.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide Departmental Representative with originals of completed forms.
 - .12 Maintain copy on site during start-up, testing and commissioning period.
 - .13 Forms to be both hard copy and electronic format.

1.8 LANGUAGE

- .1 To suit the language profile of the awarded contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Additional Comments:

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.

1.2 TRAINEES

- .1 Trainees: personnel selected for operating and maintaining this facility. Includes Facility Manager, building operators, maintenance staff, security staff, and technical specialists as required.
- .2 Trainees will be available for training during later stages of construction for purposes of familiarization with systems.

1.3 INSTRUCTORS

- .1 Departmental Representative will provide:
 - .1 Descriptions of systems.
 - .2 Instruction on design philosophy, design criteria, and design intent.
- .2 Contractor and certified factory-trained manufacturers' personnel: to provide instruction on the following:
 - .1 Start-Up, operation, shut-down of equipment, components and systems.
 - .2 Control features, reasons for, results of, implications on associated systems of, adjustment of set points of control and safety devices.
 - .3 Instructions on servicing, maintenance and adjustment of systems, equipment and components.
- .3 Contractor and equipment manufacturer to provide instruction on:
 - .1 Start-up, operation, maintenance and shut-down of equipment they have certified installation, started up and carried out PV tests.

1.4 TRAINING OBJECTIVES

- .1 Training to be detailed and duration to ensure:
 - .1 Safe, reliable, cost-effective, energy-efficient operation of systems in normal and emergency modes under all conditions.
 - .2 Effective on-going inspection, measurements of system performance.
 - .3 Proper preventive maintenance, diagnosis and trouble-shooting.
 - .4 Ability to update documentation.
 - .5 Ability to operate equipment and systems under emergency conditions until appropriate qualified assistance arrives.

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.

- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.

1.6 SCHEDULING

- .1 Include in Commissioning Schedule time for training.
- .2 Deliver training during regular working hours, training sessions to be maximum 3 hours in length.
- .3 Training to be completed prior to acceptance of facility.

1.7 RESPONSIBILITIES

- .1 Be responsible for:
 - .1 Implementation of training activities,
 - .2 Coordination among instructors,
 - .3 Quality of training, training materials,
- .2 Departmental Representative will evaluate training and materials.
- .3 Upon completion of training, provide written report, signed by Instructors, witnessed by Departmental Representative.

1.8 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.
 - .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
 - .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
 - .7 Maintenance and servicing.
 - .8 Trouble-shooting diagnosis.

- .9 Inter-Action among systems during integrated operation.
- .10 Review of O M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 20 00 Concrete Reinforcing
- .2 Section 03 30 00 Cast-in-Place Concrete

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-14, Engineering Design in Wood.
 - .3 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .4 CSA O151-09(R2014), Canadian Softwood Plywood.
 - .5 CSA O153-13 (R2017), Poplar Plywood.
 - .6 CAN/CSA-O325.16, Construction Sheathing.
 - .7 CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
 - .8 CSA S269.1-16, Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3-M92(R2013), Concrete Formwork, National Standard of Canada
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
- .3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CAN/CSA-S269.3 for formwork drawings.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork/falsework as directed by Department Representative.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management System.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 - Construction/Demolition Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic in designated containers.
 - .3 Divert wood materials from landfill to a recycling facility as approved by Department Representative.
 - .4 Divert plastic materials from landfill to a recycling facility as approved by Department Representative.
 - .5 Divert unused form release material from landfill to an official hazardous material collections site as approved by the Department Representative.

Part 2 Products materials

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
 - .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal 15 to 24 mm²/s at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .5 Formwork materials: to CSA-S269.3.
- .6 Sealant: to Section 07 92 00 - Joint Sealing.

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 Department 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 CSA S269.3.
- .5 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .6 Do not place shores and mud sills on frozen ground.
- .7 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .8 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 and CAN/CSA S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .9 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .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 architectural concrete, and place ties as directed.
 - .1 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.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .14 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 2 days for walls and sides of beams.
 - .2 2 days for columns.
 - .3 7 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.
 - .4 2 days for footings and abutments.
- .2 Remove formwork when concrete has reached 75 % of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.

- .3 Provide 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 1500 mm apart.
- .5 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 Concrete Forming and Accessories.
- .2 Section 03 30 00 Cast-in-Place Concrete

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R-18, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A143/A143M-(R2014), Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .4 ASTM A775/A775M-17, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-09/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3-14, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18-09 (R2014), Carbon Steel Bars for Concrete Reinforcement. A National Standard of Canada.
 - .4 CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .6 CSA W186-M1990 (R2016), Welding of Reinforcing Bars in Reinforced Concrete Construction.
 - .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.

- .3 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Engineer, with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .4 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
 - .1 Provide type 15M, 20M, 25M tension lap splices unless otherwise indicated.
- .5 Quality Assurance: in accordance with Section 01 45 00 - Quality Control
 - .1 Mill Test Report: provide with certified copy of mill test report of reinforcing steel, minimum 3 weeks prior to beginning reinforcing work.
 - .2 Submit in writing to Department Representative proposed source of reinforcement material to be supplied.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 01 74 21 – Construction/Demolition Waste Management And Disposal.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Place materials defined as hazardous or toxic in designated containers.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Department Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.
- .6 Welded steel wire fabric: to ASTM A185/A185M.
 - .1 Provide in flat sheets only.
- .7 Welded deformed steel wire fabric: to ASTM A497/A497M.
 - .1 Provide in flat sheets only.
- .8 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.

- .9 Mechanical splices: subject to approval of Engineer.
- .10 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
 - .1 ACI 315R unless indicated otherwise.
- .2 Obtain Department Representative's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Department Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Provide Department Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 3 weeks prior to beginning reinforcing work.
- .2 Inform Department 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 Department Representative.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

3.2 PLACING REINFORCEMENT

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

.5 Protect coated portions of bars with covering during transportation and handling.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 Concrete Forming and Accessories
- .2 Section 03 20 00 Concrete Reinforcing

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C330-17a, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - .4 ASTM C494/C494M-17, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017/C1017M-13e1, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D412-16, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .7 ASTM D624-00(2012), Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751-04(2013)e1, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .9 ASTM D1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-06 (R2016), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-13, Cementitious Materials for Use in Concrete.

1.3 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.

1.4 DESIGN REQUIREMENTS

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

1.5 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit testing, inspection results and reports for review by Department Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Submit the proposed mix design for all concrete mix types in addition to the results of the aggregate tests to the Department Representative for approval two weeks prior to their initial use.
- .4 Submit proposed methods of protection of concrete when air temperatures are expected to be above 25°C or below 5°C.
- .5 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.
- .6 Concrete hauling time: submit for review by Department Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Site Meetings: in accordance with Section 01 32 16.06 - Construction Progress Schedule - Bar (GANTT) Chart, convene pre-installation meeting one week prior to beginning concrete works.
 - .1 Ensure key personnel, site supervisor, Engineer, Consultant, speciality contractor - finishing, forming, and concrete producer attend.
 - .2 Verify project requirements.

- .3 Submit to Department Representative, minimum 3 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.
- .4 Minimum 2 weeks prior to starting concrete work, submit proposed quality control procedures for review by Department Representative on following items:
 - .1 Falsework erection.
 - .2 Hot weather concrete.
 - .3 Cold weather concrete.
 - .4 Curing.
 - .5 Finishes.
 - .6 Formwork removal.
 - .7 Joints.
- .5 Quality Control Plan: submit written report, as described in PART 3 - VERIFICATION, to Engineer verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.
- .6 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 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 by Department Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Department Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .2 Divert unused concrete materials from landfill to local facility approved by Department Representative.
 - .3 Provide an appropriate area on the job site where concrete trucks can be safely washed. If an appropriate location cannot be found on site the concrete trucks must be washed back at the concrete plant.
 - .4 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Consultant.
 - .5 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .6 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid

with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001, Type GU and HS.
- .2 Blended hydraulic cement: Type GUb and HSb to CAN/CSA-A3001-08.
- .3 Supplementary cementing materials: with minimum 15% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA-A3001.
- .4 Water: to CSA-A23.1/CSA-A23.2.
- .5 Aggregates: to CAN/CSA-A23.1/A23.2.
- .6 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 and ASTM C101. Department Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .7 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA-A23.1/A23.2.
 - .1 Compressive strength: 45 MPa at 28 days.
- .8 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 45 MPa at 28 days.
- .9 Curing compound: to CSA-A23.1/A23.2.
- .10 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - .2 Sponge rubber: to ASTM D1752, Type I, firm grade.
- .11 Weep hole tubes: galvanized steel.
- .12 Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
- .13 Polyethylene film: 10 mil thickness to CAN/CGSB-51.34.
- .14 Epoxy Adhesive: Hilti Hit HY 200, Hilti Hit HY70, or approved equivalent.

2.2 MIXES

- .1 Performance Method for specifying concrete: to meet Department Representative performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as described in PART 3 - VERIFICATION.

- .2 Provide concrete mix to meet following plastic state requirements:
 - .1 Placeability: 80mm +/- 20mm.
 - .2 Workability: free of surface blemishes, colour variations, and segregation.
- .3 Provide concrete mix to meet following hard state requirements:
 - .1 Durability and class of exposure:
 - .1 Spread and Strip Footings exposure class F-1/S-2.
 - .2 Foundation Walls and Pilasters exposure class F-1/S-2.
 - .3 Interior Slab on Grade exposure class N.
 - .4 Exterior Slab on Grade exposure class C-2
 - .2 Minimum compressive strength at () days:
 - .1 Spread and Strip Footings 30MPa @ 28 ; 32MPa @ 56.
 - .2 Foundation Walls and Pilasters 30MPa @ 28 ; 32MPa @ 56.
 - .3 Interior Slab on Grade 25MPa @ 28.
 - .4 Exterior Slab on Grade 32 MPa @ 28.
 - .3 Surface texture: steel trowel finish.
- .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
- .5 Concrete supplier's certification.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Department Representative 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 Department Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.

- .1 Place steel dowels of deformed steel reinforcing bars and epoxy grout to anchor and hold dowels in positions as indicated.
- .11 Do not place load upon new concrete until authorized by Engineer.
- .12 Bonded toppings and existing / new concrete interfaces prepared to CSA A23.1.

3.2 CONSTRUCTION

- .1 Cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Engineer and Consultant.
 - .2 Where approved by Department Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Department Representative.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Department Representative before placing of concrete.
 - .5 Check locations and sizes of sleeves and openings shown on drawings.
 - .6 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 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
- .4 Drainage holes and weep holes:
 - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .6 Finishing and curing:
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Use procedures as reviewed noted in CSA-A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .3 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete. Provide written declaration that compounds used are compatible.
 - .4 Finish concrete floor to meet requirements of CSA-A23.1/A23.2.

- .5 Provide the compatible concrete finish depending on the type of floor finish. See manufacture's recommendations in regards to the appropriate finish to allow of the desired bonding.
- .6 Provide swirl-trowelled finish unless otherwise indicated.
- .7 Provide broom concrete finish on all exterior sidewalks and aprons.
- .8 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .7 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Consultant.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form construction and expansion joints as indicated.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.
- .8 Dampproof membrane:
 - .1 Install dampproof membrane under concrete slabs-on-grade inside building.
 - .2 Lap dampproof membrane minimum 250 mm at joints and seal or as per manufacturer's recommendation.
 - .3 Seal punctures in dampproof membrane before placing concrete.
 - .4 Use patching material at least 250 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2 tolerance of 3mm in 3000mm.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following test in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.
 - .1 Concrete pours.
 - .2 Slump tests.
 - .3 Concrete strength tests.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated approved by Consultant for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory, Department Representative, Engineer, and Consultant.
- .4 Owner will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
- .5 The Contractor is to provide properly designed temperature-controlled storage boxes for test cylinders, as specified in CSA-A23.3, for a period of at least 24 hours and further

protection from adverse weather and mishandling until removed from the site. The Contractor is to provide a max-min thermometer for each storage box storage in a portable building that will be used by the Contractor's personnel or the Engineer during the first 24 hours storage period will not be permitted. Storage facilities are to be provided, installed, checked and approved before any concrete may be placed.

- .6 Secure sufficient 3 and 7 day test cylinders for testing of concrete to ensure quality control and sufficient strength for application of construction loads and stripping. Cost for these additional tests to be borne by the Contractor.
- .7 Samples of concrete to be taken as close to the point of final deposit in the form as possible, at end of pipe when pumping is used.
- .8 Testing firm to take a minimum of three (3) cylinders for a strength test and not less than one strength test for each 40m³ of concrete, or portion thereof, for each type of concrete placed and not less than one (1) test for each type of concrete placed in any one day.
- .9 Testing firm to moist cure and test one (1) cylinder in 7 days and to moist cure and test the remaining two (2) cylinders in 28 days.
- .10 Testing firm if to take one additional test cylinder during cold weather concreting and cure on job site under same conditions as the concrete it represents.
- .11 Testing firm is to take one additional air test and one additional slump test such that every 20 m³ of concrete placed is tested.
- .12 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .13 Testing firm is to report results of tests immediately to the Contractor. The Contractor is responsible for ensuring that the concrete meets the requirements of the specifications. Report adverse test results to the Engineer immediately.
- .14 Testing firm is to advise placing crews to halt placing of adverse concrete immediately, and thereafter notify Contractor to reject the concrete. The execution, or lack of execution, of this request is to be recorded.
- .15 Testing firm is to submit to the Engineer and Contractor certified copies of test results. Include the following information with the results:
 - .1 Name of the project.
 - .2 Date of sampling.
 - .3 Mix design, specified strength, slump and air content.
 - .4 Name of supplier, truck and ticket number.
 - .5 Time batched and time placed.
 - .6 Identification of sampling and testing technician.
 - .7 Cement type and admixtures used.
 - .8 Exact location in the structure of the concrete sampled.
 - .9 Ambient air and concrete temperatures.
 - .10 Nominal aggregate size.
 - .11 Water added and personnel authorizing additional water.
 - .12 Concrete density.

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- .16 Testing firm to certify, in writing, that all concrete meets the specified requirements.
 - .17 Testing firm to submit to the Engineer a final report certifying that all concrete is in accordance with the contract documents. Submit the report under the seal and signature of a professional engineer registered in the Province of Alberta.
 - .18 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5 VERIFICATION

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established in PART 2 - Products, by Engineer and Consultant and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
 - .2 ASTM A269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181-9, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G40.20/G40.21-(R2009), General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16.1-09, Limit States Design of Steel Structures.
 - .4 CSA W48-06 (R2011), Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
 - .5 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding) (Imperial Version).
- .4 The Environmental Choice Program
 - .1 CCD-047a-98, Paints, Surface Coatings.
 - .2 CCD-048-98, Surface Coatings - Recycled Water-borne.

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's:
 - .1 For finishes, coatings, primers and paints.
- .2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 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, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Protection:
 - .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
 - .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by the Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.
- .2 Steel pipe: to ASTM A53/A53M standard weight, galvanized finish.
- .3 Welding materials: to CSA W59-03.
- .4 Welding electrodes: to CSA W48 Series.

- .5 Bolts and anchor bolts: to ASTM A325.
- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600g/m² to CAN/CSA-G164.
- .2 Shop coat primer: to CAN/CGSB-1.40.
- .3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

2.4 ISOLATION COATING

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.5 SHOP PAINTING

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
- .3 Clean surfaces to be field welded; do not paint.

2.6 ANGLE LINTELS

- .1 Steel angles: prime painted, L152x102x9.5 or as indicated in Structural Drawings and Specifications. Provide 150 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish: shop painted.

2.7 SURFACE MOUNTED BOLLARDS:

- .1 Components:

- .1 Material: schedule 40, round steel pipe, 168 mm outside diameter, 7.10 mm thickness, weight 28 kg/m.
 - .2 Length: 1220 mm or as detailed.
 - .3 Anchors Plate: 10 mm thick steel plate, angled to slope, continuously welded to bottom of post with four (4) 22 mm diameter holes.
 - .4 Anchors: 19 mm diameter expansion bolts.
 - .5 Fill: concrete filled with concrete crowned cap.
- .2 Finish: Galvanized.
- .3 Location: locate bollards on each side of overhead door, door, building corners, on the north elevation and as indicated on Drawings.

2.8 CHANNEL FRAMES

- .1 Fabricate frames from steel, sizes of channel and opening as indicated.
- .2 Weld channels together to form continuous frame for jambs and head of openings, sizes as indicated.
- .3 Weld 50 x 50 x 4.8 mm thick steel strap anchors to channel jamb frame at mm on centre.
- .4 Finish: galvanized for exterior, prime coat painted for interior.

Part 3 Execution

3.1 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to the Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 CHANNEL FRAMES

- .1 Install steel channel frames to openings as indicated.

3.3 CHANNEL FRAMES

- .1 Install bollards to each side of overhead door openings, door openings facing road, building corners facing the road, and as indicated on drawings.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M92 (R2003) – Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-08, Douglas Fir Plywood.
 - .4 CSA O141-05(R2009), Softwood Lumber.
 - .5 CSA O151-09, Canadian Softwood Plywood.
 - .6 CAN/CSA-O325.0-07, Construction Sheathing.
 - .7 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2010.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for rough carpentry work and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.

1.4 DELIVERY, STORAGE AND HANDLING

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

1.5 QUALITY ASSURANCE

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 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.
- .4 Divert unused wood materials from landfill to recycling, reuse, composting facility approved by the Departmental Representative.
- .5 Do not dispose of preservative treated wood through incineration.
- .6 Do not dispose of preservative treated wood with materials destined for recycling or reuse.
- .7 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by the Departmental Representative.
- .8 Dispose of unused wood preservative material at official hazardous material collections site approved by the Departmental Representative.
- .9 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

Part 2 Products

2.1 LUMBER MATERIAL

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.

- .3 Framing and board lumber: in accordance with NBC.

2.2 PANEL MATERIALS

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .3 Plywood, OSB and wood based composite panels: to CAN/CSA-O325.

2.3 ACCESSORIES

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.

2.4 FINISHES

- .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work.

2.5 WOOD PRESERVATIVE

- .1 Surface-applied wood preservative: coloured or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
- .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
- .3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's written instructions.

3.2 PREPARATION

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 - .2 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.3 INSTALLATION

- .1 Comply with requirements of NBC, supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized fasteners.
- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.4 ERECTION

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .2 Countersink bolts where necessary to provide clearance for other work.

3.5 SCHEDULES

- .1 Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood.
- .2 Interior exposed plywood to be good one side.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-37.3-M89, Application of Emulsified Asphalts for Dampproofing or Waterproofing.
 - .3 CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
 - .4 CGSB 37-GP-6Ma-83, Asphalt, Cutback, Unfilled, for Dampproofing.
 - .5 CGSB 37-GP-9Ma-83, Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
 - .6 CGSB 37-GP-12Ma-84, Application of Unfilled Cutback Asphalt for Dampproofing.
 - .7 CGSB 37-GP-15M-76(R1984), Application of Asphalt Primer for Asphalt Roofing, Dampproofing and Waterproofing.
 - .8 CAN/CGSB-37.16-M89, Filled, Cutback, Asphalt for Dampproofing and Waterproofing.
 - .9 CAN/CGSB-37.28-M89, Reinforced Mineral Colloid Type, Emulsified Asphalt for Roof Coatings and for Waterproofing.
 - .10 CGSB 37-GP-36M-76, Application of Filled Cutback Asphalts for Dampproofing and Waterproofing.
 - .11 CGSB 37-GP-37M-77, Application of Hot Asphalt for Dampproofing or Waterproofing.
- .2 CSA International
 - .1 CAN/CSA-A123.4-04(R2008), Asphalt for Construction of Built-Up Roof Coverings and Waterproofing Systems.
- .3 Health Canada
 - .1 Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for bituminous dampproofing application and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dampproofing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan

1.4 SITE CONDITIONS

- .1 Ambient Conditions: temperature, relative humidity, moisture content.
 - .1 Apply dampproofing materials only when surfaces and ambient temperatures are within manufacturers' prescribed limits.
 - .2 Do not proceed with Work when wind chill effect would tend to set bitumen before proper curing takes place.
 - .3 Maintain air temperature and substrate temperature at dampproofing installation area above 5 degrees C for 24 hours before, during and 24 hours after installation.
 - .4 Do not apply dampproofing in wet weather.
- .2 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of asphalt, sealing compounds, primers and caulking materials.
- .3 Ventilation:
 - .1 Departmental Representative will arrange for ventilation system to be operated during installation of dampproofing. Ventilate area of Work as directed by Departmental Representative by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after dampproofing application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of dampproofing installation.

Part 2 Products

2.1 MATERIALS

- .1 Asphalt:
 - .1 For application and curing at temperatures above 5 degrees C: to CAN/CSA-A123.4.
 - .1 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.
 - .2 For application and curing at temperatures above 0 degrees C but below 5 degrees C: to CAN/CSA-A123.4.
 - .1 Package label or bill of lading for bulk hot liquid asphalt must indicate type, flash point, equiviscous temperature range and final blowing temperature.
- .2 Sealing compound: plastic cutback asphalt cement to CAN/CGSB-37.5.
- .3 Asphalt primer: to CAN/CGSB-37.

Part 3 Execution

3.1 EXAMINATION

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

3.2 WORKMANSHIP

- .1 Keep hot asphalt:
 - .1 Below its flash point.
 - .2 At or below its final blowing temperature.
 - .3 Within its equiviscous temperature range at place of application.

3.3 PREPARATION

- .1 Before applying dampproofing:
 - .1 Seal exterior joints between foundation walls and footings, joints between concrete floor slab and foundation and around penetrations through dampproofing with sealing compound.

3.4 APPLICATION

- .1 Do dampproofing in accordance with CAN/CGSB-37.3.
- .2 Do sealing work in accordance with CGSB 37-GP-11M.
- .3 Do priming of surface in accordance with CGSB 37-GP-15M.
- .4 Apply primer to CGSB primer standard.
- .5 Apply dampproofing in accordance with applicable CGSB application standard.

Material	Application	
CAN/CGSB-37.2	use	CAN/CGSB-37.3
CGSB 37-GP-6Ma	use	CGSB 37-GP-12M
CAN/CGSB-37.16	use	CGSB 37-GP-36M
CAN/CGSB-37.28	use	CAN/CGSB-37.3
CSA A123.4	use	CGSB 37-GP-37M

3.5 SCHEDULE

- .1 Apply continuous, uniform coating to entire exterior faces of foundation walls from 50 mm below finished grade level to and including tops of foundation wall footings.
- .2 Apply continuous, uniform coating to exterior side of foundation walls enclosing rooms below finished grade. Include exterior portion of interior walls where floors in adjacent rooms are at different elevations.
- .3 Apply two additional coats of dampproofing to vertical corners and construction joints for a minimum width of 230 mm on each side, and all around and for 230 mm along pipes passing through walls.

3.6 CLEANING

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

3.7 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dampproofing application.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C208-95(2001), Specification for Cellulosic Fiber Insulating Board.
 - .2 ASTM C591-01, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - .3 ASTM C612-04, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
 - .4 ASTM C726-05, Standard Specification for Mineral Fiber Roof Insulation Board.
 - .5 ASTM C728-05, Standard Specification for Perlite Thermal Insulation Board.
 - .6 ASTM C1126-04, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .7 ASTM C1289-05a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - .8 ASTM E96/E96M-05, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .3 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S604-M91, Standard for Type A Chimneys.
 - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - .3 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
 - .4 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.
- .2 Manufacturer's Instructions:

- .1 Submit manufacturer's installation instructions.

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

1.4 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 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site for recycling in accordance with Waste Management Plan.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

2.2 INSULATION

- .1 Extruded polystyrene (XPS): to CAN/ULC-S701.
 - .1 Type: 4.
 - .2 Thickness: as indicated.
 - .3 Edges: square.

2.3 ADHESIVE

- .1 Adhesive (for polystyrene): to CGSB 71-GP-24.

2.4 ACCESSORIES

- .1 Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 WORKMANSHIP

- .1 Install insulation after building substrate materials are dry.
- .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/CGA-B149.1 and CAN/CGA-B149.2.
- .5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
- .6 Offset both vertical and horizontal joints in multiple layer applications.
- .7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 EXAMINATION

- .1 Examine substrates and immediately inform Departmental Representative in writing of defects.
- .2 Prior to commencement of work ensure:
 - .1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 RIGID INSULATION INSTALLATION

- .1 Apply adhesive to insulation in accordance with manufacturer's recommendations.
- .2 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.
- .3 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.5 PERIMETER FOUNDATION INSULATION

- .1 Interior application: extend boards as indicated vertically below bottom of finish floor slab, installed on inside face of perimeter foundation walls.
- .2 Exterior application: extend boards as indicated. Install on exterior face of perimeter foundation wall with adhesive.
- .3 Under slab application: extend boards in from perimeter foundation wall. Lay boards on level compacted fill.
- .4 Perimeter heating duct application: compact walls of heating duct trench to form solid backing. Attach insulation boards to perimeter foundation wall extending from underside of finish floor to 100 mm below bottom of heating duct. Lay insulation boards in bottom of heating duct trench, extend to 150 mm beyond heating duct 600 mm minimum from

inside face of perimeter foundation wall. Secure insulation in place to prevent displacement.

3.6

CLEANING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Membrane with sealed joints.
- .2 Radon gas collector, vent piping.

1.2 RELATED SECTIONS

- .1 Section 31 23 23 - Backfilling.
- .2 Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.
- .3 Section 07 21 13 - Board Insulation.
- .4 Section 07 62 00 - Sheet Metal Flashing and Trim.
- .5 Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

- .1 ASTM D412-06ae2 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
- .2 ASTM D624-00(2012) - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
- .3 ASTM D882-12 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- .4 ASTM D1004-13 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
- .5 ASTM D2240-05(2010) - Standard Test Method for Rubber Property - Durometer Hardness.
- .6 ASTM D4551-12 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane.
- .7 ASTM E96/E96M-12 - Standard Test Methods for Water Vapor Transmission of Materials.
- .8 ASTM E1745-11 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- .9 NRCA (National Roofing Contractors Association - USA) - Roofing and Waterproofing Manual.

1.4 PERFORMANCE REQUIREMENTS

- .1 Sealed Sheet Membrane:
 - .1 Capable of containing and venting Radon gas to exterior via collector and sealed pipe.
 - .2 Seal joints and unintended tears or perforations of the membrane air tight.
 - .3 Seal pipe and joints in the vent stack, airtight.
- .2 Membrane: Capable of preventing moisture migration to interior.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data for surface conditioner flexible flashings, joint seals, and crack sealants, with temperature range for application of membrane.
- .3 Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.
- .2 Certificates: Certify that Products meet or exceed specified requirements.
- .3 Installation Data: Manufacturer's special installation requirement including special procedures and perimeter conditions requiring special attention.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Warranty Documentation: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work in accordance with manufacturer's instructions and NRCA Manual.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain ambient temperatures above 5 degrees C <40 degrees F> for twenty-four (24) hours before and during application and until liquid or mastic accessories have cured.

1.10 WARRANTY

- .1 Section 01 78 10: Warranties.
- .2 Provide a five (5) year manufacturer warranty for membrane failing to resist penetration of moisture or for collecting and venting Radon gases as specified.
- .3 For warranty repair work, remove and replace covering materials concealing membrane.

Part 2 Products

2.1 MATERIALS

- .1 Gas and Moisture Barrier Membrane: Double-ply low density polyethylene (LDPE).

- .2 Joint and Lap Seal: Non-hardening, permanently flexible, high performance sealant with vapour barrier properties as recommended by membrane manufacturer.
- .3 Sump: Circular rigid PVC, side vent holes to collect gases.
- .4 Piping: PVC pipe and fittings, diameter to suit sump gas outlets, maximum lengths to minimize jointing, adhesive sealed male/female joints.
 - .1 PVC "Top Hat" pipe collars to seal penetrations through surrounding floor.
 - .2 PVC Vent pipe cap.
 - .3 Tape Seal: Self adhesive, 30 mm <1-1/4 inch> wide.
 - .4 Circular Clamps: Stainless steel band, threaded adjustable clamp.
- .5 Adhesives, Thinner and Cleaner: As recommended by membrane manufacturer, compatible with sheet membrane.
- .6 Sealant: As recommended by membrane manufacturer.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of membrane and related components.

3.2 PREPARATION

- .1 Protect adjacent surfaces not designated to receive protection.
- .2 Clean and prepare surfaces to receive membrane in accordance with manufacturer's written instructions.
- .3 Do not apply membrane or related components to surfaces unacceptable to manufacturer.
- .4 Seal cracks and joints with sealant materials using depth to width ratio as recommended by sealant manufacturer.

3.3 INSTALLATION - SUMP AND VENT STACK

- .1 Install sump, vent stack, and accessories to manufacturer's instructions.
- .2 Place stack piping.
 - .1 Seal joints and penetrations through building construction air tight.
 - .2 Place top-hat and other accessories.
 - .3 Seal spaces between pipe and surrounding construction.
- .3 Place sump where indicated.
 - .1 Place vent stack fitting in one port.
 - .2 Connect to stack piping.
 - .3 Seal three other ports.

3.4 INSTALLATION - MEMBRANE

- .1 Install membrane and accessories to manufacturer's written instructions.
- .2 Roll out membrane. Minimize wrinkles and bubbles.
- .3 Overlap edges, ends, and joints minimum 100 mm <4 inches> and seal by contact sealant tape.
- .4 Seal joints and protrusions, permanently air tight and waterproof.
- .5 Reinforce membrane with multiple thicknesses of membrane material over static or moving joints.
- .6 Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.
- .7 Install flexible flashings and accessories.
 - .1 Seal watertight to membrane.
 - .2 Seal to adjoining surfaces.
- .8 Extend membrane over intersecting surfaces at membrane perimeter minimum 150 mm <6 inches>.
- .9 Seal items protruding or penetrating through membrane.
- .10 Install counter flashing membrane material.

3.5 PROTECTION OF FINISHED WORK

- .1 Section 01 78 40: Protecting installed work.
- .2 Do not permit traffic over unprotected or uncovered membrane.
- .3 Protect membrane from damage by adhering protection boards. Scribe and cut boards around projections and interruptions.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Aluminum Association Inc. (AAI)
 - .1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.
 - .2 AAI DAF45-03, Designation System for Aluminum Finishes.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A167-99(2004), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A240/A240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .4 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .6 ASTM B32-04, Standard Specification for Solder Metal.
 - .7 ASTM B370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .8 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
 - .9 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 1997.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
 - .2 CAN/CGSB-93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.
 - .3 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .6 Green Seal Environmental Standards
 - .1 Standard GS-03-93, Anti-Corrosive Paints.
 - .2 Standard GS-11-97, Architectural Paints.
 - .3 Standard GS-36-00, Commercial Adhesives.

- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 43 - Environmental Procedures.
- .3 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.
 - .1 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
 - .2 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3, FIELD QUALITY CONTROL.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, with AZ180 coating, regular spangle surface.

2.2 ACCESSORIES

- .1 Isolation coating: alkali resistant bituminous paint.
- .2 Plastic cement: to CAN/CGSB 37.5.
 - .1 Maximum VOC limit 50 g/L to SCAQMD Rule 1168.
- .3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.
- .4 Sealants: Section 07 92 00.
- .5 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.

- .6 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.
- .7 Washers: of same material as sheet metal, 1 mm thick with rubber packings.
- .8 Solder: to ASTM B32, alloy composition.
- .9 Flux: rosin, cut hydrochloric acid, or commercial preparation suitable for materials to be soldered.
- .10 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.
- .3 Form pieces in 2400 mm maximum lengths.
 - .1 Make allowance for expansion at joints.
- .4 Hem exposed edges on underside 12 mm.
 - .1 Mitre and seal corners with sealant.
- .5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 EAVES TROUGHS AND DOWNPIPES

- .1 Form eaves troughs and downpipes from aluminum prefinished sheet metal.
- .2 Sizes and profiles as indicated on drawings.
- .3 Provide goosenecks, outlets, strainer baskets and necessary fastenings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details.
- .2 Use concealed fastenings except where approved before installation.
- .3 Provide underlay under sheet metal.
 - .1 Secure in place and lap joints 100 mm.
- .4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

- .1 Flash joints using standing seams forming tight fit over hook strips.
- .5 Lock end joints and caulk with sealant.
- .6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.
- .7 Insert metal flashing into under cap flashing to form weather tight junction.
- .8 Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
- .9 Caulk flashing at cap flashing with sealant.
- .10 Install pans, where shown around items projecting through roof membrane.

3.3 EAVES TROUGHS AND DOWNPIPES

- .1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.
 - .1 Slope eaves troughs to downpipes.
 - .2 Seal joints watertight.
- .2 Install downpipes and provide goosenecks back to wall.
 - .1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.
 - .2 Connect downpipes to drainage system and seal joint with plastic cement.
- .3 Install splash pans as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 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.
- .3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115, Fire Tests of Fire stop Systems.

1.2 DEFINITIONS

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets.
- .3 Shop Drawings:
 - .1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
 - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
 - .1 Submit duplicate 300 x 300 mm samples showing actual fire stop material proposed for project.
- .5 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

- .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
- .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
- .4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company specializing in fire stopping installations approved by manufacturer with 5 years of documented experience.
- .2 Pre-Installation Meetings: convene pre-installation meeting one week prior to beginning work of this Section, with contractor's representative, Departmental Representative in accordance with Section 01 32 16.07 - Construction Progress Schedule - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .3 Site Meetings: as part of Manufacturer's Services described in PART 3 - FIELD QUALITY CONTROL, schedule site visits, to review Work, at stages listed.
 - .1 After delivery and storage of products, and when preparatory Work is complete, but before installation begins.
 - .2 Upon completion of Work, after cleaning is carried out.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
 - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:

- .1 Store materials indoors and in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended and conforming to specified special requirements described in PART 3.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

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 PREPARATION

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
 - .1 Ensure that substrates and surfaces are clean, dry and frost free.

- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.3 INSTALLATION

- .1 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.4 SEQUENCES OF OPERATION

- .1 Proceed with installation only when submittals have been reviewed by Departmental Representative.
- .2 Install floor fire stopping before interior partition erections.
- .3 Metal deck bonding: fire stopping to precede spray applied fireproofing to ensure required bonding.
- .4 Mechanical pipe insulation: certified fire stop system component.
 - .1 Ensure pipe insulation installation precedes fire stopping.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEANING

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

- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.
- .3 Remove temporary dams after initial set of fire stopping and smoke seal materials.

3.7 SCHEDULE

- .1 Fire stop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Top of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.
 - .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
 - .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
 - .7 Openings and sleeves installed for future use through fire separations.
 - .8 Around mechanical and electrical assemblies penetrating fire separations.
 - .9 Rigid ducts: greater than 129 cm² : fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.
 - .2 ASTM C834-10 - Standard Specification for Latex Sealants.
 - .3 ASTM C919-11 - Standard Practice for Use of Sealants in Acoustical Applications.
 - .4 ASTM C920-13 - Standard Specification for Elastomeric Joint Sealants.
 - .5 ASTM C1184-13 - Standard Specification for Structural Silicone Sealants.
 - .6 ASTM C1193-13 - Standard Guide for Use of Joint Sealants.
 - .7 ASTM C1311-10 - Standard Specification for Solvent Release Sealants.
 - .8 ASTM C1330-02(2007) - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
 - .5 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3 General Services Administration (GSA) - Federal Specifications (FS)
 - .1 FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

- .2 Primers.
- .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Samples:
 - .1 Submit 2 samples of each type of material and colour.
 - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .4 Manufacturer's Instructions:
 - .1 Submit instructions to include installation instructions for each product used.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect joint sealants from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 SITE CONDITIONS

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

1.6 ENVIRONMENTAL REQUIREMENTS

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

Part 2 Products

2.1 SEALANT MATERIALS

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

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Silicones one part: to CAN/CGSB-19.13.
- .2 Single component elastomeric sealant without isocyanates.

2.3 JOINT CLEANER

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

Part 3 Execution

3.1 EXAMINATION

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

3.2 SURFACE PREPARATION

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

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

3.3 PRIMING

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

3.4 BACKUP MATERIAL

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

3.5 MIXING

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

3.6 APPLICATION

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

3.7 CLEANING

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

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

3.8 PROTECTION

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

3.9 SCHEDULE

- .1 Silicone Sealant: use at metal flashing joints.
- .2 Elastomeric Sealant: use around drains and vents.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B29-03, Standard Specification for Refined Lead.
 - .3 ASTM B749-03, Standard Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association (CSDMA)
 - .1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.
 - .2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80-99, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-03, Standard Methods of Fire Tests of Door Assemblies.
- .6 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.
 - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CAN/ULC-S704-03, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.
 - .3 CAN4-S104-M80, Standard Method for Fire Tests of Door Assemblies.
 - .4 CAN4-S105-M85, Standard Specification for Fire Door Frames Meeting the Performance Required by CAN4-S104.

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:

- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35 degrees C to 35 degrees C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 NFPA 252 for ratings specified or indicated.
- .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104, and listed by nationally recognized agency having factory inspection services.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Honeycomb construction:
 - .1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.
- .2 Stiffened: face sheets welded, insulated core.
- .3 Polyurethane: to CAN/ULC-S704 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m³.

2.3 ADHESIVES

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.
 - .1 Adhesive: maximum VOC content 50 g/L to SCAQMD Rule 1168.
- .2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.
- .3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.
 - .1 Maximum VOC limit 50 g/L to SCAQMD.

2.5 PAINT

- .1 Field paint steel doors and frames in accordance with Sections 09 91 99. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.
 - .1 Maximum VOC emission level 50 g/L to SCAQMD Rule 1113.

2.6 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.
- .2 Exterior and interior top and bottom caps: steel.
- .3 Fabricate glazing stops as formed channel, minimum 16 mm height, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Metallic paste filler: to manufacturer's standard.
- .5 Fire labels: metal rivited.
- .6 Sealant: Refer to Section 07 92 00.
- .7 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide removable stainless steel glazing beads for use with glazing tapes and compounds and secured with countersunk stainless steel screws.
 - .2 Design exterior glazing stops to be tamperproof.

2.7 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Exterior frames: 1.6 mm welded and thermally broken type construction.
- .4 Interior frames: 1.6 mm welded type construction.
- .5 Blank, reinforce, drill and tap frames for mortised, templated hardware, electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

- .6 Protect mortised cutouts with steel guard boxes.
- .7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .8 Manufacturer's nameplates on frames and screens are not permitted.
- .9 Conceal fastenings except where exposed fastenings are indicated.
- .10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
- .4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
- .7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Exterior doors: honeycomb construction. Interior doors: hollow steel construction.
- .3 Fabricate doors with longitudinal edges locked seam. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E330.

- .5 Blank, reinforce, drill doors and tap for mortised, templated hardware electronic hardware.
- .6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .7 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .10 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel with polystyrene core laminated under pressure to face sheets.
- .2 Form face sheets for interior doors from 1.6 mm sheet steel with honeycomb core laminated under pressure to face sheets.

2.12 HOLLOW STEEL CONSTRUCTION

- .1 Form face sheets for exterior doors from 1.6 mm sheet steel.
- .2 Form face sheets for interior doors from 1.6 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with honeycomb core.
- .5 Fill voids between stiffeners of interior doors with honeycomb core.

2.13 THERMALLY BROKEN DOORS AND FRAMES

- .1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.
- .2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
- .3 Fabricate thermally broken frames separating exterior parts from interior parts with continuous interlocking thermal break.
- .4 Apply insulation.

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 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

3.4 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 1.0 mm.
 - .2 Latchside and head: 1.5 mm.
- .3 Adjust operable parts for correct function.
- .4 Install louvres.

3.5 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Aluminum Association Inc. (AAI)
 - .1 Designation System for Aluminum Finishes -2003.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A1008/A1008M-06a, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - .2 ASTM A653/A653M-06a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
 - .4 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.105-M91, Quick-Drying Primer.
 - .2 CAN/CGSB 1.181-99, Ready Mixed Organic Zinc Rich Coating.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .5 Green Seal Environmental Standards
 - .1 Standard GC-03-93, Anti-Corrosive Paints.
 - .2 Standard GS-11-97, Architectural Paints.
- .6 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1113-04, Architectural Coatings.

1.2 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Loads: Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as measured in accordance with ASTM E330.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Indicate materials, operating mechanisms, required clearances and connections.
- .4 Provide samples: in accordance with Section 01 33 00 - Submittal Procedures.

- .5 Quality Control Submittals:
 - .1 Manufacturer's Instructions: manufacturer's installation instructions.
 - .2 Manufacturer's Field Reports: manufacturer's field reports specified.
- .6 Closeout Submittals:
 - .1 Provide maintenance data for vertical lift door panels and hardware and components for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Galvanized steel sheet: commercial quality to ASTM A653/A653M with Z275 zinc coating.
- .2 Primer: to CAN/CGSB-1.181, for galvanized steel surfaces.
 - .1 Maximum VOC limit 250 g/L to SCAQMD.
- .3 Insulation: to be polyurethane.

2.2 PREFINISHED STEEL SHEET

- .1 Prefinished steel with factory applied silicone modified polyester.
 - .1 Class F1S.
 - .2 Colour selected by Departmental Representative from manufacturer's standard range.
 - .3 Specular gloss: 30 units +/-5 in accordance with ASTM D523.
 - .4 Coating thickness: not less than 25 micrometres.

2.3 DOORS

- .1 Fabricate door blades of minimum thick insulated galvanized steel as indicated. Doors must be thermally broken.
- .2 Thermal values of calculated R-value of 16.3.
- .3 Panels: Flush steel construction on outside face; 26 gauge minimum thick steel sheets, rabbeted weather joints at meeting rails; insulated.
- .4 Colour as selected by Consultant from manufacturer's standard range.
- .5 Apply shop coat of primer after fabrication of door.

- .1 Maximum VOC limit 250 g/L to GC-03.

2.4 GUIDES

- .1 Provide steel channel guides for bottom blade and steel angle guides for other blades.
- .2 Mount one set of guides to weight box and attach other set to structural steel channel or reinforced plate to form guide assembly.
- .3 Provide 6 mm thick steel base plate to bottom of guide assembly and secure assembly to door jamb opposite to weight box.
- .4 Install heavy duty channel spreader joining guides at top.

2.5 WEIGHT BOX

- .1 Construct weight box from steel plate and 6 mm thick base plate.
- .2 Reinforce weight box with formed horizontal stiffeners. Make weight box cover removable for servicing and maintenance.
- .3 Arrange for vertical loads to be carried by weight box and guide assembly.

2.6 COUNTERBALANCE

- .1 Counterbalance blades utilizing individually counter-balanced weight for standard operation.
- .2 House cast iron weights in weight box with angle guides for each weight set.
- .3 Attach counterweights to blades with preformed, galvanized flexible steel cable having minimum of 7 to 1 safety factor.
- .4 Use 4 cables for bottom blade and 2 cables for other blades above bottom blade.
- .5 Suspend cables over series of sheaves with machined grooves, rotating on sealed ball bearings mounted on cold rolled steel shaft.
- .6 Secure bottom blade cables to malleable iron threaded drums, rotating on self aligning sealed bearing.

2.7 OPERATOR

- .1 Operation: Chain operated.

2.8 ACCESSORIES

- .1 Install vinyl sealing gaskets for meeting edges of door blades and lintel closure and steel stopper with foam rubber pad for bottom of each angle guide.
- .2 Glazing: Double insulating sealed unit windows with moulded plastic (PVC) frame; nominal size as indicated; overall thickness 13 mm (1/2 inch).
- .3 Finish ferrous hardware items with minimum zinc coating of 300 g/m² to CSA G164.

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 INSTALLATION

- .1 Install doors and hardware.
- .2 Touch up doors with primer where galvanized finish damaged during fabrication.
- .3 Lubricate springs and adjust door operating components to ensure smooth opening and closing of doors.
- .4 Adjust operable parts for correct function.
- .5 Adjust weatherstripping to form weathertight seal.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A653/A653M-15e1, Standard Specification for Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM D3917-15a, Standard Specification for Dimensional Tolerance of Thermosetting Glass-Reinforced Plastic Pultruded Shapes
 - .3 ASTM D3918-2011, Standard Terminology Relating to Reinforced Plastic Pultruded Products
 - .4 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 Canadian Standards Association (CSA):
 - .1 AAMA/WDMA/CSA 101/LS.2/A440 - NAFSCSA A440.2-2011, Energy Performance Evaluation of Windows and Other Fenestration Systems
 - .2 CSA G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles
 - .3 CAN/CSA-A440.2-09/A440.3-09 - Fenestration Energy Performance/User Guide to CSA-A440.2-2014, Fenestration Energy Performance.
 - .4 CAN/CSA-A440.4-07 (R2012) - Window, Door, and Skylight Installation.
- .3 Insulating Glass Manufacturer's Alliance (IGMA):
 - .1 TM-3000 (97), Glazing Guidelines for Sealed Insulating Glass Units
- .4 American Architectural Manufacturers Association
 - .1 AAMA CW-10-12 Care and Handling of Architectural Aluminum from Shop to Site.
 - .2 AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field

1.2 SYSTEM DESCRIPTION

- .1 Windows: Pultruded tubular fibre glass sections, factory fabricated, vision glass, related flashings, anchorage and attachment devices.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide component dimensions, anchorage and fasteners, glass, internal drainage details.

- .3 Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work; installation requirements.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Manufacturer's Certificate: Certify that Products meet or exceed performance criteria tests.

1.7 QUALITY ASSURANCE

- .1 Standards And Tests:
 - .1 All tests of this Section do not need to be performed if documentation is submitted from a recognized testing agency showing relevant testing numbers.
 - .2 Glazing Unit and Frame:
 - .1 Submit, with shop drawings, test data, from a recognized testing agency, that shows the following window performance characteristics:
 - .1 Thermal transmission coefficient;
 - .2 Condensation resistance; and
 - .3 Sound transmission loss characteristic.
 - .2 Tests shall have been conducted in accordance with CAN/CSA-A440 and must meet the standards Item 2.3 Window Performance Ratings of this section on a representative sample of a complete window unit (frame plus glazing unit), Contractor responsibility.
 - .3 Submit with shop drawings data showing glazing unit shading coefficient and visible light transmission values.
 - .4 Pressure test each glazing unit to verify the air tightness of all joints such as those between glass panes and spacers and air vapour barrier; submit, upon request, reports showing test results for each glazing unit.
- .2 Mock-Ups:
 - .1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.
 - .2 Locate where directed by Consultant.
 - .3 Curtain Wall Mock-up:
 - .1 Testing shall comply with and be conducted in accordance with the procedures laid out in AAMA Standard 501, Method of Test for Metal Curtain Walls.
 - .2 Test mock-up curtain wall for resistance to air infiltration, resistance to static and dynamic water penetration and structural performance under uniform loading.

- .3 The mock-up curtain wall will be assumed to have passed these tests if its performance is shown to be as good as, or better than, the following:

Air Infiltration AAMA/WDMA/CSA 101/I.S.2/A440 - NAFSCSA A440.2-04:	A3 Rating, or 0.2 L/s/m2 at 300 Pa differential
Water Penetration AAMA/WDMA/CSA 101/I.S.2/A440 - NAFSCSA A440.2-04	B7 Rating
Structural Performance - Deflection AAMA/WDMA/CSA 101/I.S.2/A440 - NAFSCSA A440.2-04:	C5 Rating

- .4 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

.3 Certification:

- .1 Provide written certification by a Professional Engineer registered in the area having jurisdiction that the curtain wall system complies with the applicable Building Code and that it is suitable for use on this building.

1.8 DELIVERY, STORAGE, AND PROTECTION

- .1 Section 01 61 00: Transport, handle, store, and protect products.
.2 Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
.3 Jig, brace, and box the window frame assemblies for transport to minimize flexing of members or joints.

1.9 ENVIRONMENTAL REQUIREMENTS

- .1 Section 01 35 26: Environmental conditions affecting products on site.
.2 If dry glazing methods are utilized, delete this article.
.3 Deliver, store, handle and protect materials in accordance with Section 01 61 00.
.4 Handle work of this section in accordance with AAMA CW-10-12 Care and Handling of Architectural Aluminum from Shop to Site.
.5 Protect prefinished aluminum surfaces with strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 WARRANTY

- .1 Section 01 78 00: Warranties.
.2 Correct defective Work within a five (5) year period after Date of Substantial Completion.
.3 Provide five (5) year manufacturer warranty for insulated glass units from seal failure, interpane dusting or misting, and replacement of same.
.4 Warranty: Include coverage for degradation of colour finish.

Part 2 Products

2.1 DESIGN CRITERIA

- .1 Materials, fabrication, attachments, accessories, assembly and performance, other than thermal performance, shall meet or exceed applicable requirements of AAMA/WDMA/CSA 101/I.S.2/A440 - NAFSCSA A440.2.
- .2 Thermal performance shall be determined in conformance with AAMA/WDMA/CSA 101/I.S.2/A440 - NAFSCSA A440.2.
- .3 Design curtainwall to equalize both positive and negative pressure between outside air cavities surrounding insulating glass units.
- .4 Design curtainwall to provide drainage from spaces around insulating glass units to exterior.
- .5 Design windows to protect drainage openings from direct entrance of wind-driven rain by use of baffles or other protection.
- .6 Design components to minimize and accommodate thermally induced movement.
- .7 Curtain wall system constructed so that glazing unit can be removed and replaced from outside of building.

2.2 CURTAINWALL PERFORMANCE

- .1 Values shall be derived using recognized computer analysis programs such as WINDOW 6
- .2 Thermal Transmission Coefficient: per AAMA 1503.1;
 - .1 U-Value = $0.85 \text{ W/m}^2\text{°C}$ for overall window (glazing unit plus frame).

2.3 WINDOW PERFORMANCE

- .1 Meet or exceed requirements of AAMA/WDMA/CSA 101/I.S.2/A440 - NAFS, and the following performance requirements:
- .2 Air Tightness Rating: A3.
- .3 Water Tightness Rating: B7.
- .4 Wind Load Resistance Rating: C4.
- .5 Forced Entry: F2, pass test for resistance to forced entry.
- .6 Glazing: as indicated in this Section.
- .7 Overall Window U-Value: maximum $1.0 \text{ W/m}^2 \text{ °C}$.

2.4 MATERIAL AND CONSTRUCTION, CURTAINWALL FRAME

- .1 Construction:
 - .1 General:
 - .1 Pultruded composite frame.
 - .2 Butt joints secured with screws into screw ports or spigot-blocks and sealed with sealant.

- .3 Complete system to act as a rain screen so as to drain to exterior any water entering the frame cavity.
- .2 Pressure Plate System:
 - .1 Pultruded composite pressure plate.
 - .2 Prefinished snap-on extruded aluminum cap.
- .2 Flashings: aluminum finish to match curtain wall mullion sections where exposed, gravel stop edge to exterior parapet side, secured with concealed fastening method.
 - .1 Finish exposed surfaces of aluminum components in accordance with AA DAF45.
 - .1 Clear anodize finish to Architectural Class I.
 - .2 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1, Architectural Class 2, and Protective and Decorative shall meet requirements of CAN/CSA-A440/A440.1, for coating Classes 1, 2 and 3 respectively.
- .3 Air/Vapour Barrier: Connect to existing air and vapour barrier systems.
- .4 Material:
 - .1 Composite: Pultruded FRP
 - .2 Air Seal Gasket: EPDM extrusions.
 - .3 Compression and Wedge Gaskets: EPDM extrusions.
 - .4 Fasteners & Keys: Aluminum, stainless steel, die cast zinc, cadmium plated steel.
 - .5 Back Section: 145 mm x 61.5 mm
 - .6 Fibreglass pressure plates
 - .7 Caps: 63.5 mm x 19mm aluminum caps
 - .8 Finish:
 - .1 Exterior and Interior Caps, and sills: clear anodic finish, Architectural Class I.
 - .2 Back Sections: Raw Dark Grey

2.5 INSULATING GLASS UNITS

- .1 Insulating glass units: to CAN/CGSB-12.8, double unit.
 - .1 Glass: to CAN/CGSB-12.3.
 - .2 Glass thickness:
 - .1 Exterior: 4 mm tempered glass with Low-e 270 coating or equivalent.
 - .2 Interior: 6 mm laminated glass clear.
 - .3 Inter-cavity space thickness: with low conductivity spacers 12.7 mm between inner and outer lights.
 - .4 Inert gas fill: argon.

2.6 ACCESSORIES

- .1 Steel Reinforcement: sheet steel to ASTM A653M, hot dip galvanized, minimum Z275 coating designation.
- .2 Joint Sealants: Silicone – (High Impact Silicone). Refer to Section 07 92 00 – Joint Sealants.
- .3 Insulating Foam Sealant: one-part polyurethane, closed cell foam, skin-forming type, expanding maximum 25%.
- .4 Foam Backer Rod: extruded closed cell backer rod, oversize 30 to 50%.
- .5 Flashing: prefinished sheet aluminum, brake formed as indicated on drawings, 1.5 mm thick, concealed fastened.

2.7 FABRICATION, CURTAINWALL FRAME

- .1 Difference in length between opposite parallel sides of curtain wall panel shall be no more than:
 - .1 1.5 mm for panels with a diagonal measurement of 1800 mm or less
 - .2 3.0 mm for panels with a diagonal measurement over 1800 mm.
- .2 Difference in length between the two diagonal measurements of a curtain wall panel shall be no more than:
 - .1 3.0 mm for panels with a diagonal measurement of 1800 mm or less
 - .2 4.5 mm for panels with a diagonal measurement more than 1800 mm.
- .3 Seal fibreglass framing joints with silicone sealant. Mitre and sash joints at corners.
- .4 Steel reinforce vertical and horizontal components of FRP window units as required by Consultant and structural design.
- .5 Continuously and uniformly compress length of gaskets during installation, to compensate for linear shrinkage.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 71 00: Verify existing conditions before starting work.
- .2 Verify wall openings and adjoining air and vapour seal materials are ready to receive work of this Section.
- .3 Contractor to provide pictures of existing wall opening and concrete sill once existing windows are removed.

3.2 INSTALLATION - GENERAL

- .1 Erection Tolerances: Erect all component parts within the following tolerances:
 - .1 Variations from plumb or angle shown:
 - .1 3 mm maximum variation in storey height or 3050 mm run, non-cumulative.

- .2 Variations from level or slopes shown:
 - .1 3 mm maximum variation in any column-to-column space or 6100 mm run, non-cumulative.
- .3 Variations from theoretical calculated position as located in plan or elevation in relation to established floor lines, column lines and other fixed elements of the structure, including variations from plumb and level:
 - .1 6 mm maximum variation in any column-to-column space, floor-to-floor height or 6100 mm run.
- .4 Offsets in end-to-end or edge-to-edge alignment of consecutive members:
 - .1 1.5 mm maximum offset in any alignment.
- .5 Attach and seal building air-vapour barrier to curtain wall frame as detailed on drawings to maintain continuity of building envelope air-vapour barrier.
- .2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- .3 Provide alignment attachments and shims to permanently fasten system to building structure. Clean weld surfaces; apply protective primer to field welds and adjacent surfaces.
- .4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.
- .5 Provide thermal isolation where components penetrate or disrupt building insulation.
- .6 Install sill flashings.
- .7 Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.
- .8 Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- .9 Install operating sash in accordance with Section 08 80 50 - Glazing, to interior wet/dry method of glazing.
- .10 Install glass and infill panels in accordance with Section 08 80 50 - Glazing, to exterior wet/dry method of glazing.

3.3 INSTALLATION - GLAZING

- .1 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying splines or gaskets. Use solvents and cleaning agents recommended by manufacturer of sealing materials.
- .2 Install glazing gaskets uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .3 Support both lites of glass thermal units on leveled setting blocks, 4 or 6 mm minimum, spaced as recommended by glass manufacturer. Provide at least one setting block at quarter points from each corner. For casement windows, locate setting blocks closer to corners as recommended by manufacturer.
- .4 Center glass thermal units in glazing rabbet to maintain 6 mm minimum clearance between edges of glazing and plastic framing at sill or 4 mm minimum clearance between

edges of glazing and plastic framing at sill if glazing bite incorporates a drainage channel with a depth of 3 mm minimum.

- .5 Size glass thermal units to ensure exposed face of spacer is in line with glazing stops.
- .6 Use spacers and shims in accordance with glass manufacturer's recommendations.

3.4 MANUFACTURER'S FIELD SERVICES

- .1 Curtainwall product manufacturer to provide field review of the installation of their Products.
- .2 Monitor and report installation procedures – report any installation under unacceptable conditions to Departmental Representative.

3.5 CLEANING

- .1 Section 01 74 11: Cleaning installed work.
- .2 Remove all excess and scrap material and equipment involved in this installation
- .3 Remove protective material from prefinished aluminum surfaces.
- .4 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- .5 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

3.6 PROTECTION AND ADJUSTING

- .1 Adjust operating sash for smooth operation.
- .2 Protect finished Work from damage.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)
 - .1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .4 After approval samples will be returned for incorporation in Work.
- .4 Hardware List:
 - .1 Submit contract hardware list.
 - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .5 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .6 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.4 MAINTENANCE MATERIALS SUBMITTALS

- .1 Extra Stock Materials:
 - .1 Supply maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

- .2 Tools:
 - .1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
 - .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .4 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect door hardware from nicks, scratches, and blemishes.
 - .3 Protect prefinished surfaces with wrapping.
 - .4 Replace defective or damaged materials with new.
- .5 Develop Construction Waste Management Plan.

Part 2 Products

2.1 HARDWARE ITEMS

- .1 Use one manufacturer's products only for similar items.
- .2 Refer to drawing for schedule.

2.2 DOOR HARDWARE

- .1 Model: Best Locks by Stanley Security.
- .2 Locks and latches:
 - .1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, series 2000 preassembled lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
 - .2 Lever handles: plain design.
 - .3 Escutcheons: round.
 - .4 Normal strikes: box type, lip projection not beyond jamb.

- .5 Cylinders: key into keying system as directed.
- .3 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
- .4 Door Closers and Accessories:
 - .1 Door controls (closers): to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4, table A1.
 - .2 Door controls - overhead holders: to ANSI/BHMA A156.8, designated by letter C and numeral identifiers listed in Hardware Schedule.
 - .3 Closer/holder release devices: to ANSI/BHMA A156.15, designated by letter C and numeral identifiers listed in hardware schedule.
 - .4 Door co-ordinator: surface for pairs of doors with overlapping astragal.
- .5 Door bottom seal: heavy duty, door seal of extruded aluminum frame and solid closed cell neoprene weather seal, recessed in door bottom surface mounted with drip cap, closed ends, adjustable, clear anodized finish.
- .6 Thresholds: 180 mm wide x full width of door opening, mill finish, serrated surface, with thermal break of rigid PVC.
- .7 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and nylon brush solid closed cell neoprene insert, clear anodized finish.
 - .2 Adhesive backed neoprene material.
 - .2 Door bottom seal:
 - .1 Extruded aluminum frame and closed cell neoprene sweep, clear anodized finish.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
- .5 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Doors, padlocks and cabinet locks to be keyed as directed by Departmental Representative. Prepare detailed keying schedule in conjunction with Departmental Representative.

- .2 Supply keys in duplicate for every lock in this Contract.
- .3 Supply 3 master keys for each master key or grand master key group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Supply construction cores.
- .6 Hand over permanent cores and keys to Departmental Representative.

Part 3 Execution

3.1 INSTALLATION

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Supply manufacturers' instructions for proper installation of each hardware component.
- .4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames.
- .5 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .6 Install key control cabinet.
- .7 Use only manufacturer's supplied fasteners.
 - .1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores and locks when directed by Departmental Representative.
 - .1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.
 - .3 Remove protective material from hardware items where present.
 - .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Wallboard.
 - .2 ASTM C475/C475M-02(2015), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .3 ASTM C514-04(2014), Standard Specification for Nails for the Application of Gypsum Board.
 - .4 ASTM C645-09a, Standard Specification for Nonstructural Steel Framing Members.
 - .5 ASTM C754-09a, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - .6 ASTM C840-16, Standard Specification for Application and Finishing of Gypsum Board.
 - .7 ASTM C954-15, Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.122 in. (2.84 mm) in Thickness.
 - .8 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .9 ASTM C1047-14, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .10 ASTM C1178/C1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum, framing, sealants and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Test and Evaluation Reports: submit test reports in accordance with Section 01 45 00 - Quality Control, from approved independent testing laboratory, certifying partition system complies with fire-resistance rating as specified.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials inside, level, under cover. Protect from weather, damage from construction operations and other causes, in accordance with manufacturer's printed instructions.
 - .3 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.
 - .4 Store and protect partition materials from nicks, scratches, and blemishes.
 - .5 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan.

Part 2 Products

2.1 MATERIALS

- .1 Performance / Design Criteria:
 - .1 Partition assemblies to be non-combustible construction and fire resistance rated as indicated.
 - .2 Minimum sound transmission class rating of installed panel partition to be STC 30, tested to ASTM E90.
- .2 Non-structural Metal Framing:
 - .1 Non-load bearing channel stud framing: to ASTM C645, roll formed from 0.53 mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.
 - .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 32 mm flange height.
 - .3 Metal channel stiffener: 19 x 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.
- .3 Gypsum Board:
 - .1 Standard and type 'X' board: to regular, 1200 mm wide x maximum practical length, ends square cut, edges tapered.
 - .2 Metal furring runners, hangers, tie wires, inserts, anchors.

- .3 Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .4 Steel drill screws: to ASTM C514.
- .5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, metal zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
- .4 Plywood Board:
 - .1 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .2 Provide good one side plywood on all exposed interior walls, install from the top of floor to 8'-0" high.

2.2 ACCESSORIES

- .1 Acoustical insulation: type recommended by manufacturer to achieve STC rating specified.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.
 - .1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.
- .3 Insulating strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .4 Base: provide pressure treated spruce 38x 89 mm on the base of walls.

Part 3 Execution

3.1 EXAMINATION

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

3.2 ERECTION OF FRAMING

- .1 Install steel framing members to receive screw-attached gypsum board in accordance with ASTM C754 except where specified otherwise.
- .2 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .3 Place studs vertically at 400 mm on centre and maximum of 50 mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.

- .5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .6 Include two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
- .7 Install heavy gauge single jamb studs at openings.
- .8 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .9 Include 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
- .10 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .11 Extend partitions to ceiling height except where indicated.
- .12 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joint.
- .13 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .14 Install insulating strip under studs and tracks around perimeter of sound control partitions.

3.3 ERECTION OF GYPSUM BOARD AND ACCESSORIES

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.
- .3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, and grilles.
- .5 Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- .6 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .7 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .8 Install wall furring for gypsum board wall finishes in accordance with ASTM C840, except where specified otherwise.
- .9 Install acoustical insulation and sealant in sound rated partitions to correspond with tested assembly.

- .10 Install gypsum boards in direction that will minimize number of end-butt joints. Stagger end joints 250 mm minimum.

3.4 APPLICATION

- .1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- .2 Apply single and double layer gypsum board to metal furring or framing using screw fasteners to manufacturer's recommendation. Maximum spacing of screws 300 mm on centre.

3.5 INSTALLATION

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure using contact adhesive for full length.
- .2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .3 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .4 Install access doors to electrical and mechanical fixtures specified in respective sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .5 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .6 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .7 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- .8 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .9 Construct fire rated assemblies where indicated.

3.6 CLEANING

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

3.7 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .2 Maintenance Repainting Manual - current edition.
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1113-A2007, Architectural Coatings.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for paint and coating products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.
- .3 Samples:
 - .1 Submit for review and acceptance of each unit.
 - .2 Samples will be returned for inclusion into work.
 - .3 Submit 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards.
- .4 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Provide and maintain dry, temperature controlled, secure storage.
 - .2 Store painting materials and supplies away from heat generating devices.

- .3 Store materials and equipment in well ventilated area within temperature as recommended by manufacturer.
- .4 Fire Safety Requirements:
 - .1 Supply 1 9 kg Type ABC fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.
- .5 Develop Construction Waste Management Plan.
- .6 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.4 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .2 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.
 - .3 Provide minimum lighting level of 323 Lux on surfaces to be painted.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Apply paint finishes when ambient air and substrate temperatures at location of installation can be satisfactorily maintained during application and drying process, within MPI and paint manufacturer's prescribed limits.
 - .2 Test concrete, masonry and plaster surfaces for alkalinity as required.
 - .3 Apply paint to adequately prepared surfaces, when moisture content is below paint manufacturer's prescribed limits.
- .3 Additional application requirements:
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Products

2.1 MATERIALS

- .1 Supply paint materials for paint systems from single manufacturer.
- .2 Conform to latest MPI requirements for painting work including preparation and priming.

- .3 Materials in accordance with MPI - Architectural Painting Specification Manual "Approved Product" listing.
- .4 Colours:
 - .1 Submit proposed Colour Schedule to Departmental Representative for review.
 - .2 Base colour schedule on selection of 2 base colours.
- .5 Mixing and tinting:
 - .1 Perform colour tinting operations prior to delivery of paint to site, in accordance with manufacturer's written recommendations. Obtain written approval from Departmental Representative for tinting of painting materials.
 - .2 Use and add thinner in accordance with paint manufacturer's recommendations.
 - .1 Do not use kerosene or similar organic solvents to thin water-based paints.
 - .3 Thin paint for spraying in accordance with paint manufacturer's written recommendations.
 - .4 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .6 Gloss/sheen ratings:
 - .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

Gloss Level-Category	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish	Max. 5	Max. 10
Gloss Level 2 - Velvet	Max.10	10 to 35
Gloss Level 3 - Eggshell	10 to 25	10 to 35
Gloss Level 4 - Satin	20 to 35	min. 35
Gloss Level 5 - Semi-Gloss	35 to 70	
Gloss Level 6 - Gloss	70 to 85	
Gloss Level 7 - High Gloss	More than 85	

- .2 Gloss level ratings of painted surfaces as indicated.
- .7 Exterior painting:
 - .1 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
 - .1 EXT 5.1D - Alkyd gloss finish.
 - .2 Galvanized Metal: high contact/high traffic areas (doors, frames, railings and handrails, etc.).
 - .1 EXT 5.3B - Alkyd gloss finish.
- .8 Interior painting:
 - .1 Concrete horizontal surfaces: floors.
 - .1 INT 3.2B - Alkyd floor enamel low gloss finish.
 - .2 Structural Steel and Metal Fabrications: columns, beams, joists and miscellaneous metal.
 - .1 INT 5.1E Alkyd – semi-gloss finish.

- .3 Galvanized Metal: high contact/high traffic areas (doors, frames, railings and handrails, etc.).
 - .1 INT 5.3C - Alkyd semi-gloss finish (over cementitious primer).
- .4 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock" type material, etc.
 - .1 INT 9.2A - Latex semi gloss level finish (over latex sealer).

Part 3 Execution

3.1 GENERAL

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheets.
- .2 Perform preparation and operations for interior painting in accordance with MPI - Architectural Painting Specifications Manual except where specified otherwise.

3.2 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

3.3 PREPARATION

- .1 Protection of in-place conditions:
 - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
 - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .3 Protect factory finished products and equipment.
- .2 Surface Preparation:
 - .1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
 - .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
 - .3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

- .4 Clean and prepare surfaces in accordance with MPI - Architectural Painting Specification Manual specific requirements and coating manufacturer's recommendations.
- .5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
- .6 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .8 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.
- .9 Touch up of shop primers with primer as specified.

3.4 APPLICATION

- .1 Paint only after prepared surfaces have been accepted by Departmental Representative.
- .2 Use method of application approved by Departmental Representative.
 - .1 Conform to manufacturer's application recommendations.
- .3 Apply coats of paint in continuous film of uniform thickness.
 - .1 Repaint thin spots or bare areas before next coat of paint is applied.
- .4 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .5 Sand and dust between coats to remove visible defects.
- .6 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .7 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .8 Finish closets and alcoves as specified for adjoining rooms.
- .9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .10 Mechanical/Electrical Equipment:
 - .1 Paint conduits, piping, hangers, ductwork and other mechanical and electrical equipment exposed in finished areas, to match adjacent surfaces, except as indicated.
 - .2 Do not paint over nameplates.
 - .3 Keep sprinkler heads free of paint.
 - .4 Paint fire protection piping red.

- .5 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .6 Paint natural gas piping yellow.
- .7 Paint both sides and edges of backboards for telephone and electrical equipment before installation.
 - .1 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Place paint defined as hazardous or toxic waste, including tubes and containers, in containers or areas designated for hazardous waste.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 National Research Council (NRC)/Institute for Research in Construction (IRC)
 - .1 Construction Technology Update No. 9-1997, Evolution of Wall Design for Controlling Rains Penetration.
 - .2 Construction Technology Update No. 17-1998, Pressure Equalization in Rainscreen Wall systems.
 - .3 Construction Technology Update No. 34-1999, Designing Exterior Walls According to the Rainscreen Principle.
- .2 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
 - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .3 CAN/CSA:
 - .1 A660 – Certification of Manufacturers of Steel Building Systems.
 - .2 S16 – Design of Steel Structures.
 - .3 S136 – North American Specification for the Design of Cold Formed Structural Steel Members.
 - .4 W47.1 – Certification of Companies for Fusion Welding of Steel.
 - .5 W55.3 – Certification of Companies for Resistance Welding of Steel and Aluminum.
 - .6 W59 – Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Institute of Steel Construction (CISC):
 - .1 CISC – Handbook of Steel Construction.
 - .2 CISC/CPMA - 1-73a A Quick Drying One-Coat Paint for use on Structural Steel.
 - .3 CISC/CPMA – 2-75 A Quick Drying Primer for use on Structural Steel.
- .5 Canadian Sheet Steel Building Institute (CSSBI):
 - .1 C1 – Certificate of Design and Manufacturing Conformance with NBCC.
 - .2 S8 – Quality and Performance Specification for Pre-Finished Sheet Steel for Building Products.
 - .3 CSSBI 30M-06, Standard for Steel Building Systems.
- .6 Federal Specifications (FS):
 - .1 SSPC-Paint 15 - Primer for Use Over Hand Cleaned Steel performs to SSPC-Paint 15 standards
 - .2 SSPC-SP2 – Hand Tool Cleaning.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting 2 weeks prior to beginning work of this Section with contractor's representative, Departmental Representative and Consultant in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.
 - .2 Arrange for site visit with Departmental Representative prior to start of Work to examine existing site conditions adjacent to demolition work.
 - .3 Hold project meetings every week.
 - .4 Ensure contractor's site supervisor, and project manager attend.
 - .5 Contractor will submit written notification of change to meeting schedule established upon contract award 24 hours prior to scheduled meeting.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Certification: Submit written "Certificate of design and manufacturing conformance" prepared and signed by a Professional Engineer, registered to practice in in Province of Alberta, Canada verifying that the metal building system design and metal roof system design (including panels, clips, and support system components) meet indicated loading requirements and codes of authorities having jurisdiction.
 - .1 Certification shall reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end-use categories, governing code bodies, including year, and load applications.
- .3 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for sealants, insulation, and building materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures, for the following.
 - .1 Sealants.
 - .2 Tape.
 - .3 Proprietary joints.
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .1 Submit drawings for fabricator designed assemblies, components and connections. Stipulation to this effect may appear on submitted drawings.

- .5 Delegated Design Submittals:
 - .1 Indicate plans and grid lines, structural members and connection details, bearing and anchorage details roof cladding, wall cladding, framed openings, accessories, schedule of materials and finishes, camber and loadings, fasteners and welds.
 - .2 Indicate detailed description of mechanical, electrical and other systems in Work.
 - .3 Describe requirements of other systems of components related to this Work but provided by others.
 - .1 Obtain necessary information required to detail this Work including methods of integration and securing.
 - .4 Submit erection drawings to Departmental Representative for approval, before construction.
 - .5 Indicate erection dimensions and methods.
- .6 Manufacturer's Instructions: submit application instructions for sealant.
- .7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations.
 - .2 Store and protect components and equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 QUALITY ASSURANCE

- .1 Manufacturer's Qualifications:
 - .1 Manufacturer regularly engaged, for past 10 years, in manufacture of metal building systems of similar type to that specified.
 - .2 Accredited based on the requirements of CSA A660 Certification.
- .2 Installer's Qualifications:
 - .1 Installer regularly engaged, for past 5 years, in installation of metal building systems of similar type to that specified.

- .2 Employ persons trained for installation of metal building systems.

1.6 WARRANTY

- .1 Contractor warrants Work of this section is in accordance for 10 years.

Part 2 Products

2.1 MATERIALS

- .1 Fire resistive building elements: in accordance with Section 07 84 00.
- .2 Doors: in accordance with Section 08 11 00 and 08 36 19.
- .3 Windows: in accordance with Section 08 50 00.
- .4 Sealants: in accordance with Section 07 92 00.
- .5 Thermal Insulation: in accordance with Section 07 21 13.

2.2 SYSTEM DESCRIPTION

- .1 Provide building structure and enclosure to physical dimensions as indicated.
- .2 Building occupancy as defined by National Building Code of Canada.
- .3 Generally, building is intended to enclose vocational activities.

2.3 DESIGN CRITERIA

- .1 Building watertight construction.
- .2 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with "Rain Screen Principles", as described by NRC/IRC.
- .3 Vapour seal building enclosure to withstand, without failure, design RH at design ambient temperature condition, maintained against interior atmospheric pressure of 250 Pa.
- .4 Design building enclosure elements to accommodate, by means of expansion joints, movement in wall and structural movements without permanent distortion, damage to infills, racking of joints, breakage of seals, water penetration or glass breakage.
- .5 Design foundations in accordance with NBC requirements to permissible soil loads indicated.
- .6 Design structure of the building to meet NBC requirements.
- .7 Completed building: exterior to interior sound attenuation not less than STC 30.
- .8 Design, assemble and secure building elements to building frame to ensure stresses in sealants and seals are within sealant manufacturer's recommended maximum.
- .9 Allow for ceiling, piping, conduit and other interior dead loads imposed on this structure.
- .10 Building interior environment: heated to maintain temperature of 20 degrees C minimum to 25 degrees C maximum with relative humidity of 25% to 50%.
- .11 Building lighting: maintain measured lighting level of 10 lx at 1500 mm above finished floor, after building finishes and painting complete.

- .12 Access units, doors, and windows to sizes and locations indicated weather resistant insulated.

2.4 PERFORMANCE CRITERIA

- .1 Maintain following tolerances for building structure and enclosure elements.
 - .1 Maximum variation from plane or location shown on shop drawings: 1 mm/1 m of length and up to 1 mm/5 m maximum.
 - .2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

2.5 STRUCTURE

- .1 Structural Mill Sections or Welded-up Plate Sections: Design in accordance with CSA - S16 Design of Steel Structures.
- .2 Cold-Formed Steel Structural Members: Design in accordance with CSA S136 - North American Specification for the Design of Cold-Formed Steel Structural Members.
- .3 Structural System: Design in accordance with specified building code (Refer to Design Loads and Building Codes).
- .4 Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly as specified in this specification section.
- .5 Bolts for Field Assembly of Primary Steel: High-strength bolts as indicated on erection drawings of metal building system manufacturer.
- .6 Beam and Post Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
- .7 Exterior Columns: Welded-up "H" sections or cold-formed "C" sections.
- .8 Interior Columns: "H" sections or tube columns.
- .9 Connection of Primary Structural Members: ASTM A 325 bolts through factory-punched holes.
- .10 Primary Structural Members: Paint with metal building system manufacturer's standard primer with surface preparation as specified in this specification section.
- .11 Foundation: Refer to Division 03 for requirements.
- .12 Primary Framing:
 - .1 Rigid Frames:
 - .1 Frames: Welded-up plate section columns and roof beams, complete with necessary splice plates for bolted field assembly.
 - .1 Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes factory fabricated.

- .2 Columns and Roof Beams: Fabricated complete with holes in webs and flanges for attachment of secondary structural members and bracing, except for fieldwork as noted on erection drawings furnished by metal building system manufacturer.
- .2 Bolts for Field Assembly of Frame Members: ASTM A 325 high-strength bolts as indicated on erection drawings furnished by metal building system manufacturer.
- .2 Endwall Structural Members: Cold-formed channel members designed in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members or welded-up plate sections designed in accordance with CSA - S16 Design of Steel Structures.
 - .1 Endwall Frames: Endwall corner posts, endwall roof beams, and endwall posts as required by design criteria.
 - .2 Splice Plates and Base Clips: Shop fabricated complete with bolt connection holes.
 - .3 Base Plates, Cap Plates, Compression Splice Plates, and Stiffener Plates: Factory welded into place and connection holes shop fabricated.
 - .4 Beams and Posts: Factory fabricated complete with holes for attachment of secondary structural members, except for field work as noted on erection drawings furnished by metal building system manufacturer.
- .3 Intermediate Frames: Substituted for end-wall roof beams, when specified.
 - .1 Factory fabricate necessary endwall posts and holes for connection to intermediate frame used in endwall.
- .13 Purlins:
 - .1 "Z"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
- .14 Truss Purlins:
 - .1 Cold-formed trusses, factory assembled.
- .15 Outer Flange of Purlins: Factory-punched holes for panel connections.
- .16 Attach purlins to main frames and endwalls using 12.7mm-diameter bolts.
- .17 Brace purlins spaced at intervals indicated on erection drawings furnished by metal building system manufacturer.
- .18 Concentrated Loads: Hung at purlin panel points.
- .19 Eave Members:
 - .1 Eave Struts: Factory punched 178mm, 216mm, 254mm, or 292mm-deep "C" sections, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
- .20 Girts:
 - .1 "Z" or "C"-shaped, precision-roll-formed, acrylic-coated G30 galvanized steel in different gauges to meet specified loading conditions.
- .21 Outer Flange of Girts: Factory-punched holes for panel connections.

- .22 Bracing:
 - .1 Locate bracing as indicated on the Drawings.
 - .2 Diagonal Bracing:
 - .1 Hot-rolled rods of sizes indicated on the Drawings.
 - .3 Flange Braces and Purlin Braces: Cold formed and installed as indicated on the Drawings.
- .23 Welding:
 - .1 Welding Procedures, Operator Qualifications, and Welding Quality Standards: CSA W59 – Welded Steel Structures and AWS D1.3 - Structural Welding Code – Sheet Steel.
 - .2 Welding inspection, other than visual inspection as defined by CSA W59, shall be identified and negotiated before bidding.
 - .3 Certification of Welder Qualification: Supply when requested.
- .24 Painting of Structural Steel Framing System:
 - .1 Structural Steel: Prime paint as temporary protection against ordinary atmospheric conditions.
 - .2 Perform subsequent finish painting, if required, in field as specified in the painting section.
 - .3 Before painting, clean steel of loose rust, loose mill scale, dirt, and other foreign materials.
 - .4 Steel Fabricator: Not required to sand blast, flame clean, or pickle steel before painting, unless otherwise specified.
 - .5 Primary Frames:
 - .1 Clean steel in accordance with SSPC-SP2.
 - .2 Factory cover steel with 1 coat of gray water-reducible alkyd primer paint formulated to equal or exceed performance requirements CAN/CSA 1-73a or 2-75.
 - .3 Minimum Coating Thickness: 1.0 mil.
 - .4 Secondary Structural Members – Roll-Formed:
 - .5 Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
 - .6 Acrylic-Coated G30 Galvanized Steel: Equal or exceed performance requirements of SSPC Paint-15.
 - .6 Truss Purlins:
 - .1 Hot-dipped zinc coating, ASTM A 653, G30; followed by 1 coat of clear acrylic finish.
 - .2 Acrylic-coated G30 galvanized steel: Equal or exceed performance requirements of SSPC Paint-15.

2.6 COMPONENTS

- .1 Standing seam metal roofing system:
 - .1 Standing seam metal roofing by metal building system manufacturer.

- .2 Thermal performance of U-factor 0.029 or better.
- .3 Design Requirements:
 - .1 Design roof panels and liner panels in accordance with CSA S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .2 Design roof paneling system to support design live, snow, and wind loads.
 - .3 Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
 - .4 Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.
 - .5 Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
- .4 Factory roll-formed, 610mm wide, with 2 major corrugations, 51mm high (70mm including seam), 610mm on center.
- .5 Flat of the Panel: Cross flutes 152mm on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
- .6 Variable Width Panels:
 - .1 For roof lengths not evenly divisible by the 610mm panel width, factory-manufactured variable-width (229mm, 305mm, 381mm, 457mm, and 533-wide) panels shall be used to ensure modular, weathertight roof installation.
 - .2 Minimum Length: 4572mm.
 - .3 Supply maximum possible panel lengths.
- .7 Panel Material and Finish:
 - .1 24-gauge galvanized steel, G90 coating, ASTM A 653, G90.
 - .2 Paint with exterior colors finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating or approved equivalent.
 - .3 PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.
 - .1 Not to peel, crack, or chip.
 - .2 Chalking: Not to exceed ASTM D 4214, #8 rating.
 - .3 Fading: Not more than 5 color-difference units, ASTM D 2244.
- .8 Hem exposed edges on underside 12 mm, mitre and seal.
- .9 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .10 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.
- .11 Protect metals against oxidization by backpainting with isolation coating.
- .12 Extend eave panels beyond structural line of sidewalls.
- .13 Factory punch panels at panel end to match factory-punched holes in eave structural member.

- .14 Panel End Splices: Factory punched and factory notched.
- .15 Panel End Laps: Locate directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid 4-panel lap-splice condition.
- .16 End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
- .17 Self-Drilling Fasteners: Not permitted.
- .18 Ridge Assembly:
 - .1 Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
 - .2 Factory punch parts for correct field assembly.
 - .3 Install panel closures and interior reinforcing straps to seal panel ends at ridge.
 - .4 Do not expose attachment fasteners on weather side.
 - .5 Use lock seam plug to seal lock seam portion of panel.
 - .6 High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.
- .19 Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
 - .1 Stainless Steel Tabs: Factory centered on roof clip when installed to ensure full movement in either direction.
 - .2 Maximum Force of 8 Pounds: Required to initiate tab movement.
 - .3 Each Clip: Accommodates a minimum of 32mm movement in either direction.
- .20 Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and of roof panels.
- .21 Fasteners:
 - .1 Make connections of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.
 - .2 Fasten panel clips to structural members with fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched holes in structural members.
- .22 Accessories:
 - .1 Accessories (i.e., ventilators, skylights, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
 - .2 Exterior Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating or approved equivalent.
 - .3 Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

- .4 Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
 - .1 Parts: Compatible and not cause corrosive condition.
 - .2 Copper and Lead Materials: Do not use with Galvalume panels.
- .5 Snow stops standard with metal building system manufacturer. Above exterior exits, extending 600mm each side minimum.
- .23 Energy Conservation:
 - .1 Insulate purlins (optional) to eliminate "thermal short circuits" between purlins and roof panels.
 - .1 Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and roof panels by use of thermal block at each purlin location.
- .24 Roof insulation system:
 - .1 Sub-Structural System and support brackets complete with thermal spacers to metal building system manufacturer recommendation and to meet design requirements.
 - .2 Continuous air and vapour barrier completely sealed.
 - .3 Water vapour permeance rating: 0.03 (ASTM E96).
 - .4 Painted Liner Panels:
 - .1 Exposed Side: 0.15-mil min primer and 0.70-mil minimum interior white polyester paint.
 - .2 Unexposed Side: 0.1-mil minimum primer and 0.40 minimum polyester backer.
 - .5 Unfaced Insulation: NAIMA 202. Multiple layers to achieve thermal performance indicated.
- .25 Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating.
- .2 Insulated metal panel system:
 - .1 Insulated fluted metal panel system to meet design requirements and thermal performance as indicated.
 - .2 Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
 - .3 Wall Panels, 26-gauge, AZ50 aluminum-zinc coated steel:
 - .1 Steel-faced, shop-assembled, factory-foamed, insulated panel units.
 - .2 Double tongue-and-groove, side-joint design, with fasteners concealed within side joint.
 - .3 Nominal Thickness: as indicated to meet thermal requirements.
 - .4 One piece from base to top of wall.
 - .5 Exterior Face:
 - .1 Architectural Corrugations: 10mm deep on nominal 254mm centers.

- .2 Finish: Non-directional embossed finish. Metal building system manufacturer shall warrant coating for 25 years against peeling, cracking, chipping, chalking not to exceed ASTM D 4214 #8 rating, and fading not more than 5 color-difference units, ASTM D 2244.
- .6 Core: Poured-in-place polyurethane foam with a minimum 93 percent closed-cell structure.
- .7 Interior Face: Roll-formed from pre-painted steel with 2mm-deep corrugations on 152mm centers.
 - .1 Paint with USDA-approved interior white polyester paint.
- .4 Panel Physical Properties:
 - .1 R-Value: Based on actual test results from ASTM C 518 of panel core material. 76mm-Thick Panels: Minimum R value of 23.
 - .2 Insulated Panels carry the following listings:
 - .1 Factory Mutual Class 1 Rating for wall and ceiling construction FM 4880.
 - .2 Guide NYWR, Insulated Wall Construction Subject 1040.
 - .3 Surface Burning Characteristics: Panel core (152mm unfaced) tested in accordance with ASTM E 84.
 - .4 Flame Spread: 25.
 - .5 Smoke Developed: 450.
 - .6 1-Hour or 2-Hour Fire-Resistance Ratings: Achieve by incorporating 2 or 4 layers of 15.9mm Type X gypsum wallboard on interior side of insulated panels.
 - .1 Rated-Wall Assembly: UL listing U652.
 - .5 Accessories (i.e., doors, windows): Design to fit wall panel system or framed openings and furnish as standard by metal building system manufacturer, unless otherwise noted.
 - .6 Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
- .3 Non-Insulated metal panel system:
 - .1 Fluted metal panel system to meet design requirements and profile to match insulated metal panel.
 - .2 Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
- .4 Fasteners:
 - .1 To metal building system manufacturer’s recommendation to suit application and meet all design requirements.
- .5 Sealant: Refer to Section 07 92 00.
- .6 Doors: Refer to Section 08 11 00 and 08 36 19.
- .7 Windows: Refer to Section 08 50 00.
- .8 Wall assemblies: Refer to Section 09 21 99.

- .9 Painting: Refer to Section 09 91 99.

2.7 FABRICATION

- .1 Maintain air and vapour barrier throughout building enclosure elements.
- .2 Locate vapour barrier on warm side of thermal insulation.
- .3 Locate air barrier as detailed.
- .4 Complete enclosure assembly with exterior skin, glass units, access units doors, inner air/vapour seal membrane, thermal insulation and interior finish.
- .5 Accurately fit and rigidly frame together joints, corners and mitres.
 - .1 Match components carefully to produce continuity of line and design.
 - .2 Make joints and connections toward exterior weathertight.
 - .3 Provide hairline joints for materials in contact.
 - .4 Co-ordinate location of visible joints.

Part 3 Execution

3.1 EXAMINATION

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

3.2 ERECTION

- .1 Erect structural steel framing system in accordance with the Drawings and metal building system manufacturer's erection drawings.
- .2 Field Modifications:
 - .1 Require approval of metal building system manufacturer.
 - .2 Responsibility of building erector.
 - .3 Field Modifications to Truss Purlins: Not allowed, unless indicated on erection drawings furnished by metal building system manufacturer.
- .3 Fixed Column Bases: Grout flush with floor line after structural steel erection is complete.

3.3 INSTALLATION

- .1 Install building components as per manufacturer instructions.
- .2 Insulation Installation: Install insulation in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.

- .3 Install insulation support system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.
- .4 Install building components to provide a weathertight building.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer's verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Ensure manufacturer's representative is present before and during critical periods of installation.
 - .4 Schedule site visits:
 - .1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of Work, after cleaning is carried out.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove excess sealant by moderate use of low VOC mineral spirits or other solvent as directed by sealant manufacturer.
 - .2 Clean surfaces.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

- .1 Protect finished surfaces with strippable coatings, strippable wrappers, plywood or sheet materials as required before acceptance of Work.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by sealants, insulation, and building materials installation.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .2 Drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
 - .3 Drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for Unit heaters, fans and fire extinguishers for incorporation into manual.
 - .1 Operation and maintenance manual approved by, and final copies deposited with, Consultant before final inspection.
 - .2 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Operation instruction for systems and component.
 - .4 Description of actions to be taken in event of equipment failure.
 - .5 Colour coding chart.
 - .3 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .4 Performance data to include:

- .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
- .2 Equipment performance verification test results.
- .3 Special performance data as specified.
- .5 Approvals:
 - .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless directed by Consultant.
 - .2 Make changes as required and re-submit as directed by Consultant.
- .6 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .7 Site records:
 - .1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour waterproof ink for each service.
 - .4 Make available for reference purposes and inspection.
- .8 As-Built drawings:
 - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
 - .2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .3 Submit to Consultant for approval and make corrections as directed.
 - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Execution

2.1 EXAMINATION

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

2.2 PAINTING REPAIRS AND RESTORATION

- .1 Do painting in accordance with Section 09 91 23 - Interior Painting.
- .2 Prime and touch up marred finished paintwork to match original.
- .3 Restore to new condition, finishes which have been damaged.

2.3 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork.

2.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

2.5 DEMONSTRATION

- .1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .2 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .3 Instruction duration time requirements as specified in appropriate sections.

2.6 CLEANING

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

2.7 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM A125-1996(2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A563-07a, Standard Specification for Carbon and Alloy Steel Nuts.
- .2 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
 - .1 MSS SP58-2002, Pipe Hangers and Supports - Materials, Design and Manufacture.
 - .2 MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.
 - .3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.
- .3 Underwriter's Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta.
 - .2 Submit shop drawings for:
 - .1 Bases, hangers and supports.
 - .2 Connections to equipment and structure.
 - .3 Structural assemblies.
- .4 Certificates:
 - .1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Manufacturers' Instructions:
 - .1 Provide manufacturer's installation instructions.

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58.
 - .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
 - .4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

2.2 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with MSS SP58.

2.3 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut carbon steel retaining clip.
 - .1 Rod: 9 mm UL listed 13 mm FM approved.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed.
- .4 Hanger rods: threaded rod material to MSS SP58:
 - .1 Ensure that hanger rods are subject to tensile loading only.
 - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
 - .3 Do not use 22 mm or 28 mm rod.

- .5 Adjustable clevis: material to MSS SP69 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
 - .1 Ensure "U" has hole in bottom for rivetting to insulation shields.
- .6 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
 - .1 Finishes for steel pipework: galvanized.
- .7 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

2.5 EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

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 datasheet.

3.2 INSTALLATION

- .1 Install in accordance with:
 - .1 Manufacturer's instructions and recommendations.
- .2 Clamps on riser piping:
 - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
 - .2 Bolt-tightening torques to industry standards.
 - .3 Steel pipes: install below coupling or shear lugs welded to pipe.

3.3 HANGER SPACING

- .1 Plumbing piping: to Provincial Code.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.4 m	1.8 m

3.4 HANGER INSTALLATION

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

- .1 Adjust hangers and supports:
 - .1 Ensure that rod is vertical under operating conditions.
 - .2 Equalize loads.
- .2 Adjustable clevis:
 - .1 Tighten hanger load nut securely to ensure proper hanger performance.
 - .2 Tighten upper nut after adjustment.
- .3 Beam clamps:
 - .1 Hammer jaw firmly against underside of beam.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.2 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 THERMOSTAT (LOW VOLTAGE)

- .1 Low voltage wall thermostat:
 - .1 For use on 24 V circuit at 1.5 A capacity.
 - .2 With heat anticipator adjustable 0.1 to 1.2 A.
 - .3 Temperature setting range: 10 degrees C to 25 degrees C.
 - .4 With sub-base.

2.2 THERMOSTAT GUARDS

- .1 Thermostat guards: plastic. Slots for air circulation to thermostat.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

- .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25 mm from exterior wall.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for piping, valves and fittings for gas fired equipment.

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B18.2.1-96, Square and Hex Bolts and Screws Inch Series.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A47/A47M-99(2004), Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M-04, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
 - .3 ASTM B75M-99, Standard Specification for Seamless Copper Tube Metric.
 - .4 ASTM B837-01, Standard Specification for Seamless Copper Tube for Natural Gas and Liquefied Petroleum (LP) Gas Fuel Distribution Systems.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
- .4 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
 - .1 CAN/CSA B149.1HB-00, Natural Gas and Propane Installation Code Handbook.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet for piping, fittings and equipment.
 - .2 Indicate on manufacturers catalogue literature following: valves.
- .3 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Instructions: submit manufacturer's installation instructions.
- .6 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Pre-Installation Meeting:

- .1 Convene pre-installation meeting one week prior to beginning work of this Section
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
 - .1 NPS 1/2 to 2, screwed.
- .2 Copper tube: to ASTM B837.

2.2 JOINTING MATERIAL

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Brazing: to ASTM B837.

2.3 FITTINGS

- .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
 - .3 Welding: butt-welding fittings.
 - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
 - .5 Bolts and nuts: to ASME B18.2.1.
 - .6 Nipples: schedule 40, to ASTM A53/A53M.
- .2 Copper pipe fittings, screwed, flanged or soldered:
 - .1 Cast copper fittings: to ASME B16.18.
 - .2 Wrought copper fittings: to ASME B16.22.

2.4 VALVES

- .1 Provincial Code approved, lubricated plug type.

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 datasheet.

3.2 PIPING

- .1 Install in accordance with Section CAN/CSA B149.1.
- .2 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.

3.3 VALVES

- .1 Install valves with stems upright or horizontal unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CAN/CSA B149.1 and requirements of authorities having jurisdiction.

3.5 ADJUSTING

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1.
- .2 Pre-Start-Up Inspections:
 - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
 - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.6 CLEANING

- .1 Cleaning: in accordance with Section CAN/CSA B149.1.
- .2 Perform cleaning operations in accordance with manufacturer's recommendations.
- .3 Upon 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 National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 99-2010, Standards Handbook.
 - .2 ANSI/AMCA Standard 210-2007/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for roof and wall exhausters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .2 Include:
 - .1 Fan performance curves showing specified point of operation.
 - .2 Sound rating data.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 Addresses of suppliers.
 - .3 List of specialized tools necessary for adjusting, repairing or replacing.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect roof and wall exhausters from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force. Provide confirmation of testing.
 - .2 Capacity: as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed to ANSI/AMCA Standard 99.
- .3 Sound ratings: comply with ANSI/AMCA Standard 301, tested to ANSI/AMCA Standard 300.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA Standard 210.
- .5 Bearings: sealed lifetime with oil retaining, dust excluding seals and a certified minimum rated life of 80,000 hours.

2.2 ROOF EXHAUSTERS

- .1 Centrifugal direct driven.
 - .1 Housings: spun aluminum complete with resilient mounted motor and fan.
 - .2 Impeller: aluminum non-overloading.
 - .3 12 mm mesh 2.0 mm diameter aluminum birdscreen.
 - .4 Motorized gasketed aluminum backdraft dampers.
 - .5 Disconnect switch within fan housing.
 - .6 Continuous curb gaskets, stainless steel securing bolts and screws, and special mated sound insulating 300 mm high curbs where indicated. Hinge curb plate for access to internals for maintenance.
- .2 Sound curbs: of same manufacturer as fan and built to suit model specified.
 - .1 Double baffle and self-flashing type. Required decibel sound attenuation spectrum:

Frequency Octave Band	1	2	3	4	5	6	7	8
dB Attenuation	3	5	11	16	22	20	17	13

- .2 Pressure loss through curbs: 37 Pa maximum at rated L/s.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for roof and wall exhausters installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

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

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM E90-09, Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for louvers, intakes and vents and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Pressure drop.
 - .2 Face area.
 - .3 Free area.
- .3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Test Reports: submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GOOSENECK HOODS

- .1 Thickness: to SMACNA.
- .2 Fabrication: to SMACNA.
- .3 Joints: to SMACNA. Proprietary manufactured flanged duct joint considered class A seal.
- .4 Supports: as required.
- .5 Complete with integral birdscreen of 2.7 mm diameter aluminum wire. Use 12 mm mesh on exhaust 19 mm mesh on intake.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for louvres, intakes and vents installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

- .1 In accordance with manufacturer's and SMACNA recommendations.
- .2 Anchor securely into opening. Seal with caulking to ensure weather tightness.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with applicable Provincial/Territorial regulations.
- .2 Certifications:
 - .1 Catalogued or published ratings: obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 TYPE B GAS VENT

- .1 ULC labelled, 288 degrees C rating maximum, atmospheric gas vent only.
- .2 Sectional, prefabricated, double wall with 13 mm air space. Aluminum inner wall. Galvanized steel outer wall. Mated fittings and couplings.

2.2 ACCESSORIES

- .1 Hangers and supports: in accordance with recommendations SMACNA.

- .2 Rain cap.
- .3 Expansion sleeves with heat resistant caulking, held in place as required.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for chimney and stack installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION - GENERAL

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.
- .3 Support chimneys at bottom, roof and intermediate levels as required.
- .4 Install thimbles where penetrating roof. Pack annular space with heat resistant caulking.
- .5 Install flashings on chimneys penetrating roofs, as required.
- .6 Install rain caps and cleanouts, as required.

3.3 CLEANING

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM E84-11a, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - .2 ASTM C916-1985(R2007), Standard Specification for Adhesives for Duct Thermal Insulation.
 - .3 ASTM C1071-05e1, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2012, Standard for the Installation of Air Conditioning and Ventilating Systems.
 - .2 NFPA 90B-2012, Standard for the Installation of Warm Air Heating and Air Conditioning Systems (ANSI).
- .3 Underwriters' Laboratories (UL) Inc.
 - .1 UL 2021-1997, Fixed and Location-Dedicated Electric Room Heaters.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures etc.
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .2 Indicate on drawings:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 NATURAL GAS FIRED UNIT HEATERS

- .1 Cabinet Unit Heaters: to UL 2021.
- .2 Cabinet: type ducted, 1.6 mm thick steel with rounded exposed corners and edges, removable panels, glass fibre insulation and integral air outlet and inlet.
 - .1 Insulation Materials: to ASTM C1071; ensure surfaces exposed to airstream have erosion-resistant coating to prevent erosion of glass fibres.
 - .1 Thickness: 13 mm.
 - .2 Thermal conductivity (k-Value): 0.037 W/m x K at 24 degrees C mean temperature.
 - .3 Fire-hazard classification flame-spread index of 25 maximum and smoke-developed index of 50 maximum to ASTM E 84.
- .3 Finish with factory applied primer coat.
- .4 Fans: centrifugal double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.
- .5 Motor: multi-speed, tapped wound permanent split capacitor type with sleeve bearings, built-in thermal overload protection and resilient rubber isolation mounting.
 - .1 Include spark free non-ferrous fan construction and explosion proof motor construction in bracket.
- .6 Capacity: as indicated.
- .7 Control:
 - .1 on-off with integral overloads.
 - .2 Control thermostat: room electric, low voltage, electronic, rating to suit cabinet unit heater, locking cover, set point locking device, concealed adjustment, plastic cover and guard.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Provide supplementary suspension steel as required.
- .3 Install thermostats in locations indicated.
- .4 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.3 CLEANING

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

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ANSI/CSA
 - .1 ANSI Z832-20 / CSA 2-34, Gas-fired Tubular and Low-Intensity Infrared Heaters
 - .2 ANSI Z21.20 / CAN 1-6.4, Standard for Automatic Gas Ignition Systems

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for unit heaters and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Manufacturer's Instructions: provide to indicate special handling criteria, installation sequence, cleaning procedures etc.
- .4 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Alberta, Canada.
 - .2 Indicate on drawings:
 - .1 Equipment, capacity and piping connections.
 - .2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for unit heaters for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 NATURAL GAS FIRED TUBULAR INFRARED HEATERS

- .1 Gas-fired infrared space heaters shall be furnished and installed in accordance with governing codes and as shown per building drawing(s) as describe here.
- .2 Heaters shall be made of aluminized steel body construction, and shall have a specially designed internal plenum chamber. This chamber shall provide optimum air/gas mixture for complete combustion. The carbon monoxide emission level should be .001% based on the maximum allowable emission level of 0.04%.
- .3 Heaters shall have 48.72% radiant efficiency as determined by ANSI Z83.6, Section 2.9. Radiant coefficient readings shall be obtained with a potassium bromide filter to duplicate the results obtained at the Canadian Standards Association Laboratories.
- .4 Heaters shall operate satisfactorily in any position from horizontal to forty-five (45°) degrees from horizontal. Heaters shall be design certified by the Canadian Standards Association (CSA) to American National Standard Z83.19/CSA 2.35. The manufacturer shall provide a written limited warranty of ten (10) years covering the emitter tiles, the cast iron burner, and body construction, and a limited warranty of one (1) year for all components utilized in the heater's control assembly

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for unit heaters installation in accordance with manufacturer's written instructions.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's instructions.
- .2 Install thermostats in locations indicated.
- .3 Before acceptance, set discharge patterns and fan speeds to suit requirements.

3.3 CLEANING

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

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Building wire and cable.
- .2 Non-metallic sheathed cable.
- .3 Armoured cable.
- .4 Wiring connectors and connections.

1.2 RELATED SECTIONS

- .1 Section 26 05 53 - Electrical Identification.
- .2 Section 31 23 18 - Trenching: Trenching and backfilling for direct burial cable installation.

1.3 REFERENCES

- .1 CSA C22.1-15 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations
- .2 CSA C22.2 No. 0.3 - Test Methods for Electrical Wires and Cables.
- .3 CSA C22.2 No. 48-09 - Non-metallic Sheathed Cable.
- .4 CSA C22.2 No. 51 Armoured Cables.
- .5 CAN/CSA C22.2 No. 65-03 (CSA/UL/ANCE) – Wire Connectors.
- .6 CSA C22.2 No. 75-08 (CSA/UL/ANCE) - Thermoplastic-Insulated Wires and Cables.
- .7 CSA C22.2 No. 123 Aluminum Sheathed Cables.
- .8 CSA C22.2 No. 131 Type TECK 90 Cable.
- .9 NECA (National Electrical Contractors Association) - Standard of Installation.
- .10 NETA (International Electrical Testing Association) - ATS-2003 –Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Product Data: Provide for each cable assembly type.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Procedures for submittals.
- .2 Test Reports: Indicate procedures and values obtained.
- .3 Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- .4 Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.6 SUBMITTALS AT PROJECT CLOSEOUT

- .1 Section 01 73 00: Procedures for submittals.
- .2 Project Record Documents: Record actual locations of components and circuits.

1.7 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to CSA C22.1.
- .2 Provide products listed and classified by CSA (Canadian Standards Association) or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 FIELD SAMPLES

- .1 Provide to Section 01 43 00.
- .2 Submit 1 each, 450 mm length of cable assembly from each reel.
- .3 Select each length to include complete set of manufacturer markings.
- .4 Attach tag indicating cable size and application information.

1.10 PROJECT CONDITIONS

- .1 Verify that field measurements are as indicated.
- .2 Conductor sizes are based on copper unless indicated as aluminum or "AL".
- .3 If aluminum conductor is substituted for copper conductor, size to match circuit requirements for conductor ampacity and voltage drop.
- .4 Wire and cable routing indicated is approximate unless dimensioned.

1.11 COORDINATION

- .1 Coordinate Work to Section 01 33 00.
- .2 Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

Part 2 Products

2.1 BUILDING WIRE

- .1 Description: Single conductor insulated wire.
- .2 Conductor: Copper.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation: Thermosetting polyethylene (XLPX) material rated 90 degrees C.

2.2 NONMETALLIC-SHEATHED CABLE

- .1 Description: Type NMD.
- .2 Conductor: Copper. #12 minimum size
- .3 Insulation Voltage Rating: 300 volts.

2.3 SERVICE ENTRANCE CABLE

- .1 Description: Type USE1 90.
- .2 Conductor: Copper for sizes smaller than 4 AWG; aluminum for sizes 4 AWG and larger.
- .3 Insulation Voltage Rating: 600 volts.

2.4 ARMoured CABLE

- .1 Description: Type AC.
- .2 Conductor: Copper.
- .3 Insulation Voltage Rating: 600 volts.
- .4 Insulation Temperature Rating: 90 degrees C
- .5 Insulation Material: Thermosetting.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 73 00: Verification of existing conditions before starting work.
- .2 Verify that interior of building has been protected from weather.
- .3 Verify that mechanical work likely to damage wire and cable has been completed.
- .4 Verify that raceway installation is complete and supported.

3.2 PREPARATION

- .1 Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS

- .1 Concealed Dry Interior Locations: Use only building wire in raceway, non-metallic-sheathed cable or armoured cable.
- .2 Exposed Dry Interior Locations: Use only building wire in raceway, armoured cable.
- .3 Above Accessible Ceilings: Use only building wires in raceway, non-metallic-sheathed cable or armoured cable.
- .4 Wet or Damp Interior Locations: Use only building wires in raceway, armoured cable with jacket.
- .5 Exterior Locations: Use only building wire in raceway, service entrance cable or armoured cable with jacket.
- .6 Underground Installations: Use only building wire in raceway, service-entrance cable in duck bank

3.4 INSTALLATION

- .1 Section 01 43 00: Manufacturer's written instructions.
- .2 Route wire and cable as required to meet project conditions.
- .3 Install cable to the CSA C22.1.
- .4 Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- .5 Use stranded conductors for control circuits.
- .6 Use conductor not smaller than 12 AWG for power and lighting circuits.
- .7 Use conductor not smaller than 16 AWG for control circuits.
- .8 Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 25 m.
- .9 Pull all conductors into raceway at same time.
- .10 Use suitable wire pulling lubricant for building wire 4 AWG and larger.
- .11 Protect exposed cable from damage.
- .12 Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure [or ceiling suspension system]. Do not rest cable on ceiling panels.
- .13 Use suitable cable fittings and connectors.
- .14 Neatly train and lace wiring inside boxes, equipment, and panelboards.
- .15 Clean conductor surfaces before installing lugs and connectors.
- .16 Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- .17 Terminate aluminum conductors with tin-plated aluminum- bodied compression connectors only. Fill with anti- oxidant compound before installing conductor.
- .18 Use suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- .19 Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

- .20 Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
- .21 Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- .22 Trench and backfill for direct burial cable installation as specified in Section 32 23 18 and Section 32 23 23. Install warning tape along entire length of direct burial cable, within 75 mm of grade.
- .23 Identify and colour code wire and cable to Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

3.5 FIELD QUALITY CONTROL

- .1 Section 01 43 00: Field inspection and testing,
- .2 Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Equipment grounding conductors.
- .2 Bonding.

1.2 REFERENCES

- .1 CSA-C22.1-15 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations.
- .2 CSA C22.2 No.0.4 - Bonding of Electrical Equipment.
- .3 CSA C22.2 No. 41 - Grounding and Bonding Equipment.

1.3 SYSTEM DESCRIPTION

- .1 Underground water pipe.
- .2 Metal frame of the building.
- .3 Ground ring specified in Section 33 79 19.
- .4 Underground gas piping system.

1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 78 10: Submission procedures.
- .2 Certificate of Compliance: Indicate approval of installation by electrical contractor.

1.5 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 3 years experience.

1.6 REGULATORY REQUIREMENTS

- .1 Products: Listed and classified by Underwriters Laboratories as suitable for the purpose specified and indicated.

Part 2 Products

2.1 WIRE

- .1 Material: Stranded copper. Minimum #6AWG.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 70 00: Verify existing conditions before starting work.

3.2 INSTALLATION

- .1 Install to manufacturer's written instructions.
- .2 Provide bonding to meet Regulatory Requirements.
- .3 Bond together metal siding not attached to grounded structure; bond to ground.
- .4 Bond together reinforcing steel and metal accessories in fountain structures.
- .5 Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Use #2AWG bare copper conductor.
- .6 Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- .7 Interface with site grounding system.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Conduit and equipment supports.
- .2 Anchors and fasteners.

1.2 REFERENCES

- .1 CSA C22.1 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations
- .2 CECA - Canadian Electrical Contractors Association.

1.3 SUBMITTALS

- .1 Submit to Section 01 33 00.
- .2 Product Data: Provide manufacturer's catalogue data for fastening systems.
- .3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.4 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by Canadian Standards Association or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

Part 2 Products

2.1 PRODUCT REQUIREMENTS

- .1 Materials and Finishes: Provide adequate corrosion resistance.
- .2 Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- .3 Anchors and Fasteners:
 - .1 Concrete Structural Elements: Use expansion anchors.
 - .2 Steel Structural Elements: Use beam clamps.
 - .3 Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 - .4 Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts and hollow wall fasteners.
 - .5 Solid Masonry Walls: Use expansion anchors
 - .6 Sheet Metal: Use sheet metal screws.
 - .7 Wood Elements: Use wood screws.

2.2 STEEL CHANNEL

- .1 Description: Galvanized steel.

Part 3 Execution

3.1 INSTALLATION

- .1 Install products to manufacturer's written instructions.
- .2 Provide anchors, fasteners, and supports to CSA C22.1.
- .3 Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- .4 Obtain permission from Consultant before using powder-actuated anchors.
- .5 Obtain permission from Consultant before drilling or cutting structural members.
- .6 Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- .7 Install surface-mounted cabinets and panelboards with minimum of four anchors.
- .8 In wet and damp locations use steel channel supports to stand cabinets and panelboards 25 mm off wall.
- .9 Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Metal conduit.
- .2 Flexible metal conduit.
- .3 Liquid tight flexible metal conduit.
- .4 Electrical metallic tubing.
- .5 Nonmetal conduit.
- .6 Electrical nonmetallic tubing.
- .7 Fittings and conduit bodies.

1.2 RELATED SECTIONS

- .1 Section 07 84 00 - Firestopping.
- .2 Section 26 05 34 - Boxes.
- .3 Section 26 05 37 - Duct Bank.
- .4 Section 26 05 26 - Grounding And Bonding.
- .5 Section 26 05 29 - Electrical Supporting Devices.
- .6 Section 26 05 53 - Electrical Identification.

1.3 REFERENCES

- .1 CSA C22.1 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations
- .2 CAN/CSA-C22.2 No. 18 - Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .3 CSA C22.2 No.45 - Rigid Metal Conduit
- .4 CSA C22.2 No. 45.1 - Rigid Metal Conduit - Steel.
- .5 CSA C22.2 No. 56 - Flexible Metal Conduit and Liquid - Tight Flexible Metal Conduit
- .6 CSA C22.2 N0. 83.1 (CSA/UL) - Electrical Metallic Tubing –Steel.
- .7 CSA C22.2 No. 211.1 - Rigid Types EB1 and DB2/ES2 PVC Conduit
- .8 CSA C22.2 No.211.2 - Rigid PVC (Unplasticized) Conduit
- .9 CSA C22.2 No. 211.3 (CSA/UL) - Reinforced Thermosetting Resin Conduit (RTRC) on Fittings.
- .10 CSA C22.2 No. 227.1 (CSA/UL) - Electrical Nonmetallic Tubing
- .11 CSA C22.2 No. 227.2.1 (CSA/UL) Liquid-Tight Flexible Nonmetallic Conduit
- .12 NFPA 70 – National Electrical Code.

1.4 DESIGN REQUIREMENTS

- .1 Conduit Size: Canadian Electrical Code.

1.5 SUBMITTALS

- .1 Submit to Section 01 33 00.
- .2 Product Data: Provide for metallic conduit, flexible metal conduit, liquid tight flexible metal conduit, metallic tubing, non-metallic conduit, non-metallic tubing and fittings.

1.6 PROJECT RECORD DOCUMENTS

- .1 Submit to Section 01 78 10.
- .2 Accurately record actual routing of conduits larger than 51 mm inches.

1.7 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by [CSA (Canadian Standards Association)] [ULC (Underwriters Laboratories, Inc.,)] [testing firm acceptable to authority having jurisdiction] as suitable for purpose specified and shown.

1.8 FIELD SAMPLES

- .1 Provide to Section 01 43 00.
- .2 Provide field sample of conduit, two each at 610 mm long.
- .3 Provide field sample of expansion/deflection fitting, two each.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, protect, and handle Products to site to Section 01 61 00.
- .2 Accept conduit on site. Inspect for damage.
- .3 Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- .4 Protect PVC conduit from sunlight.

1.10 PROJECT CONDITIONS

- .1 Verify that field measurements are as shown on Drawings.
- .2 Verify routing and termination locations of conduit prior to rough-in.
- .3 Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

Part 2 Products

2.1 CONDUIT REQUIREMENTS

- .1 Minimum Size: 19 unless otherwise specified.
- .2 Underground Installations:
 - .1 More than 1525 from Foundation Wall: Use thick wall non-metallic conduit.
 - .2 Within 1525 mm from Foundation Wall: Use thick wall non-metallic conduit and thin wall non-metallic conduit.
 - .3 In or Under Slab on Grade: Use thick wall non-metallic conduit, and thin-wall non-metallic conduit.
 - .4 Minimum Size: 19.
- .3 Outdoor Locations, Above Grade: Use rigid steel.
- .4 In Slab Above Grade:
 - .1 Use thick wall non-metallic conduit.
 - .2 Maximum Size Conduit in Slab: 19 mm; 13 for conduits crossing each other.
- .5 Wet and Damp Locations: Use thick wall non-metallic conduit.
- .6 Dry Locations:
 - .1 Concealed: Use electrical metallic tubing and thick wall non-metallic conduit.
 - .2 Exposed: Use electrical metallic tubing and thick wall non-metallic conduit.

2.2 METAL CONDUIT

- .1 Rigid Steel Conduit: C22.2 No. 45.1.
- .2 Fittings and Conduit Bodies: Material to match conduit.

2.3 FLEXIBLE METAL CONDUIT

- .1 Description: Interlocked aluminum construction.
- .2 Fittings: CSA C22.2 No. 56.

2.4 LIQUID TIGHT FLEXIBLE METAL CONDUIT

- .1 Description: Interlocked aluminum construction with PVC jacket.
- .2 Fittings: CSA C22.2 No. 56.

2.5 ELECTRICAL METALLIC TUBING (EMT)

- .1 Description: CSA C22.2 N0. 83.1; galvanized tubing.
- .2 Fittings and Conduit Bodies: CSA C22.2 N0. 83.1; steel set screw type.

2.6 NON-METALLIC CONDUIT

- .1 Description: CSA C22.2 No. 211.1; Schedule 80 PVC.
- .2 Fittings and Conduit Bodies: CSA C22.2 No. 211.1.

2.7 NON-METALLIC TUBING

- .1 Description: CSA 227.1.
- .2 Fittings and Conduit Bodies: CSA 227.1.

Part 3 Execution

3.1 INSTALLATION

- .1 Install conduit to CSA C22.1.
- .2 Install non-metallic conduit to manufacturer's written instructions.
- .3 Arrange supports to prevent misalignment during wiring installation.
- .4 Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- .5 Group related conduits; support using conduit rack.
- .6 Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- .7 Fasten conduit supports to building structure and surfaces to Section 26 05 29.
- .8 Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports
- .9 Do not attach conduit to ceiling support wires.
- .10 Arrange conduit to maintain headroom and present neat appearance.
- .11 Route exposed conduit parallel and perpendicular to walls.
- .12 Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- .13 Route conduit in and under slab from point-to-point.
- .14 Do not cross conduits in slab.
- .15 Maintain adequate clearance between conduit and piping.
- .16 Maintain 300 mm clearance between conduit and surfaces with temperatures exceeding 40 degrees C.
- .17 Cut conduit square using saw or pipe cutter; de-burr cut ends.
- .18 Bring conduit to shoulder of fittings; fasten securely.
- .19 Join non-metallic conduit using cement as recommended by manufacturer.
 - .1 Wipe non-metallic conduit dry and clean before joining.
 - .2 Apply full even coat of cement to entire area inserted in fitting.
 - .3 Allow joint to cure for 20 minutes, minimum.

- .20 Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.
- .21 Install no more than equivalent of three 90-degree bends between boxes.
 - .1 Use conduit bodies to make sharp changes in direction, as around beams.
 - .2 Use hydraulic one-shot bender to fabricate bends in metal conduit larger than 50 mm size.
- .22 Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- .23 Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and expansion joints.
- .24 Provide suitable pull string in each empty conduit except sleeves and nipples.
- .25 Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- .26 Ground and bond conduit to Section 26 05 26.
- .27 Identify conduit to Section 26 05 53.

3.2 INTERFACE WITH OTHER PRODUCTS

- .1 Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Wall and ceiling outlet boxes.
- .2 Pull and junction boxes.

1.2 RELATED SECTIONS

- .1 Section 07 84 00 - Firestopping.
- .2 Section 08 31 13 - Access Doors And Frames.
- .3 Section 26 27 16 - Cabinets And Enclosures.

1.3 REFERENCES

- .1 CAN/CSA-C22.2 No. 18 - Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
- .2 CSA C22.1 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations
- .3 CSA C22.2 No. 18.1 (CSA/UL/ANCE) - Metallic Outlet Boxes.
- .4 CSA C22.2 No. 40 - Cutout, Junction and Pull Boxes.
- .5 CAN/CSA-C22.2 No. 85 - Rigid PVC Boxes and Fittings

1.4 SUBMITTALS FOR CLOSEOUT

- .1 Section 01 78 10: Submittals for project closeout.
- .2 Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.5 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by CSA (Canadian Standards Association) or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

Part 2 Products

2.1 OUTLET BOXES

- .1 Sheet Metal Outlet Boxes: CSA C22.2 No. 18, galvanized steel.
 - .1 Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 13 mm male fixture studs where required.
 - .2 Concrete Ceiling Boxes: Concrete type.
- .2 Non-metallic Outlet Boxes: CSA C22.2 No. 18.
- .3 Cast Boxes: CSA C22.2 No. 18, Type FD, aluminum. Provide gasketed cover by box manufacturer.
- .4 Wall Plates for Finished Areas: As specified in Section 26 27 26.

2.2 PULL AND JUNCTION BOXES

- .1 Sheet Metal Boxes: CSA C22.2 No. 18, galvanized steel.
- .2 Hinged Enclosures: As specified in Section 26 27 16.
- .3 Surface Mounted Cast Metal Box: CSA C22.2 No. 18, Type 4; flat-flanged, surface mounted junction box:

- .1 Material: Galvanized cast iron.
- .2 Cover: Provide with ground flange, neoprene gasket, and stainless steel cover screws.
- .4 In-Ground Cast Metal Box: CSA C22.2 No. 18, Type 6, inside flanged, recessed cover box for flush mounting:
 - .1 Material: Galvanized cast iron
 - .2 Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
 - .3 Cover Legend: "ELECTRIC".
- .5 Fibreglass Hand Holes: Die moulded glass fibre hand holes:
 - .1 Cable Entrance: Pre-cut 150 mm x 150 mm cable entrance at centre bottom of each side.
 - .2 Cover: Glass fibre weatherproof cover with non-skid finish.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

3.2 INSTALLATION

- .1 Install boxes to CSA C22.1.
- .2 Install in locations as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- .3 Set wall mounted boxes at elevations to accommodate mounting heights indicated or specified in section for outlet device.
- .4 Electrical boxes are shown on drawings in approximate locations unless dimensioned. Adjust box location up to 3m if required to accommodate intended purpose.
- .5 Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- .6 Maintain headroom and present neat mechanical appearance.
- .7 Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- .8 Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 150 mm from ceiling access panel or from removable recessed luminaries.
- .9 Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- .10 Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
- .11 Locate outlet boxes to allow luminaries positioned as shown on reflected ceiling plan.
- .12 Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- .13 Use flush mounting outlet box in finished areas.
- .14 Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- .15 Do not install flush mounting box back-to-back in walls; provide minimum 150 mm separation. Provide minimum 600 mm separation in acoustic rated walls.
- .16 Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- .17 Use stamped steel bridges to fasten flush mounting outlet box between studs.
- .18 Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- .19 Use adjustable steel channel fasteners for hung ceiling outlet box.
- .20 Do not fasten boxes to ceiling support wires.

- .21 Support boxes independently of conduit.
- .22 Use gang box where more than one device is mounted together. Do not use sectional box.
- .23 Use gang box with plaster ring for single device outlets.
- .24 Use cast outlet box in exterior locations exposed to the weather and wet locations.
- .25 Set floor boxes level.
- .26 Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.3 INTERFACE WITH OTHER PRODUCTS

- .1 Coordinate installation of outlet box for equipment connected under Section 26 05 80.

3.4 ADJUSTING

- .1 Section 01 73 00: Adjusting installed work.
- .2 Adjust floor box flush with finish flooring material.
- .3 Adjust flush-mounting outlets to make front flush with finished wall material.
- .4 Install knockout closures in unused box openings.

3.5 CLEANING

- .1 Section 01 73 00: Cleaning installed work.
- .2 Clean interior of boxes to remove dust, debris, and other material.
- .3 Clean exposed surfaces and restore finish.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Nameplates and labels.
- .2 Wire and cable markers.
- .3 Conduit markers.

1.2 RELATED SECTIONS

- .1 Section 09 91 10 - Painting.

1.3 SUBMITTALS

- .1 Submit to Section 01 33 00.
- .2 Product Data: Provide catalogue data for nameplates, labels, and markers.
- .3 Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.4 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.5 EXTRA MATERIALS

- .1 Provide to Section 01 73 00.
- .2 Provide two of each type.

Part 2 Products

2.1 NAMEPLATES AND LABELS

- .1 Nameplates: Engraved three-layer laminated plastic, black letters on white background.
- .2 Locations:
 - .1 Each electrical distribution and control equipment enclosure.
 - .2 Communication cabinets.
- .3 Letter Size:
 - .1 Use 3 mm letters for identifying individual equipment and loads.
 - .2 Use 6 mm letters for identifying grouped equipment and loads.
- .4 Labels: Embossed adhesive tape, with 5 mm white letters on black background. Use only for identification of individual wall switches and receptacles and control device.

2.2 WIRE MARKERS

- .1 Description: tape or tubing type wire markers.
- .2 Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- .3 Legend:

- .1 Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
- .2 Control Circuits: Control wire number indicated on schematic and interconnection diagrams on drawings.

2.3 CONDUIT MARKERS

- .1 Description: Field Paint.
- .2 Location: Provide markers for each conduit longer than 2 m.
- .3 Spacing: 6 m on centre.
- .4 Colour:
 - .1 120/208 Volt System: Grey.

Part 3 Execution

3.1 PREPARATION

- .1 Degrease and clean surfaces to receive nameplates and labels.

3.2 APPLICATION

- .1 Install nameplate and label parallel to equipment lines.
- .2 Secure nameplate to equipment front using adhesive.
- .3 Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- .4 Identify conduit using field painting to Section 09 91 10.
- .5 Paint coloured band on each conduit longer than 2 m.
- .6 Paint bands m on centre.
- .7 Colour:
 - .1 208 Volt System: Grey.
- .8 Identify underground conduits using underground warning tape. Install one tape per trench at 75 mm below finished grade.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

- .1 Section 01 10 00 - Summary of Work: Owner-provided equipment.
- .2 Section 22 47 00 - Plumbing Equipment.
- .3 Section 26 05 33 - Conduit.
- .4 Section 26 05 19 - Building Wire And Cable.
- .5 Section 26 05 34 - Boxes.

1.3 REFERENCES

- .1 CSA-C22.1-15 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations.
- .2 CSA-C22.2 No. 127-09 - Equipment and Lead Wires.
- .3 NEMA WD 6-2002 (R2008) - Wiring Devices - Dimensional Requirements.
- .4 NEMA WD 1-1999 (R2010) - General Colour Requirements for Wiring Devices.
- .5 CSA (Canadian Standards Association).
- .6 UL (Underwriters Laboratories Inc.)

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Obtain and review shop drawings, product data, and manufacturer's instructions for equipment provided under other sections.
 - .3 Determine connection locations and requirements.
- .3 Sequencing:
 - .1 Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
 - .2 Sequence electrical connections to coordinate with start-up schedule for equipment.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide wiring device manufacturer's catalogue information showing dimensions, configurations, and construction.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submission procedures.

- .2 Installation Data: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

Part 2 Products

2.1 CORDS AND CAPS

- .1 Attachment Plug Construction: Conform to WD 1.
- .2 Configuration: WD 6; match receptacle configuration at outlet provided for equipment.
- .3 Specify Type SJO (hard usage), Type SO (extra hard usage), or other special cord type as required.
- .4 Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit over-current protection.

Part 3 Execution

3.1 EXAMINATION

- .1 Section 01 70 00: Verify existing conditions before starting work.
- .2 Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

- .1 Make electrical connections to equipment manufacturer's written instructions.
- .2 Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- .3 Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- .4 Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.
- .5 Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- .6 Install disconnect switches, controllers, control stations, and control devices as indicated.
- .7 Modify equipment control wiring with terminal block jumpers as indicated.
- .8 Provide interconnecting conduit and wiring between devices and equipment where indicated.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Distribution panelboards.
- .2 Branch circuit panelboards.

1.2 RELATED SECTIONS

- .1 Section 26 05 26 - Grounding and Bonding.
- .2 Section 26 05 53 - Electrical Identification.

1.3 REFERENCES

- .1 CSA C22.1 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations
- .2 CSA C22.2 No.29 - Panelboards and Enclosed Panelboards.
- .3 NEMA AB1 - Moulded Case Circuit Breakers, Moulded Case Switches, and Circuit - Breaker Enclosures.
- .4 NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
- .5 NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- .6 NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittals for information.
- .2 Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 SUBMITTALS FOR CLOSEOUT

- .1 Section 01 73 00: Submittals for project closeout.
- .2 Record actual locations of panelboards and record actual circuiting arrangements in project record documents.
- .3 Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

- .1 Products: Listed and classified by CSA (Canadian Standards Association) or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 MAINTENANCE MATERIALS

- .1 Section 01 73 00.
- .2 Provide two of each panelboard key.

Part 2 Products

2.1 BRANCH CIRCUIT PANELBOARDS

- .1 Manufacturers:
 - .1 Schneider.
 - .2 Culter-Hammer.
 - .3 Siemens
 - .4 Substitutions: Refer to Section 01 61 00.
- .2 Description: CSA C22.2 No.29, circuit breaker type, lighting and appliance branch circuit panelboard.
- .3 Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- .4 Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt
- .5 Moulded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- .6 Enclosure: NEMA PB 1, Type 2.
- .7 Cabinet Front: Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray for 120/208V.

Part 3 Execution

3.1 INSTALLATION

- .1 Install panelboards to CSA C22.1.
- .2 Install panelboards plumb.
- .3 Height: 1800 mm to top of panelboard; install panelboards taller than 1800 mm with bottom no more than 100 mm above floor.
- .4 Provide filler plates for unused spaces in panelboards.
- .5 Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- .6 Provide engraved plastic nameplates under the provisions of Section 26 05 53.
- .7 Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 5 empty DN27. Identify each as SPARE.
- .8 Ground and bond panelboard enclosure according to Section 26 05 26.

3.2 FIELD QUALITY CONTROL

- .1 Section 01 43 00: Field inspection, testing and adjusting.

- .2 Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

3.3 ADJUSTING

- .1 Section 01 73 00: Adjusting installed work.
- .2 Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other.
- .3 Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Wall switches.
- .2 Receptacles.
- .3 Device plates and decorative box covers.

1.2 RELATED SECTIONS

- .1 Section 09 69 00 - Access Flooring: Access floor boxes.
- .2 Section 26 05 34 - Boxes.

1.3 REFERENCES

- .1 CSA C22.1 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations
- .2 CSA-C22.2 No.42 - General Use Receptacles, Attachment Plugs and Similar Devices.
- .3 CSA-C22.2 No.42.1 - Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
- .4 CSA-C22.2 No.55 - Special Use Switches.
- .5 CSA-C22.2 No.111 - General-Use Snap Switches (Bi-national standard, with UL 20).
- .6 C22.2 No. 184 – Solid State Lighting Controls.
- .7 C22.2 No. 184.1 - Solid-State Dimming Controls (Bi-National standard with UL 1472)

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Product Data: Provide manufacturer's catalogue information showing dimensions, colours, and configurations.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittals for information.
- .2 Submit manufacturer's installation instructions.

1.6 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

- .1 Provide products listed and classified by CSA (Canadian Standards Association) or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 EXTRA MATERIALS

- .1 Section 01 73 00.
- .2 Provide two of each style, size, and finish wall plate.
- .3 Provide two protective rings.

Part 2 Products

2.1 WALL SWITCHES

- .1 Manufacturers:
 - .1 Hubbell
 - .2 Substitutions: Refer to Section 01 61 00.
- .2 Description: CSA-C22.2 No.111, General-Duty, AC only general-use snap switch.
- .3 Body and Handle: White plastic with toggle handle.
- .4 Indicator Light: Lighted handle type switch; red colour lens.
- .5 Locator Light: Lighted handle type switch; red colour handle.
- .6 Ratings:
 - .1 Voltage: 120 volts, AC.
 - .2 Current: 15 amperes.

2.2 RECEPTACLES

- .1 Manufacturers:
 - .1 Hubbell
 - .2 Substitutions: Refer to Section 01 61 00.
- .2 Description: CSA-C22.2 No.42, General-duty general use receptacle.
- .3 Device Body: White plastic.
- .4 Configuration: Type as specified and indicated.
- .5 Convenience Receptacle: Type 5-15 or 5-20RA as indicated on the drawings.
- .6 GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

- .1 Decorative Cover Plate: White, smooth plastic.
 - .1 Hubbell
 - .2 Substitutions: Refer to Section 01 61 00.
- .2 Weatherproof Cover Plate: "In Use" hinged cover.
 - .1 Hubbell
 - .2 Substitutions: Refer to Section 01 61 00.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions prior to beginning work to Section 01 73 00.
- .2 Verify that outlet boxes are installed at proper height.
- .3 Verify that wall openings are neatly cut and will be completely covered by wall plates.
- .4 Delete the following paragraph if floor boxes are not used on project.
- .5 Verify that floor boxes are adjusted properly.
- .6 Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- .7 Use the following paragraph if access floor boxes are installed under this section.
- .8 Verify that openings in access floor are in proper locations.

3.2 PREPARATION

- .1 Provide extension rings to bring outlet boxes flush with finished surface.
- .2 Clean debris from outlet boxes.

3.3 INSTALLATION

- .1 Install to CSA C22.1.
- .2 Install devices plumb and level.
- .3 Install switches with OFF position down.
- .4 Install wall dimmers to achieve full rating specified and indicated after de-rating for ganging as instructed by manufacturer.
- .5 Do not share neutral conductor on load side of dimmers.
- .6 Install receptacles with grounding pole on bottom.
- .7 Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- .8 Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- .9 Use the following paragraph where higher quality terminations are required to suit project.
- .10 Connect wiring devices by wrapping conductor around screw terminal.
- .11 Use jumbo size plates for outlets installed in masonry walls.
- .12 Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- .1 Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights specified and indicated on drawings.
- .2 Install wall switch 1065mm above finished floor.
- .3 Install convenience receptacle 600 mm above finished floor.
- .4 Install convenience receptacle 150 mm above counter or backsplash of counter.
- .5 Install dimmer 1065mm above finished floor.
- .6 Install telephone jack 600 mm above finished floor.
- .7 Install telephone jack for side-reach wall telephone to position top of telephone at 1200mm above finished floor.
- .8 Install telephone jack for forward-reach wall telephone to position top of telephone at 1065mm above finished floor.

3.5 FIELD QUALITY CONTROL

- .1 Section 01 43 00: Field inspection, testing, adjusting, and balancing.
- .2 Inspect each wiring device for defects.
- .3 Operate each wall switch with circuit energized and verify proper operation.
- .4 Verify that each receptacle device is energized.
- .5 Test each receptacle device for proper polarity.
- .6 Test each GFCI receptacle and Arc fault devices for proper operation.

3.6 ADJUSTING

- .1 Section 01 73 00: Adjusting installed work.
- .2 Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- .1 Section 01 73 00: Cleaning installed work.
- .2 Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

PART 1 General

1.1 SECTION INCLUDES

- .1 Interior luminaires and accessories.
- .2 Exit signs.
- .3 Ballasts.
- .4 Fluorescent dimming ballasts and controls.
- .5 Fluorescent lamp emergency power supply.
- .6 Lamps.
- .7 Luminaire accessories.

1.2 RELATED SECTIONS

- .1 Section 23 82 00 - Terminal Heat Transfer Units: Air distribution accessories for air handling luminaires.

1.3 REFERENCES

- .1 ANSI/NEMA C78.379 - Classification of the Beam Patterns of Reflector Lamps.
- .2 CSA C22.1 - Canadian Electrical Code, Part I (23rd Edition), Safety Standard for Electrical Installations.
- .3 CSA C22.2 No. 9.0 - General Requirements for Luminaires
- .4 CSA C22.2 No. 250.0 - Luminaires (Bi-National Standard, with UL 1598)
- .5 CSA C22.2 No. 141 - Unit Equipment for Emergency Lighting
- .6 CAN/CSA-E920-98(R 2007) - Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements (Adopted IEC 920:1990, first edition, including Amendment 1:1993 and Amendment 2:1995, with Canadian deviations)
- .7 CAN/CSA-E928-98(R 2007) - Auxiliaries for Lamps - A.C. Supplied Electronic Ballasts for Tubular Fluorescent Lamps - General and Safety Requirements (Adopted IEC 928:1995, second edition, with Canadian deviations)
- .8 CAN/CSA-E61347-2-3-03(R 2008) - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps (Adopted CEI/IEC 61347-2-3:03(R2008), first edition, 2000-10, with Canadian deviations)
- .9 NEMA WD 6 - Wiring Devices - Dimensional Requirements.

1.4 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- .3 Product Data: Provide dimensions, ratings, and performance data.

1.5 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittals for information.
- .2 Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 SUBMITTALS FOR CLOSEOUT

- .1 Section 01 33 00 and 01 73 00: Submittals for project closeout.
- .2 Submit manufacturer's operation and maintenance instructions for each product.

1.7 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to requirements of CSA C22.1.
- .2 Products: Listed and classified by CSA (Canadian Standards Association) or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.9 EXTRA PRODUCTS

- .1 Section 01 73 00.
- .2 Provide two of each plastic lens type.
- .3 Provide one replacement lamps for each lamp type.
- .4 Provide two of each ballast type.

PART 2 Products

2.1 LUMINAIRES

- .1 Manufacturers:
 - .1 As indicated on the drawings.

2.2 EMERGENCY LIGHTING UNITS

- .1 Manufacturers:
 - .1 Emergi-Lite.
 - .2 Ready Lite
 - .3 Lumacell
 - .4 Substitutions: Refer to Section 01 61 00.
- .2 Description: Self-contained battery emergency lighting unit.
- .3 Battery: 12 volt, Nickel-Cadmium type, with 1 hour capacity.
- .4 Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
- .5 Lamps: 5W LED.
- .6 Remote Fixtures: 5W LED.
- .7 Housing: Steel with white hammer tone finish.
- .8 Indicators: Lamps to indicate AC ON and RECHARGING.
- .9 TEST Switch: Transfers unit from external power supply to integral battery supply.
- .10 Electrical Connection: Hardwired.
- .11 Input Voltage: 120 volts.

2.3 EXIT SIGNS

- .1 Manufacturers:
 - .1 Emergi-Lite.
 - .2 Ready Lite
 - .3 Lumacell
 - .4 Substitutions: Refer to Section 01 61 00.

- .2 Description: Exit sign fixture
- .3 Housing: Sheet steel.
- .4 Face: Steel stencil face with Green Running Man
- .5 Directional Arrows: Universal type for field adjustment.
- .6 Mounting: Universal, for field selection.
- .7 Lamps: LED Type.
- .8 Input Voltage: 120 volts.

2.4 FLUORESCENT BALLASTS

- .1 Description: High power factor type electromagnetic ballast, suitable for lamps specified.
- .2 Voltage: 120 volts.
- .3 Source Quality Control: Certify fluorescent ballast design and construction by Certified Ballast Manufacturers, Inc.

PART 3 Execution

3.1 INSTALLATION

- .1 Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- .2 Support luminaires larger than 600 x 1200 mm size independent of ceiling framing.
- .3 Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- .4 Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- .5 Install recessed luminaires to permit removal from below.
- .6 Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- .7 Install clips to secure recessed grid-supported luminaires in place.
- .8 Install wall mounted luminaires and exit signs at height as indicated on Drawings.
- .9 Install accessories provided with each luminaire.
- .10 Connect luminaires and exit signs to branch circuit outlets provided under Section 26 05 34 using flexible conduit.
- .11 Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- .12 Bond products and metal accessories to branch circuit equipment grounding conductor.
- .13 Install specified lamps in each exit sign and luminaire.

3.2 INTERFACE WITH OTHER PRODUCTS

- .1 Interface with air handling accessories provided and installed under Section 23 36 00.

3.3 FIELD QUALITY CONTROL

- .1 Section 01 43 00: Field inspection, testing, adjusting.
- .2 Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

- .1 Section 01 73 00: Adjusting installed work.
- .2 Aim and adjust luminaires as indicated.
- .3 Position exit sign directional arrows as indicated.

3.5 CLEANING

- .1 Section 01 73 00: Cleaning installed work.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosures.
- .4 Clean photometric control surfaces as recommended by manufacturer.
- .5 Clean finishes and touch up damage.

3.6 DEMONSTRATION AND INSTRUCTIONS

- .1 Section 01 73 00: Demonstrating installed work.
- .2 Demonstrate luminaire operation for minimum of two hours.

3.7 PROTECTION OF FINISHED WORK

- .1 Section 01 73 00: Protecting installed work.
- .2 Re-lamp luminaires that have failed lamps at Substantial Completion.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Exterior luminaires and accessories.

1.2 REFERENCES

- .1 CAN/CSA-C239-02 (R2007) Performance Standard for Dusk-to-Dawn Luminaires.
- .2 CAN/CSA- C22.2 No. 9.0-96 (R2006) General Requirements for Luminaires, E60598-2-3B-98(R2007) - Amendment 2:2002 to CAN/CSA-E60598-2-3-98, Luminaires - Part 2-3: Particular Requirements - Luminaires for Road and Street Lighting (Adopted Amendment 2:2000 to CEI/IEC 598-2-3:1993).
- .3 CAN/CSA-E61347-2-3-03 (R2008) - Lamp Controlgear - Part 2-3: Particular Requirements for A.C. Supplied Electronic Ballasts for Fluorescent Lamps (Adopted CEI/IEC 61347-2-3-03(R 2008) first edition, 2000-10, with Canadian deviations).
- .4 CAN/CSA-E922-98 (R2007) - Ballasts for Discharge Lamps (Excluding Tubular Fluorescent Lamps) - General Safety Requirements (Adopted IEC 922:1989, first edition, including Amendment 1:1990 and Amendment 2:1992, with Canadian deviations).
- .5 CSA C22.2 No. 9.0-96 (R2006) - General Requirements for Luminaires.
- .6 CAN/CSA-C239-02 (R2007) - Performance Standard for Dusk-to-Dawn Luminaires.
- .7 Reflector Lamps - Classification of Beam Patterns of Reflector Lamps.
- .8 IES RP-8 - Recommended Practice for Roadway Lighting.
- .9 IES RP-20 - Lighting for Parking Facilities.

1.3 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Procedures for submittals.
- .2 Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard Product of the manufacturer.
- .3 Product Data: Provide dimensions, ratings, and performance data.

1.4 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittals for information.
- .2 Test Reports: Indicate measured illumination levels.
- .3 Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 SUBMITTALS FOR CLOSEOUT

- .1 Section 01 73 00: Submittals for project closeout.
- .2 Maintenance Data: For each luminaire.

1.6 QUALIFICATIONS

- .1 Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.7 REGULATORY REQUIREMENTS

- .1 Products: Listed and classified by Canadian Standards Association or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Store and handle lighting poles to C22.2 No. 206.

1.9 COORDINATION

- .1 Refer to Section 01 31 00.
- .2 Provide bolt templates and pole mounting accessories to installer of pole foundations.

1.10 EXTRA PRODUCTS

- .1 Refer to Section 01 73 00.

Part 2 Products

2.1 LUMINAIRES AND ACCESSORIES

- .1 Manufacturers:
 - .1 As indicated on the drawings..
 - .2 Alternates must be submitted for approval 7 days prior to closing Complete with photometric layouts.
 - .3 Substitutions: Refer to Section 01 61 00.

2.2 LED Drivers

- .1 Description:
- .2 Voltage: 120-277 auto adjusting volts.
- .3 Source Quality Control: Certify CSA,RoHS Compliant

2.3 LAMPS

- .1 Lamp Types: As specified for luminaire. .

Part 3 Execution

3.1 INSTALLATION

- .1 Install lamps in each luminaire.
- .2 Bond luminaires and metal poles to branch circuit equipment grounding conductor.

3.2 FIELD QUALITY CONTROL

- .1 Section 01 43 00: Field inspection, testing and adjusting.
- .2 Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- .3 Measure illumination levels to verify conformance with performance requirements.
- .4 Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.3 ADJUSTING

- .1 Section 01 73 00: Adjusting installed work.
- .2 Aim and adjust luminaires to provide illumination levels and distribution

3.4 CLEANING

- .1 Section 01 73 00: Cleaning installed work.
- .2 Clean electrical parts to remove conductive and deleterious materials.
- .3 Remove dirt and debris from enclosure.
- .4 Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

- .1 Section 01 73 00: Protecting installed work.
- .2 Re-lamp luminaires which have failed lamps at Substantial Completion.

END OF SECTION

Notes:

- All specifications are referenced from The City of Red Deer Contract Specifications – 2017 Edition
- Any site work that is not covered by the sections listed below is to be completed in accordance with The City of Red Deer Contract Specifications – 2017 Edition

SECTION	NAME
01 57 13	TEMPORARY EROSION AND SEDIMENT CONTROL
02 41 14	ASPHALT PAVEMENT REMOVAL
31 22 13	ROUGH GRADING <ul style="list-style-type: none">• TOPSOIL STRIPPING• COMMON EXCAVATION• BORROW EXCAVATION• WASTE EXCAVATION
32 11 16	GRANULAR SUB-BASE
32 11 23	GRANULAR BASE COURSE
32 12 16	HOT-MIX ASPHALT CONCRETE PAVING
32 91 19	TOPSOIL PLACEMENT AND GRADING
32 92 19	MECHANICAL SEEDING

PWGSC

**Geotechnical Investigation
Pê Sâkâstêw Centre
Hobbema, AB**

Prepared by:

AECOM

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Calgary, AB, Canada T2H 2V6
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403 254 3301 tel
403 270 9196 fax

Project Number:

60289799

Date:

July, 2013

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report (collectively, the "Information"):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represents Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Consultant shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. Consultant accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

Consultant agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but Consultant makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by Consultant represent Consultant's professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since Consultant has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, Consultant, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

GENERAL STATEMENT NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to the suitability of the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. The description of the project represents an understanding of the significant aspects of the project relative to the design and construction of earth work, foundations, and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, AECOM Canada Ltd. should be given the opportunity to review the changes and to modify or reaffirm, in writing, the conclusions and recommendations of this report.

The analyses and recommendations represented in this report are based on the data obtained from the testholes drilled at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere on the site are not significantly different from those encountered at the testhole locations. However, variation in the soil conditions between the testholes may exist. Also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions different from those encountered in the exploratory borings are observed or encountered during construction, or appear to be present beneath or beyond excavations, AECOM Canada Ltd. should be advised at once so that the conditions can be observed and reviewed and, where necessary, the recommendations reconsidered.

Since it is possible for conditions to vary from those identified at the testhole locations and from those assumed in the analysis and preparation of recommendations, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications, or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, it is recommended that all construction operations dealing with earthwork and the foundations be observed by an experienced geotechnical engineer. In addition, it is recommended that a qualified geotechnical engineer review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in the report.

July 29, 2013

Mr. Yvon Labrecque
Lead Project Manager
Public Works and Government Services Canada
5th Floor, Telus Plaza North
10025 Jasper Avenue North
Edmonton, Alberta
T5J 1S6

Dear Mr Labrecque:

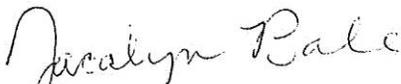
Project No: 60289799
**Regarding: Geotechnical Investigation - Pê Sâkâstêw Centre
Hobbema, Alberta**

This report presents the results of a geotechnical investigation conducted by AECOM Canada Ltd. at the Pê Sâkâstêw Centre located in Hobbema, Alberta. The objective of the investigation was to determine the subsurface soils at the site and thickness of the existing gravel pavement structure, and provide recommendations for the asphalt pavement structures for parking lots, perimeter road and pathways.

This report provides a summary of the subsurface conditions and engineering properties of the soils encountered at the site, and provides recommendations for pavement structure.

If you have any questions concerning this report please do not hesitate to contact the undersigned at (780)-930-3535.

Sincerely,
AECOM Canada Ltd.



Jacalyn Bale, BEng, EIT
Junior Geotechnical Engineer
jacalyn.bale@aecom.com

JB:am
Encl.

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	Jacalyn Bale	July 11, 2013	Draft report issued for review.
2	Jacalyn Bale	July 16, 2013	Draft report issued for review
3	Anwar Majid	July 29, 2013	Final Report

AECOM Signatures

Report Prepared By:

Jacalyn Bale

Jacalyn Bale, BEng, EIT
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Anwar Majid
July 29/2013

Report Reviewed By:

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PERMIT TO PRACTICE AECOM CANADA LTD.	
Signature	<i>J. Bale</i>
Date	<i>July 29/2013</i>
PERMIT NUMBER: P 10450	
The Association of Professional Engineers and Geoscientists of Alberta	

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Appendices

- Appendix A. AECOM (2008) - Geotechnical Recommendations for Pê Sâkâstêw Centre Site Paving (Project Number: 2977-373-00, dated November 6, 2008).
Appendix B. Testhole Logs
Appendix C. Laboratory Test Results

1. Introduction

1.1 General

This report presents the results of a geotechnical investigation conducted by AECOM Canada Ltd. (AECOM) at the Pê Sâkâstêw Centre in Hobbema, Alberta. The report also provides recommended asphalt pavement structures for the existing and new parking lots, existing perimeter road, and pathways. The location of the site is shown on **Figure 1**.

It is understood that the existing perimeter road has a gravel pavement. Public Works and Government Services Canada (PWGSC) intends to pave the gravel perimeter road and parts of existing gravel parking lot with asphalt.

The objective of the investigation was to determine subsurface soil conditions and gravel thickness at the existing parking lots and perimeter road, and provide recommended asphalt pavement structure for the new and existing parking lots and existing perimeter road.

This report is subject to general statement regarding normal variable of subsurface conditions provided in this report.

1.2 Project Details

The project consists of asphalt pavements for a new parking lot, extension of an existing gravel surfaced parking lot, existing gravel perimeter road, and pathways. The locations of the proposed new parking lot, proposed parking lot extension, and the perimeter road are shown on **Figure 2**.

The gravel thickness at the perimeter roads and existing parking lot is variable. Based on the results of the site investigation and recommended pavement structure it will be determined during construction if the existing gravel structure is sufficient as subbase course or additional gravel will need to be placed prior to constructing the base course and asphalt surface.

1.3 Scope of Work

The scope of work for this task was provided in our proposal dated April 18, 2013. The scope of work included the following tasks:

- Coordinate with Alberta One Call to determine the location of underground utilities proximate to the proposed drilling sites;
- Conduct a site investigation consisting of one day of drilling to determine the subsurface soil conditions and the existing pavement structure by drilling 6 testholes to depths of 2 m;
- Conduct laboratory testing on select soil samples to determine soil index and engineering properties; and,
- Prepare a geotechnical report that presents the findings of the site investigation and laboratory testing, and provides pavement design recommendations for the parking lot and perimeter road.

2. Method of Investigation

2.1 Review of Available Information

AECOM previously conducted a site investigation at the site (AECOM 2008). This report was reviewed prior to conducting the site investigation. The report is provided in **Appendix A**. The estimated locations of the testholes drilled by AECOM (2008) at the site are shown on **Figure 2**.

2.2 Utility Locates

Prior to conducting the site investigation, Alberta One Call was contacted to locate any buried utilities near the testhole locations. A private locator (Ivis Inc.) was also contracted to locate the private utilities at the site (with the exception of waterlines).

The water source for the centre is a private well; input for the locations of existing waterlines was provided by Warren Buffalo, Chief Engineering and Maintenance at Pê Sâkâstêw Centre.

2.3 Site Investigation

The site investigation was conducted on June 7, 2013 by Jacalyn Bale, EIT of AECOM. The site investigation consisted of drilling testholes using a truck mounted auger rig operated by Canadian Geological Drilling Ltd. of Edmonton, Alberta. The drill rig was equipped with solid and hollow stem augers.

A total of 7 testholes were drilled at the site. The testhole locations are shown on **Figure 2**. The location and depths of the testholes are summarized in **Table 2-1**.

Table 2-1: Summary of Testhole Locations and Depths

Testhole	Depth (m)	Location
TH13-01 and TH13-07	2.74	Proposed Visitor Parking Lot
TH13-02	2.74	Proposed Parking Lot Extension
TH13-03, TH13-04 and TH13-05	2.74 – 3.51	Perimeter Road
TH13-06	2.74	Existing Asphalt Parking Lot

Testholes were logged based on drilling behaviour and visual observations of the returned drill cutting. The soils were classified using the modified Unified Soil Classification (USC) system. Disturbed samples including grab samples and Standard Penetration Test (SPT) split-spoon samples were collected at regular intervals. Seepage was observed in testhole TH13-06 and groundwater was observed at the base of testholes TH13-06 and TH13-07. The testholes were backfilled after completion with drill cuttings and capped with bentonite chips or asphalt cold patch. Testhole logs are provided in **Appendix B**.

2.4 Laboratory Testing

Soil samples collected during the site investigation were sent to AECOM's Calgary Materials Testing Laboratory for soil classification and determination of engineering properties. The laboratory testing included the determination of moisture contents, grain size distributions (sieve and hydrometer analyses), Atterberg limits, standard Proctor maximum dry density (SPMDD) and optimum moisture contents (OMC), and California Bearing Ratio (CBR). The

laboratory test results are shown on the testhole logs and are also presented separately in **Appendix C**. A summary of the number and type of soil tests is provided in **Table 2-2**.

Table 2-2: Summary of Laboratory Tests

Test	Number	Remarks
Moisture Content	25	Test conducted on all samples
Grain Size Distribution	2	Hydrometer or sieve analysis
Atterberg Limits	2	Determination of plastic and liquid limits, and plasticity index
Standard Proctor	1	Determination of SPMDD and OMC
CBR	1	Determination of compacted subgrade California Bearing Ratio; used in pavement design

3. Subsurface Conditions

3.1 General

The subsurface stratigraphy was generally consistent across the site. In unpaved areas topsoil was encountered at the surface underlain by organic clay. In paved areas gravel or asphalt underlain by gravel was encountered at the surface. Clay was encountered below the topsoil/organic clay and pavement structure in all testholes.

Detailed descriptions of the soils encountered at the testhole locations are provided in the testhole logs in **Appendix B**. A description of the terms and symbols used on the logs is also included in **Appendix B**. The testhole locations are shown on **Figure 2**.

3.1.1 Asphalt

A layer of asphalt was encountered at the surface of testholes TH13-02 and TH13-06 drilled on an existing asphalt pavement structure. Thickness of asphalt was 50 mm and 60 mm in TH13-02 and TH13-06, respectively.

3.1.2 Gravel

Gravel was encountered in all testholes drilled on the paved areas (existing perimeter road and proposed parking lot extension). In some locations the gravel was silty or clayey, this gravel is described in **Section 3.1.2.1**. In other areas the gravel was well graded; this gravel is discussed in **Section 3.1.2.2**.

3.1.2.1 Silty/Clayey Gravel

A layer of silty or clayey gravel with some sand was encountered at the surface of testholes TH13-01 and TH13-04 with thicknesses of 300 mm and 150 mm, respectively. The gravel was poorly graded, brown, moist to damp, and compact. Moisture content was determined for one sample of silty gravel from testhole TH13-01; the sample had a moisture content of 17.6 %.

Based on observations during drilling the gravel is classified as silty gravel or clayey gravel (USC = GM, GC).

3.1.2.2 Well Graded Gravel

A layer of well graded gravel was encountered in testholes TH13-02, TH13-03, TH13-05 and TH13-06 with thickness ranging from 400 mm to 675 mm. The gravel was sandy with trace silt and trace clay. The gravel was brown, damp to moist, and compact. Sieve analysis was conducted on one sample of well graded gravel from testhole TH13-02. The sample had 53 % gravel, 36 % sand and 11 % silt/clay.

Moisture content of three samples ranged from 3.5 % to 5.8 % with an average of 4.4 %. Based on observations during drilling the gravel is classified as well graded gravel (USC = GW).

3.1.3 Topsoil and Organic Clay

A layer of topsoil was encountered at the surface of testholes TH13-07 underlain by a layer of organic clay. The topsoil was 300 mm thick, and the underlying layer of organic clay was 150 mm thick. The organic clay was black, dark grey, and brown. Moisture content of a sample from organic clay and was 25%.

3.1.4 Clay

Clay was encountered in all testholes underlying the gravel or organic clay and was the main soil unit encountered at the site. The clay was silty and sandy with trace gravel, and trace alkali and coal inclusions. Occasionally the clay contained pockets of fine grained sand or laminations of silty clay. The clay was described as firm to stiff, brown to grey, with occasional grey or reddish brown mottling. SPT "N" blow counts ranged from 5 to 17 with an average of 10 indicating the clay is firm to very stiff.

Moisture tests were determined for 18 samples and Atterberg limits were determined for two samples. The results are summarized in **Table 3-1**.

Table 3-1: Summary of Atterberg and Moisture Contents – Clay

	Minimum (%)	Maximum (%)	Average (%)
Liquid Limit	24.1	34.3	29.2
Plastic Limit	14.8	16.6	15.7
Moisture Content	9.4	31.8	20.0

A CBR test and standard Proctor test was conducted on one combined clay sample from testholes TH13-04 and TH13-05. The results are summarized in **Table 3-2**.

Table 3-2: Summary of CBR and Standard Proctor Test Results – Combined Clay Sample

Testholes	Soaked CBR (%)	Unsoaked CBR (%)	SPMDD (kg/m ³)	OMC (%)	Moisture Content (%)
TH13-04 and TH13-05	4.3	5.0	1822	14.2	16.5

Grain size distribution and Atterberg limits were also determined for the combined clay sample from testholes TH13-04 and TH13-05. The results are summarized in **Table 3-3**.

Table 3-3: Particle Size Distribution and Atterberg Limits – Combined Clay Sample

Testholes	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)
TH13-04 and TH13-05	0	28.8	44.2	27.0	34.3	16.6

Although the grain size distribution indicates the clay contains mainly silt sized particles, based on the Atterberg limits and observations during drilling the clay is classified as low to medium plastic, or low plastic clay (USC = CL, CL-CI, CI).

3.1.5 Sand

A layer of sand was encountered below the clay in testhole TH13-03. The sand extended from a depth of 2.6 m to the termination depth of the testhole (2.74 m). The sand was silty, contained trace clay, was brown, fine grained, saturated and loose. Moisture content was determined for one sample and was 20 %. Based on observations during drilling the sand is classified as silty sand (USC = SM).

4. Pavement Recommendation

4.1 Asphalt Pavement Design – Parking Lots and Perimeter Road

4.1.1 General

The pavement structure was designed following the procedure outlined in Alberta Transportation (AT) Pavement Design Manual which is based on AASHTO Design Guide (1993). With this method the thickness of the different pavement layers can be calculated using the design traffic/design Equivalent Single Axle Loads (ESALs), and Resilient Modulus (M_R) of the subgrade soils.

4.1.2 Design Traffic

The traffic data for the site was not available during preparation of this report; therefore, it was assumed that the pavement will be subject to moderate traffic level (50,000 ESALs or less) for a design life of 25 years.

4.1.3 Subgrade Resilience Modulus

The subgrade resilient modulus was calculated using a CBR value of 4 and an empirical equation provided in AASHTO Guide for Design of Pavement Structures (AASHTO 1993). The resilient modulus was calculated to be approximately 40 MPa.

4.1.4 Layer Coefficients

Structural layer coefficients are required for flexible pavement design. The layer coefficients provided in **Table 4-3** were used in the pavement design.

Table 4-1: Structural Layer Coefficients

Pavement Component	Structural Layer Coefficient
Asphalt	0.40
Crushed Gravel	0.14
Pit Run Gravel	0.10

4.1.5 Structural Number

The Structural Number was calculated using design charts for resilient modulus of 40 MPa provided in the AT Pavement Design Guide, and a reliability of 85 %. A Structural Number of 60 mm was calculated using this approach.

4.1.6 Recommended Asphalt Pavement Structures

The thickness of different pavement layers was calculated using equations and layer coefficients provided in the AT Pavement Design Guide. The recommended pavement structure is provided below:

- Asphalt - 75 mm Asphalt
- Granular Base Course (Crushed Gravel - AT Des. 2 Cl. 25) - 150 mm
- Granular Subbase Course (Pit Run Gravel - AT Des. 6 Cl. 80) - 200 mm
- Prepared subgrade

4.2 Asphalt Pavement - Pathways

The subgrade for the pathways should be prepared in accordance with our recommendations in **Section 4.3.1** prior to construction of asphalt pavement. The following structure is recommended for the pathways.

- Asphalt - 75 mm Asphalt
- Granular Base Course (Crushed Gravel - AT Des. 2 Cl. 25) - 250 mm

4.3 Subgrade Preparation

4.3.1 New Pavement Areas (Proposed New Parking Lot - TH13-01 and TH13-07)

Approximately 450 mm thick topsoil and organic clay was encountered at the new parking lot location. The surficial topsoil, organic clay, any soft/wet soils and unsuitable soils should be completely removed from the pavement footprint. The exposed subgrade, after removal of the existing pavement structure, should be scarified to a depth of 150 mm and compacted to at least 98 % of the SPMDD. After compaction the subgrade should be proof-rolled to identify any soft spots. The soft spots should be subcut to a minimum depth of 0.6 m and backfilled with pit run gravel compacted to 98 % of the SPMDD. The native inorganic clay excavated from the site can be used for backfilling the soft spots provided that all deleterious materials are removed and the material is placed at acceptable moisture content (± 2 % of the OMC). The prepared subgrade should be graded to drain towards catch basin locations.

Preparation of the subgrade should be carried out within restricted areas. This is to avoid loosening of the prepared areas by site traffic before placement and compaction of the granular material. The subgrade should not be exposed to precipitation and frost.

Observation of compaction and asphalt laying operations should be carried out by qualified personnel.

4.3.2 Existing Gravel Pavement Areas (Parking Lot Extension and Perimeter Road)

It is understood that the existing gravel structure will be left in place as subbase course. The gravel thickness is variable at the site; therefore, thickness of the existing gravel should be confirmed during construction prior to pavement construction. The existing gravel structure consists of pit run gravel. At locations where existing pit run gravel is less than minimum recommended 200 mm thick subbase course, additional pit run should be placed to meet the minimum recommended thickness of 200 mm. At locations where gravel thickness is greater than 200 mm, the extra gravel thickness can be removed. The surplus gravel can be re-used at site as subbase course.

Prior to placing additional pit run gravel, the existing gravel subbase course should be scarified and re-compacted to at least 98 % of the SPMDD within 2 % of the OMC. Any additional pit run gravel to be placed should also be compacted. The prepared subbase course should be proof-rolled to identify any soft spots. The soft spots should be subcut to a minimum depth of 0.6 m and backfilled with pit run gravel compacted to 98 % of the SPMDD.

The base course can be placed on prepared subbase course after proof rolling and repair of weak spots. Observation of compaction and asphalt laying operations should be carried out by qualified personnel.

4.4 Fill Placement and Compaction

The materials used to achieve the design grades should comprise general engineered fill. The general engineered fill should comprise clean, well-graded granular soils or inorganic low plastic clay soils. Fill materials should be placed in compacted lifts not exceeding 200 mm in thickness. General engineered fills should be compacted to a minimum of 98 % of maximum density.

The granular subbase and base course should be placed in compacted lifts not exceeding 200 mm in thickness and should be compacted to a minimum compaction of 98 % of the SPMDD.

4.5 Site Drainage and Erosion Control

The road should be crowned or super-elevated to a minimum of 2 % to shed water to the adjacent ditches. Gradients less than 2 % may result in poor drainage and ponding that may cause pavement failure.

The native soils in the area are erosion susceptible therefore ditch gradients in excess of 2 % may cause ditch erosion and ditch gradient less than 0.5 % may result in inadequate longitudinal drainage. The longitudinal gradients less than 0.5 % may also result in localized ponding, growth of aquatic plants, odour from stagnant water, and insects. The lower longitudinal gradient will reduce erosion but will result in increased silt deposition within the ditches.

Erosion protection for ditch slopes can be provided through the application of a layer of topsoil and grass seed. Erosion protection mats may be required to reduce ditch erosion in the short term. Silt fences may also be required during construction to reduce silt flow into the water bodies.

5. References

AECOM 2008

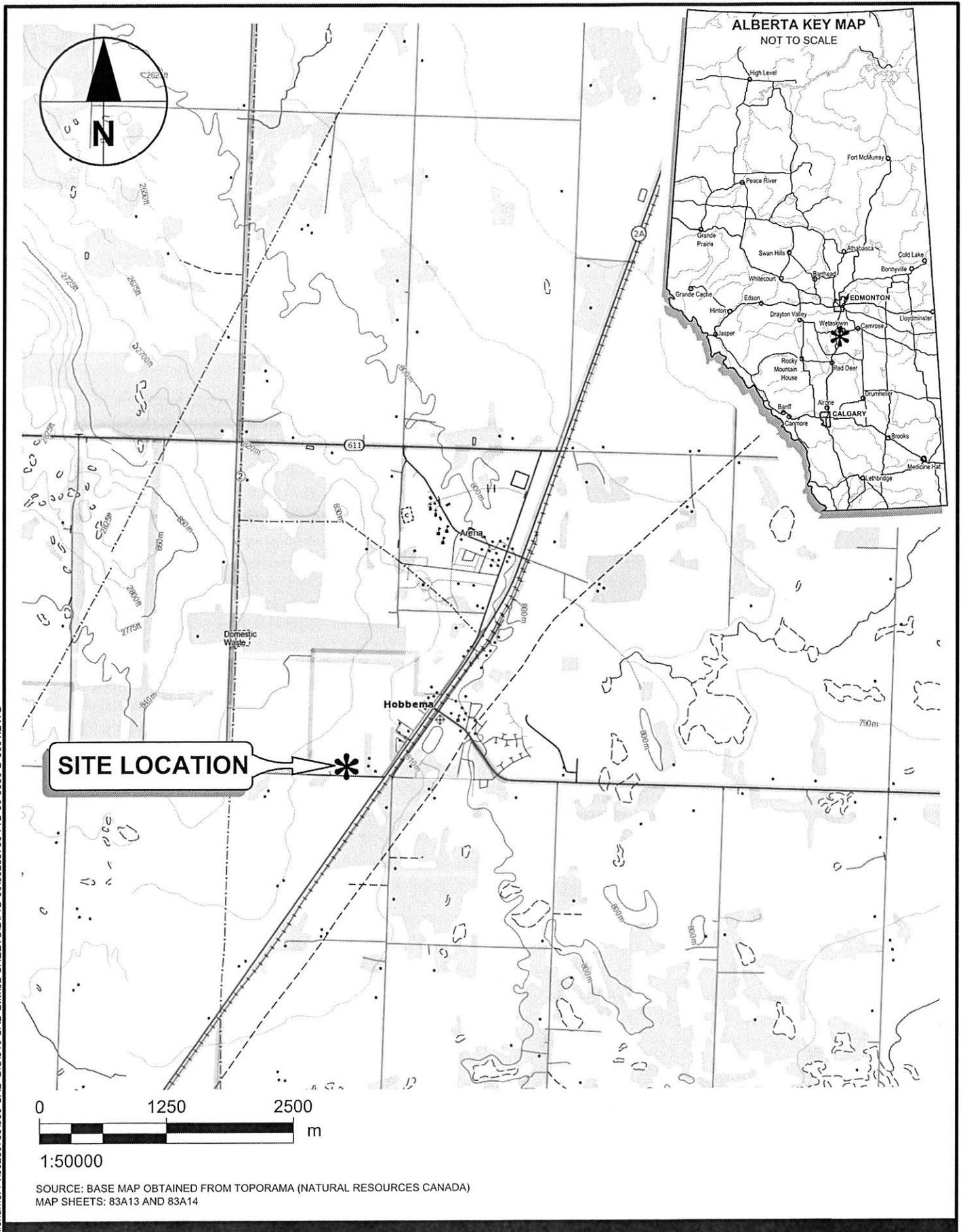
Geotechnical Recommendations for Pê Sâkâstêw Centre Site Paving – Project Number: 2977-373-00, dated November 6, 2008).

AASHTO 1993.

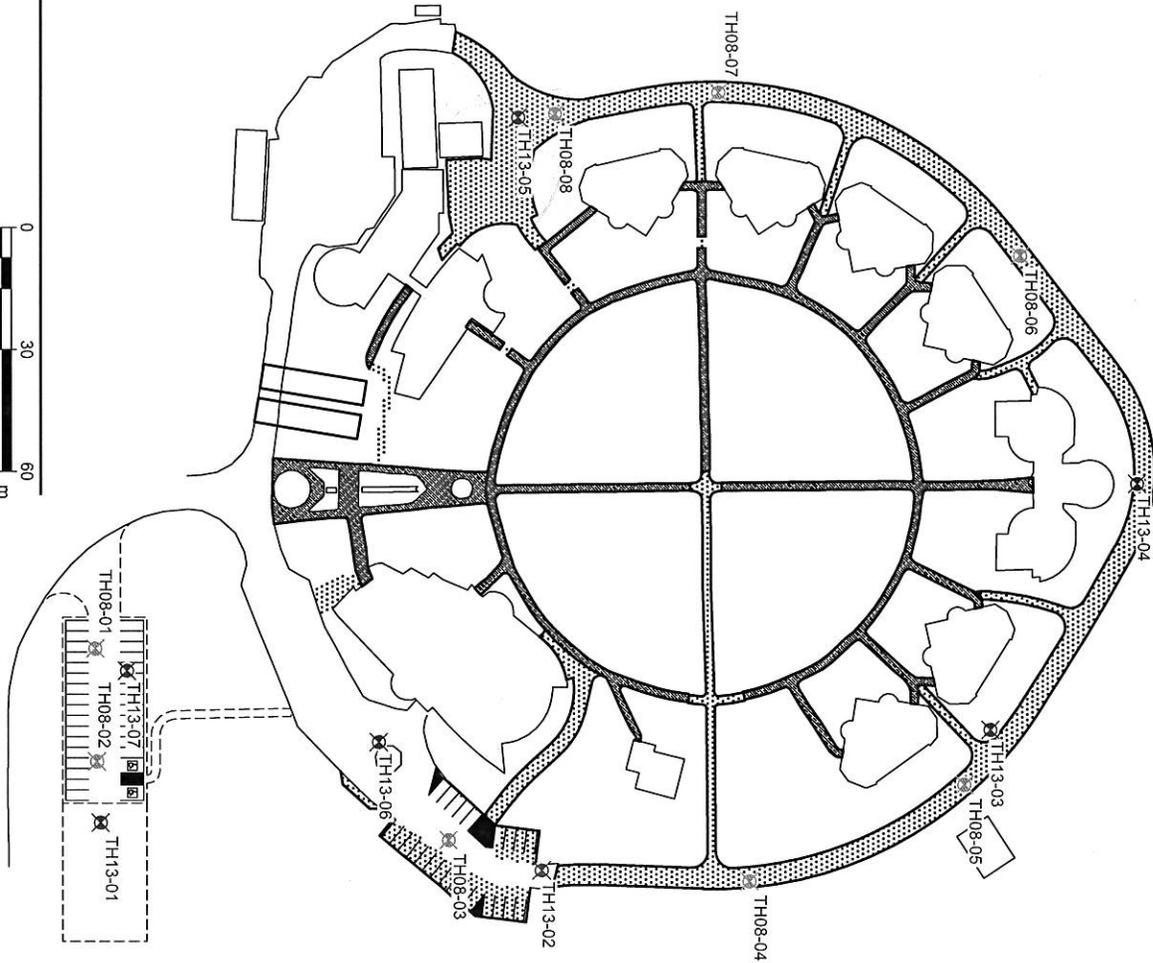
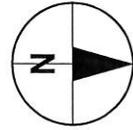
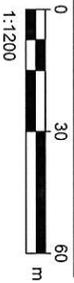
AASHTO Guide for Design of Pavement Structures. American Association of State Highway and Transportation Officials (January 1993).

Figures

- Figure 1 Site Location Plan
- Figure 2 Testhole Location Plan



- LEGEND**
- ☒ TESTHOLE LOCATION (AECOM 2013)
 - ☒ ESTIMATED TESTHOLE LOCATION (AECOM 2008)



Appendix A

**AECOM (2008) – Geotechnical
Recommendations for
Pe Saskastew Site Paving.
(Project No. 2977-373-00,
dated Nov 6, 2008)**

AECOM
17007 – 107th Avenue, Edmonton, AB, Canada T5S 1G3
T 780.486.7000 F 780.486.7070 www.aecom.com

November 6, 2008

Project Number: 2977-373-00

Mr Steve Phypers
Public Works and Government Services Canada
c/o Bowden Institution
Highway 2 South
Innisfail, AB T46 1V1

Dear Mr Phypers:

Re: Pe Sakastew Site Paving - Geotechnical Recommendations

1.0 Introduction

Public Works and Government Services Canada (PWGSC) required geotechnical services to assist in the pavement design for the proposed parking lot and existing perimeter roads for the Pe Sakastew Institution located in Hobbema, Alberta. An intrusive geotechnical investigation was designed and executed to determine the underlying ground conditions.

2.0 Geotechnical Investigation

Mobile Augers and Research Ltd. were contracted under the supervision of UMA Engineering Ltd. (UMA) to conduct the investigation, which commenced on September 5, 2008 once an Alberta-1-Call had been carried out. A total of eight boreholes were drilled with a solid stem auger rig to depths between 2.0 and 4.3 metres below ground surface (mBGS). In-situ Standard Penetration Tests (SPT) were performed within each borehole and grab samples and SPT split spoon samples were retrieved for moisture content testing and visual classification.

Exploratory boreholes TH08-01 and TH08-02 were drilled at the location of the proposed parking lot whereas boreholes TH08-03 to TH08-08 were set out such that geotechnical information could be obtained for the existing gravel perimeter roads. Results from in-situ and geotechnical laboratory tests are noted on the logs attached in Appendix A.

The investigation has indicated that the gravel layer may be suitable to found the pavement structure once proof rolled. However, to tie into the existing asphalt elevation a sub-cut may be required and a tie in length of 500 mm is recommended. Soft and/or loose material within the clay fill and clay till strata may exist beneath the gravel layer if a sub-cut is required and this is not suitable as sub-grade and can either be proof rolled or stripped, thus providing a suitable firm founding stratum to assist in limiting any future settlement and prevent bearing capacity failure.

The founding stratum shall be inspected by an experienced geotechnical engineer prior to pavement construction, which will consist of a granular sub-base, base course and asphalt surfacing. The following thicknesses have been based on a CBR value of 3 and inherent properties shall be further defined within the technical specifications.

- Asphalt 75 mm;
- Base course 150 mm; and
- Existing Perimeter Road Gravel 150 mm.

4.3 Walking Paths

With reference to the topographical survey and visual inspection of these areas, it was noted that a thin veneer of raveling asphalt is present at some locations over a granular base. It is proposed the existing asphalt be removed and the underlying granular base is proof rolled to provide a suitable subgrade to found the pavement structure. This founding stratum shall be inspected by an experienced geotechnical engineer insitu density tests be conducted with a nuclear densometer prior to pavement construction.

The following structure is recommended to provide longevity and protection against frost heave.

- Asphalt 75 mm;
- Base course 250 mm.

A lesser structure can be recommended if a maintenance programme is to be adopted.

Please do not hesitate to contact us if you have any questions.

Sincerely,

UMA Engineering Ltd. doing business as AECOM

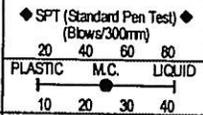


Karan Jalota, BEng (HONS) DIS
karan.jalota@aecom.com

KJ:sm

PROJECT: Pe Sakastew Site Paving		CLIENT: PWGSC	TESTHOLE NO.: TH08-01
LOCATION: Proposed Parking Lot		PROJECT NO.: 2977-373-00	
CONTRACTOR: Mobile Augers and Research Ltd.		METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON
		<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY
			<input type="checkbox"/> CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	OL		TOPSOIL (610mm) - silty, soft, damp, black.					
1	CI		CLAY (FILL) - silty, medium plastic, firm to stiff, damp, mottled grey and brown. - sandy, silty.		1			1
2	CI		- less sand.		2	11		2
3	CI		CLAY TILL - some silt, some sand, trace gravel, firm to stiff, medium plastic, damp.		3			3
4	CI		- trace coal, trace white inclusions, trace oxidation, stiff to very stiff.		4	9		4
5			End of testhole at 4.27 mbgs. - no water upon completion.		5			5
6					6	17		6
7								7
8								8
9								9
10								10



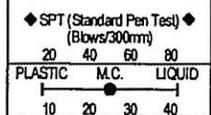
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UMA | AECOM

LOGGED BY: DJW	COMPLETION DEPTH: 4.27 m
REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-02
LOCATION: Proposed Parking Lot		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	OL	[Vertical Lines]	TOPSOIL (610mm) - clayey, soft to firm, damp, black, trace rootlets.					
1	CI	[Diagonal Lines]	CLAY (FILL) - silty, some sand, medium plastic, soft to firm, damp, mottled grey and brown.	<input checked="" type="checkbox"/>	1			1
2	CI	[Diagonal Lines]	CLAY TILL - sandy, some silt, trace gravel, medium plastic, stiff, moist, brown, trace oxidation, trace white inclusions.	<input checked="" type="checkbox"/>	2	5		2
3	CI	[Diagonal Lines]	- mottled grey and brown.	<input checked="" type="checkbox"/>	3			3
4	CI	[Diagonal Lines]	- trace coal.	<input checked="" type="checkbox"/>	4	13		4
5			End of testhole at 4.27 MBGS. - no water upon completion.	<input checked="" type="checkbox"/>	5			5
6				<input checked="" type="checkbox"/>	6	13		6



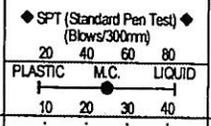
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UMA | AECOM

LOGGED BY: DJW	COMPLETION DEPTH: 4.27 m
REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	Page 1 of 1

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-03
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
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DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (455mm)- sandy, well graded, moist, compact, brown.					
0.5	CI		CLAY TILL - silty, some sand, trace gravel, medium plastic, moist, stiff, brown, trace coal, trace white inclusions, trace oxidation.		1			1
1.98			End of testhole at 1.98 mBGS. - no water upon completion.		2	10		2



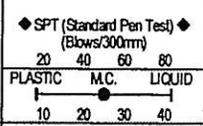
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UMA | AECOM

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REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-04
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
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DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (1.1m) - sandy, well graded, moist, compact, brown.					
1	CI		CLAY TILL - silty, trace sand, trace gravel, medium plastic, stiff, damp, brown.		1			1
2			End of testhole at 1.98 mBGS. - no water upon completion.		2	9		2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10



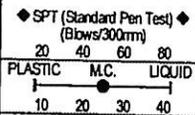
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REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	Page 1 of 1

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-05
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
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DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (300mm) - sandy, well graded, moist, compact, brown.					
0			CLAY (FILL) - sandy, some silt, medium plastic, soft to firm, moist, trace coal, trace oxidation, mottled grey and brown.					
1	CI				1			1
2					2	5		2
			End of testhole at 1.98 mBGS. - no water upon completion.					

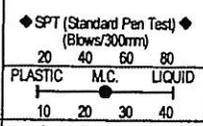


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	REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
	PROJECT ENGINEER: Karan Jalota	Page 1 of 1

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-06
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
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DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (150mm) - sandy, well graded, moist, compact, brown.					
0			CLAY TILL - some silt, some sand, trace gravel, medium plastic, firm to stiff, moist, mottled brown and grey, trace coal, trace oxidation, trace white inclusions.					
1	C		- stiff to very stiff.		1			1
2			End of testhole at 1.98 mBGS. - no water upon completion.		2	15		2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10



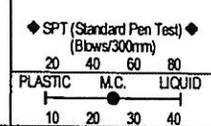
LOG OF TESTHOLE PE SAKASTEWINSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 BY:

UMA | AECOM

LOGGED BY: DJW	COMPLETION DEPTH: 1.98 m
REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-07
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (150mm) - sandy, well graded, moist, compact, brown.					
0			CLAY TILL - silty, some sand, trace gravel, medium plastic, stiff, moist, mottled grey and brown, trace coal, trace oxidation, trace white inclusions.					
1	CI		- stiff to very stiff.		1			1
2			End of testhole at 1.98 mBGS. - no water upon completion.		2	15		2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10



LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

UMA | AECOM

LOGGED BY: DJW	COMPLETION DEPTH: 1.98 m
REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-08
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

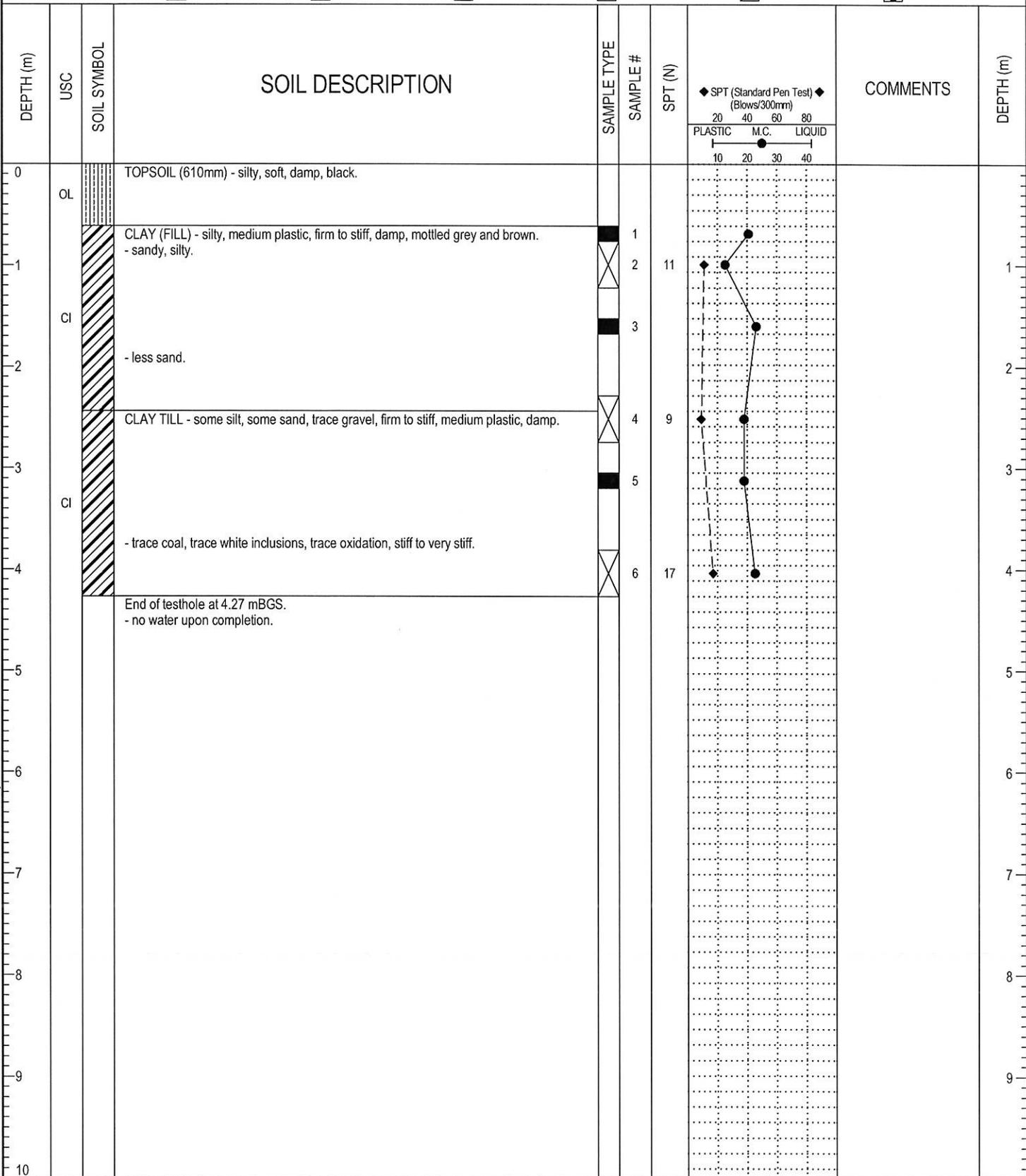
DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	PLASTIC	M.C.	LIQUID	COMMENTS	DEPTH (m)
0	GW		GRAVEL (300mm) - sandy, well graded, moist, compact, brown.								
	CI		CLAY (FILL) - silty, some sand, medium plastic, moist to wet, mottled grey and brown.								
1	CI		CLAY TILL - silty, sandy, trace gravel, medium plastic, stiff, moist, mottled grey and brown, trace coal, trace oxidation, trace white inclusions.		1						1
2	CI		CLAY TILL - silty, sandy, trace gravel, medium plastic, stiff, moist, mottled grey and brown, trace coal, trace oxidation, trace white inclusions.		2	10					2
2			End of testhole at 1.98 mBGS. - no water upon completion.								2
3											3
4											4
5											5
6											6
7											7
8											8
9											9
10											10

LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

UMA | AECOM

LOGGED BY: DJW	COMPLETION DEPTH: 1.98 m
REVIEWED BY: KJ	COMPLETION DATE: 9/5/08
PROJECT ENGINEER: Karan Jalota	

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-01
LOCATION: Proposed Parking Lot		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE



LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

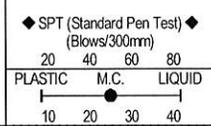
PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-02
LOCATION: Proposed Parking Lot		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	SPT (Standard Pen Test) (Blows/300mm)		COMMENTS	DEPTH (m)
							PLASTIC	LIQUID		
0			TOPSOIL (610mm) - clayey, soft to firm, damp, black, trace rootlets.							
0.5	OL									
1	CI		CLAY (FILL) - silty, some sand, medium plastic, soft to firm, damp, mottled grey and brown.	<input checked="" type="checkbox"/>	1					
1.5	CI		CLAY TILL - sandy, some silt, trace gravel, medium plastic, stiff, moist, brown, trace oxidation, trace white inclusions.	<input checked="" type="checkbox"/>	2	5				
2	CI		CLAY TILL - sandy, some silt, trace gravel, medium plastic, stiff, moist, brown, trace oxidation, trace white inclusions.	<input checked="" type="checkbox"/>	3					
2.5	CI		- mottled grey and brown.	<input checked="" type="checkbox"/>	4	13				
3	CI		- mottled grey and brown.	<input checked="" type="checkbox"/>	5					
4	CI		- trace coal.	<input checked="" type="checkbox"/>	6	13				
4.27			End of testhole at 4.27 mBGS. - no water upon completion.							

LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 BY:

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-03
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE <input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE		

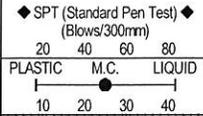
DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (455mm)- sandy, well graded, moist, compact, brown.					
0.5			CLAY TILL - silty, some sand, trace gravel, medium plastic, moist, stiff, brown, trace coal, trace white inclusions, trace oxidation.	<input checked="" type="checkbox"/>	1			1
1.98			End of testhole at 1.98 mBGS. - no water upon completion.	<input checked="" type="checkbox"/>	2	10		2



LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-04
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0			GRAVEL (1.1m) - sandy, well graded, moist, compact, brown.					
	GW			<input checked="" type="checkbox"/>	1			
1			CLAY TILL - silty, trace sand, trace gravel, medium plastic, stiff, damp, brown.					
	CI			<input checked="" type="checkbox"/>	2	9		
2			End of testhole at 1.98 mBGS. - no water upon completion.					
3								
4								
5								
6								
7								
8								
9								
10								

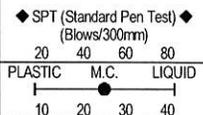


LOG OF TESTHOLE PE SAKASTEW.INSTITUTION.GPJ UMA.GDT. PRINT: 11/5/08 By:

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-05
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):

SAMPLE TYPE GRAB SHELBY TUBE SPLIT SPOON BULK NO RECOVERY CORE

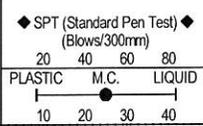
DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	CW		GRAVEL (300mm) - sandy, well graded, moist, compact, brown.					
0			CLAY (FILL) - sandy, some silt, medium plastic, soft to firm, moist, trace coal, trace oxidation, mottled grey and brown.					
1	Cl				1			1
2			End of testhole at 1.98 mBGS. - no water upon completion.		2	5		2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10



LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-06
LOCATION: Existing Perimeter Roads	PROJECT NO.: 2977-373-00	
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE
	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK
	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (150mm) - sandy, well graded, moist, compact, brown.					
0			CLAY TILL - some silt, some sand, trace gravel, medium plastic, firm to stiff, moist, mottled brown and grey, trace coal, trace oxidation, trace white inclusions.					
1	CI		- stiff to very stiff.	<input checked="" type="checkbox"/>	1			1
2			End of testhole at 1.98 mBGS. - no water upon completion.	<input checked="" type="checkbox"/>	2	15		2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

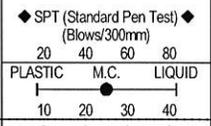


LOG OF TESTHOLE - PE SAKASTEWS INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 BY:

PROJECT: Pe Sakastew Site Paving CLIENT: PWGSC TESTHOLE NO.: TH08-07
 LOCATION: Existing Perimeter Roads PROJECT NO.: 2977-373-00
 CONTRACTOR: Mobile Augers and Research Ltd. METHOD: Solid Stem Auger ELEVATION (m):

SAMPLE TYPE GRAB SHELBY TUBE SPLIT SPOON BULK NO RECOVERY CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (150mm) - sandy, well graded, moist, compact, brown.					
0			CLAY TILL - silty, some sand, trace gravel, medium plastic, stiff, moist, mottled grey and brown, trace coal, trace oxidation, trace white inclusions.					
1	CI		- stiff to very stiff.	<input checked="" type="checkbox"/>	1			1
2			End of testhole at 1.98 mBGS. - no water upon completion.	<input checked="" type="checkbox"/>	2	15		2
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10

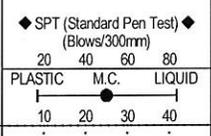


LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

PROJECT: Pe Sakastew Site Paving	CLIENT: PWGSC	TESTHOLE NO.: TH08-08
LOCATION: Existing Perimeter Roads		PROJECT NO.: 2977-373-00
CONTRACTOR: Mobile Augers and Research Ltd.	METHOD: Solid Stem Auger	ELEVATION (m):

SAMPLE TYPE GRAB SHELBY TUBE SPLIT SPOON BULK NO RECOVERY CORE

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	SPT (N)	COMMENTS	DEPTH (m)
0	GW		GRAVEL (300mm) - sandy, well graded, moist, compact, brown.					
			CLAY (FILL) - silty, some sand, medium plastic, moist to wet, mottled grey and brown.					
1	CI			<input checked="" type="checkbox"/>	1			1
			CLAY TILL - silty, sandy, trace gravel, medium plastic, stiff, moist, mottled grey and brown, trace coal, trace oxidation, trace white inclusions.	<input checked="" type="checkbox"/>	2	10		2
2	CI							
			End of testhole at 1.98 mBGS. - no water upon completion.					
3								3
4								4
5								5
6								6
7								7
8								8
9								9
10								10



LOG OF TESTHOLE PE SAKASTEW INSTITUTION.GPJ UMA.GDT PRINT: 11/5/08 By:

Appendix B

Testhole Logs

EXPLANATION OF FIELD & LABORATORY TEST DATA

The field and laboratory test results, as shown for each hole, are described below.

1. NATURAL MOISTURE CONTENT

The relationship between the natural moisture content and depth is significant in determining the subsurface moisture conditions. The Atterberg Limits for a sample should be compared to its natural moisture content and plotted on the Plasticity Chart in order to determine the soil classification.

2. SOIL PROFILE AND DESCRIPTION

Each soil strata is classified and described noting any special conditions. The modified Unified Soil Classification (UCS) system is used. The soil profile refers to the existing ground level at the time the hole was done. Where available, the ground elevation is shown. The soil symbols used are shown in detail on the soil classification chart.

3. TESTS ON SOIL SAMPLES

Laboratory and field tests are identified by the following and are on the logs:

- N - Standard Penetration Test (SPT) Blow Count. The SPT is conducted in the field to assess the in situ consistency of cohesive soils and the relative density of non-cohesive soils. The N value recorded is the number of blows from a 63.5 kg hammer dropped 760 mm which is required to drive a 51 mm split spoon sampler 300 mm into the soil.

- SO₄ - Water Soluble Sulphate Content. Expressed in percent. Conducted primarily to determine requirements for the use of sulphate resistant cement. Further details on the water soluble sulphate content are given in Section 6.

- γ_D - Dry Unit Weight. Usually expressed in kN/m³.

- γ_T - Total Unit Weight. Usually expressed in kN/m³.

- Q_U - Unconfined Compressive Strength. Usually expressed in kPa and may be used in determining allowable bearing capacity of the soil.

- C_U - Undrained Shear Strength. Usually expressed in kPa. This value is determined by either a direct shear test or by an unconfined compression test and may also be used in determining the allowable bearing capacity of the soil.

- C_{PEN} - Pocket Penetrometer Reading. Usually expressed in kPa. Estimate of the undrained shear strength as determined by a pocket penetrometer.

The following tests may also be performed on selected soil samples and the results are given on separate sheets enclosed with the logs:

- Grain Size Analysis
- Standard or Modified Proctor Compaction Test
- California Bearing Ratio Test
- Direct Shear Test
- Permeability Test
- Consolidation Test
- Triaxial Test

4. SOIL DENSITY AND CONSISTENCY

The SPT test described above may be used to estimate the consistency of cohesive soils and the density of cohesionless soils. These approximate relationships are summarized in the following tables:

Table 1 Cohesive Soils

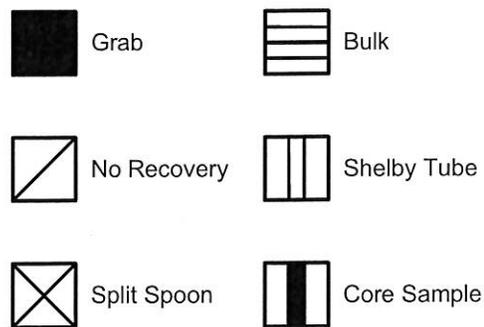
N	Consistency	C _u (kPa) approx.
0 - 1	Very Soft	<10
1 - 4	Soft	10 - 25
4 - 8	Firm	25 - 50
8 - 15	Stiff	50 - 100
15 - 30	Very Stiff	100 - 200
30 - 60	Hard	200 - 300
>60	Very Hard	>300

Table 2 Cohesionless Soils

N	Density
0 - 5	Very Loose
5 - 10	Loose
10 - 30	Compact
30 - 50	Dense
>50	Very Dense

5. SAMPLE CONDITION AND TYPE

The depth, type, and condition of samples are indicated on the logs by the following symbols:



6. WATER SOLUBLE SULPHATE CONCENTRATION

The following table, from CSA Standard A23.1-00, indicates the requirements for concrete subjected to sulphate attack based upon the percentage of water-soluble sulphate as presented on the logs. CSA Standard A23.1-00 should be read in conjunction with the table.

Table 3 Requirements For Concrete Subjected to Sulphate Attack*

Class of exposure	Degree of exposure	Water-soluble sulphate (SO ₄) in soil sample, %	Sulphate (SO ₄) in ground-water samples, mg/L	Minimum Specified 56 d compressive strength, MPa †	Maximum water/cementing materials ratio ‡	Air content category §	Cementing materials to be used **††
S-1	Very severe	over 2.0	over 10,000	35	0.40	2	50
S-2	Severe	0.20 - 2.0	1,500 - 10,000	32	0.45	2	50
S-3	Moderate	0.10 - 0.20	150 - 1,500	30	0.50	2	20E††, 40, or 50E

* For sea water exposure see Clause 15.4

† Where supplementary cementing materials are used, the owner may also specify other test ages.

‡ See Clause 15.1.4

§ For steel trowelled interior slabs on grade, subject to sulphate attack but not freeze-thaw, air entrainment is not required.

** See Clause 15.1.5

†† Cementing material combinations with equivalent performance may be used (see Clauses 3.2, 3.3, and 3.4)

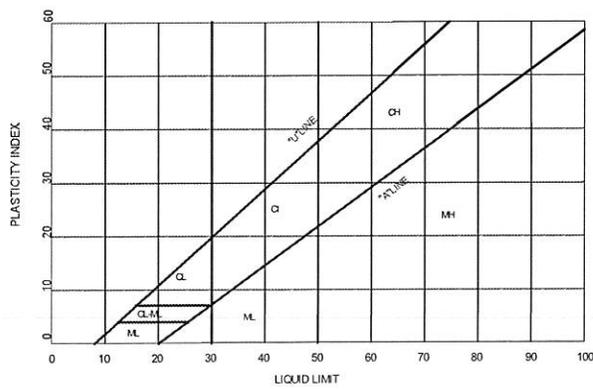
‡‡ Type 20E cement with moderate sulphate resistance (see Clause 3.1.2)

Note: Type 50E cement shall not be used in reinforced concrete exposed to both chlorides and sulphates. Refer to Clause 15.4.

7. GROUNDWATER TABLE

The groundwater table is indicated by the equilibrium level of water in a standpipe installed in a testhole or test pit. This level is generally taken at least 24 hours after installation of the standpipe. The groundwater level is subject to seasonal variations and is usually highest in the spring. The symbol on the logs indicating the groundwater level is an inverted solid triangle (\blacktriangledown).

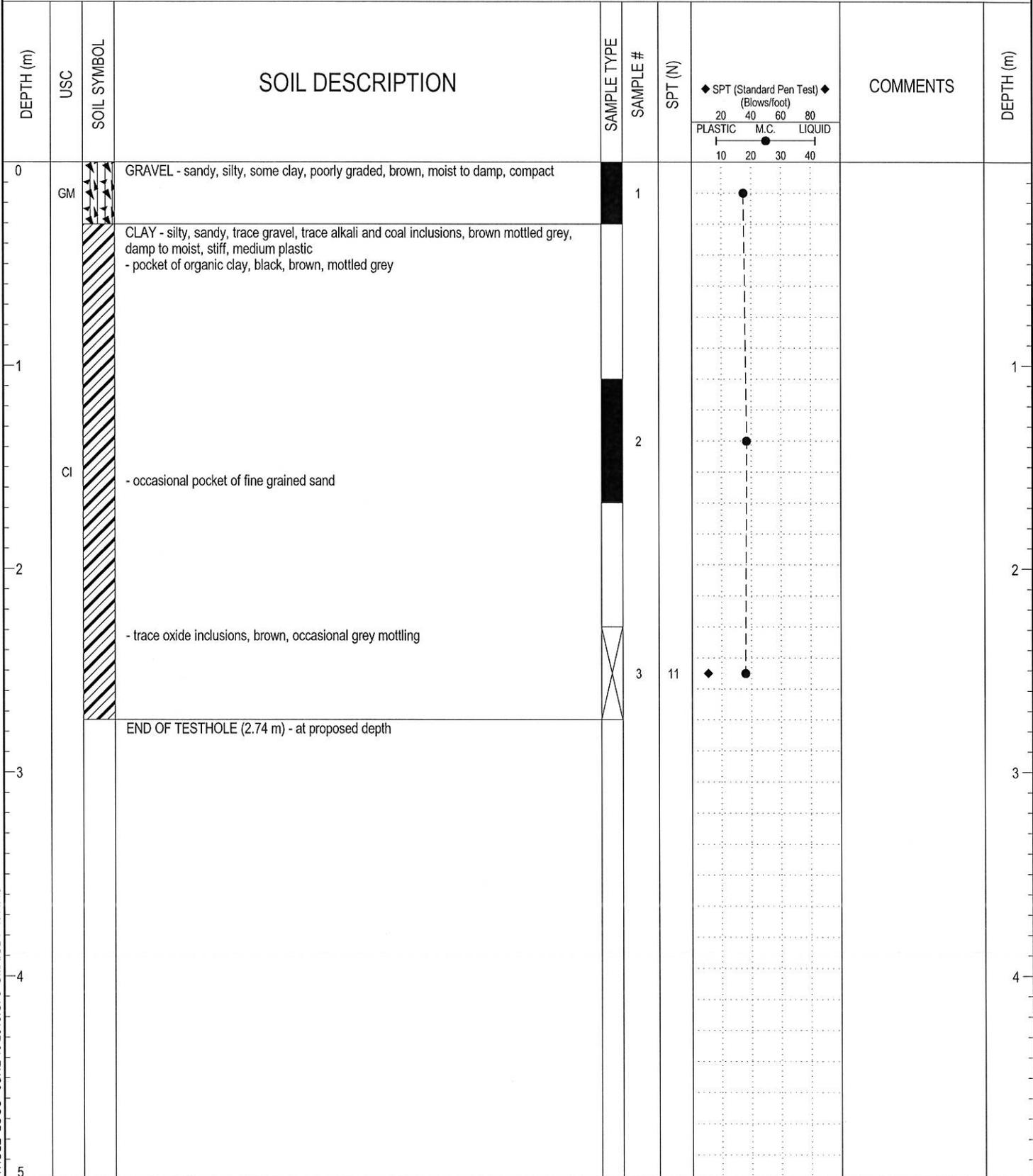
MAJOR DIVISION		LOG SYMBOLS	USC	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS	GRAVELS (MORE THAN HALF COARSE GRAINS LARGER THAN 4.75 mm)	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL GRADED GRAVELS, LITTLE OR NO FINES	$C_u \cdot \frac{D_{60}}{D_{10}} > 4$ $C_c \cdot \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$	
		GRAVELS WITH FINES	GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
			GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE W_p LESS THAN 4
		SANDS (MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75 mm)	CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u \cdot \frac{D_{60}}{D_{10}} > 6$ $C_c \cdot \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
	SP			POORLY GRADED SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
	SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE W_p LESS THAN 4	
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE 'A' LINE W_p MORE THAN 7		
	FINE GRAINED SOILS	SILTS (BELOW 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50$	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
			$W_L > 50$	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS	
		CLAYS (ABOVE 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30$	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	
$30 < W_L < 50$			CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
$W_L > 50$			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
ORGANIC SILTS & CLAYS (BELOW 'A' LINE)		$W_L < 50$	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		$W_L > 50$	OH	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE	
BEDROCK			BR	SEE REPORT DESCRIPTION		



NOTE:
1. BOUNDARY CLASSIFICATION POSSESSING CHARACTERISTICS OF TWO GROUPS ARE GIVEN GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL MIXTURE WITH CLAY BINDER BETWEEN 5% AND 12%

SOIL COMPONENTS					
FRACTION	SIEVE SIZE (mm)	DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS			
		PASSING	RETAINED	IDENTIFIER	
GRAVEL	COARSE	75	19	50 - 35	AND
	FINE	19	4.75		
SAND	COARSE	4.75	2.00	35 - 20	Y
	MEDIUM	2.00	0.425		
	FINE	0.425	0.080		
SILT (non-plastic) or CLAY (plastic)	0.080			20 - 10	SOME
				10 - 1	TRACE
OVERSIZE MATERIALS					
ROUNDED OR SUB-ROUNDED COBBLES 75 mm TO 200 mm BOULDERS >200 mm			ANGULAR ROCK FRAGMENTS ROCKS > 0.75 m3 IN VOLUME		

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-01
LOCATION: UTM NAD 83 Zone 12N: 5854499 N, 333492 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

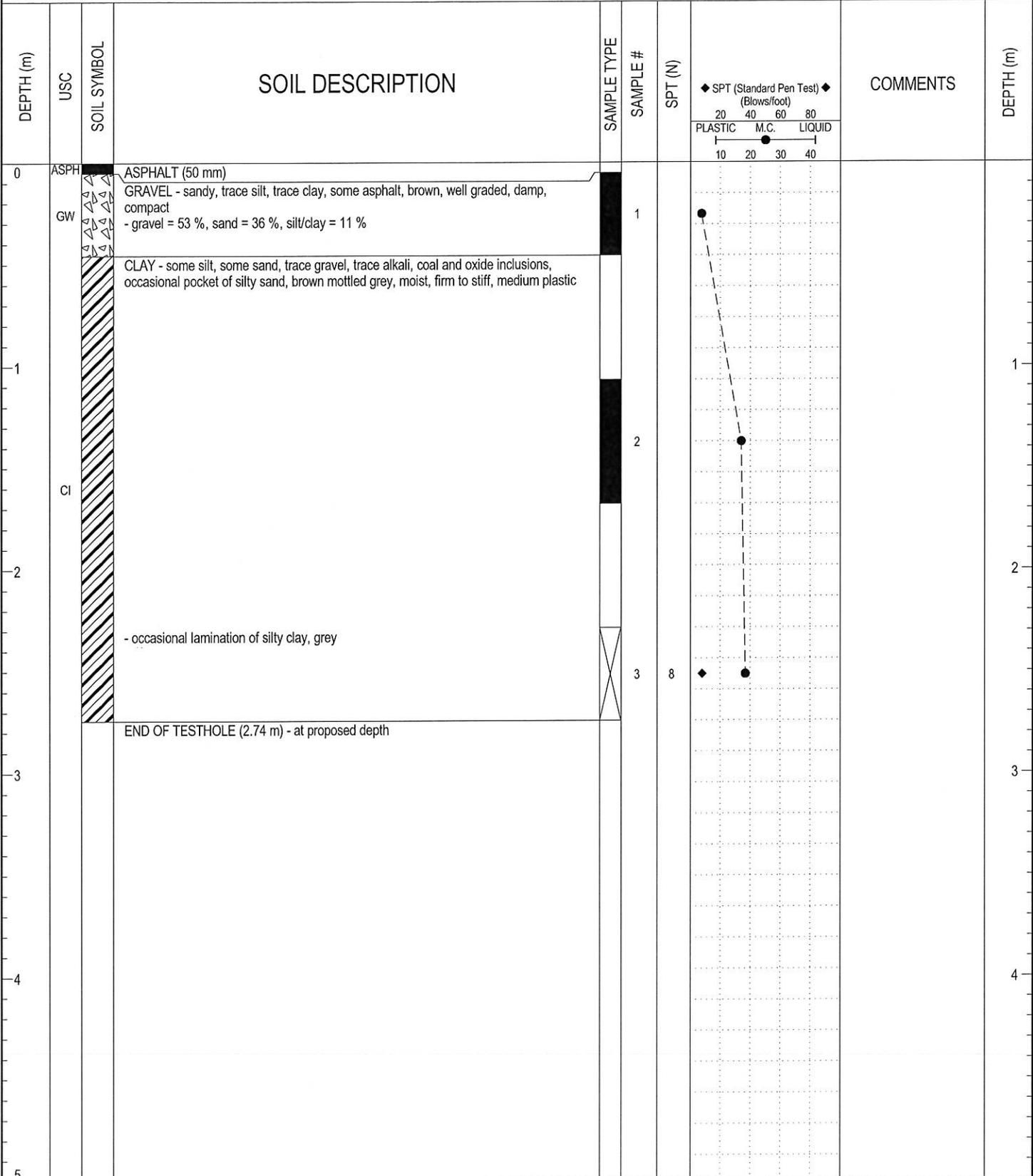


LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UMA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 2.74 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	Page 1 of 1

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-02
LOCATION: UTM NAD 83 Zone 12N: 5854607 N, 333508 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

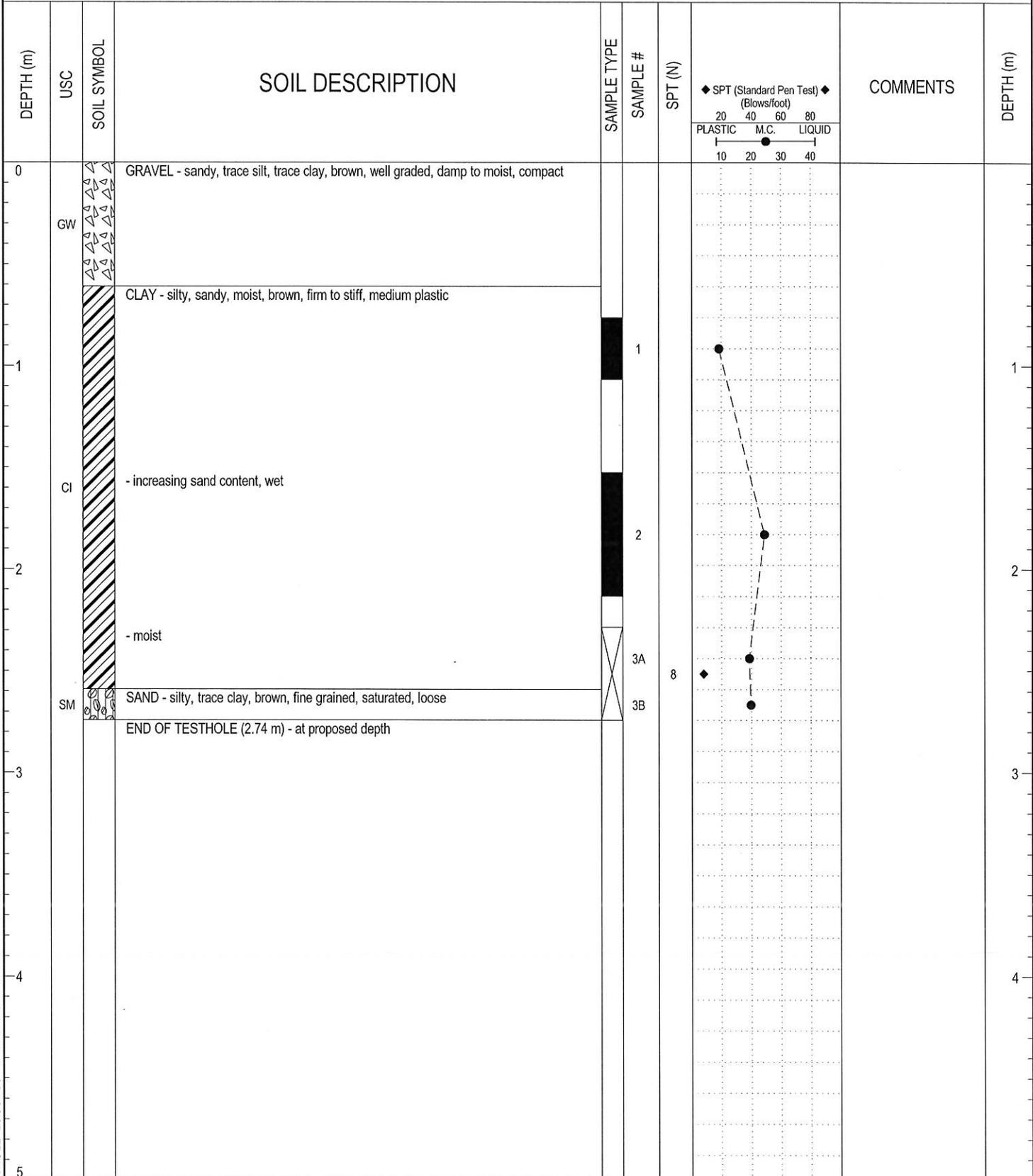


LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UMA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 2.74 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	Page 1 of 1

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-03
LOCATION: UTM NAD 83 Zone 12N: 5854719 N, 333478 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

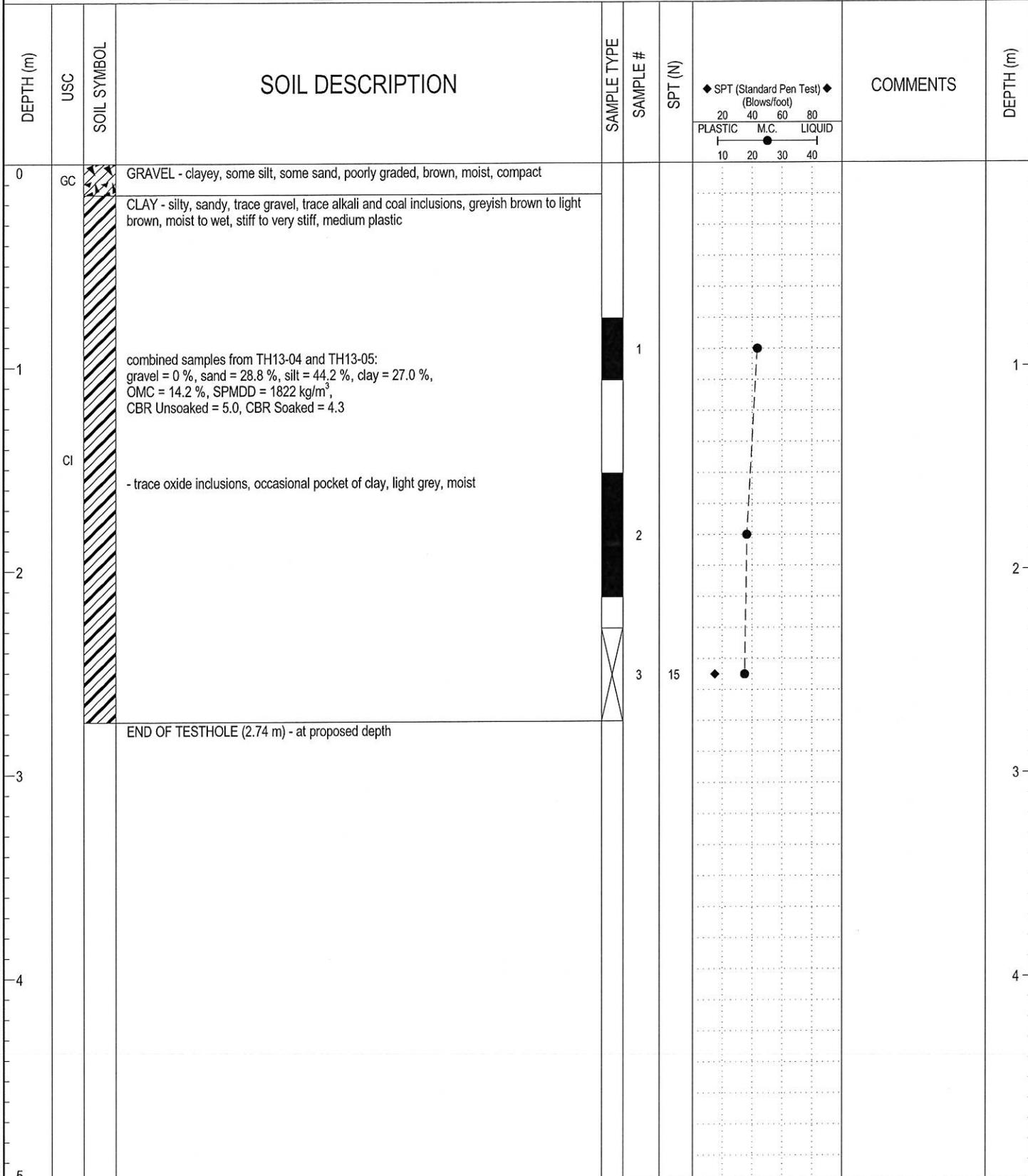


LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UMA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 2.74 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	Page 1 of 1

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-04
LOCATION: UTM NAD 83 Zone 12N: 5854758 N, 333419 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

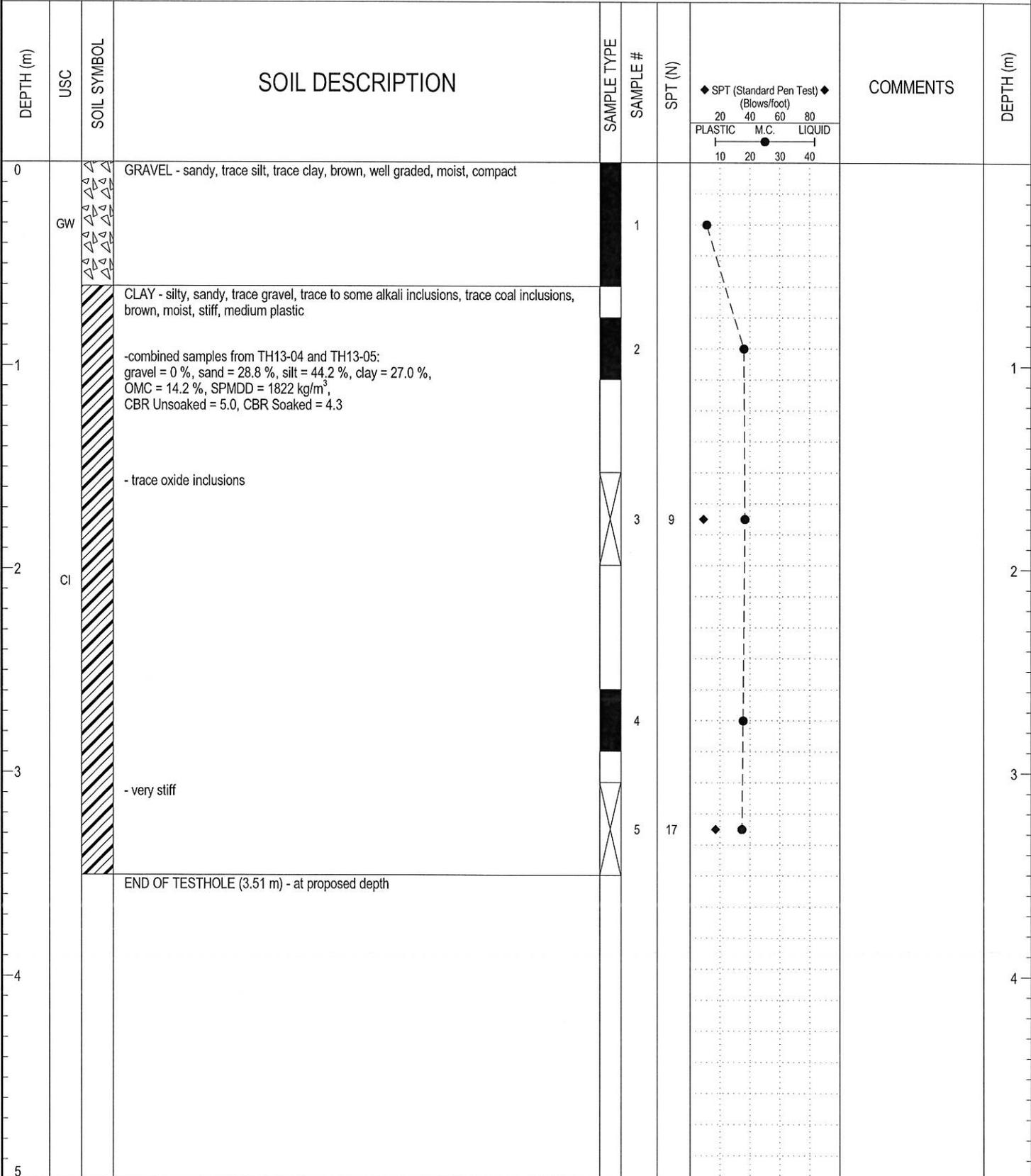


LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UMA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 2.74 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	Page 1 of 1

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-05
LOCATION: UTM NAD 83 Zone 12N: 5854609 N, 333323 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
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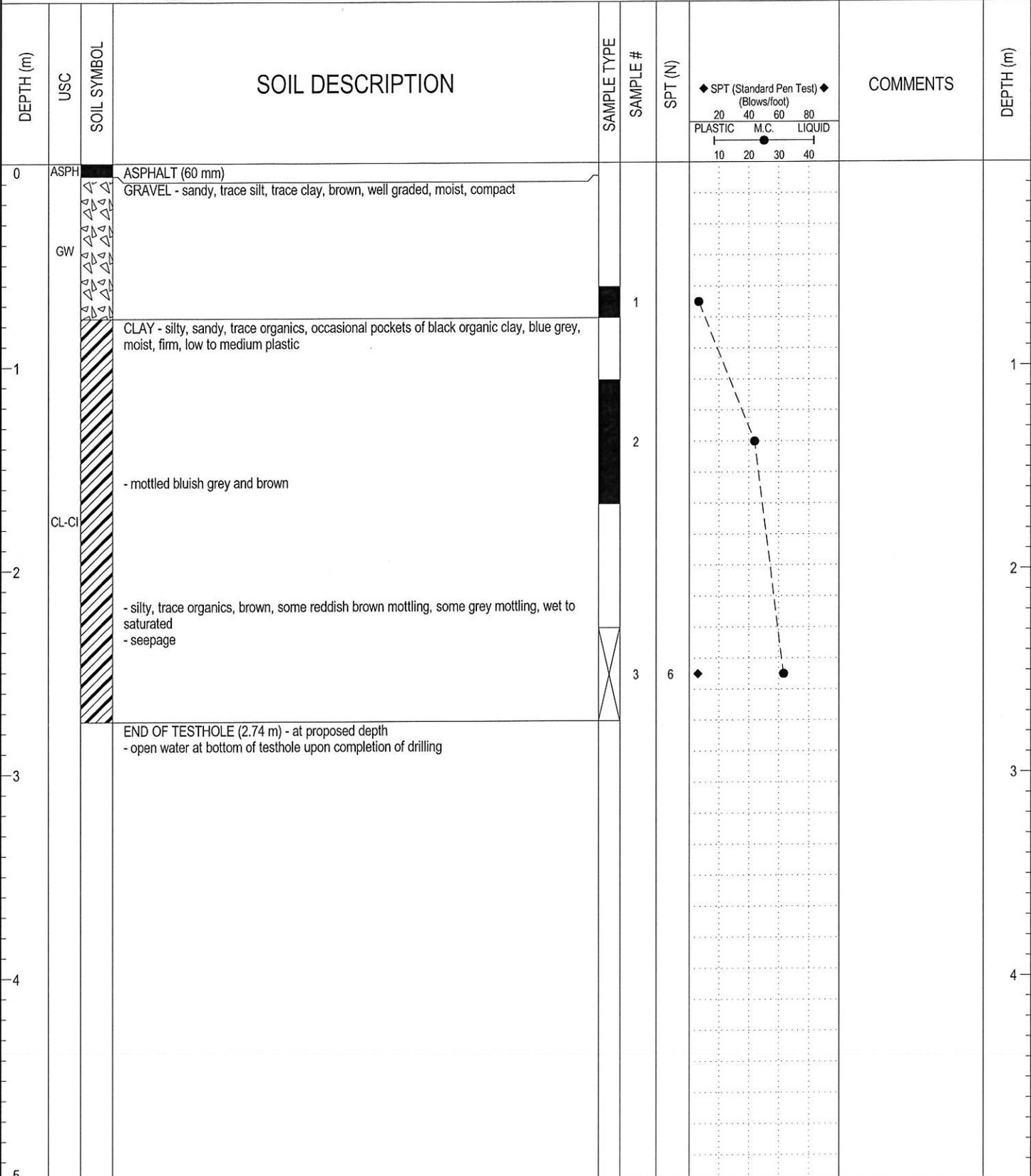


LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UWA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 3.51 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-06
LOCATION: UTM NAD 83 Zone 12N: 5854568 N, 333475 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

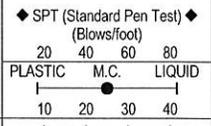
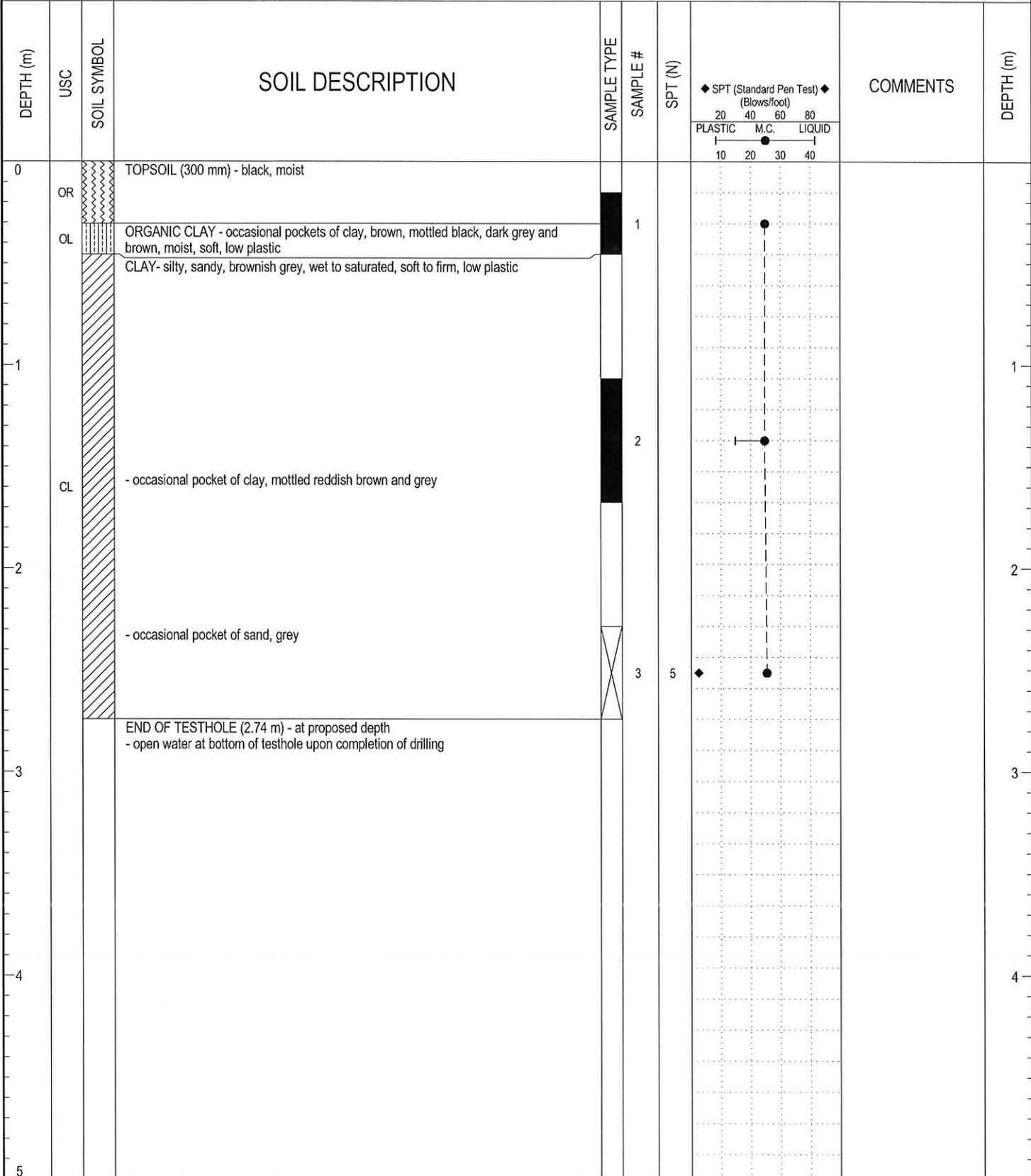


LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UMA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 2.74 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	Page 1 of 1

PROJECT: Geotechnical Investigation - Pê Sâkâstêw Centre	CLIENT: PWGSC	TESTHOLE NO: TH13-07
LOCATION: UTM NAD 83 Zone 12N: 5854507 N, 333455 E (hand held GPS)		PROJECT NO.: 60289799
CONTRACTOR: Canadian Geological Drilling Ltd	METHOD: Solid Stem Auger	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE



LOG OF TESTHOLE LOGS - JUNE 10 2013.GPJ UMA.GDT 7/11/13



LOGGED BY: JB	COMPLETION DEPTH: 2.74 m
REVIEWED BY: KMT	COMPLETION DATE: 7/6/13
PROJECT ENGINEER: AM	Page 1 of 1

Appendix C

Laboratory Test Results

SIEVE ANALYSIS

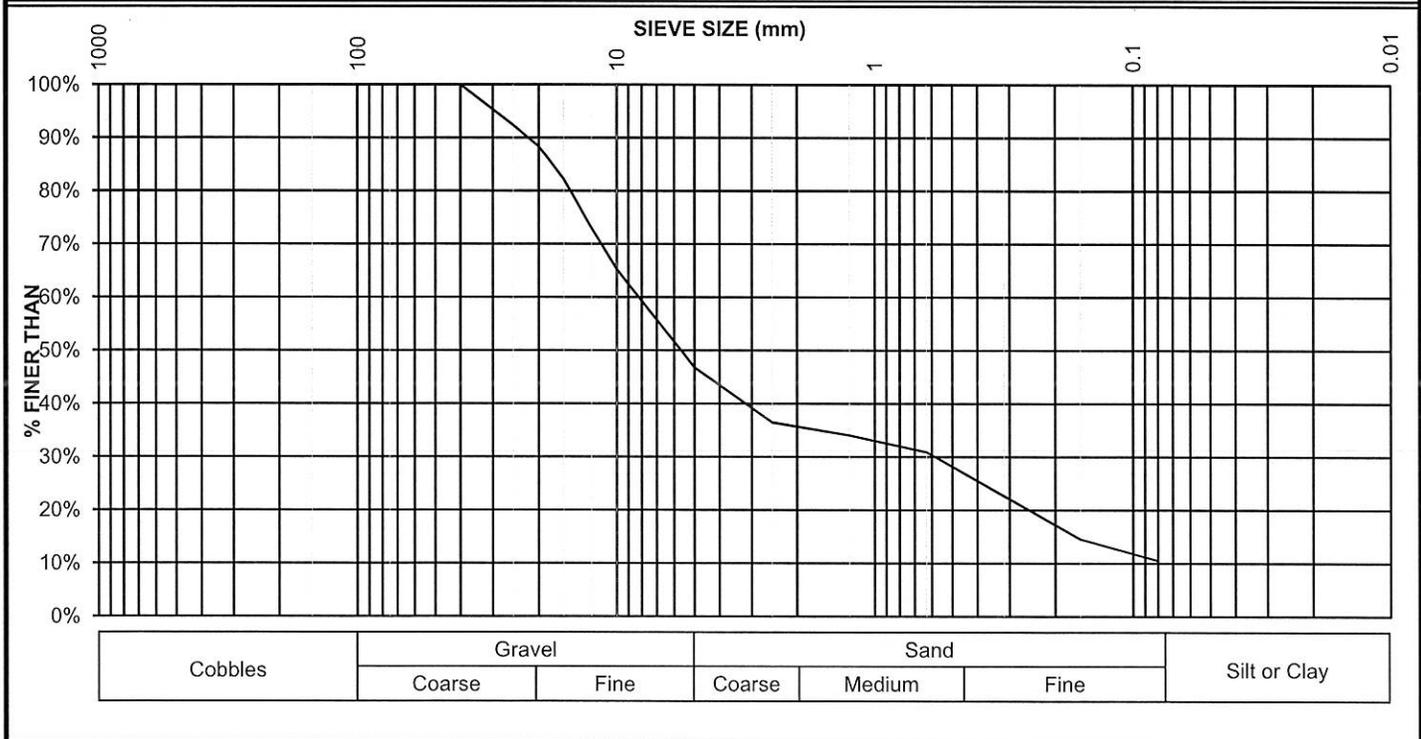
CLIENT : Public Works
 PROJECT : Pe Saskastew
 JOB No. : 60289799
 LOCATION :
 BOREHOLE: TH13-02
 DATE : June 13, 2013

DESIGNATION:
 SAMPLE: 1
 DEPTH :
 TECHNICIAN : CK

TOTAL DRY WEIGHT OF SAMPLE	SIEVE NO. (µm)	SIZE OF OPENING		WEIGHT RETAINED (g)	PERCENT RETAINED	PERCENT FINER THAN	SPECIFICATION	
		APPROX. INCHES	mm				LOWER	UPPER
<u>Before Washing</u>	150000	6	150.0			100%		
Wet + Tare	3022.8	75000	3	75.0		100%		
Dry+Tare	50000	2	50.0			100%		
Tare	222.9	40000	1 1/2	40.0		100%		
Wt. Dry	2692.6	25000	1	25.0	205.9	8%	92%	
<u>Moisture Content</u>	20000	3/4	20.0	314.3	12%	88%		
Wet + Tare	2584.3	16000	5/8	16.0	478.8	18%	82%	
Dry+Tare	2494.5	12500	1/2	12.5	725.9	27%	73%	
Tare	242.0	10000	3/8	10.0	936.3	35%	65%	
MC (%)	4.0%	5000	0.185	5.0	1432.8	53%	47%	
Passing	5000							
<u>After Washing</u>	2500	0.0937	2.5	1710.1	64%	36%		
Wt. Dry+Tare	2645.4	1250	0.0469	1.25	1775.6	66%	34%	
Tare	331.2	630	0.0234	0.630	1860.0	69%	31%	
Wt. Dry	2314.2	315	0.0116	0.315	2082.4	77%	23%	
Tare No.	160	0.0059	0.160	2300.6	85%	15%		
	80	0.0029	0.080	2409.5	89%	11%		
	PAN							

Classification: GP-GM
 Cc 0.5
 Cu 107

Description and Remarks: Fracture =75% , Sample contains chunks of asphalt



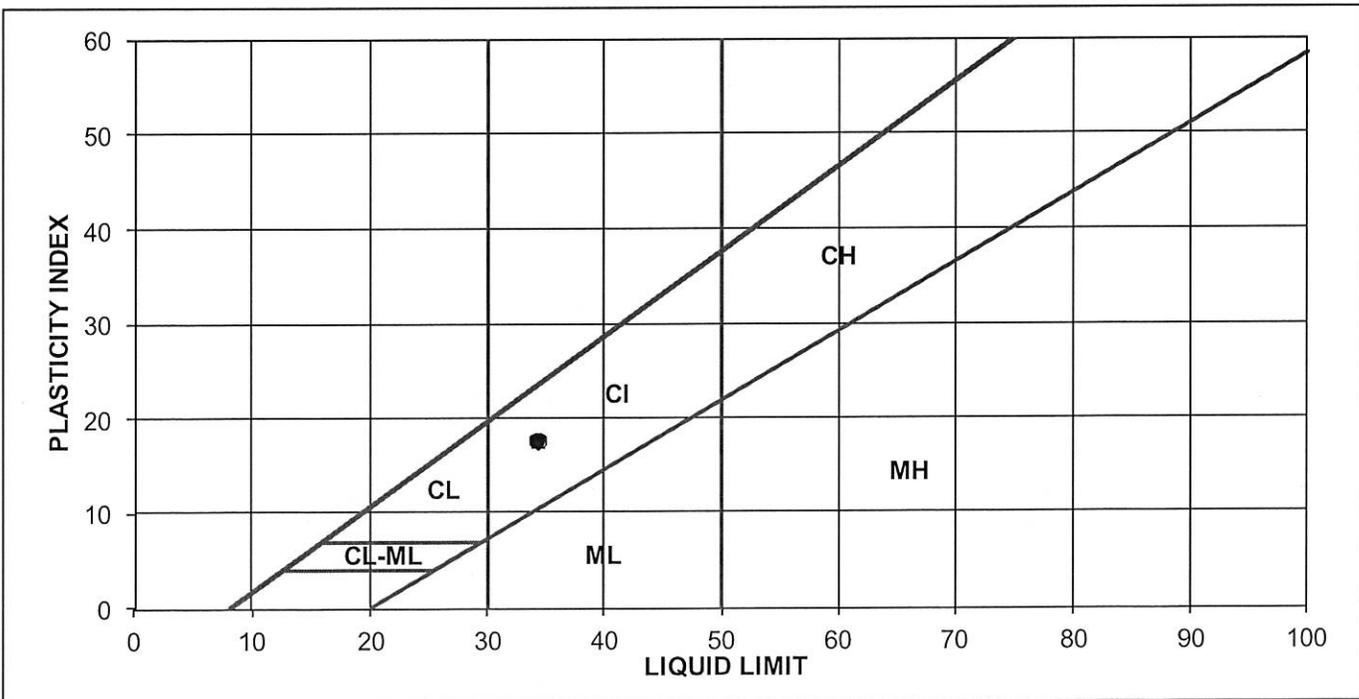
ATTERBERG LIMITS

AECOM

CLIENT :	Public Works	SAMPLE:	Combined
PROJECT :	Pe Saskastew	DEPTH :	
JOB No. :	60289799	TECHNICIAN :	GU
LOCATION :			
TESTHOLE :	13-004 & 05		
DATE :	June 17, 2013		

LIQUID LIMIT						
Trial No.	1					
Number of Blows	28					
Container Number						
Wt. Sample (wet+tare)(g)	52.07					
Wt. Sample (dry+tare)(g)	43.04					
Wt. Tare (g)	16.32					
Wt. Dry Soil (g)	26.7					
Wt. Water (g)	9.0					
Water Content (%)	33.8%					

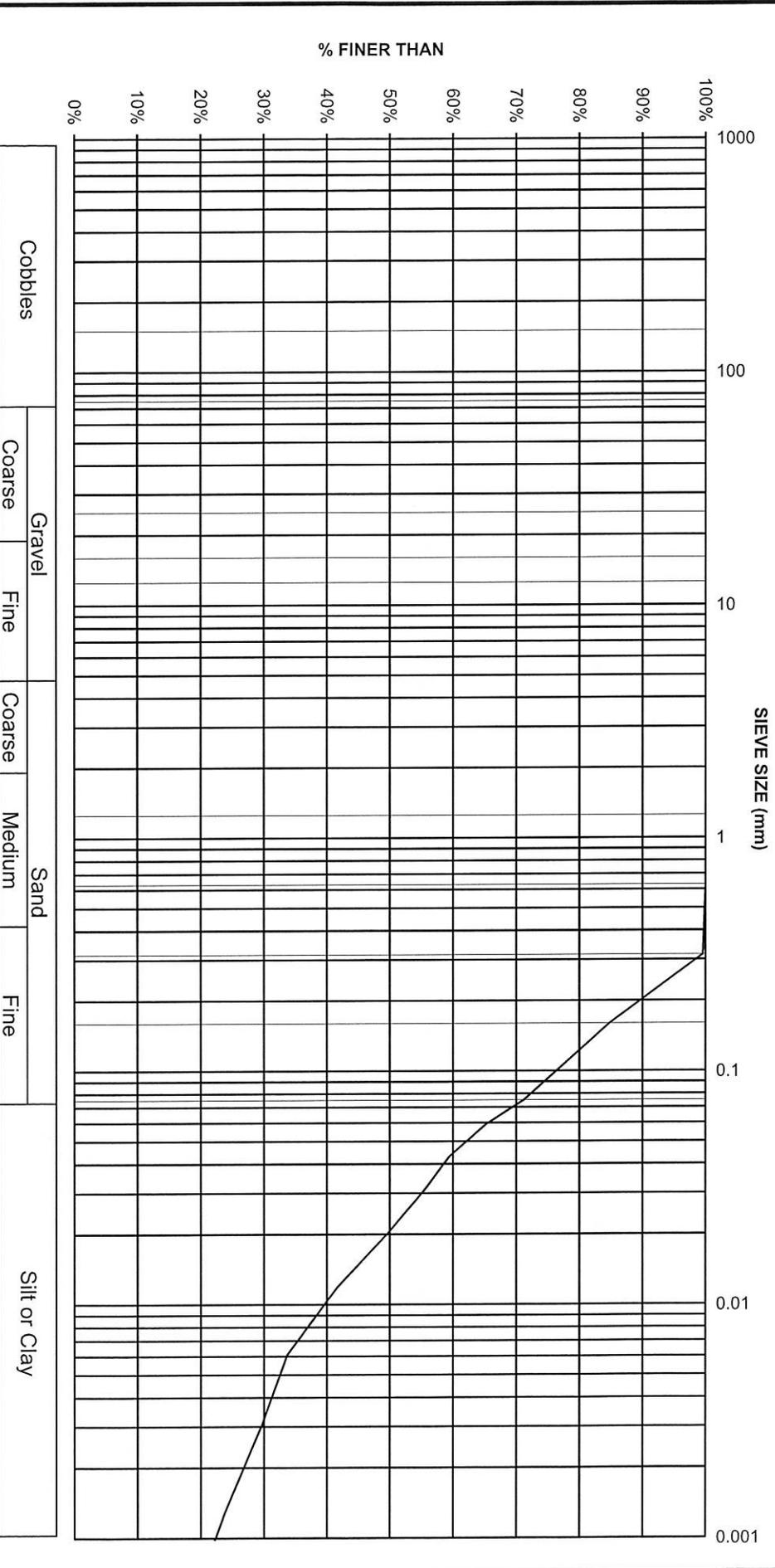
AVERAGE VALUES		PLASTIC LIMIT			
Liquid Limit	34.3	Trial No.	1		
Plastic Limit	16.6	Container Number			
Plasticity Index	17.7	Wt. Sample (wet+tare)(g)	28.97		
SAMPLE DESCRIPTION		Wt. Sample (dry+tare)(g)	26.53		
Classification:	CI	Wt. Tare (g)	11.79		
		Wt. Dry Soil (g)	14.7		
		Wt. Water (g)	2.4		
		Water Content (%)	16.6%		



GRAIN SIZE ANALYSIS

AECOM

CLIENT :	Public Works	SAMPLE :	Combined
PROJECT :	Pe Saskastew	DEPTH :	Various
JOB No. :	60289799	TECHNICIAN :	GU
LOCATION :			
TESTHOLE :	13-04 & 05		
DATE :	June 20, 2013		



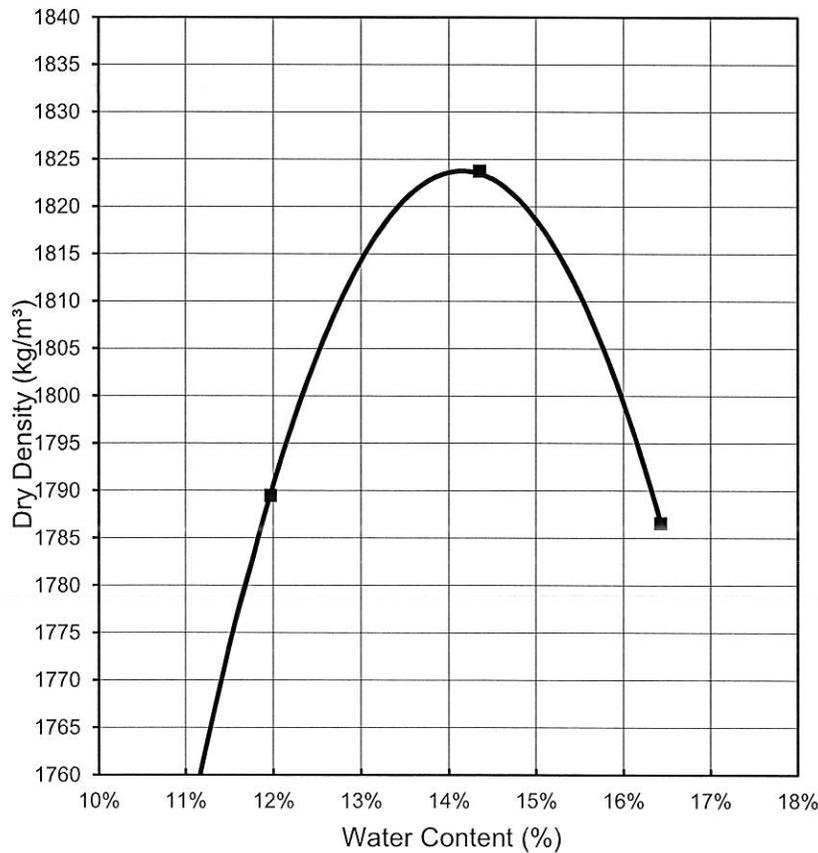
Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

PROCTOR TEST

AECOM

CLIENT : Public Works
 PROJECT : Pe Saskastew
 JOB No. : 60289799
 LOCATION :
 TESTHOLE : TP13-04 & 05
 DATE : June 17, 2013
 SAMPLE: Combined
 DEPTH :
 TECHNICIAN : GU

TRIAL No.	1	2	3	4		
DENSITY DETERMINATION						
Mould Number						
Volume of Mould (cm ³)	940.0	940.0	940.0	940.0		
Wt. Sample (wet+mould)(g)	6081.0	6157.9	6152.8			
Wt. Mould (g)	4197.6	4197.6	4197.6			
Wet Density (kg/m ³)	2004	2085	2080			
Dry Density (kg/m ³)	1789	1824	1787			
WATER CONTENT DETERMINATION						
Tare Number						
Wt. Sample (wet+tare)(g)	323.3	276.8	683.9			
Wt. Sample (dry+tare)(g)	290.2	243.8	589.4			
Wt. Tare (g)	13.6	13.8	14.0			
Wt. Dry Soil (g)	276.6	230.0	575.4			
Wt. Water (g)	33.1	33.0	94.5			
Water Content (%)	12.0%	14.3%	16.4%			



At Optimum:
 Water Content 14.2%
 Dry Density (kg/m³) 1822

Method of Compaction:	D-698
Dia. of Mould (cm):	10
No. of Layers:	3
No. Blows per Layer:	25
Ht. of Free Fall (cm):	30
Wt. of Tamper (g)	2500
Shape of Tamping Face:	FLAT

Description of Sample:
 Olive gray clay till trace gravel

Rock Corrections:		
% Rock	Density	Optimum

Remarks:

C.B.R. TEST

AECOM

CLIENT :	Public Works	SAMPLE:	4=1-3, 5=2-5
PROJECT :	Pe Saskastew	DEPTH :	
JOB No. :	60289799	TECHNICIAN :	RGD
LOCATION :			
BOREHOLE:	TH 13- 04 & 05		
DATE :	June 20, 2013		

Density Determination		Water Content Determination		
Mould Number	3		Before	After
Wt. Sample (wet+mould) (g)	8592	Wt. Sample (wet+tare) (g)	404	732
Wt. Mould (g)	4198	Wt. Sample (dry+tare) (g)	348	631
Wt Sample (wet) (g)	4395	Wt. Tare	13	14
Volume of Mould	2124	Wt. Dry Soil (g)	335	617
Wet Density (kg/m ³)	2069	Wt. Water (g)	56	101
Dry Density (kg/m ³)	1773	Water Content (%)	16.7%	16.4%

Expansion Test				Water Content Data - Soaked Sample Top 25 mm	
Expansion (mm)	Reading (0.001 in)	Date	Elapsed Time	Tare Number	
NA	0	20-Jun-13	0	Wt. Sample (wet+tare) (g)	550
0.457	18	21-Jun-09	24	Wt. Sample (dry+tare) (g)	470
0.533	21	22-Jun-09	48	Wt. Tare	13
0.559	22	23-Jun-09	72	Wt. Dry Soil (g)	457
0.686	27	24-Jun-09	96	Wt. Water (g)	80
				Moisture Content (%)	17.5%

Penetration Test Data							
Before Soaking				After Soaking			
Dial Reading	Penetration (in)	Load (N)	Pressure (MPa)	Dial Reading	Penetration (in)	Load (N)	Pressure (MPa)
0	0.000	3	0.00	0	0.000	3	0.00
107	0.025	289	0.15	125	0.025	337	0.17
162	0.050	436	0.22	183	0.050	492	0.25
200	0.075	537	0.28	218	0.075	586	0.30
250	0.100	672	0.35	243	0.100	653	0.34
290	0.125	779	0.40	266	0.125	714	0.37
315	0.150	846	0.44	286	0.150	768	0.40
349	0.175	936	0.48	304	0.175	816	0.42
379	0.200	1017	0.52	319	0.200	856	0.44
464	0.300	1242	0.64	374	0.300	1003	0.52
526	0.400	1407	0.73	419	0.400	1123	0.58
574	0.500	1534	0.79	453	0.500	1213	0.63

C.B.R. Value Unsoaked:	5.0	C.B.R. Value Soaked:	4.3
------------------------	-----	----------------------	-----

SUMMARY			
Before Soaking		After Soaking	
CBR at 0.1" Penetration	5.0	CBR at 0.1" Penetration	4.9
Surcharge (lb)	10	Surcharge (lb)	10
Method of Compaction	STD	Soaked for (days)	4
RING #	3491	Swell (mm)	0.6858
Moisture Content (%)	16.7%	Moisture Content (%)	16.4%
Dry Density (kg/m ³)	1773	Dry Density (kg/m ³)	1778

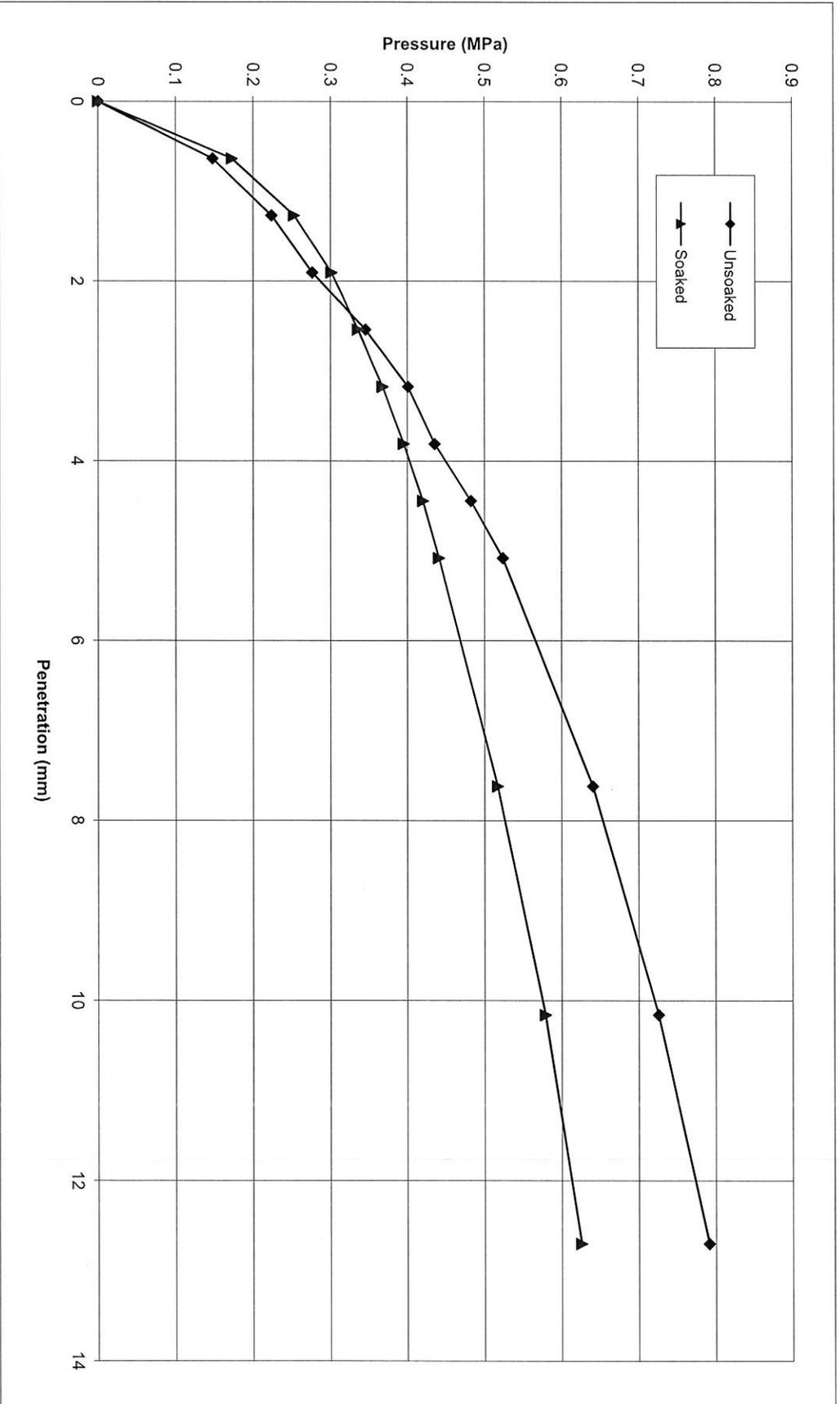
SAMPLE DESCRIPTION :	REMARKS :
Olive gray clay till trace gravel	

C.B.R. TEST

AECOM

CLIENT : Public Works
PROJECT : Pe Saskastew
JOB No. : 60289799
LOCATION :
BOREHOLE : TH 13- 04 & 05
DATE : June 20, 2013

SAMPLE: 4=1-3, 5=2-5
DEPTH :
TECHNICIAN : RGD



ATTERBERG LIMITS

AECOM

CLIENT : Public Works
 PROJECT : Pe Saskastew
 JOB No. : 60289799
 LOCATION : SAMPLE: 02
 TESTHOLE : 13-07 DEPTH :
 DATE : June 17, 2013 TECHNICIAN : GU

LIQUID LIMIT						
Trial No.	1					
Number of Blows	29					
Container Number						
Wt. Sample (wet+tare)(g)	51.88					
Wt. Sample (dry+tare)(g)	44.75					
Wt. Tare (g)	14.59					
Wt. Dry Soil (g)	30.2					
Wt. Water (g)	7.1					
Water Content (%)	23.6%					

AVERAGE VALUES		PLASTIC LIMIT			
Liquid Limit	24.1	Trial No.	1		
Plastic Limit	14.8	Container Number			
Plasticity Index	9.2	Wt. Sample (wet+tare)(g)	29.78		
SAMPLE DESCRIPTION		Wt. Sample (dry+tare)(g)	27.49		
Classification: CL		Wt. Tare (g)	12.06		
		Wt. Dry Soil (g)	15.4		
		Wt. Water (g)	2.3		
		Water Content (%)	14.8%		

