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Project #: 210245

Simpson, Saskatchewan

Last Mountain Lake National Wildlife Area
Construction of Last Mountain Lake
Observation Tower

Solicitation # K2E50-210245/A



**Environment and Climate Change Canada
Real Property Management Division**

PROJECT MANUAL

FOR

**Project No. LML-001 e-f
Last Mountain Lake National Park Observation Tower
Simpson, Saskatchewan**

Issued for Construction
31 July 2019

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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises general construction of a wildlife observation tower, located at Last Mountain Lake Wildlife Area, Simpson, Saskatchewan.

1.2 CONTRACT METHOD

- .1 Construct Work under single stipulated price contract.

1.3 LAWS, NOTICES, PERMITS AND FEES

- .1 The Contractor shall apply and pay for the Plans Examination and Building Permit. Include the Building Permit cost and plans examination fee (if applicable) in the Bid Price.

1.4 SUPPLEMENTARY INFORMATION FOR PROGRESS PAYMENTS

- .1 Successful Contractor will be required to submit a detailed breakdown of costs for each elemental section into three funding accountabilities within 5 business days of Contract Award and with every change to the project. The funding accountability will be detailed as directed, and on a form provided by the Departmental Representative, for parts of Work, aggregating total amount of Contract Price, to facilitate evaluation of application for payments. After review by Departmental Representative, cost breakdown will be used as basis for progress payment.

1.5 WORK BY OTHERS

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

1.6 WORK SEQUENCE

- .1 Construct Work in stages to accommodate Departmental Representative intermittent use of premises during construction.
- .2 Co-ordinate Progress Schedule.
- .3 Maintain fire access/control.

1.7 CONTRACTOR USE OF PREMISES

- .1 Co-ordinate use of premises under direction of Departmental Representative.
- .2 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

- .3 Remove or alter existing work to prevent injury or damage to portions of existing work that remain.
- .4 Repair or replace portions of existing work that have been altered during construction operations to match existing or adjoining work, as directed by Departmental Representative.
- .5 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.8 DOCUMENTS REQUIRED

- .1 Successful bidding Contractor is to obtain required sets of Contract Documents for construction purposes, which includes two (2) sets for "as-built" and record purposes.
 - .1 Contractor is responsible for costs of printing, handling, and shipping of Contract Documents.
- .2 Maintain at job site, one copy of each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

END OF SECTION

Part 1 General

1.1 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Where security is reduced by work, provide temporary means to maintain security.
- .3 Closures: Protect work temporarily until permanent enclosures are completed.

1.2 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to occupants, public, and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.3 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Bar (GANTT) Chart.
- .2 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic, and security regulations.
- .3 Keep within limits of work and avenues of ingress and egress.
- .4 Ingress and egress of Contractor vehicles at site is limited to areas as directed by Departmental Representative.

1.4 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

1.5 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions.
- .2 Smoking is not permitted inside buildings.
- .3 Confirm, with park management, outdoor locations where personnel are allowed to smoke.

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 business days in advance of meeting date to Departmental Representative.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three days after meetings; transmit to Departmental Representative, meeting participants, and affected parties not in attendance.
- .8 Representatives of Contractor, Subcontractor, and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.

1.2 PRECONSTRUCTION MEETING

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Departmental Representative, Contractor, major Subcontractors, field inspectors, and supervisors will be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum five business days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Schedule of Work: in accordance with Section 01 32 16 - Construction Progress Schedules - Bar (GANTT) 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 facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00 - Construction Facilities.
 - .5 Site security in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

- .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
- .7 Departmental Representative-provided products.
- .8 Record drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .9 Maintenance manuals in accordance with Section 01 78 00 - Closeout Submittals.
- .10 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00 - Closeout Submittals.
- .11 Monthly progress claims, administrative procedures, photographs, hold backs.
- .12 Appointment of inspection and testing agencies or firms.
- .13 Insurances, transcript of policies.

1.3 PROGRESS MEETINGS

- .1 During course of Work and two weeks prior to project completion, schedule progress meetings bi-weekly and as requested by Departmental Representative.
- .2 Contractor, major Subcontractors involved in Work, and Departmental Representative are to be in attendance.
- .3 Notify parties minimum three days prior to meetings.
- .4 Record minutes of meetings; circulate to attending parties and affected parties not in attendance within three days after meeting.
- .5 Agenda to include the following:
 - .1 Review, approval of minutes of previous meeting.
 - .2 Review of Work progress since previous meeting.
 - .3 Field observations, problems, conflicts.
 - .4 Problems that 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 and expedite as required.
 - .10 Maintenance of quality standards.
 - .11 Review proposed changes for effect 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, 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 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 it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative, within 10 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 re-submit 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 as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill.
 - .7 Building footings.
 - .8 Slab on grade.
 - .9 Structural Steel.
 - .10 Stairs and landings.
 - .11 Siding.

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 impacts, 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 and remedial measures will be discussed and negotiated.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Provide submittals listed for review to Departmental Representative. 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 for 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 are 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 at time of submission, in writing, 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 that are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.
- .4 Allow 10 working days for Departmental Representative's review of each submission.

- .5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
- .7 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .8 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Relationship to adjacent work.
- .9 After Departmental Representative's review, distribute copies.
- .10 Submit electronic copy of shop drawings for each requirement requested in specification Sections, and as Departmental Representative may reasonably request.
- .11 Submit electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

- .12 Submit electronic 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.
- .13 Submit electronic 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.
- .14 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative:
 - .1 Documentation of testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .15 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .16 Delete information not applicable to project.
- .17 Supplement standard information to provide details applicable to project.
- .18 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .19 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining general conformance with design intent.
 - .1 This review shall not mean that Departmental Representative 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 samples for review in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative's business address.
- .3 Notify Departmental Representative in writing, at time of submission, of deviations in samples from requirements of Contract Documents.
- .4 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state so in writing to Departmental Representative prior to proceeding with Work.
- .5 Make changes in samples that Departmental Representative may require, consistent with Contract Documents.
- .6 Reviewed and accepted samples will become standard of quality of work and material against which installed Work will be verified.

1.4 MOCK-UPS

- .1 Erect mock-ups in accordance with 01 45 00 - Quality Control.

1.5 PHOTOGRAPHIC DOCUMENTATION

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution, as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 2 locations.
 - .1 Viewpoints and location: As determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly as directed by Departmental Representative.
 - .1 Upon completion of: excavation, foundation, framing and services before concealment, of Work, as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Saskatchewan
 - .1 Occupational Health and Safety Act 1996, updated 2014.

1.2 SAFETY PLAN

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.3 RESPONSIBILITY

- .1 The "Prime Contractor" according applicable local jurisdiction, is responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.4 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site-specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports weekly to Departmental Representative.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets.

- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 5 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.5 FILING OF NOTICE

- .1 If required by authority having jurisdiction, file Notice of Project with Provincial authorities prior to beginning of Work.

1.6 SAFETY ASSESSMENT

- .1 Perform site-specific safety hazard assessment related to project.

1.7 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.8 REGULATORY REQUIREMENTS

- .1 Perform Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Saskatchewan Occupational Health and Safety Regulations.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORESEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator, follow procedures in accordance with Acts and Regulations of Province having jurisdiction, and advise Departmental Representative verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have working knowledge of occupational safety and health regulations.
 - .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

- .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
- .4 Be on site during execution of Work.

1.12 POSTING OF DOCUMENTS

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

1.13 CORRECTION OF NON-COMPLIANCE

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

1.14 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.15 POWDER ACTUATED DEVICES

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

1.16 WORK STOPPAGE

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

1.17 FIRE PROTECTION

- .1 Comply with requirements of the local Fire Commissioner's Office.
- .2 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
- .3 Burning rubbish and construction waste materials is not permitted on site.
- .4 Maintain placed or installed firestopping to protect the portions of the Work during construction.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Definitions:
 - .1 Environmental Pollution and Damage: Presence of chemical, physical, or 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 humans; or degrade environment aesthetically, culturally, or historically.
 - .2 Environmental Protection: Prevention/control of pollution and habitat or environment disruption during construction.
- .2 Reference Standards:
 - .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.
 - .2 EPA General Construction Permit (GCP) 2012.

1.2 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.
- .3 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 Include in Environmental Protection Plan:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures comply with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas,

- structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
- .7 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
 - .1 Plans to include measures to minimize amount of material transported onto paved public roads by vehicles or runoff.
- .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .9 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .12 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .13 Waste Water Management Plan identifying methods and procedures for management and discharge of waste waters that are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .14 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

1.3 EXTERIOR SITE

- .1 Take measures to prevent spread of non-native, invasive plants and seeds.
 - .1 Wash trucks down before entry to work site.

1.4 FIRES

- .1 Fires and burning of rubbish on site is not permitted.
- .2 Where fires or burning is permitted, prevent staining or smoke damage to structures, materials or vegetation that is to be preserved.
 - .1 Restore, clean, and return stained or damaged work to new condition.
- .3 Provide supervision, attendance, and fire protection measures as directed.

1.5 DRAINAGE

- .1 Develop and submit Erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures comply with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations, EPA 832/R-92-005, Chapter 3 US EPA General Construction Permit.
- .2 Storm Water Pollution Prevention Plan (SWPPP) to be substituted for erosion and sediment control plan.
- .3 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .4 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .5 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.6 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect 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 metres minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas designated by Departmental Representative.

1.7 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Use waterway beds for borrow material only after written receipt of approval from Departmental Representative.
- .3 Waterways to be kept free of excavated fill, waste material, and debris.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

1.8 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this Contract.

- .2 Control emissions from equipment and plant in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.
 - .1 Provide temporary enclosures where directed by Departmental Representative.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.9 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: Include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Departmental Representative.

1.10 NOTIFICATION

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: After receipt of such notice, inform Departmental Representative of proposed corrective action and take such action for approval by Departmental Representative.
 - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions will be granted, nor equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

Not used.

Part 3 Execution

3.1 CLEANING

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

- .2 Leave Work area clean at end of each day.
- .3 Bury rubbish and waste materials on site where directed after receipt of written approval from Departmental Representative.
- .4 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .5 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .6 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

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

1.2 BUILDING SMOKING ENVIRONMENT

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

1.3 NATIONAL PARKS ACT

- .1 Perform Work in accordance with the Canada National Parks Act.

END OF SECTION

Part 1 General

1.1 INSPECTION

- .1 Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work wherever it is in progress.
- .2 Give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals, whether by Departmental Representative instructions or by 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 Work and pay cost of examination and correction. If Work is found in accordance with Contract Documents, cost of examination and replacement will be borne by Departmental Representative.

1.2 INDEPENDENT INSPECTION AGENCIES

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

1.3 ACCESS TO WORK

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

1.4 PROCEDURES

- .1 Notify appropriate agency and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples 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.

1.5 REJECTED WORK

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

1.6 REPORTS

- .1 Submit three hard copies and one electronic copy of inspection and test reports to Departmental Representative.
- .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

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

1.8 MOCK-UPS

- .1 Prepare mock-ups for Work specifically requested in specifications. Include for Work of Sections required to provide mock-ups.
- .2 Construct in locations acceptable to Departmental Representative.
- .3 Prepare mock-ups for Departmental Representative's review with reasonable promptness and in orderly sequence, to not cause delays in Work.
- .4 Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract Time, and no claim for extension for such default will be allowed.
- .5 If requested, Departmental Representative will assist in preparing schedule-fixing dates for preparation.

- .6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.9 MILL TESTS

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

END OF SECTION

Part 1 General

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

1.3 DEWATERING

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

1.4 WATER SUPPLY

- .1 Provide continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
- .3 Pay for utility charges at prevailing rates.

1.5 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, as required for operations on site.
- .2 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Contractor.
- .3 Provide and maintain temporary lighting throughout project.

1.6 FIRE PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.
 - .2 CAN/CSA Z321-96 (R2006), Signs and Symbols for the Workplace.

1.2 SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas that have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.4 SCAFFOLDING

- .1 Scaffolding in accordance with CSA S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms, temporary stairs.

1.5 HOISTING

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

1.6 CONSTRUCTION PARKING

- .1 Parking will be permitted on site.
- .2 Provide and maintain adequate access to project site.
- .3 Clean runways and taxi areas where used by Contractor's equipment.

1.7 OFFICES

- .1 Provide office heated to 22°C, lighted 750 lx, ventilated, and of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.

- .3 Subcontractors are to provide their own offices as necessary. Direct location of these offices.

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.

1.9 SANITARY FACILITIES

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

1.10 CONSTRUCTION SIGNAGE

- .1 Signs and notices for safety and instruction in both official languages; graphic symbols to CAN/CSA Z321.
- .2 Maintain approved signs and notices in good condition for duration of project and dispose of off-site on completion of project or earlier if directed by Departmental Representative.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period except as otherwise specifically directed by Departmental Representative.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Repair damage to roads caused by construction operations.
- .7 Construct access and haul roads necessary.
- .8 Haul roads: Construct with suitable grades and widths; sharp curves, blind corners; avoid dangerous cross traffic.
- .9 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .10 Dust control: Adequate to ensure safe operation at all times.

- .11 Location, grade, width, and alignment of construction and hauling roads: Subject to approval by Departmental Representative.
- .12 Lighting: Assure full and clear visibility for full width of haul road and work areas during night work operations.
- .13 Provide snow removal during period of Work.
- .14 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.12 CLEAN-UP

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

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

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

1.2 HOARDING

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

1.3 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.4 WEATHER ENCLOSURES

- .1 Close off floor areas where walls are not finished; seal off other openings.
- .2 Provide weather enclosures or other means as necessary to protect foundation excavations to maintain soil bearing capacity.

1.5 ACCESS TO SITE

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

1.6 PUBLIC TRAFFIC FLOW

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

1.7 FIRE ROUTES

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

1.8 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.

Simpson, Saskatchewan

1.9 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 locations and installation schedule with Departmental Representative, minimum 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

Part 1 General

1.1 REFERENCES

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

1.2 QUALITY OF PRODUCTS

- .1 Products, materials, equipment, and articles incorporated in Work are to be new, not damaged nor defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source, and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should disputes arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks, and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

- .1 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.

Simpson, Saskatchewan

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 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .6 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .7 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original.

1.5 TRANSPORTATION

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

1.6 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions, so that Departmental Representative may 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. Perform in a manner to neither damage nor put at risk any portion of Work.
- .2 For remedial work, employ specialists familiar with materials affected.

1.10 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 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.

1.11 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.

Simpson, Saskatchewan

1.12 PROTECTION OF WORK IN PROGRESS

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Owner's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in Place of Work, acceptable to Departmental Representative.

1.3 SURVEY REFERENCE POINTS

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

1.4 SURVEY REQUIREMENTS

- .1 Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement, and landscaping features.
- .4 Stake slopes and berms.
- .5 Stake batter boards for foundations.
- .6 Establish foundation column locations and floor elevations.

1.5 RECORDS

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

1.6 SUBMITTALS

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

- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.7 SUBSURFACE CONDITIONS

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

END OF SECTION

Part 1 General

1.1 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit 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.
- .7 Execute Work by methods to avoid damage to other Work, and that will provide proper surfaces to receive patching and finishing.
- .8 Restore work with new products in accordance with requirements of Contract Documents.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.
- .2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .3 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 on-site containers for collection of waste materials and debris. Equip containers with covers to prevent spread of waste by wind, and entry into container by unauthorized persons.
- .6 Provide and use marked separate bins for recycling. Refer to Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Dispose of waste materials and debris off site.
- .8 Clean construction zones and immediate surrounding area with magnetic sweeper, weekly at minimum, during demolition and construction.
- .9 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.
- .10 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

1.2 FINAL CLEANING

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

- .6 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .7 Remove dirt and other disfiguration from exterior surfaces.
- .8 Clean construction zones and immediate surrounding area with magnetic sweeper at completion of project.
- .9 Clean and sweep roofs, deck and stairs.

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .2 Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, re-modeling, repair and demolition operations.
- .3 Hazardous: Exhibiting the characteristics of hazardous substances including properties such as ignitability, corrosiveness, toxicity or reactivity.
- .4 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including properties such as ignitability, corrosiveness, toxicity, or reactivity.
- .5 Non-toxic: Not poisonous to humans either immediately or after a long period of exposure.
- .6 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- .7 Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- .8 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form; recycling does not include burning, incinerating, or thermally destroying waste.
- .9 Return: To give back reusable items or unused products to vendors for credit.
- .10 Reuse: To reuse a construction waste material in some manner on the project site.
- .11 Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- .12 Sediment: Soil and other debris that has been eroded and transported by storm or well production run off water.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.
- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
 - .1 Solvents in paints and other coatings;
 - .2 Wood preservatives; strippers and household cleaners;

- .3 Adhesives in particleboard, fiberboard, and some plywood; and foam insulation.
- .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- .18 Construction Waste Management Plan: A project related plan for the collection, transportation, and disposal of the waste generated at the construction site; the purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate waste management requirements with all Divisions of the Work for the project, and ensure that requirements of the Construction Waste Management Plan are followed.
- .2 Preconstruction Meeting: Arrange a pre-construction meeting in accordance with Section 01 31 19 – Project Meetings before starting any Work of the Contract attended by the Owner, Contractor, affected Subcontractors and Departmental Representative to discuss the Construction Waste Management Plan and to develop mutual understanding of the requirements for a consistent policy towards waste reduction and recycling.

1.3 SUBMITTALS

- .1 Provide required information in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Draft Construction Waste Management Plan (Draft CWM Plan): Submit to Departmental Representative a preliminary analysis of anticipated site generated waste by listing a minimum of five (5) construction or demolition waste streams that have potential to generate the most volume of material indicating methods that will be used to divert construction waste from landfill and source reduction strategies; Departmental Representative will provide commentary before development of Contractor's Construction Waste Management Plan.
 - .2 Construction Waste Management Plan (CWM Plan): Submit a CWM Plan for this project prior to any waste removal from site and that includes the following information:
 - .1 Material Streams: Analysis of the proposed jobsite waste being generated, including material types and quantities forming a part of identified material streams in the Draft CWM Plan; materials removed from site destined for alternative daily cover at landfill sites and land clearing debris cannot be considered as

contributing to waste diversion and will be included as a component of the total waste generated for the site.

- .2 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.
- .3 Alternative Waste Disposal: Prepare a listing of each material proposed to be salvaged, reused, recycled or composted during the course of the project, and the proposed local market for each material.
- .4 Landfill Materials: Identify materials that cannot be recycled, reused or composted and provide explanation or justification; energy will be considered as a viable alternative diversion strategy for these materials where facilities exist.
- .5 Landfill Options: The name of the landfill where trash will be disposed of; landfill materials will form a part of the total waste generated by the project.
- .6 Materials Handling Procedures: A description of the means by which any recycled waste materials will be protected from contamination, and a description of the means to be employed in recycling the above materials consistent with requirements for acceptance by designated facilities.
- .7 Transportation: A description of the means of transportation of the recyclable materials, whether materials will be site separated and self hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site, and destination of materials.

1.4 PROJECT CLOSEOUT SUBMISSIONS

- .1 Record Documentation: Submit as constructed information in accordance with Section 01 78 00 – Closeout Submittals as follows:
 - .1 Construction Waste Management Report (CWM Report): Submit a CWM Report for this project in a format acceptable to submittal requirements and that includes the following information:
 - .1 Accounting: Submit information indicating total waste produced by the project.
 - .2 Composition: Submit information indicating types of waste material and quantity of each material.
 - .3 Diversion Rate: Submit information indicating total waste diverted from landfill as a percentage of the total waste produced by the project.
 - .4 Transportation Documentation: Submit copies of transportation documents or shipping manifests indicating weights of materials, and other evidence of disposal indicating final location of waste diverted from landfill and waste sent to landfill.

- .5 Multiple Waste Hauling: Compile all information into a single CWM Report where multiple waste hauling and diversion strategies were used for the project.

1.5 QUALITY ASSURANCE

- .1 Resources for Development of Construction Waste Management Report (CWM Report): The following sources may be useful in developing the Draft Construction Waste Management Plan:
 - .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, and incorporate into CWM Plan.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Storage Requirements: Implement a recycling/reuse program that includes separate collection of waste materials as appropriate to the project waste and the available recycling and reuse programs in the project area.
- .2 Handling Requirements: Clean materials that are contaminated before placing in collection containers and ensure that waste destined for landfill does not get mixed in with recycled materials:
 - .1 Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.
 - .2 Arrange for collection by or delivery to the appropriate recycling or reuse facility.
- .3 Hazardous Waste and Hazardous Materials: Handle in accordance with applicable regulations.

Part 2 Products

Not used.

Part 3 Execution

3.1 CWM PLAN IMPLEMENTATION

- .1 Manager: Contractor is responsible for designating an on-site party or parties responsible for instructing workers and overseeing and documenting results of the CWM Plan for the project.
- .2 Distribution: Distribute copies of the CWM Plan to the job site foreman, each Subcontractor, the Owner, the Departmental Representative and other site personnel as required to maintain CWM Plan.
- .3 Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, composting, and return methods being used for the project to Subcontractors at appropriate stages of the project.

- .4 Separation Facilities: Lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, composting and return:
 - .1 Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.
 - .2 Hazardous wastes shall be separated, stored, and disposed of in accordance with local regulations.
- .5 Progressive Documentation: Submit a monthly summary of waste generated by the project to ensure that waste diversion goals are on track with project requirements:
 - .1 Submission of waste summary can coincide with application for progress payment, or similar milestone event as agreed upon between the Contractor and Departmental Representative.
 - .2 Monthly waste summary shall contain the following information:
 - .1 The amount in tonnes or m³ and location of material landfilled,
 - .2 The amount in tonnes or m³ and location of materials diverted from landfill, and
 - .3 Indication of progress based on total waste generated by the project with materials diverted from landfill as a percentage.

3.2 SUBCONTRACTOR'S RESPONSIBILITY

- .1 Subcontractors shall cooperate fully with the Contractor to implement the CWM Plan.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Procedures for Acceptance of Work:
 - .1 Contractor's Inspection:
 - .1 Contractor: Conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .2 Notify Departmental Representative, in writing, of satisfactory completion of Contractor's inspection; submit verification that corrections have been made.
 - .3 Request Departmental Representative inspection.
 - .2 Departmental Representative Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: Submit written certificates, in English, indicating that tasks have been performed as follows:
 - .1 Work: Completed and inspected for compliance with Contract Documents.
 - .2 Defects: Corrected and deficiencies completed.
 - .3 Equipment and systems: Tested, adjusted, balanced, and fully operational.
 - .4 Certificates required by Fire Commissioner and Utility companies: Submitted.
 - .5 Operation of systems: Demonstrated to designated personnel.
 - .6 Work: Complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks have been completed, request final inspection of Work by Departmental Representative and Contractor.
 - .2 When Work incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Contractor's Representative and Departmental Representative, in accordance with Section 01 31 19 - Project Meetings to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, three print and one electronic final copies of operating and maintenance manuals in English.
 - .1 Provide electronic O & M manuals on CD or DVD.
- .3 Provide spare parts, maintenance materials, and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source, and quality of products supplied.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: Vinyl, hard covered, 3 'D' ring, with spine and face pockets.
 - .1 When multiple binders are used, correlate data into related consistent groupings.
- .3 Text: Manufacturer's printed data, or typewritten data.

1.4 CONTENTS – O&M MANUALS

- .1 Binder Cover and Binder Edge

- .1 Include: Building Name, address, project name, project number, completed date.
- .2 Title Page
 - .1 O&M Manual for... Building name, address, date, general contractor information: name address, phone number.
 - .2 Consultant name address, phone number.
 - .3 Table of contents indicates each binder's contents.
- .3 Index and tabs
 - .1 Dividers with permanently marked tabs separate each section and sub section.
 - .2 Tab labels typed, not hand written.
 - .3 Main tab for each specification section.
- .4 Tab A: Signed Letter of Warranty, to include:
 - .1 Date.
 - .2 Project name.
 - .3 Project number.
 - .4 Building Location.
 - .5 Warranty start date and end, to be from date of substantial, declared by Consultant.
 - .6 Organization, names and phone numbers of persons to call for warranty services.
 - .7 All warranties to be included from all contractors in this section and extended warranties.
- .5 Tab B: Contact Information for all Subcontractors and Suppliers, including:
 - .1 Name, address, telephone number of manufacturer, installing contractor.
 - .2 24-hour number for emergency service for all equipment in this section identified by equipment.
- .6 Tab C: All Reports and Permits:
 - .1 All permits, including building permit.
- .7 Tab D: As-Built Drawings:
 - .1 Marked-up by contractor, changes marked in red to also be given to Consultant.
- .8 Tab G: Shop Drawings:
 - .1 Copy of all reviewed "by the Consultant" shop drawings.
- .9 Tab H: Maintenance
 - .1 Copy of specific service and maintenance manuals.
 - .2 Preventative and corrective maintenance, with service procedures and schedules.

- .3 Schedule for preventive maintenance in a printed format and electronic format compatible with Owner's system.
- .4 Recommended frequency of performance for each preventive maintenance task, cleaning, inspection and scheduled overhauls or reconditioning.
- .5 Instructions for minor repairs or adjustments required for preventive maintenance routines.
- .6 Listing of any special tools required to service or maintain the equipment.
- .10 Last Tab: Miscellaneous Items
 - .1 Health and Safety submittals including: site specific hazard assessment, safety manual TOC and company safety policy, MSDS sheets (if applicable) signed site orientations for worker, copy of first aid certificate, copy of emergency plan and muster location.
 - .2 Special requirements for equipment, not to be used for reports.

1.5 AS-BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store as-built documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label as-built documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.
- .4 Maintain as-built documents in clean, dry and legible condition.
 - .1 Do not use as-built documents for construction purposes.
- .5 Keep as-built documents and samples available for inspection by Departmental Representative.
- .6 Record as-built information on drawings and in designated copy of Project Manual provided by Departmental Representative.
- .7 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

- .8 Maintain information during construction on project site drawings and accurately record deviations of newly installed or existing works from Contract documents.
- .9 Use red felt tip marking pens for recording information.
- .10 Mark on one set of prints and at completion of project and prior to final inspection; neatly transfer notations to second set.
- .11 Ensure but do not limit recording of following information on as-built drawings:
 - .1 Locations of appurtenances concealed in construction, referenced to visible and accessible features of structure.
 - .2 Changes made by Change Order.
 - .3 Measured locations of appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.
- .12 Incorporate as-built information into CAD drawings.
- .13 Submit as-built drawings to Departmental Representative.
 - .1 Provide in electronic form as CAD .dwg format, on CD or DVD.
- .14 Specifications: Mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.

1.6 FINAL SURVEY

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

1.7 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.8 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.

- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.
 - .3 Deliver to site; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.10 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative approval.

- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.
- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .3 Cross-reference to warranty certificates as applicable.
 - .4 Starting point and duration of warranty period.
 - .5 Summary of maintenance procedures required to continue warranty in force.
 - .6 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .7 Organization, names and phone numbers of persons to call for warranty service.

- .3 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
- .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Formwork and supporting falsework shall be designed and constructed in accordance with the requirements of CSA A23.1, CSA STD. S269.1 and ACI 347 as applicable to the work.
- .2 Assume full responsibilities for the design and for the adequacy and safety of all formwork and falsework.
- .3 The design and erection of formwork and relating supporting works shall comply to Construction Safety Legislation and Regulations.

1.2 QUALITY ASSURANCE

- .1 Qualifications of Workmen; provide at least one journeyman carpenter who is to be present at all times during execution of this portion of the Work and who is thoroughly familiar with the type of materials being installed, the referenced standards, and the requirements of this work, and who is to direct all work performed under this section.

1.3 PRODUCT HANDLING

- .1 Protection: use all means necessary to protect formwork materials before, during and after installation and to protect the installed work and materials of all other trades.
- .2 Replacements: in the event of damage, immediately make all repairs and replacements necessary to the approval of the Departmental Representative and at no additional cost to the Departmental Representative.

Part 2 Products

2.1 FORM MATERIALS

- .1 Formwork Lumber: plywood and wood formwork materials to CSA-A23.1.
- .2 Steel panel and other sheet material forms to CSA-A23.1.
- .3 Falsework materials to CSA STD.S269.1.

2.2 TIES AND SPREADERS

- .1 Form accessories to be partially or wholly embedded in concrete such as ties, hangers, etc., shall be an approved commercially manufactured type. Wire is not acceptable. After breakback, the portion remaining with the concrete shall leave no metal within 25 mm of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed 22 mm in diameter.

2.3 ALTERNATE FORMING SYSTEMS

- .1 Alternate forming systems may be used subject to the advance review and approval of the Departmental Representative.

2.4 MATERIALS

- .1 Polyethylene vapour barrier membrane: to CAN/CGSB 51.34 M86, Type 1, 0.15mm thick.
- .2 Void Form: Moisture resistant treated cardboard, voided, with hardboard surface for reinforcing chair support, structurally sufficient to support weight of wet concrete mix until initial set.
- .3 Sealants for porous to porous materials: to conform to CAN/CGSB-19.13 M87.
- .4 Sealants for porous to non-porous materials to conform to CAN/CGSB 19.24 M90.
- .5 Sealant primers in accordance with manufacturer's recommendations.

2.5 OTHER MATERIALS

- .1 All other materials, not specifically described but required for proper completion of concrete formwork, to be selected by the Contractor and subject to the advance review of the Departmental Representative.

Part 3 Execution

3.1 SURFACE CONDITIONS

- .1 Inspection
 - .1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
 - .2 Verify that forms may be constructed in accordance with all pertinent codes and regulations. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.
- .2 Discrepancies
 - .1 In the event of discrepancy, immediately notify the Departmental Representative.
 - .2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FORMWORK ERECTION

- .1 Construct formwork, shoring and bracing to meet design and code requirements, accurately, so that resultant finished concrete conforms to shapes, lines and dimensions indicated on drawings.
- .2 Arrange and assemble formwork so as to permit easy dismantling and stripping so that concrete is not damaged during its removal.
- .3 Align joints and make watertight, to prevent leakage of mortar and disfigured appearance of concrete. Keep form joints to minimum.
- .4 Obtain Departmental Representative's permission before framing openings in structural members, which are not indicated on structural drawings.
- .5 Provide bracing to ensure stability of formwork as a whole. Shore or strengthen all previously constructed parts liable to be overstressed by construction loads.
- .6 Provide chamfer strips on external corners of beams, columns, curbs, and housekeeping pads.
- .7 Construct formwork to maintain the following maximum tolerances:
- .8 Deviation from horizontal and vertical lines: 5 mm in 3 m
- .9 Deviation of building dimensions indicated on drawings and position of columns, walls and partitions: 5 mm
- .10 Deviation in cross sectional dimensions of columns or beams, or in thickness of slabs and walls: 5 mm
- .11 Camber slabs and beams: 5 mm per 3 m of span unless otherwise indicated on drawings. Maintain rigid to prevent deformation under load and provide positive means of adjustment of shores and struts.
- .12 Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices and embedded parts. Do not apply form release agent where concrete surfaces are to receive special finishes which are affected by agent.

3.3 INSERTS/EMBEDDED PARTS/OPENINGS

- .1 Provide formed openings where required for pipes, conduits, sleeves and other work to be embedded in or passing through concrete members.
- .2 Accurately locate and set in place items which are to be cast directly into concrete.
- .3 Co-ordinate work of other sections and co-operate with trades involved in forming and/or setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts. Do not perform work unless specifically indicated on drawings or approved prior to installation.

- .4 Install all concrete accessories in accordance with drawings and manufacturer's recommendations, straight, level and plumb. Ensure items are not disturbed during concrete placement.
- .5 Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close temporary ports or openings with tight fitting panels, flush inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

3.4 RE-USE OF FORMS

- .1 Except as specifically approved in advance by the Departmental Representative, re-use of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
- .2 Re-use of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete as viewed by the Engineer.

3.5 FIELD QUALITY CONTROL

- .1 Inspect and check completed formwork, shoring and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties and other parts are secure.
- .2 Inform Departmental Representative when formwork is complete and has been cleaned to allow for inspection.

3.6 CLEANING

- .1 Clean forms as erection proceeds, to remove foreign matter. Remove cuttings, shavings and debris from within forms. Flush completely with water or air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
- .2 During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within a heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORM REMOVAL

- .1 Vertical forms not supporting concrete weight may be removed after 45 degree days.
- .2 Formwork for beam soffits, slabs and other parts that support concrete weight shall remain in place undisturbed for 150 degree days. Reshoring at this time is required and shall be planned in advance and subject to approval. Reshoring shall remain in place until concrete has reached its twenty-eight (28) day specified strength and/or a minimum of an additional 150 degree days.

- .3 A degree day is defined using the average high and low temperature for the day, i.e. high 20°C and low 10°C would be a 15 degree day. The high and low temperature may be natural or artificial heat. If artificial heat is used a high-low recording thermometer shall be placed at a location designated by the Discipline Representative.
- .4 Alternatively, the forms, shores, etc., shall remain in place until the concrete has reached eighty percent (80%) of its specified twenty-eight (28) day strength and a minimum of twenty-one (21) calendar days at a minimum temperature of 10°C.
- .5 When formwork is removed during the curing period the exposed concrete shall be cured as specified.
- .6 In all cases forms and their supports shall not be disturbed without the prior approval of the Departmental Representative.
- .7 Remove formwork progressively and in accordance with code requirements and so that no loads or unbalanced loads are imposed on structure.
- .8 Loosen forms carefully. Do not wedge pry bars, hammers or tools against concrete surfaces.

3.8 VAPOUR BARRIER MEMBRANE

- .1 Install vapour barrier membrane under concrete slab-on-grade inside building.
- .2 Lap vapour barrier membrane minimum 150mm at joints and seal to manufacturer's instructions.
- .3 Seal punctures in vapour barrier membrane before placing concrete. Use patching material at least 150mm larger than puncture and seal to manufacturer's recommendations.

3.9 VOID FORMS

- .1 Thickness as shown on the drawings. Wrap void form under gradebeams in 0.10mm polyethylene film and lap and tape all joints. Slit poly film prior to installing treated sideboards.
- .2 Cover top surface of void form for structural slabs with 0.10mm (4 mil) polyethylene film, lap and tape all joints.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA A23.1 "Concrete Materials and Methods of Concrete Construction".
- .2 CSA A23.3 "Design of Concrete Structures".
- .3 CSA G30.18 "Carbon Steel Bars for Concrete Reinforcement".
- .4 ACI 315 "American Concrete Institute - Details and Detailing of Concrete Reinforcement".

1.2 TESTING

- .1 Reinforcing steel samples may be taken from bundles delivered from the mill, at the Departmental Representative's discretion, if the reinforcing steel grade stamp indicating yield strength is not clearly visible on the bars.
- .2 Where bundles are identified by heat number and a mill analysis accompanies the report, one tensile and one bending test specimen will be taken from each ten tonnes, or fraction thereof, of each size of reinforcement steel.
- .3 Where positive identification of heat numbers cannot be made, or where random samples are taken, one series of tests will be made from each 2½ tonnes, or fraction thereof, of each size and kind of reinforcement steel.
- .4 All testing to be at the Contractor's expense.

1.3 DELIVERY AND STORAGE

- .1 Reinforcing steel and accessories shall be delivered, handled and stored in a manner which prevents bond damage to its fabricated form or contamination with foreign matter.

1.4 QUALITY ASSURANCE

- .1 Perform concrete reinforcing work in accordance with CSA A23.1, unless indicated otherwise herein.
- .2 Provide at least one person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the best methods for their installation and who shall direct all work performed under this Section.

1.5 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with the General Conditions.

- .2 Clearly indicate bar sizes, spacings, splice locations and quantities of reinforcing steel, bending and cutting schedules, and supporting and spacing devices.
- .3 Prepare shop drawings under the direction of a Professional Engineer who is experienced in reinforcement detailing.
- .4 All shop drawings are to be reviewed by the Departmental Representative before fabrication commences.

Part 2 Products

2.1 SHOP DRAWINGS

- .1 Reinforcing steel: to be high strength grade 400 MPa (58 ksi) yield, deformed billet steel bars conforming to requirements of CSA G30.18-M; sizes indicated on drawings.

2.2 ACCESSORY MATERIALS

- .1 Tie Wire: minimum 1.29 mm or heavier annealed type, or patented system approved by Consultant.
- .2 Chairs, Bolster, Support Bars, Spacers: adequately sized and shaped for strength and support of reinforcing during construction conditions. Porous brick materials are not to be used for reinforcing chairs.
- .3 Special Chairs, Bolsters, Support Bars, Spacers: (where adjacent to exposed concrete surfaces) plastic coated type; sized and shaped as required.

Part 3 Execution

3.1 GENERAL

- .1 Placing of reinforcing steel including cleaning, splicing, bending to be in accordance with CSA A23.1 and the reviewed placing drawings and design drawings.

3.2 FABRICATION

- .1 Fabricate concrete reinforcing in accordance with drawings and CSA A23.1, American Concrete Institute ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".
- .2 Locate reinforcing splices, not indicated on drawings, at points of minimum stress. Splice 36 bar diameters minimum. Location of splices is to be reviewed by the Departmental Representative.
- .3 Bend all bars cold.

3.3 PLACEMENT

- .1 Place reinforcing as indicated on drawings, adequately supported and secured against displacement. Do not deviate from true alignment.

- .2 Before placing concrete, ensure reinforcing is clean, free of loose scale, dirt or other foreign coatings which would reduce the bond to concrete.
- .3 Support bars for top steel in slabs to be 15M minimum and to be supported at a maximum of 1200 mm. Slab bottom reinforcing to be supported at a maximum of 1200 mm.
- .4 Reinforcing is to be checked, in place, by the Contractor prior to calling the Departmental Representative for inspection. Completeness of reinforcing is the responsibility of the Contractor.

3.4 CLEARANCE

- .1 Preserve clear space between bars of not less than 1½ times the nominal diameter of reinforcing bars.
- .2 In no case let the clear distance to be less than 40 mm nor less than 1½ times the maximum size of aggregate, unless indicated otherwise on the drawings.
- .3 Provide the following minimum concrete covering of reinforcement:
 - .1 Concrete below ground deposited against forms: 50 mm
 - .2 Concrete deposited against earth: 75 mm
 - .3 Concrete elsewhere: As per CSA A23.1 unless indicated otherwise on the drawings.

3.5 SPLICING

- .1 Place bars in horizontal members with minimum laps at splices sufficient to develop the strength of the bars.
- .2 Wherever possible, stagger the splices of adjacent bars.
- .3 Splice 36 bar diameters minimum.
- .4 Wire fabric - make all splices in wire fabric at least 1½ meshes wide.
- .5 Other splices - make only those other splices that are indicated on the reviewed shop drawings or specifically approved by the Departmental Representative.
- .6 Dowels - place all required steel dowels and securely anchor them into position before the concrete is placed.
- .7 Obstructions - in the event conduits, piping, sleeves or any other items interfere with placing reinforcement as indicated on the drawings or as otherwise required, immediately advise the Departmental Representative and obtain approval of new procedure before placing concrete.
- .8 Welding - do not weld reinforcing bars without written permission from the Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CSA – "Cementitious Materials for use in concrete."
- .2 CSA A23.1 - "Concrete Materials and Methods of Concrete Construction".
- .3 CSA A23.2 - "Method of Test for Concrete".
- .4 CSA A23.3 - "Design of Concrete Structures".
- .5 CSA A266.1 - "Air Entraining Admixtures for Concrete".

1.2 QUALITY ASSURANCE

- .1 Provide at least one person who shall be present at all times during execution of this portion of the Work and who shall be thoroughly trained and experienced in placing the types of concrete specified and who shall direct all work performed under this section.
- .2 The concrete producer/contractor shall certify that "the concrete produced is as per proposed mix proportions, will produce concrete of the specified quality and strength, and comply with Cast-in-Place Concrete Section 033000 of the specification", before concrete work proceeds.
- .3 Perform cast-in-place concrete work to requirements of CSA A23.1, A23.2 and A23.3.

1.3 INSPECTION AND TESTING

- .1 Testing of concrete will be performed in accordance with CSA A23.2 "Method of Test for Concrete".
- .2 Required in place testing will be paid for by the Contractor.
- .3 Testing will be performed by a certified testing firm approved by the Departmental Representative and paid for by the Contractor. Testing firm shall be qualified in accordance with CSA A283 "Qualification Code for Concrete Testing" and supplement.
- .4 One set of three (3) test cylinders shall be taken for every 50 cu. meters of concrete placed, with a minimum of one set per day.
- .5 One slump test shall be taken for each set of test cylinders taken.
- .6 One additional test cylinder shall be taken during freezing weather (below -5°C), and shall be cured on jobsite under same conditions as concrete it represents.
- .7 Testing information should include date and time, name of job, location of job, location of where concrete was placed, strength of concrete specified, slump, air content, admixtures used and temperatures: concrete – air.

- .8 All forms and reinforcing to be inspected by the Departmental Representative before concrete is poured.

1.4 MIX DESIGN

- .1 The Contractor shall submit proposed mix designs for review by the Departmental Representative two weeks prior to commencement of construction. The proposed mix designs shall include the following items: cement type, admixtures, mix proportions, slump, coarse aggregate size, air content, density, compression strength and water/cementing materials ratio. Appended to the proposed mix designs shall be properties of aggregates including sieve analysis, specific gravity and low density material determination of both fine and coarse aggregate.
- .2 Each proposed mix design shall be accompanied by a laboratory report from an approved independent testing laboratory performed within the last six month period.
- .3 The laboratory report will include strength, density, air content and slump test results. The test specimens shall be prepared with materials supplied by the concrete producer and similar to the proposed mix ingredients.
- .4 Where the concrete producer can furnish established evidence, certified by an independent testing laboratory, that his current supply of cement, admixture, aggregates and water meet the requirements of this specification, and his established mix designs using these ingredients meet all the requirements of this specification, these reports may be submitted to the Departmental Representative for review in lieu of the proposed mix approach. The laboratory submittal must include the compressive strength standard deviation calculated in accordance with ACI 318.

Part 2 Products

2.1 CONCRETE MATERIALS

- .1 Cement: General use type GU or sulphate resistant type HS, Portland type, conforming to requirements of CSA A30001.
- .2 Fine and Coarse Aggregate: conforming to requirements of CSA A23.1. Aggregates used in concrete for interior floor slabs shall have low density material not exceeding 0.3% by weight.
- .3 Waters: clean and free from injurious amounts of oil, alkali, organic matter, or other deleterious materials.
- .4 All concrete to be transit-mixed and in accordance with CSA A23.1.
- .5 Grout to be non-shrinking, non-metallic, pre-blended grouting compound; capable of a minimum compressive strength of 20 MPa at 3 days and 50 MPa at 28 days.

2.2 CONCRETE MIXES

- .1 Mix concrete in accordance with requirements of CSA A23.1. Concrete mix design to be suitable for pumpability if this method of placement is to be used.
- .2 All concrete shall have the following minimum requirements unless noted otherwise on the drawings. Water/cementitious ratio shall not exceed 0.50 and the ratio of Supplementary Cementing Materials to total cementitious content shall not exceed 20%. The water/cementitious ratio is selected for reasons other than strength alone and strength may not be the governing criteria.

Type	Location	f'c MPa	Cement Type	Aggreg. Max. mm	Slump (mm)	Total Air Content %
1.	Grade Beams and Pile Caps	30	HS	20	50 to 100	4 to 6
2.	Exterior Slabs	30	HS	20	50 to 100	4 to 6
3.	Interior Grade Supported Slabs	30	GU	20	50 to 100	*****

- .3 Each load of ready mixed or transit-mixed concrete delivered to the project site shall be accompanied by duplicate delivery slips providing the following information:
 - .1 Name of ready-mix batch plant.
 - .2 Serial number of ticket.
 - .3 Date and truck number.
 - .4 Name of Contractor.
 - .5 Specific designation of project.
 - .6 Specific class of concrete.
 - .7 Amount of concrete in cubic meters.
 - .8 Time of loading or first mixing aggregate, cement and water.
- .4 Use set-retarding admixtures during hot weather only when approved by Departmental Representative in writing.

2.3 ADMIXTURES

- .1 Air Entrainment: to CSA A266.1 - "Air-Entraining Admixtures for Concrete".
- .2 .2 Chemicals: to CSA A266.2 - "Chemical Admixtures for Concrete".

- .3 .3 Use of calcium chloride or admixtures containing calcium chloride is prohibited.

2.4 CURING COMPOUNDS

- .1 Clear sealer shall qualify under C.G.S.B. 90-GP-1 to be compatible with any subsequent finishes.

Part 3 Execution

3.1 INSPECTION

- .1 Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- .2 Verify that all items to be embedded in concrete are in place.
- .3 Verify that concrete may be placed to the lines and elevations indicated on the drawings, with all required clearance from reinforcement.

3.2 DISCREPANCIES

- .1 In the event of discrepancy, immediately notify the Departmental Representative.
- .2 Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

- .1 Ensure that all forms have been cleaned and oiled in accordance with Section 031000.
- .2 Thoroughly clean all transporting and handling equipment.

3.4 PLACING CONCRETE

- .1 Place concrete in accordance with requirements of CSA A23.1 and as indicated on drawings.
- .2 Notify Departmental Representative and Inspection and Testing Firm a minimum of 48 hours prior to commencement of concreting operations.
- .3 Ensure all anchors, seats, plates and other items to be cast into concrete are present and held securely in place.
- .4 Maintain accurate records of poured concrete items. Record date, location of pour, quantity, air temperature and test samples taken.
- .5 Ensure reinforcement, inserts and embedded parts are not disturbed during concrete placement.
- .6 Prepare previously placed concrete by cleaning thoroughly with approved methods.

- .7 Pour concrete continuously between predetermined construction and control joints. All construction joints subject to approval of the Departmental Representative.
- .8 Convey concrete to the place of final deposit by methods which will prevent the segregation or loss of material.
- .9 Equipment to be such that when concreting has once started, the depositing of concrete is to proceed at a rate and sequence such that concrete is at all times sufficiently plastic to ensure that each successive lift can be vibrated into the previous lift for proper bonding.
- .10 Conveying and placing equipment to be free of hardened concrete and foreign material. Clean at frequent intervals.
- .11 Concrete to be deposited as close as practicable to final position. Avoid segregation due to rehandling or flowing. Place in horizontal lifts to maintain a level surface.
- .12 Free fall of concrete not to exceed 3000 mm. If segregation is likely, tremies or trunks to be used.
- .13 Consolidate thoroughly and uniformly by tamping, hand tools, vibrators and finishing machines. Use internal vibrators wherever practicable. External-type vibrators only where satisfactory surfaces cannot be obtained with internal type. Keep one spare vibrator on site for emergency use.
- .14 Internal vibrators applied vertically at the point of deposit in the areas of freshly placed concrete. Allow to sink in the concrete until penetrated into the previous layer of concrete. Extreme care to be taken not to disturb the reinforcing steel or the forms. Do not use vibrators to make concrete flow in forms. Keep vibrators constantly moving to prevent segregation.
- .15 All finished concrete floor slabs to be Class A and steel-trowelled. Floor level shall be accurate to 5 mm in 3000 mm.
- .16 Apply curing compound to concrete immediately after stripping forms or finishing, but not before surface moisture has evaporated.
- .17 Place grout under all steel column base plates and beam bearing plates directly supported by concrete using manufacturer's standard method.

3.5 COLD WEATHER REQUIREMENTS

- .1 When the air temperature is at or below 5°C or when there is a probability of it falling to that limit during the placing or curing period, cold weather requirements shall be applicable.
- .2 Provide heating equipment or heating plant on the job ready for use when concrete is being placed during cold weather. Such equipment shall be adequate for the purpose of maintaining the required temperature during the placing and curing of the concrete. The methods used for heating shall be

approved by the Departmental Representative. All heaters shall be vented to the exterior.

- .3 Concrete shall not be placed on or against reinforcing, formwork, ground or any surface that is at a temperature of less than 5°C.
- .4 When being placed, the concrete shall have a temperature between 15°C and 30°C.
- .5 The temperature of the concrete at all surfaces shall be maintained at not less than 21°C for four days, or at not less than 10°C for seven days after placing. Means shall be provided to humidify the air within enclosures and to keep the concrete and formwork continuously moist if dry heat is used.
- .6 At the end of the specified protection period, the temperature of the concrete shall be reduced gradually at a rate not exceeding 3°C per day.
- .7 All protective coverings shall be kept clear of the concrete and form surfaces to permit free circulation of air and shall be maintained intact for at least 24 hours after the artificial heat is discontinued.

3.6 HOT WEATHER REQUIREMENTS

- .1 When the air temperature exceeds 30°C, hot weather requirements shall be applicable.
- .2 Time of initial mixing to complete discharge shall not exceed one hour and fifteen minutes and concrete placed shall not exceed 30°C.
- .3 Concrete form surfaces and reinforcing steel shall be sprinkled with cool water just prior to placing concrete. Standing water or puddles shall be removed prior to concrete placement.
- .4 Special wind protection shall be provided as required to prevent rapid moisture loss.
- .5 Beams and slabs shall be kept continuously damp for twenty-four (24) hours by normal curing procedures as outlined by this Specification.
- .6 The use of water reducing agents shall be subject to the approval of the Departmental Representative when hot weather conditions prevail.

3.7 CURING AND PROTECTION

- .1 All equipment needed for the curing and protection of the concrete previously approved by the Departmental Representative shall be on hand and ready for use before actual placing is started.
- .2 Freshly placed concrete shall be protected from the effects of direct sunshine, drying winds, cold, excessive heat and running water by the use of adequate tarpaulins or other suitable material to cover completely, or enclose all freshly finished surfaces until the end of the curing period specified.

- .3 The water for curing shall be clean and free from any material that will cause staining or discoloration of the concrete. A liquid membrane curing compound shall be used under circumstances where the application of moisture is impracticable and where such compound will not jeopardize the appearance of the concrete nor the bonding of future floor finishes.
- .4 Formed surfaces shall be kept wet by sprinkling. When forms are removed during curing period, apply curing compound as per manufacturer's recommendations.
- .5 Horizontal surfaces shall be kept moist by ponding, sprinkling or absorptive mat kept continuously wet. In lieu thereof apply curing compound as per manufacturer's recommendations.
- .6 Installation of windbreaks and shading shall be provided when necessary.
- .7 Duration of curing all concrete surfaces shall continue until the cumulative number of days or fraction thereof, during which temperature of the air in contact with the concrete is above 10°C, has totaled seven (7) days.

3.8 PATCHING

- .1 After the removal of the forms concrete surfaces will be subject to inspection by the Departmental Representative.
- .2 All exposed metal form ties, nails and wire shall be removed, fins broken off, and all loose concrete removed.
- .3 Form tie pockets shall be thoroughly wetted and patched with grout or mortar. Exterior face form tie pockets below grade may be filled with bituminous mulch.
- .4 Honeycombed and other defective surfaces shall be chipped away to a depth of not less than 25 mm with the edges perpendicular to the surface, thoroughly wetted and patched with grout or mortar as directed by the Departmental Representative.
- .5 Grout or mortar shall be thoroughly compacted into place and finished to match the adjoining concrete.
- .6 On all exposed smooth vertical surfaces of the exposed concrete, except at unfinished areas: remove blemishes, formwork joint marks by rubbing with carborundum block and water. Leave finished surfaces smooth, unmarred. Complete rubbing within twenty-four (24) hours of stripping formwork.

3.9 DEFECTIVE CONCRETE

- .1 Concrete not meeting the requirements of the specifications and drawings shall be considered defective concrete.
- .2 Concrete not conforming to the lines, detail and grade specified herein or as shown on the drawings shall be modified or replaced at the Contractor's expense and to the satisfaction of the Departmental Representative. Finished lines, dimensions and surfaces shall be correct and true within tolerances specified in the Formwork Section of these Specifications.

- .3 Concrete not properly placed, all honeycombing, and other defects in critical areas of stress shall be repaired or replaced at the Contractor's expenses and to the satisfaction of the Departmental Representative.
- .4 Concrete of insufficient strength or improper consistency shall be, as required by the Departmental Representative, subject to one or more of the following:
 - .1 Changes in mix proportions for the remainder of the work.
 - .2 Cores drilled and tested from the areas in question as directed by the Departmental Representative and in accordance with CSA A23.2. The test result shall be indicative of the strength of the in-place concrete.
 - .3 Load testing of the structural elements in accordance with CSA A23.3.
 - .4 The changes in the mix proportions and all above noted testing shall be at the Contractor's expense.

3.10 JOINTS

- .1 Provide full depth 6 mm thick asphalt impregnated fibre board isolation joints in slabs where indicated on drawings.
- .2 Provide control joints as detailed and indicated on drawings.
- .3 The location and detail of all construction joints not detailed on the plans shall be approved by the Departmental Representative.
- .4 In general, locate construction joints at mid-span of slab, beams, joists and girders, unless a beam intersects a girder at this point, then off-set a distance equal to twice the width of the beam.
- .5 Construction joints in walls and columns to be at underside of floor slabs.
- .6 Provide keys to all construction joints approximately 1/3 the depth of slabs or width of beams and walls. On slabs the key shall be full length and on beams and walls the keys shall be 300 mm long and placed intermittently at 300 mm centers for the depth of the member.
- .7 Roughen surface of contact to approval, clean off all laitance.
- .8 Construction joints shall be properly keyed and allow continuous reinforcing to pass through the joint.
- .9 Saw cut control joints in slabs as soon as possible without spalling the cut edge of the concrete. Cuts to be made within 24 hours of casting the floor slab. Saw cut minimum depth to be 1/4 of slab thickness or as noted on the drawings.

3.11 ANCHOR BOLTS AND WELDMENTS

- .1 Set anchor bolts and weldments to the following tolerances:
 - .1 Alignment: $\pm 3\text{mm}$ of location, plumb and true.

- .2 Projection: \pm 6mm of elevations called for.

3.12 BASE PLATES GROUTING

- .1 Mix and place as per Manufacturer's specifications. Pack grout tightly under plates and leave no voids. Neatly finish edges.

3.13 EXPOSED CONCRETE WALLS/BEAMS

- .1 After patching all defective concrete and form tie holes, allow patch grout to cure before proceeding with sack-rubbed finish procedure.
- .2 Saturate and keep concrete wet for at least one hour prior to applying finish.
- .3 Apply a sand/cement slurry and rubber float to a uniform finish to all exposed concrete walls and beams. Grout to consist of 1 part cement, 1½-2 parts sand passing 630 um sieve and sufficient water to make a thick creamy consistency and pre-shrunk for one hour prior to application.
- .4 Cure sand/cement coating for at least 36 hours and protect from construction damage.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 CISC "Code of Standard Practice for Structural Steel."
- .2 CSA Standard S16 "Design of Steel Structures" and including the "CISC Commentary on CSA S16".
- .3 CSA Standards W47.1-03 and W59 "Certification of Companies for Fusion Welding of Steel" and "Welded Steel Construction (Metal-Arc Welding)."
- .4 Conform to the Provincial Occupational Health and Safety Act including regulations.

1.2 QUALITY ASSURANCE

- .1 Steel fabricator approved by CISC and certified in Division 1, 2 or 3 by the Canadian Welding Bureau in accordance with the current edition of CSA W47.1.
- .2 The fabricator shall review the drawings and any discrepancies shall be reported to the Departmental Representative for clarification prior to starting fabrication.
- .3 In the event of conflict between pertinent codes, standards, and/or regulations, the most stringent shall govern.

1.3 DESIGN REQUIREMENTS

- .1 All connections designed by the fabricator to CSA S16.
- .2 Where loads or reactions are shown on drawings, connect for these forces and take into consideration all joint eccentricities and pass through forces.
- .3 Where no loads are shown for beam connections, proportion connections for the UDL/2 capacity of the member according to the CISC Handbook of Steel Construction, minimum two bolts per connection side. No connection to be made less than one half depth of member.
- .4 Members have been designed as simply supported unless otherwise specified on drawings.
- .5 Use CISC double angle or end plate connections unless indicated otherwise.
- .6 Connect spandrel members and those subject to torsion using top and bottom flange clips.

1.4 SHOP DRAWINGS

- .1 Prepare erection drawings, shop details and material lists for all structural steel, in accordance with the requirements of CSA Standard S16. Shop drawings shall be sealed by a registered Professional Engineer with permission to consult in Saskatchewan.
- .2 Submit shop drawings for review by the Departmental Representative prior to fabrication. Departmental Representative's review of shop drawings will be limited to member sizes and arrangement. Fabricator remains responsible for accuracy of dimensions and details, and for design of connections.
- .3 Structural drawings take precedence over the shop drawings unless otherwise instructed in writing by the Departmental Representative.

1.5 TESTING AND INSPECTION

- .1 Upon request, provide mill test certificates for all material to be used for fabrication.
- .2 Provide access to the fabricator's plant for the Departmental Representative's inspection of the fabrication.

1.6 DELIVERY AND STORAGE

- .1 Structural steel shall be delivered, handled and stored in a manner which prevents deterioration and damage to its fabricated form.
- .2 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Departmental Representative and at no additional cost to the Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 All structural steel except as otherwise noted on the drawings or specified herein shall be of new material conforming to CSA G40.20/G40.21 Grade 350W.
- .2 Hollow Structural Sections: New material conforming to CSA G40.20/G40.21 Grade 350W Class C.
- .3 All structural bolts shall conform to ASTM Specification A325.
- .4 All anchor bolt material shall conform to ASTM A307 or CSA G40.20/G40.21 Grade 260W with nuts and washers being of equal or greater quality.
- .5 All shop primer shall be rust inhibitor type, conform to minimum requirements of CISC CPMA 2-75 quick drying primer.
- .6 All other materials, not specifically described but required for a complete and proper installation of structural steel, shall be new, free from rust, first quality of

their respective kinds, and subject to the approval of the Departmental Representative.

- .7 Welding Electrodes: E70XX/basic electrodes.

2.2 FABRICATION

.1 General

- .1 Fabricate items of structural steel in accordance with the drawings, CISC Specifications and as indicated on the final reviewed shop drawings.
- .2 Properly mark and match-mark materials for field assembly.
- .3 Where finishing is required, complete the assembly, including bolting and welding of units, before start of finishing operations.

.2 Connections

- .1 Weld or bolt shop connections as shown. Bolt field connections, except where welded connections or other connections are shown or specified.
- .2 Seal weld all connections fabricated from hollow structural sections.
- .3 Accurately cut and mill column ends to assure full contact of bearing surfaces.

.3 Welded Construction

- .1 Comply with CSA Standard W59 for procedures, appearance and quality of welds and welders, and methods used on correcting welding work.
- .2 Obtain written permission of Departmental Representative prior to altering or field welding of structural members.

.4 Holes/Anchors for Other Work

- .1 Provide punched holes as necessary or as indicated for securing other work to structural steel framing, and openings for the passage of other work through steel framing members. Reinforce openings to maintain required design strength. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work. No torch cut holes are permitted.

.5 Tolerances

- .1 All other structural steel tolerances as per CSA S16.

Part 3 Execution

3.1 CERTIFICATION AND EXAMINATION

- .1 The steel erector shall be certified in Division 3 or better by the Canadian Welding Bureau.
- .2 Prior to installation of the work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. Notify the Departmental Representative of any discrepancies.
- .3 Verify that structural steel has been fabricated and may be erected in strict accordance with the original design, the reviewed shop drawings, and the referenced standards.

3.2 ERECTION

- .1 High Strength Bolts
 - .1 High strength bolts shall be installed in accordance with the CSA Standard S16. Tighten by the "Turn of the Nut" method.
 - .2 Do not enlarge improperly sized or misaligned holes in members by burning or by the use of drift pins. Ream holes that must be enlarged to admit bolts and use oversized bolts. The Departmental Representative must be notified of this condition and approve the correction at the connection.
- .2 Anchors
 - .1 Furnish anchor bolts and other connectors required for securing structural steel to in-place work.
 - .2 Furnish templates and other devices for presetting bolts and other anchors in concrete to assure accurate placement of anchors.
- .3 Setting Bases and Bearing Plates
 - .1 Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
 - .2 Set loose and attached base plates and bearing plates for structural members on shims. Leveling nuts or other adjustable devices may be used providing the base plate is shimmed to support erection loads.
 - .3 Any misalignment between anchor bolts and bolt holes in steel members shall be resolved by submitting a request to the Departmental Representative for review. The request shall show an industry acceptable method. Flame cutting to enlarge holes is not an acceptable solution.

- .4 Tighten the anchor bolts after supported members have been positioned and plumbed.
- .5 Grouting of base plates and bearing plates shall be as specified in Cast-In-Place Concrete Section. Grouting shall be performed prior to placing loads on structure.
- .4 Field Assembly
 - .1 Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - .2 Level and plumb individual members of the structure within tolerances specified in CSA Standard S16. Contractor shall provide and install all temporary bracing required until structure is complete. The erector shall ensure during erection that an adequate margin of safety exists in the uncompleted structure including individual member attachment.
 - .3 Establish required leveling and plumbing measurements on the mean operating temperature of the structure.
- .5 Gas Cutting
 - .1 Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing, except on secondary members which are not under stress and will be concealed in the finished structure and then only when approved by the Departmental Representative. Finish gas-cut sections equal to a sheared appearance.
- .6 Field Workers
 - .1 Field welders shall use the welding design, procedures and recommended equipment approved by the steel manufacturer. All field welding shall be in accordance with Table 5-3 of W59 in regard to ambient and preheat temperatures.
 - .2 Welders employed for erection and field changes are to possess valid "S" Classification "O" Certificates issued by the Canadian Welding Bureau.
 - .3 Welders employed for welding hollow core sections are to possess valid "T" Classification "O" Certificates issued by the Canadian Welding Bureau.
- .7 Touch-Up Painting
 - .1 Immediately after erection, remove all slag and clean field welds, bolted connections and abraded areas of the shop paint. Apply paint to all field welds, nuts, bolts, washers and damaged prime surfaces with the same

material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 0.05 mm.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Metal deck design, fabrication and erection shall conform to the following codes and standards:

- .1 CSA S136 "Cold Formed Steel Structural Members".

- .2 CSA S16 "Limit States Design of Steel Structures".

1.2 DESIGN REQUIREMENTS

- .1 Design deck in accordance with CSSBI Standards, CSA S136 and the design criteria on the drawings.
- .2 Deck is required to stabilize the structure by diaphragm action. Exercise special care with all deck connections to ensure diaphragm action.
- .3 Span deck units over three or more supports where possible.
- .4 Thickness of deck if indicated on the drawings is the minimum required for diaphragm action. Increase thickness as required to suit built up snow loads and joist spacing indicated on drawings.

1.3 SHOP DRAWINGS

- .1 Prepare and submit to the Departmental Representative, shop drawings in accordance with the General Conditions showing all sizes, gauge, locations and markings of decking units, the size of holes to be cut in the shop, types of end enclosures and fittings and all methods of securing, anchoring and attaching to structural members.
- .2 Show verification that the members used are adequate to carry the live and dead loads shown on the drawings within deflection limits indicated on the drawings with a maximum not to exceed 1/300 of the span.

1.4 HANDLING AND PROTECTION

- .1 Use all means necessary to protect metal decking before, during and after installation and to protect the installed work and material of all other trades.
- .2 In the event of damage, immediately make all repairs and replacements necessary to the approval of the Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 All metal decking manufactured from structural quality steel conforming to ASTM A446 minimum Grade A and CSSBI Publications 38.12-76 and 38.36-76. Prepainted 5000 series on one side. Colour as selected by the Architect.
- .2 Zinc coatings shall be used as per CSSBI Spec. 101M-78 with a metal deck designation of Z275.
- .3 Metal deck depth as specified on drawings.
- .4 Cover plates, cell closures and flashings supplied in similar materials and coating as metal deck.
- .5 Welding Electrodes: E60XX
- .6 Fasteners: Self Drilling No. 14 hex head of hardened cadmium plated steel or stainless steel, complete with washers.
- .7 Field coating: basic zinc chromate.
- .8 Furring supports: Pre-bent channels and angles galvanized to Z275 zinc coating.

Part 3 Execution

3.1 FABRICATION

- .1 Metal deck fabricated in accordance with CSA Standard S136 "Cold Formed Steel Structural Members" and CSSBI Publications.
- .2 Steel roof units shall span over three or more supports unless prevented by the structural steel layout.
- .3 Steel units shall have interlocking male and female side laps.

3.2 INSPECTION

- .1 Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
- .2 Verify that metal decking may be fabricated and installed in strict accordance with the original design, the reviewed Shop Drawings, and the referenced standards.
- .3 In the event of discrepancy, immediately notify the Departmental Representative.

- .4 Do not proceed with installation on areas of discrepancies until all such discrepancies have been fully resolved.

3.3 ERECTION

- .1 Properly align the metal deck and weld to the supporting steel by means of 20 mm diameter plug welds at a maximum spacing of 300 mm or by #14 self drilling fasteners at 200 mm spacing unless noted otherwise on the drawings. For uplift conditions anchoring shall be at a maximum spacing of 150 mm for a distance of 1000 mm from exterior of roof edge.
- .2 End laps shall not be less than 50 mm and to occur over supports.
- .3 Mechanically fasten (button punched) side laps at not more than 400 mm or as indicated on the drawings if more severe.
- .4 Install all closures and flashings at openings and columns as shown or as required as per the drawings.
- .5 Apply a suitable zinc primer to all areas where the zinc coating has been damaged and including all welds.
- .6 When uplift forces are indicated and for all roof deck, then use 20 mm steel washers under head of screws and when welding deck to the support steel.
- .7 The use of self-tapping fasteners to be used only after written approval from the Departmental Representative is obtained.

3.4 CLEAN-UP

- .1 Remove all debris of this trade and leave work ready for other trades.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 ASTM A123/A123M-13, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A1011/A1011M-13, Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- .3 CAN/CGSB-1.181-99 - Ready-Mixed, Organic Zinc-Rich Coating.
- .4 CSA W59-13, Welded Steel Construction.
- .5 NAAMM MBG 531-17 - Metal Bar Grating Manual.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate with other work having a direct bearing on work of this section.
- .2 Coordinate the Work with placement of frames, tolerances for placed frames and openings.

1.3 SUBMITTALS

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Submit manufacturer's instructions, printed product literature and data sheets; include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Provide span and deflection tables.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.
 - .2 Indicate details of gratings, component supports, anchorage, openings, perimeter construction details, and tolerances.
 - .3 Indicate welded connections using standard welding symbols. Indicate net weld lengths.
- .4 Samples: Submit duplicate manufacturer samples for indicated and specified gratings and stair nosings, 150 x 150 mm in size, illustrating surface finish, colour, and texture.

Part 2 Products

2.1 MATERIALS

- .1 Metal bar grating: to NAAMM MBG 531, Type W-19-4, carbon steel, welded, regular duty, plain surface.
 - .1 Steel: To ASTM A1011/A1011M, CS Type B.
- .2 Welding materials: To CSA W59.

2.2 FABRICATION

- .1 Fabricate gratings and stair nosings to NAAMM MBG 531.
- .2 Stair nosings: Steel, rolled floor ("checker") plate, minimum 3.2 mm thickness.

2.3 FINISHES

- .1 Galvanizing: Hot-dip, to ASTM A123/A123M.
- .2 Touch-up coating for galvanized surfaces: CAN/CGSB-1.181, zinc rich.

Part 3 Execution

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that opening sizes and dimensional tolerances are acceptable.
- .3 Verify that supports anchors are correctly positioned.

3.2 INSTALLATION

- .1 Install components to manufacturer's written instructions.
- .2 Place frames in correct position, plumb and level.
- .3 Set perimeter closure flush with top of grating and surrounding construction.
- .4 Secure to prevent movement.
- .5 Clean welds and damaged coatings and apply two (2) coats of touch-up zinc-rich primer.

3.3 ERECTION TOLERANCES

- .1 Conform to limits specified in NAAMM MBG 531 as applicable.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CSA O112.9-10 (R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
- .2 National Lumber Grades Authority (NLGA)
 - .1 NLGA Standard Grading Rules for Canadian Lumber (2014 edition).

1.2 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 wood products and accessories. Include product characteristics, performance criteria, physical size, finishes, and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Saskatchewan.
 - .2 Indicate materials, dimensions, elevations, sections, details, attachments to other work, and installation details.
- .4 Samples:
 - .1 Submit samples of each type and size of cedar lumber specified and indicated, in 150 mm lengths, showing profiles, thicknesses, and colours.

1.3 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

1.4 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 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.

Part 2 Products

2.1 FRAMING STRUCTURAL AND PANEL MATERIALS

- .1 Cedar lumber: To NLGA Standard Grading Rules for Canadian Lumber and Western Red Cedar Lumber Association.
 - .1 Lumber for above-grade application: D and Better Clear.
 - .1 Use S4S materials for railings and balusters.
 - .2 Foundation cedar lumber: Foundation grade.

2.2 ACCESSORIES

- .1 Fasteners: Stainless steel, Grade 304.
- .2 Hasps: Stainless steel, fixed, padlock secured, hardened steel loop, concealed fastening.
- .3 Hinges: Stainless steel, heavy duty, fixed pin.
 - .1 T-hinge or strap hinge styles are acceptable.
- .4 Cane bolts: Stainless steel, 450 mm (18 inches) long, 16 mm (5/8 inch) diameter, complete with guide brackets and hanger.
- .5 General purpose adhesive: CSA O112.9.

2.3 EXAMINATION

- .1 Verify conditions of substrates are acceptable for product installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate.
 - .2 Inform Departmental Representative of unacceptable conditions.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.

2.4 FRAMING

- .1 Select exposed framing for appearance. Install lumber materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- .3 Install members true to line, levels and elevations, square and plumb.
- .4 Construct continuous members from pieces of longest practical length.
- .5 Construct framing members full length without splices.
- .6 Install spanning members with "crown-edge" up.
- .7 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

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

2.5 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: Remove waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 93.1-M85, Sheet Aluminum Alloy, Prefinished, Residential.
- .2 Canadian Standards Association (CSA)
 - .1 CSA HA Series-M1980, Standards for Aluminum and Aluminum Alloys.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.2 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 datasheets; include product characteristics, performance criteria, physical size, finishes, and limitations.
 - .2 Submit WHMIS MSDS - Material Safety Data Sheets for products used on the project.
- .3 Samples: Submit duplicate 50 x 50 mm samples of each type of sheet metal material, finishes, and colours.

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

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Aluminum sheet: Utility quality to CSA HA Series.
 - .1 Thickness: 0.81 mm (0.032 inch).
 - .2 Finish: Pre-finish sheet aluminum with factory-applied silicone modified polyester.
 - .3 Colour: As selected by Departmental Representative from manufacturer's standard range.

2.2 ACCESSORIES

- .1 Eavestrough hangers: Purpose-made for attachment of gutters, aluminum, screw attachment, channeled or ribbed body.
- .2 Sealants:
 - .1 Elastomeric Sealant: Elastomeric polyurethane polymer sealant to ASTM C920, as required for watertight installation.
 - .2 Butyl Sealant: Single-component, solvent-release butyl rubber sealant to ASTM C1311, for use in joints with limited movement.
 - .3 Epoxy Seam Sealer: Aluminum seam-cementing compound, 2-part, non-corrosive, as recommended by manufacturer for exterior non-moving joints.
- .3 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

- .1 Fabricate eavestroughs as indicated.
- .2 Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

2.4 EAVESTROUGHES AND DOWNSPOUTS

- .1 Form eavestroughs and downspouts from prefinished aluminum sheet metal.
 - .1 Eavestroughs: As shown on drawings.
 - .2 Downspouts: Rectangular, 100 x 125 mm (4 x 5 inches), corrugated.
- .2 Provide goosenecks, outlets, strainer baskets, and necessary fastenings.

Part 3 Execution

3.1 EAVESTROUGHES AND DOWNSPOUTS

- .1 Install eavestroughs and secure to building at 450 mm on centre, with purpose-made eavestrough hangers.
 - .1 Slope eavestroughs evenly to downspouts.
 - .2 Provide endcaps at gutter ends.
 - .3 Seal joints watertight.
- .2 Install downspouts and provide goosenecks as required.
 - .1 Install downspouts, provide elbows and offsets, and secure downspouts to wall construction using downspout supports spaced maximum 1800 mm (6 feet) on center.
 - .2 Maximum distance of downspout support from top or bottom of downspout: 600 mm (24 inches).

- .3 Provide 45° elbows at bottom of downspouts to direct water away from wall surface or foundation.
- .4 Seal joints watertight.

3.2 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 REFERENCE STANDARDS

- .1 CAN/CSA-S16, "Limit States Design of Steel Structures".
- .2 CAN/CSA-G40.20, "General Requirements for Rolled or Welded Structural Quality Steels".
- .3 CAN/CSA-G40.21, "Structural Quality Steel".
- .4 CSA-W47.1, "Certification of companies for Fusion Welding of Steel Structures".
- .5 CSA-W59, "Welded Steel Construction (Metal Arc Welding)".
- .6 ASTM A252, "Welded and Seamless Steel Pipe Piles".

1.2 SOILS REPORT

- .1 Refer to soils report which is included in these specifications.

1.3 QUALIFICATIONS

- .1 Engage a Professional Structural Engineer registered in the Province of Saskatchewan, fully qualified and experienced in building pile foundations and soil mechanics to directly supervise the installation of piles.
- .2 The Contractor performing the Work of this Section shall be properly equipped to execute the Work with experienced and trained personnel.

1.4 QUALITY CONTROL AND DESIGN SERVICE LIFE EXPECTANCY

- .1 Perform steel work in accordance with the requirements of CSA-S16 unless indicated otherwise herein.
- .2 Screw pile foundation to be designed for the vertical and horizontal loadings as indicated on drawings and with sufficient corrosion resistance for a minimum of 25 years service life.
- .3 The Contractor must not assign the responsibility of coordination of placing of screw pile cap plates. To this end, a full time qualified superintendent representing the Contractor is to be in attendance during all phases of the work.

1.5 INSPECTION AND TESTING

- .1 Full time pile inspection of piling operations will be carried out by an independent geotechnical firm, retained and paid for by the Contractor and approved by the Departmental Representative.

- .2 Inspection testing firm to submit to the Departmental Representative a final report summarizing their inspection and testing and Contractor's degree of compliance with the contract documents and reviewed shop drawings, including any remedial requirements that may have been required during the course of work. This report is to be submitted under the seal and signature of a Professional Geotechnical Engineer registered in the Province of Saskatchewan.
- .3 Notify the Departmental Representative and inspection and testing firm five (5) working days in advance of starting piling work on site.

1.6 SUBMITTALS

- .1 Prior to commencing the work, the Contractor's Departmental Representative is to submit documentation showing evidence of registration in the Province of Saskatchewan as well as qualifications and experience. The Contractor's Departmental Representative is to further acknowledge in writing that he or she has reviewed the specifications and drawings and is aware that he or she is to inspect the fabrication and installation of work and certify the work at completion.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with these specifications. All shop drawings to be designed and sealed by a professional engineer registered in the Province of Saskatchewan.
- .2 Clearly indicate the following information:
 - .1 Pile layout, schedule of installation and placing sequence.
 - .2 Type of pile, sizes and details.
 - .3 Load capacity of each pile.
 - .4 Splice detail
 - .5 Elevation of pile bases.
 - .6 Elevation of top of pile.
 - .7 Pile cap sizes and details.
- .3 Review of the shop drawings by the Departmental Representative is intended to assist the Contractor and does not relieve the Contractor of his or her responsibility for the completeness and accuracy of his or her work and its conformance with the contract drawings and specifications.

1.8 FIELD RECORDS AND DRAWINGS

- .1 Maintain accurate records of all piles installed. Records are to include the following:
 - .1 Location of piles.
 - .2 Sequence of placing.
 - .3 Final base and head elevations.
 - .4 Drilled shaft and helix diameters.
 - .5 Condition of base material.
 - .6 Date and time of drilling.
 - .7 Details of unusual occurrences.
 - .8 Inspector's name.
- .2 Submit three (3) copies of all field records and drawings to the Departmental Representative.

Part 2 Products

2.1 STEEL MATERIALS

- .1 Steel pipe shaft: Conform to ASTM A252, "Welded and Seamless Steel Pipe Piles", grade 2 or 3.
- .2 CAN/CSA: G40.21M Grade 350W for Rolled Steel Section and 300W for plates and helical plates.
- .3 Bolts: ASTM-325

Part 3 Execution

3.1 INSTALLATION

- .1 Notify the Departmental Representative and inspection testing firm 48 hours prior to any installations on site.
- .2 Ensure site conditions are adequate to support piling equipment and to allow for proper performance of pile operations.
- .3 Ensure piling equipment is adequate for soil conditions.
- .4 Do not use piling methods that could cause damage to nearby or existing structures.

- .5 Install piles where indicated on drawings.
- .6 Ensure pile shafts are drilled vertically and founded with minimum depths in bearing material as indicated on the drawings and soil report.
- .7 Contractor shall furnish and install all screw piles per plan and approved pile design documents.
- .8 Discontinue piling operations and immediately notify the Departmental Representative in the event that unusual soil conditions are encountered such that pile load capacities cannot be obtained.

3.2 SPECIAL CONDITIONS

- .1 The Contractor is to undertake a thorough inspection of existing structure and facilities and document any existing damage. The Contractor will be responsible for repairs of any damage caused by piling operations.

3.3 TOP OF PILE ELEVATION

- .1 Trim top of piles to elevation shown on approved pile documents and field weld pile cap to conform to layout of drawings.

3.4 TOLERANCES

- .1 Do not deviate from true vertical alignment more than 2% of pile length.
- .2 Do not deviate from centre of true location more than 50 mm.
- .3 Do not deviate from specified head elevations more than 25 mm.

3.5 NON-CONFORMING PILES

- .1 Non-conforming piles are piles that are placed out position or are damaged and/ or piles not conforming to size, length and material specifications
- .2 Provide additional piles or supplement piles with additional piles caps or steel beams to meet specified requirements as directed by the Discipline Representative at no additional cost to the contract.

END OF SECTION

**NATIONAL CONSERVATION PLAN INVESTMENTS
BUNDLE DESIGN SERVICES
GEOTECHNICAL INVESTIGATION
LAST MOUNTAIN LAKE NATIONAL WILDLIFE AREA
NEAR SIMPSON, SK**

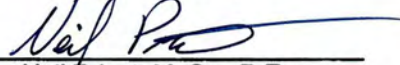
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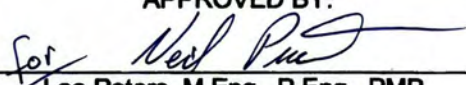

for Lee Peters, M.Eng., P.Eng., PMP.
Department Head – Geo-Environmental

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1.0 INTRODUCTION

Kontzamanis Graumann Smith MacMillan Inc. (KGS Group) was retained by Republic Architecture Inc to complete a geotechnical site investigation for the proposed National Conservation Plan Investments Bundle Design Services within the Last Mountain Lake National Wildlife Area (Figure 1). The purpose of the investigation was to determine the subsurface and groundwater conditions at various sites in order to provide design recommendations for proposed parking areas, roadways, observation towers, a pavilion (replacing an existing gazebo), and a sheltered picnic area.

The main components of the geotechnical investigation consisted of:

- A subsurface field investigation consisting of the advancement of nineteen (19) test holes completed to depths of 1.8 m to 7.5 m below ground surface (BEGS).
- A diagnostic laboratory testing program that includes moisture content, grain size analysis, Atterberg limit testing, and water soluble sulphate content.
- Measurement of groundwater conditions based on field observations.
- A geotechnical report outlining the field and laboratory results, parking area, roadway, observation tower, picnic area, and pavilion recommendations.

2.0 BACKGROUND

The Last Mountain Lake National Wildlife Area is located around the northernmost region of Last Mountain Lake near Simpson, SK.

It is understood that the proposed National Conservation Plan Investments Bundle Design Services will consist of:

- Fifteen (15) new gravel parking areas
- Two (2) new observation towers
- Widening of two (2) existing gravel roadways running along the crown of two (2) earthfill dams
- One (1) sheltered picnic area
- One (1) new pavilion, to replace the existing gazebo near the current Last Mountain Lake National Wildlife Area Information Kiosk

It is understood that the proposed observation towers, picnic area, and pavilion will be supported by deep foundations.

It is also understood that the proposed new pavilion will may not be heated during winter months.

3.0 KGS FIELD INVESTIGATION PROGRAM

3.1 TEST HOLE DRILLING AND SAMPLING PROGRAM

A test hole drilling and sampling program was completed on December 4 and 5, 2017. A total of nineteen (19) test holes were drilled at the locations shown on Figure 1 using a solid stem, truck-mounted auger rig owned and operated by Cross Borders Consulting Ltd. of Pilot Butte, SK.

Test holes drilled to investigate the subsurface conditions below the proposed Tower 1 (TH17-T01), Tower 2 (TH17-T02), the proposed new pavilion (TH17-L05), and the proposed picnic area (TH17-L10) were advanced to depths of 7.5, 6.2, 7.5, and 3 m below existing ground surface (BEGS), respectively.

All remaining test holes were drilled to investigate the subsurface soil conditions below the existing gravel roadways and proposed/existing gravel parking areas, and were advanced to depths of 1.8 to 3 m BEGS.

Disturbed soil samples were collected directly off the auger flights as well as from split spoon sampler. The samples were visually classified in the field by KGS Group personnel according to the modified Unified Soils Classifications System (USCS). Standard Penetration Tests (SPTs) were conducted at regular interval to determine the relative soil density. Clay and clay till samples were tested with a pocket penetrometer to estimate the undrained shear strength in conjunction with the SPT results. Upon completion of the drilling, the test holes were examined for indications of seepage and/or sloughing then backfilled with auger cuttings

Test holes drilled near Dam 1 (TH17-D01) and Dam 2 (TH17-D02) were positioned outside of the earthfill dams and backfilled with bentonite in order to avoid negatively impacting the overall hydraulic conductivity of the dams.

3.2 LABORATORY TESTING PROGRAM

A diagnostic laboratory testing program was performed on select soil samples to determine index properties of the subsurface soils. Diagnostic testing completed include moisture content, grain size analysis, Atterberg limit testing, and water soluble sulphate content. The soil samples were submitted to the laboratory of ALS Environmental in Saskatoon, SK. The moisture content testing results, the grain size distribution analyses, and Atterberg limits data are summarized in Tables 21 and 22. Diagnostic laboratory testing results are presented in the test hole logs included in Appendix A. Laboratory testing results, as received by KGS from ALS environmental, have been included in Appendix B.

4.0 SITE STRATIGRAPHY AND GROUNDWATER CONDITIONS

4.1 EARTHFILL DAMS

TH17-D01 and TH17-D02 were drilled on the edge of the existing earthfill dams in order to avoid disturbing soils within the dams.

The subsurface soil conditions near Dam 1 (TH17-D01) consisted of about 0.8 m of sand fill overlying sand (extending to 2.4 m BEGS), then clay till, which extended a depth of at least 3 m (i.e., the maximum depth explored with the test hole).

The subsurface soil conditions near Dam 2 (TH17-D02) consisted of about 1 m of sand fill overlying clay till, which extended a depth of at least 1.8 m (i.e., the depth at which auger refusal on cobbles/boulders was encountered).

Groundwater seepage and sloughing conditions were not encountered during drilling TH17-D01 and TH17-D02. Both test holes remained dry and open immediately after drilling.

4.2 PARKING AREAS

In general, the near surface sub-grade soils below the proposed parking areas consisted of a thin layer of topsoil overlying clay till and/or sand. Silt was encountered near surface in TH17-L11 and TH17-L14. Test holes within the proposed parking areas (with the exception of TH17-L05) were advanced to a maximum depth of 3 m BEGS.

Trace groundwater seepage originating from saturated sand lenses/layers was encountered below depths of 1.5 and 1.8 m BEGS while drilling TH17-L09 and TH17-L10, respectively. Both test holes remained open immediately after drilling.

Groundwater seepage and sloughing conditions were not encountered while drilling TH17-L01 to TH17-L15, inclusive, (again with the exception of TH17-L05). All previously mentioned test holes remained dry and open immediately after drilling.

4.3 PAVILION

The sub-grade soil conditions near the proposed pavilion location consisted of 0.8 m of sand fill overlying sand (extending to 1.5 m BEGS), followed by clay till, which extended to a depth of at least 7.5 m. A saturated sand layer was encountered between 5.7 and 6.9 m BEGS in TH17-L05.

Groundwater seepage and sloughing conditions were encountered below 3 m in TH17-L05. The test hole sloughed to 5.2 m immediately after drilling.

4.4 OBSERVATION TOWERS

Tower 1

The subsurface soil conditions near the proposed location of Tower 1 consisted of sand extending from ground surface to a depth of 7.5 m. Groundwater seepage was encountered during drilling below 3 m BEGS. TH17-T01 sloughed to 2 m immediately after drilling.

Tower 2

The subsurface soil conditions near the proposed location of Tower 2 consisted of a thin layer (0.1 m) of organic topsoil overlying clay till, which extended to a depth of at least 7.5 m. A sand layer was encountered between 1.5 and 6.3 m BEGS. Groundwater seepage was encountered during drilling below 3 m. TH17-T02 sloughed to 5.6 m immediately after drilling.

4.5 PICNIC AREA

The sub-grade soil conditions near the proposed picnic area location consisted of about 1.5 m of sand overlying clay till, which extended to a depth of at least 3 m.

Groundwater seepage and sloughing conditions from saturated sand lenses were encountered below 1.8 m in TH17-L10. The test hole was open with trace water immediately after drilling.

4.6 GROUNDWATER CONDITIONS

Groundwater seepage and sloughing conditions were encountered during test hole drilling. Based on the depths at which groundwater seepage was encountered during drilling, the groundwater table was anticipated to be situated below depths ranging from 1.5 to 3 m BEGS on December 4/5, 2017. Groundwater levels encountered within this site may differ from those reported herein in response to seasonal conditions and following precipitation or spring snow melt events.

4.7 POTENTIAL DIFFICULT GROUND CONDITIONS

Sporadic and irregular zones of cobbles, boulders and granular layers were encountered within clay till deposits during drilling. These zones should be expected to be water bearing, which may cause difficulties during pile installation. Construction difficulties associated with groundwater seepage and/or sloughing conditions should be expected, and contractors should anticipate that dewatering and/or temporary shoring may be required where excavations extend below the groundwater table elevation.

4.8 ENCOUNTERED SOIL TYPES

Topsoil

Up to about 150 mm of organic topsoil was encountered at the surface of our test hole locations. The topsoil was black, moist, and contained rootlets.

Clay Fill

The samples of the clay fill material recovered during drilling were brown to dark brown in colour, moist, very stiff, and of low to intermediate plasticity. The water content measured in the clay fill material varied between 8.4 and 14.6 percent.

Clay Till

The samples of the clay till recovered during drilling were brown to dark brown and/or grey in colour, damp to moist, firm to hard, and of low to intermediate plasticity. Cobbles and/or boulders were encountered during drilling, and resulted in auger refusal at 1.8 m and 6.3 m BEGS in TH17-D02 and TH17-T02, respectively. The water content measured in the clay till deposits ranged between 3.6 and 14.5 percent. SPTs and pocket penetrometer tests were performed during field investigation, and the results have been shown on the individual test hole logs included in Appendix A.

Sand Fill

The samples of the sand fill material recovered during drilling were brown to dark brown in colour, damp, compact, poorly graded and fine to coarse grained. The water content measured in the sand fill material was measured at 6.9 percent.

Sand

The samples of the sand recovered during drilling were brown to dark brown in colour, damp to wet, compact to dense, poorly graded and fine to coarse grained. The water content measured in the sand ranged between 2.5 and 16.8 percent. SPTs were performed during field investigation, and the results have been shown on the individual test hole logs included in Appendix A.

Silt

The samples of the silt recovered during drilling were brown to dark brown in colour, moist, firm to stiff, and of low to intermediate plasticity. The water content measured in the silt deposits ranged between 10.1 and 17.6 percent. SPT and pocket penetrometer tests were performed during field investigation, and the results have been shown on the individual test hole logs included in Appendix A.

5.0 GEOTECHNICAL CONSIDERATIONS

It is understood that deep foundations (i.e., piles) are the preferred foundation type for the proposed picnic area, pavilion, and observation towers. Driven piles (treated timber, steel pipe, steel H, or precast concrete) or helical screw piles should perform satisfactorily in support of the proposed picnic area, pavilion, and observation towers. Auger refusal was encountered on a cobble/boulder while drilling TH17-T02 at Tower 2, and is considered indicative of potential shallow pile termination during installation near the proposed picnic area, pavilion, and Tower 2 location.

5.1 DRIVEN PILES

The proposed picnic area, pavilion, and observation towers may be supported by piles driven to sufficient depth to achieve the design capacity. Suitable driven piling materials include treated timber piles, steel pipe piles, precast concrete piles, and steel H-piles. Both shaft friction and end bearing capacity may be included in determining pile capacity. Construction difficulties associated with the presence of cobbles/boulders may be encountered. Pre-drilling may be required during the installation of some driven piles within the subject site.

For all pipe pile types and sizes, shaft friction should only be applied to the exterior surface area of the pile. In the case of steel H-piles, shaft friction may be applied to the exterior sides of the two flanges plus twice the depth of the web (i.e. the box perimeter). For pipe piles with a closed-end configuration, end bearing may be applied to the full cross-sectional area of the toe of the pile. For H-piles and open end pile configurations, the area over which end bearing may be applied varies with the pile diameter. For small diameter pipes piles with nominal diameter of 300 mm or smaller and H-Piles, there is a higher potential for 'plugging' of the pile to occur during installation, and as such, it is reasonable to apply the end bearing to the full cross-sectional area of the toe of the pile which may be taken as the area enclosed by the outer circumference of a pipe section, or the cross sectional area of a rectangle bounded by the flanges in the case of steel H sections.

End bearing resistance values may be provided once specific foundation details (pile type, diameter, etc.) are made available.

Should end bearing be considered in the foundation design, the pile details (i.e. type), location and bearing strata would need to be reviewed to ensure that the piles are not overstressed and suitable refusal criteria can be determined.

Dynamic load testing using Pile Driving Analyser (PDA) equipment is a non-destructive load test method which can be performed during or after pile installation using conventional pile driving equipment. This test can be applied to driven steel, timber and concrete piles. The use of this testing can potentially increase the ultimate bearing capacity and/or the geotechnical resistance factor.

Steel piles (pipe or H section) driven to practical refusal may be designed with an ULS capacity of 50% of the yield stress of the steel, multiplied by the cross sectional area of the steel. Due to limitations on the drivability of the pile imposed by the yield strength of the pile, as a guide to initial design and selection of pile wall thickness and steel grade, it is recommended that the maximum design 'allowable' compressive resistance of a steel pile be limited to $0.25F_yA_s$; where: F_y is the nominal yield stress of the steel, and A_s is the cross-sectional area of steel in the pile. As a minimum, steel H-piles should meet the requirements of CAN/CSA-G40.20/G40.21, Grade 350 W, and pipe piles should have a minimum yield strength of 310 MPa (i.e. ASTM A252 Grade 3 steel). The piles should be free of protrusions, which could create voids in the soil around the pile during driving.

TABLE 1
PICNIC AREA - ESTIMATED SHAFT FRICTION UNIT RESISTANCES
FOR DRIVEN STEEL PIPE PILES & STEEL H-PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
Below 2	20	15	50

TABLE 2
PICNIC AREA - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR DRIVEN
PRECAST CONCRETE PILES & TREATED TIMBER PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
Below 2	24	18	60

TABLE 3
PAVILION - ESTIMATED SHAFT FRICTION UNIT RESISTANCES
FOR DRIVEN STEEL PIPE PILES & STEEL H-PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
Below 2	30	22	75

TABLE 4
PAVILION - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR DRIVEN
PRECAST CONCRETE PILES & TREATED TIMBER PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
Below 2	36	27	90

TABLE 5
TOWER 1 - ESTIMATED SHAFT FRICTION UNIT RESISTANCES
FOR DRIVEN STEEL PIPE PILES & STEEL H-PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
2 - 8	12	9	31
Below 8	18	13	45

TABLE 6
TOWER 1 - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR DRIVEN
PRECAST CONCRETE PILES & TREATED TIMBER PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
2 - 8	15	11	39
Below 8	22	17	57

TABLE 7
TOWER 2 - ESTIMATED SHAFT FRICTION UNIT RESISTANCES
FOR DRIVEN STEEL PIPE PILES & STEEL H-PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
2 - 6	22	16	55
Below 6	40	30	100

TABLE 8
TOWER 2 - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR DRIVEN
PRECAST CONCRETE PILES & TREATED TIMBER PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
2 - 6	26	19	66
Below 6	48	36	120

The ULS values provided in Tables 1 to 8, inclusive, represent the nominal (ultimate) geotechnical resistance, R_n . The appropriate geotechnical resistance factor (Φ) should be applied to the ULS resistance values to determine the factored ULS resistance values provided in Tables 1 to 8, inclusive using in the following equation:

$$\Phi R_n \geq \sum \alpha_i S_{ni}$$

where:

Φ – geotechnical resistance factor: $\Phi = 0.4$ for compressive resistance

$\Phi = 0.3$ for tensile resistance

R_n – nominal (ultimate) geotechnical resistance

$\sum \alpha_i S_{ni}$ – summation of the factored overall load effects for a given load combination

The recommended SLS values should limit settlement to less than 25 mm.

Driven piles should be designed and constructed according to the following recommendations:

- The spacing between adjacent piles should be a minimum of 3 pile diameters, as measured from centre to centre.
- To minimize the potential for uplift due to frost action; all piles should have a minimum embedded length of 8 m with reinforcing over the full length of the pile.
- All piles should be driven continuously to their required design length once driving is initiated.
- In addition to piles acting individually, friction piles can act as a group when closely spaced, less than 3 pile diameters apart. Group action occurs when the soil between

adjacent piles is dragged down and shaft resistance develops around the perimeter of the group only. If it is necessary to space piles closer than 3 pile diameters apart, the capacity of these piles acting as a group will need to be evaluated once final geometry and spacing of the piles is known.

- Detailed record keeping and full time inspection by experienced geotechnical personnel is recommended throughout construction of the foundations to verify and ensure that the design capacities indicated in this report are achieved.
- The presence of cobbles and/or boulders within the clay till may create some difficulty during driving, and there is a risk of reduced capacity from shallow refusal. Where the pile capacity is found to be insufficient to support the design loads, additional piles may be required.
- Void form (minimum of 150 mm) should be installed below all pile caps to protect against potential uplift.

5.2 HELICAL SCREW PILES

Helical screw piles consist of a steel shaft with one or more helix flightings. Due to the potential for shallow pile termination, the use of multiple helix screw piles is not recommended for Tower 2, the proposed picnic area, and/or the Pavilion. Tower 1 may be designed with single or multiple helix screw piles.

TABLE 9
PICNIC AREA - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
Below 2	10	7	25

TABLE 10
PAVILION - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
Below 2	24	18	60

TABLE 11
TOWER 1 - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
2 - 8	12	9	31
Below 8	18	13	45

TABLE 12
TOWER 2 - ESTIMATED SHAFT FRICTION UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS (kPa)
	Compressive	Tensile	
0 - 2	0	0	0
2 - 6	16	22	55
Below 6	40	30	100

TABLE 13
PICNIC AREA - ESTIMATED END BEARING UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS End Bearing (kPa)
	Compressive	Tensile	
Below 4	180	135	450

TABLE 14
PAVILION - ESTIMATED END BEARING UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS End Bearing (kPa)
	Compressive	Tensile	
Below 4	540	405	1350
Below 6	630	470	1575

TABLE 15
TOWER 1 - ESTIMATED END BEARING UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS End Bearing (kPa)
	Compressive	Tensile	
Below 4	660	495	1650
Below 6	800	600	2000

TABLE 16
TOWER 2 - ESTIMATED END BEARING UNIT RESISTANCES FOR HELICAL SCREW PILES

Depth Below Grade (m)	Serviceability Limit State, SLS (kPa)		Unfactored Ultimate Limit State, ULS End Bearing (kPa)
	Compressive	Tensile	
Below 4	180	135	450
Below 6	600	450	1500

The ULS values provided in Tables 9 to 16, inclusive, represent the nominal (ultimate) geotechnical resistance, R_n . The appropriate geotechnical resistance factor (Φ) should be applied to the ULS resistance values to determine the factored ULS resistance values provided in Tables 9 to 16, inclusive using in the following equation:

$$\Phi R_n \geq \sum \alpha_i S_{ni}$$

where:

Φ – geotechnical resistance factor $\Phi = 0.4$ for compressive resistance

$\Phi = 0.3$ for tensile resistance

R_n – nominal (ultimate) geotechnical resistance

$\sum \alpha_i S_{ni}$ – summation of the factored overall load effects for a given load combination

The recommended SLS values will limit settlement to less than 25 mm.

Helical screw piles should be designed and constructed according to the following recommendations:

- The screw piles should be driven to a minimum depth of 4 metres measured from ground surface to the top of the uppermost helix.
- Screw piles designed with tensile loading should be driven to a minimum depth equal to the greater of 5 m or $3B$, where B = helix diameter in metres.
- Multiple helix screw piles should have a minimum helical spacing of 3 helix diameters.
- The helical plate shall be normal to the central shaft (within 3 degrees) over its entire length.
- During installation, the torque applied to the screw pile should be continuously monitored in order to avoid pile damage and monitor subsurface soil consistency.
- Screw piles should be designed on the basis of appropriate geotechnical engineering principals pertaining to helical pile foundations.
- A representative of the Geotechnical Consultant should inspect and document the installation of each screw pile on a continuous basis.
- Cobbles and/or boulders within the clay till may result in shallow pile termination
- Void form (minimum of 150 mm) should be installed below all pile caps to protect against potential uplift.

5.3 FLOOR SLAB

It is understood that the proposed picnic area and Pavilion will be constructed with a slab-on-grade floor.

If frost heaving is a concern, rigid polystyrene insulation may be utilized to minimize, but not eliminate potential frost heave below the proposed picnic area and pavilion.

It is understood that the proposed picnic area will be unheated and the pavilion will be heated using electrical convection heaters which may not be active year round. The insulation recommendations provided below assume that the building will be unheated during winter

months. If an interior building temperature of at least 7° C will be maintained year round, the insulation requirements may be significantly reduced.

Insulation should be placed directly below the floor beneath the entire building footprint. The insulation should extend laterally a minimum of 2.44 m beyond the exterior of the building on all sides. The insulation should be a minimum of 125 mm thick and be covered with a minimum of 300 mm of soil to protect from damage. To promote drainage, the insulation should be sloped away from the proposed picnic area/pavilion.

The following design is recommended for a slab-on-grade floor:

- Sub-excavate (if required) to the sub-grade design elevation and perform a proof roll compaction test to expose any soft spots. If any soft spots are encountered the in-situ soil should be sub-excavated a minimum 600 mm depth and replaced with compacted granular subbase (Type 8).
- A minimum 300 mm thick layer of granular base should be placed immediately below the slab. All granular material should be placed in a maximum 150 mm thick lifts and compacted to 98% Standard Proctor Maximum Dry Density (SPMDD).
- Some movements, potential cracking, and/or differential settlement of the concrete slab is likely to occur with grade supported slabs due to the expansive (swelling and shrinking) nature of the underlying glacial till.
- Floor slabs bearing on a minimum of 300 mm of granular base overlying sand may be designed on the basis of a sub-grade modulus of 20 MN/m³

The specifications for Sask Highways Type 33 Base Aggregate and Type 8 Sub-Base Aggregate have been included in Appendix C – Granular Material Specifications.

5.4 LATERAL THRUST

The stress-strain behavior of soil can be determined from advanced in-situ testing (e.g. pressuremeter testing) or full scale pile load test. However, in the absences of such detailed testing, the soil behavior can be estimated using an equivalent spring constant referred to as the lateral sub-grade reaction modulus (K_s) for preliminary design purposes. The soil response to horizontal loading is simulated by representing the soil around the pile with a series of horizontal springs.

For the cohesionless soils (i.e., sand) encountered near the proposed location of Tower 1, the lateral sub-grade reaction modulus is dependent on depth and vertical overburden stress and can generally be estimated from Equation 1 for piles subjected to small displacement:

$$K_s = \frac{4,000z}{d} \quad \text{[Equation 1]}$$

Where K_s = coefficient of horizontal subgrade reaction (kN/m³), z = the depth below ground surface, and d is the diameter of the pile (m).

For the cohesive soils, such as the clay till near the proposed location of the proposed picnic area, pavilion, and Tower 2, the lateral sub-grade reaction modulus is typically independent of depth or vertical overburden stress and can generally be estimated from Equation 2 for piles subjected to small displacement:

$$K_s = \frac{67C_u}{d} \quad \text{[Equation 2]}$$

Where K_s = coefficient of horizontal subgrade reaction (kN/m³), C_u = undrained shear strength of the clay (kPa), and d is the diameter of the pile (m). For near surface clay till deposits near the proposed location of the picnic area, pavilion, and Tower 2, KGS Group recommends C_u = 50 kPa

It is anticipated that most of the lateral resistance will be provided by the soil in the upper 10 m depending on the relative stiffness of the pile and surrounding soil. Resistance provided by soil subjected to seasonal moisture changes and freeze/thaw effects (i.e., the upper 2 m) should be ignored.

KGS Group can perform a more rigorous lateral pile and group analysis that incorporate the material and section properties of the pile, final lateral deflection criteria and a more representative constitutive model of the soil to confirm the lateral load capacity of the piles and pile group, if required.

5.5 SEISMIC SITE CLASSIFICATION

The site classification for seismic site response as described in the NBCC 2010 (Table 4.1.8.4A) can be based on the average estimated shear wave velocity or average estimated undrained shear strength or average standard penetration test (SPT) blow count in the upper 30 m. Based on the standard penetration tests as well as the pocket penetrometer tests up to about 7.5 m, the subject site can be classified as Site Class D. A higher site classification may be provided by conducting additional geophysical tests.

5.6 FROST PENETRATION

The depth of frost penetration in this area will vary depending on air temperature, ground cover, the type of any fill material used during development and other factors.

The average depth of frost penetration is estimated to be approximately 2.2 m. The clay soils will heave upon freezing, and that fact must be considered in design. Site drainage away from all structures should be maintained after development.

The burial depth of water lines or other lines that cannot be allowed to freeze should consider local practice. In general, it is recommended that water lines be buried at least 2.5 m below ground or finished grade to reduce the risk of freezing. Shallower lines can be protected using heat trace or closed cell extruded polystyrene insulation. The amount and extent of insulation required will be dependent on several factors, particularly the thermal regime around the pipe, the depth of burial, surface conditions, and fluid temperature, if present.

5.7 EXCAVATION AND CONSTRUCTION DEWATERING

It is understood that utility excavations are generally shallow, up to about 3 m below the existing ground surface. Based on the depths at which groundwater seepage was encountered, the groundwater table was anticipated to be situated at about 3 m BEGS near the proposed pavilion location on December 5, 2017. Conventional temporary unsupported excavations with appropriately designed side slopes are expected to be feasible where the groundwater table is below the base of the excavation. However, groundwater elevations vary seasonally and

annually such that actual groundwater levels at the site during construction may differ from those identified in this report. Unsupported excavations below the groundwater table should be analyzed on a case-by-case basis.

Temporary unsupported excavations near the proposed pavilion location which are above the groundwater table should be sloped no steeper than 1H:1V (Horizontal: Vertical; H:V) for an excavation depth of 3 m or less. Flatter slopes may be required if weak soil layers or perched water tables are encountered during the excavation. All excavations should be carried out in accordance with applicable occupational health and safety rules and regulations.

Stockpiles of materials and excavated soil should be placed away from the crest of excavations by a distance equal to at least one half of the depth of the excavation or 2.0 m, whichever is greater.

If deep excavation with a shoring system is considered, KGS Group recommends that an excavation and shoring plan should be prepared and submitted by a registered Professional Engineer who is skilled in these designs.

5.8 FINAL BACKFILL

Excavations should be backfilled and compacted uniformly in maximum 150 mm lifts to a density of at least 98% Standard Proctor Maximum Dry Density (SPMDD). The top meter of the backfill should consist of well compacted clayey soils to reduce surface runoff infiltration.

5.9 GRADE BEAMS

The grade beams should be reinforced at both top and bottom throughout their entire length. Grade beams should be constructed with a minimum net void space of 150 mm between the underside of the grade beam and the sub-grade soil.

5.10 PARKING AREAS

It is understood that construction of six (6) new and reconstruction of nine (9) existing parking areas is proposed across the subject site. Sub-grade preparation for each proposed parking area should consist of:

- Sub-excavate the surficial soils to the sub-grade design elevation and perform proof-roll compaction of the clay till sub-grade. Scarify and recompact the top 150 mm of sub-grade to 95% of Standard Proctor Maximum Dry Density (SPMDD). Areas that exhibit unsuitable deflection or deleterious materials (organic matter and concrete waste) should be sub-excavated an additional 600 mm and replaced with compacted granular subbase.
- Place a light non-woven geotextile separator on the finished sub-grade prior to placement of granular material.

Multiple soil types were encountered near surface below the proposed parking area locations. A CBR of 4, 5, and 12 may be used for parking area granular section design bearing on silt, clay till/clay fill, and sand/sand fill, respectively. CBR values were determined through a correlation with the group index value, which was obtained through Atterberg limit testing and grain size analysis. The results of our group index testing and corresponding CBR correlations have been presented in Table 22. The recommended granular sections for parking areas constructed at Locations 11 and 14, based on a CBR of 4 have been presented in Table 17.

TABLE 17
LOCATIONS 11 AND 14 - RECOMMENDED DESIGN THICKNESSES FOR GRANULAR PARKING AREAS (CBR = 4)

Pavement Structure	Light Traffic Loading 1830 kg Wheel Load	Medium Traffic Loading 3180 kg Wheel Load	Heavy Traffic Loading 5400 kg Wheel Load
Base Course (Type 33)	150 mm	200 mm	250 mm
Subbase (Type 8)	225 mm	275 mm	350 mm
Sub-grade	- Proof-rolled with heavy sheepsfoot roller - Place non-woven geotextile.		

The recommended granular sections for parking areas constructed at Locations 1, 2, 3, 6, 8, 9, 12 and 13, based on a CBR of 5, have been presented in Table 18.

TABLE 18
LOCATIONS 11 AND 14 - RECOMMENDED DESIGN THICKNESSES FOR GRANULAR PARKING AREAS (CBR = 5)

Pavement Structure	Light Traffic Loading 1830 kg Wheel Load	Medium Traffic Loading 3180 kg Wheel Load	Heavy Traffic Loading 5400 kg Wheel Load
Base Course (Type 33)	150 mm	200 mm	250 mm
Subbase (Type 8)	200 mm	250 mm	300 mm
Sub-grade	- Proof-rolled with heavy sheepsfoot roller - Place non-woven geotextile.		

The recommended granular sections for parking areas constructed at Locations 4, 5, 7, 10, and 15 based on a CBR of 12, have been presented in Table 19.

TABLE 19
LOCATIONS 4, 5, 7, 10, AND 15 - RECOMMENDED DESIGN THICKNESSES FOR
GRANULAR PARKING AREAS (CBR = 12)

Pavement Structure	Light Traffic Loading 1830 kg Wheel Load	Medium Traffic Loading 3180 kg Wheel Load	Heavy Traffic Loading 5400 kg Wheel Load
Base Course (Type 33)	100 mm	125 mm	175 mm
Subbase (Type 8)	150 mm	175 mm	200 mm
Sub-grade	- Proof-rolled with heavy sheepsfoot roller - Place non-woven geotextile.		

Non-woven geotextile should be placed in accordance with the manufacturer's recommendations, and care should be taken to avoid damage during compaction of the overlying materials. All materials should be placed in maximum 150 mm thick lifts and compacted to 98% SPMDD.

Periodic maintenance of the gravel structures (i.e., smoothing ruts and/or placement of additional granular material) will be required.

The specifications for Sask Highways Type 33 Base Aggregate and Type 8 Sub-Base Aggregate have been included in Appendix C – Granular Material Specifications.

5.11 DAM ROADWAYS

It is understood that the roadways across the earthfill dams will be widened to accommodate an additional lane of traffic. Additional fill will be required to maintain the existing dam crest elevation and sideslope angle. Before placing any fill material, sub-grade preparation for each proposed roadway additions area should consist of:

- Remove all organic material, soft/loose soil and/or other deleterious materials from below the proposed earthfill dam expansion. Scarify and re-compact the top 150 mm of sub-grade to a minimum of 95% of Standard Proctor Maximum Dry Density (SPMDD). A proof roll test should then be subject to a proof-roll compaction test. Areas that exhibit unsuitable deflection or deleterious materials (organic matter and concrete waste)

should be sub-excavated an additional 600 mm and replaced with compacted granular subbase.

- To minimize the potential for differential settlement between the new and existing dam sections, fill used in the dam expansion should be similar to the soil within existing dam structure. Low plastic clay till, similar to that encountered in TH17-D01 and TH17-D02 should perform satisfactorily as fill material.
- Additions to the existing dams should be conducted in accordance with applicable regulations and not negatively impact the functionality of the existing dams.
- Fill should be placed in thin lifts (maximum 150 mm loose) and compacted to a density of at least 98% SPMDD.
- Place a light non-woven geotextile separator between the compacted fill and the granular roadway structure.

A CBR of 12 may be used for dam roadway granular section design. CBR values were determined through a correlation with the group index value, which was obtained through Atterberg limit testing and grain size analysis. The results of our group index testing and corresponding CBR correlations have been presented in Table 22. The recommended granular sections for roadways across Dam 1 and Dam 2 have been presented in Table 20.

TABLE 20
DAM 1 AND DAM 2 - RECOMMENDED DESIGN THICKNESSES FOR GRANULAR ROADWAYS (CBR = 12)

Pavement Structure	Light Traffic Loading 1830 kg Wheel Load	Medium Traffic Loading 3180 kg Wheel Load	Heavy Traffic Loading 5400 kg Wheel Load
Base Course (Type 33)	100 mm	125 mm	175 mm
Subbase (Type 8)	150 mm	175 mm	200 mm
Sub-grade	- Proof-rolled with heavy sheepsfoot roller - Place non-woven geotextile.		

Non-woven geotextile should be placed in accordance with the manufacturer's recommendations, and care should be taken to avoid damage during compaction of the overlying materials. All materials should be placed in maximum 150 mm thick lifts and compacted to 98% SPMDD.

The specifications for Sask Highways Type 33 Base Aggregate and Type 8 Sub-Base Aggregate have been included in Appendix C – Granular Material Specifications.

Periodic maintenance of the gravel structures (i.e., smoothing ruts and/or placement of additional granular material) will be required.

5.12 FOUNDATION CONCRETE

Water soluble sulphate tests were conducted on soil samples collected from 3.5 m, and 6.3 m below ground surface in TH17-T02. The sulphate concentrations were measured at 0.775% and 0.083% by dry weight. According to CSA A23.1, the potential for sulphate attack ranges from negligible to severe. Therefore, it is recommended that sulphate resistant (HS) cement be used for all concrete in contact with the sub-grade soil. All concrete at this site should be manufactured in accordance with current CSA standards.

Water soluble sulphate salts in combination with moist soil conditions or low pH soils, could result in corrosion of some types of metal water lines, elbows, connectors, etc., in contact with the soil. The water soluble sulphate test results have plotted on the testhole logs included in Appendix A.

6.0 STATEMENT OF LIMITATIONS

6.1 THIRD PARTY USE OF REPORT

This report has been prepared for Republic Architecture Inc to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions undertaken based on this report.

6.2 GEOTECHNICAL INVESTIGATION STATEMENT OF LIMITATIONS

The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of the field investigations and laboratory testing, combined with an interpretation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at this site. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group or if the assumptions stated herein are not in keeping with the design, this office should be notified in order that the recommendation can be reviewed and modified if necessary.

REFERENCES

Canadian Geotechnical Society, 2006, Canadian Foundation Engineering Manual (4th Edition).

TABLES

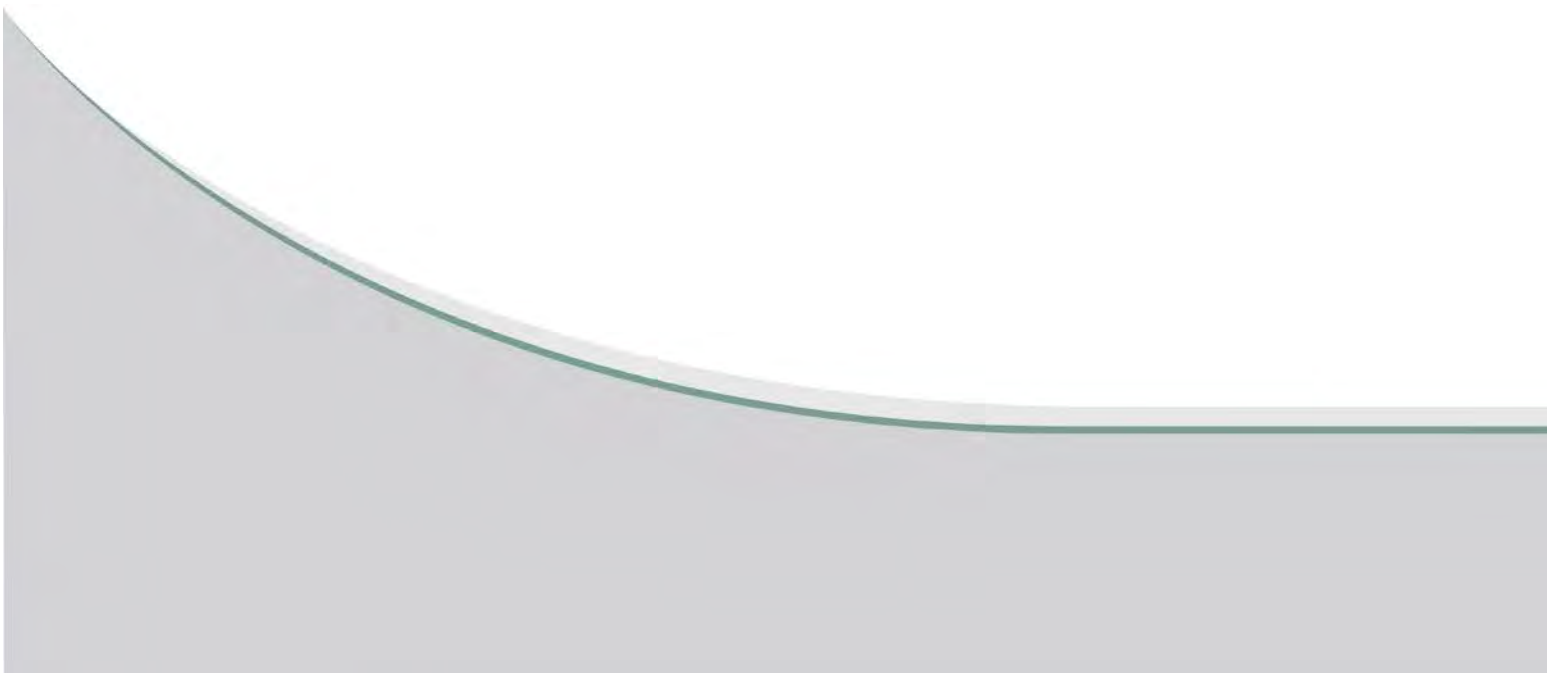
**TABLE 21
MOISTURE CONTENTS**

Test Hole No.	Sample No.	Dep (m)	Water Content (%)
17-D01	24	0.5	6.89
17-D02	28	0.5	6.97
17-D02	29	1	8
17-D02	30	2	9.61
17-L01	16	0.5	8.54
17-L03	8	0.5	13.5
17-L05	51	0.5	8.61
17-L05	52	1	10.1
17-L05	53	2	9.43
17-L05	54	3	11
17-L05	55	5	13
17-L05	56	6	15.6
17-L05	57	7.5	14
17-L06	31	0.5	10.5
17-L06	32	1	3.59
17-L06	33	2	2.47
17-L08	39	0.5	8.4
17-L08	40	1	14.6
17-L08	41	2	10.7
17-L09	43	0.5	9.54
17-L09	44	1	14.5
17-L09	45	2	16.1
17-L10	47	0.5	7.51
17-L11	58	0.5	13
17-L11	59	1	17.6
17-L11	60	2	12.9
17-L12	68	0.5	12.6
17-L14	76	0.5	12
17-L14	77	1	11.7
17-L14	78	2	12.1
17-L15	80	0.5	9.09
17-T01	2	1	12.9
17-T01	3	2	14.8
17-T01	4	3.5	16.8
17-T01	5	4.5	17.6
17-T01	6	6	15.1
17-T02	62	0.5	8.56
17-T02	63	1	8.68
17-T02	64	2	14
17-T02	65	3.5	8.9
17-T02	66	4.5	8.89
17-T02	67	6.2	9.92

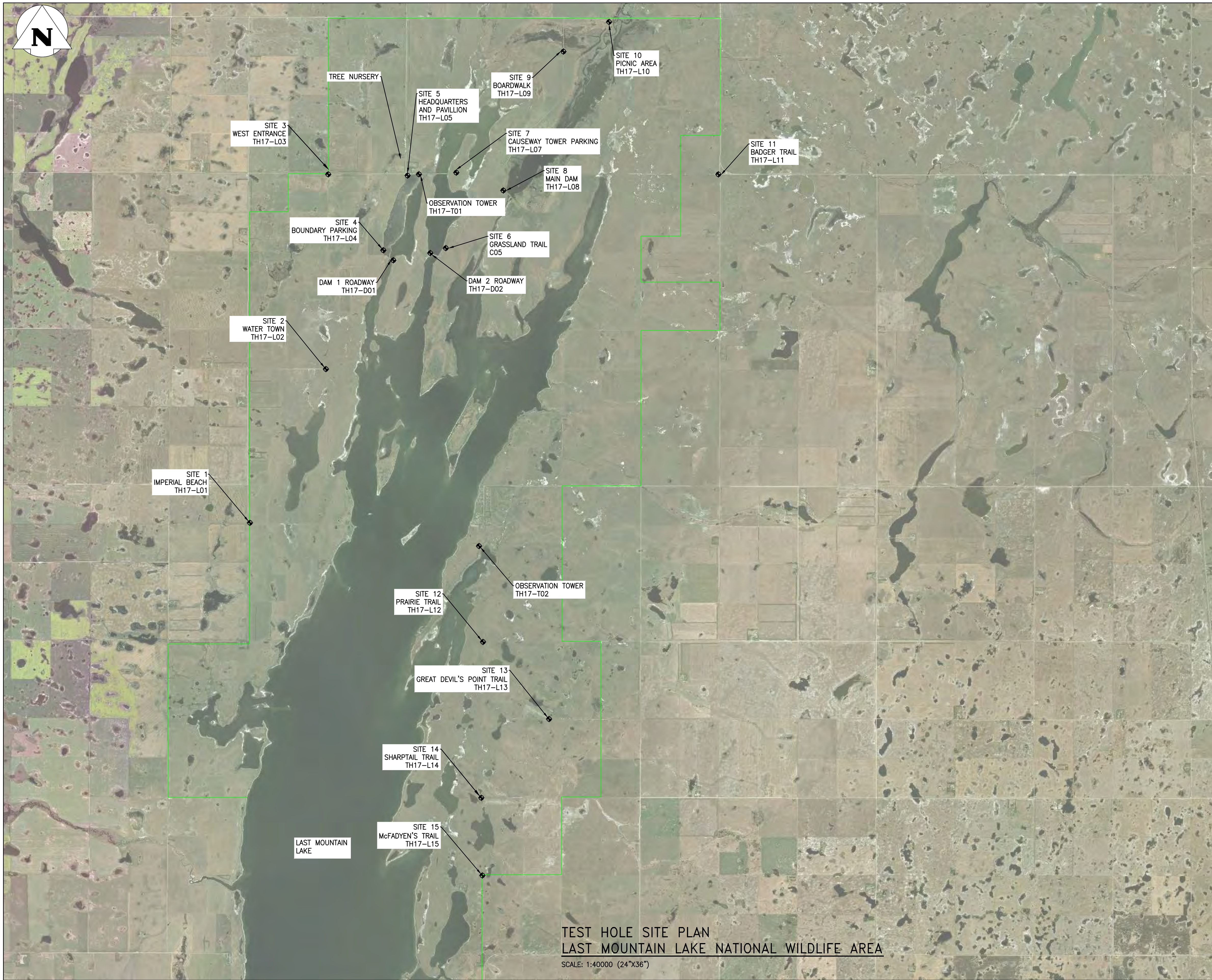
TABLE 22
GRAIN SIZE ANALYSIS AND ATTERBERG LIMITS

Test Hole No.	Sample No.	Depth (m)	Particle Size						Atterberg Limits			Group Index	CBR
			Gravel (%) 75 to 4.75 mm	Sand(%)			Silt (%) <0.075 to 0.002 mm	Clay (%) <0.002 mm	Liquid Limit	Plastic Limit	Plasticity Index		
				Coarse <4.75 to 2.0 mm	Medium <2.0 to 0.425 mm	Fine <0.425 to 0.075 mm							
17-D01	24	0.5	74.3				25.7		-	-	-	-	-
17-D02	28	0.5	69.6				30.4		21	16	5	1	12
17-D02	29	1	1.1	2	12.2	58.3	8.3	18.1	-	-	-		
17-L01	16	0.5	54.9				45.1		22	15	7	3.5	9
17-L03	8	0.5	28.6				71.4		30	15	15	9.5	5
17-L05	51	0.5	66.4				33.6		23	17	6	1.5	12
17-L05	52	1	2.7	5.3	16.8	34.5	22.3	18.4	-	-	-	-	-
17-L09	44	1	47.8				52.2		23	15	8	5.5	
17-L10	47	0.5	85.1				14.9		-	-	-	-	-
17-L11	58	0.5	40.6				59.4		31	14	18	6.5	5
17-L12	68	0.5	38.8				61.2		33	15	18	7	6
17-L14	76	0.5	27.4				72.6		23	18	5	10.5	4
17-L15	80	0.5	41.2				58.8		-	-	-	-	-
17-T01	2	1	-	-	-	-	-	-	23	17	5	0	15
17-T01	3	2	<1.0	<1.0	4.4	81.6	6.3	6.6					
17-T02	65	3.5	<1.0	5.4	18.3	35.1	27	13.9	-	-	-		

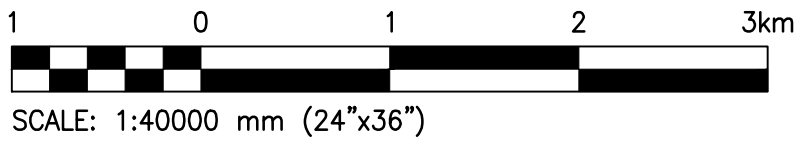
FIGURES



File Name: U:\PMS\17-2215-002\17-2215-002.env.dwg - Tab: F01 Plotted By: jbingaman 18/02/05 [Mon 11:13am]
24"x36" PLOT SCALE: 1:1



- NOTES:**
1. IMAGE COURTESY OF ©2017 DIGITALGLOBE ©CNES (2017) DISTRIBUTION AIRBUS DS®2017 MICROSOFT CORPORATION.
 2. DRAWINGS ARE BASED ON SURVEY CONDUCTED BY KGS GROUP ON OCTOBER 19, 2017, CSRS PPP CORRECTED POSITION.

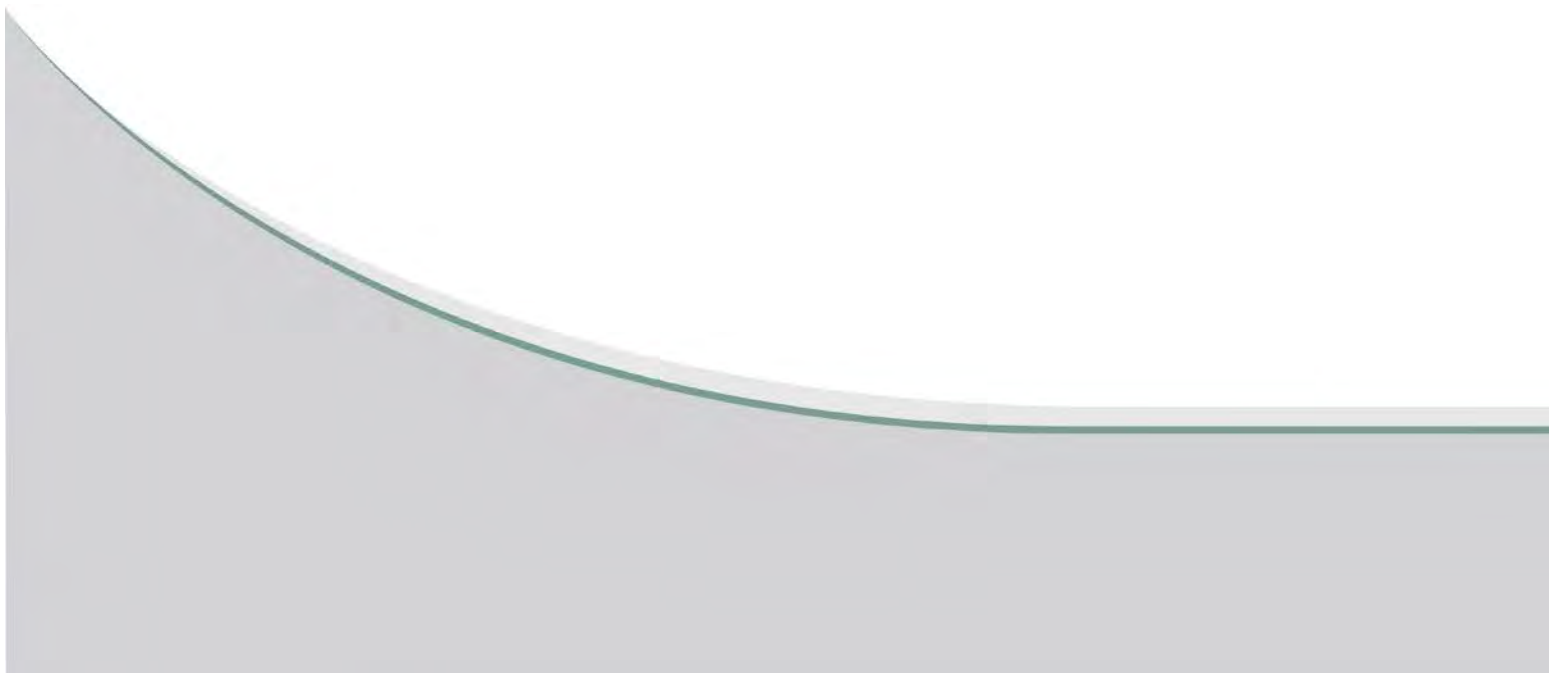


0	18/02/02	ISSUED WITH FINAL REPORT		
NO.	YY/MM/DD	DESCRIPTION	DESIGN BY	DESIGN CHECK
REVISIONS / ISSUE				
CLIENT:				
REPUBLIC ARCHITECTURE INC.				
PROJECT:				
NATIONAL CONSERVATION PLAN INVESTMENTS BUNDLE DESIGN SERVICES				
DWG. DESCRIPTION:				
SITE PLAN LAST MOUNTAIN LAKE NATIONAL WILDLIFE AREA				

AUTHENTICATION FOR CURRENT REVISION ENG. STAMP	DESIGN BY:	DATE (YY/MM/DD):
	DESIGN CHECK:	DATE:
	DRAWN BY: ZA	DATE: 17/10/25
	DWG CHECK: JJB	DATE: 17/10/25
DWG. NO. 17-2215-002 F01		REV: 0

APPENDIX A

TEST HOLE LOGS



CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Dam 1
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,694,359
 E 482,946

ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N)	DYNAMIC CONE		Cu POCKET PEN (kPa)	Cu TORVANE (kPa)
							blows/0.15 m ▲	(N) blows/ft △	PL	MC	LL
	(m) (ft)						20 40 60	20 40 60	20 40 60 80	20 40 60 80	20 40 60 80
	1		SAND FILL - Brown, compact, moist, well graded, fine to coarse grained, some silt, some gravel, trace clay		24						
	5		SAND (SP) - Dark brown, moist, compact, poorly graded, fine to coarse, some silt, trace gravel, trace clay		25						
	2				26						
	3		CLAY TILL (CI) - Brown, damp, stiff, medium plastic, silty, sandy, trace gravel, oxide staining		27						
	10		END OF TEST HOLE AT 3 m								
	4		Notes: 1. Dry and open immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface								
	15										
	5										
	6										
	20										
	7										
	25										
	8										

SAMPLE TYPE Auger Grab

CONTRACTOR Cross Borders Consulting INSPECTOR K. RUNTZ


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DATE 2/5/18


CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Dam 2
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,694,499
 E 483,730

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
							20 40 60		20 40 60 80	PL MC LL
	1		SAND FILL - Brown, damp, compact, poorly graded, fine to coarse grained, some clay, trace silt, trace gravel		28					
	5		CLAY TILL (CI) - Dark brown, moist, very stiff, medium plastic, silty, sandy, trace gravel, oxide staining		29					
	2		END OF TEST HOLE AT 1.8 m		30					
	3		Notes: 1. Auger refusal encountered on cobble/boulder at 1.8 m 2. Dry and open immediately after drilling 3. Backfilled with auger cuttings and bentonite at surface							
	4									
	5									
	6									
	7									
	8									
	9									

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ

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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 1
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,688,895
 E 479,986

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL % 20 40 60 80
			TOPSOIL - Black, moist, organic, rootlets	16					
			CLAY TILL (CI) - Brown, damp, stiff, medium plastic, silty, sandy, trace gravel, oxide staining	17					
	1								
	5								
	2			18					
	3			19					
	10		END OF TEST HOLE AT 3 m						
			Notes:						
			1. Dry and open immediately after drilling						
			2. Backfilled with auger cuttings and bentonite at surface						
	4								
	15								
	5								
	6								
	20								
	7								
	25								
	8								
	9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ


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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 2
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,692,089
 E 481,564

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆	
							20 40 60 80	PL MC LL
			TOPSOIL - Black, moist, organic, rootlets	12				
			CLAY TILL (CI) - Light brown, damp, stiff, medium plastic, silty, sandy, trace gravel, oxide staining	13				
1								
5								
2				14				
3	10		END OF TEST HOLE AT 3 m	15				
			Notes:					
			1. Dry and open immediately after drilling					
			2. Backfilled with auger cuttings and bentonite at surface					
4								
15								
5								
6	20							
7								
25								
8								
9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ


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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 3
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,696,142
E 481,594

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL %
			CLAY TILL (CI) - Brown, moist, firm, medium plastic, silty, some sand, trace gravel	8					
	1		- Oxide staining below 1 m	9					
	5			10					
	2			11					
	3		END OF TEST HOLE AT 3 m						
	10		Notes:						
	4		1. Dry and open immediately after drilling						
	15		2. Backfilled with auger cuttings and bentonite at surface						
	6								
	20								
	7								
	25								
	8								
	9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ


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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 4
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,694,558
 E 482,756

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲		DYNAMIC CONE (N) blows/ft ▲		Cu POCKET PEN (kPa) ★		Cu TORVANE (kPa) ◆	
						20	40	60	80	20	40	60	80
			TOPSOIL - Black, moist, organic, rootlets	20									
			SAND (SM) - Brown, damp, compact, poorly graded, fine to coarse grained, silty, some clay, trace gravel	21									
1													
5			- Moist below 1.5 m	22									
2													
3			CLAY TILL (CI) - Grey, moist, very stiff, medium plastic, silty, some sand, trace gravel	23									
10			END OF TEST HOLE AT 6.4 m										
			Notes:										
			1. Sloughed to 5.6 m immediately after drilling										
			2. Backfilled with auger cuttings and bentonite at surface										
4													
15													
5													
6													
20													
7													
25													
8													
9													

SAMPLE TYPE  Auger Grab

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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 5
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,696,108
 E 483,260

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL
			SAND FILL - Dark brown, damp, compact, poorly graded, fine to coarse grained, silty, some clay, trace gravel	51					
	1		SAND (SM) - Brown, damp, compact, poorly graded, fine to coarse grained, silty, some clay, trace gravel	52					
	5		CLAY TILL (CI) - Brown, moist, very stiff, medium plastic, sandy, some clay, trace gravel, oxide staining	53		▲ 5 ▲ 7 ▲ 7			
	2								
	3		- Saturated sand lenses, seepage and sloughing below 3 m	54					
	4								
	5		- Grey, some sand below 5 m	55		▲ 7 ▲ 10 ▲ 12			
	6		SAND (SM) - Grey, wet, dense, poorly graded, fine to coarse grained, silty, trace gravel, trace clay, clay lenses	56					
	7		CLAY TILL (CI) - Grey, moist, very stiff, medium plastic, silty, some sand, trace gravel	57					
	25		END OF TEST HOLE AT 7.5 m						
	8		Notes: 1. Sloughed to 5.2 m immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface						

SAMPLE TYPE ☒ Auger Grab ☐ Split Spoon

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PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 6
DRILLING METHOD 150 mm ø Solid Stem Auger


JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,964,598
 E 484,058

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft ▲	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL
						20 40 60		20 40 60 80	%
			CLAY FILL - Dark brown, moist, very stiff, medium plastic, silty, sandy, trace gravel	31					
			CLAY TILL (CI) - Brown, damp, stiff, medium plastic, silty, sandy, trace gravel	32					
			SAND (SM) - Brown, damp, compact, fine to coarse grained, poorly graded, silty, trace clay	33					
			- Fine to medium grained below 2 m	34					
			END OF TEST HOLE AT 3 m						
			Notes:						
			1. Dry and open immediately after drilling						
			2. Backfilled with auger cuttings and bentonite at surface						

GEOTECHNICAL-SOIL LOG C:\USERS\KRUNTZ\DESKTOP\TEMPORARY FILES\ASK PARKS - LAST MOUNTAIN PARKING LOTS\17-2215-002.GPJ

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ


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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 7
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,695,798
 E 484,271

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆
						20 40 60	20 40 60 80 PL MC LL %
	1		SAND (SM) - Brown, damp, compact, poorly graded, fine to medium grained, silty, trace clay, trace gravel	35			
	5			36			
	2		CLAY TILL (CI) - Brown, moist, hard, medium plastic, silty, some sand, trace gravel, oxide staining	37			
	3			38			
	10		END OF TEST HOLE AT 3 m				
	4		Notes: 1. Dry and open immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface				
	15						
	5						
	6						
	20						
	7						
	25						
	8						
	9						

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ

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PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 8
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,695,798
 E 485,248

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL % 20 40 60 80
			CLAY FILL - Brown, moist, very stiff, medium plastic, silty, sandy, trace gravel	39					
			CLAY TILL (CI) - Dark Brown, moist, stiff, medium plastic, silty, some sand, trace gravel, oxide staining	40					
			- Brown below 1.2 m						
				41					
				42					
			END OF TEST HOLE AT 3 m						
			Notes:						
			1. Dry and open immediately after drilling						
			2. Backfilled with auger cuttings and bentonite at surface						

GEOTECHNICAL-SOIL LOG C:\USERS\KRUNTZ\DESKTOP\TEMPORARY FILES\SASK PARKS - LAST MOUNTAIN PARKING LOTS\17-2215-002.GPJ

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting

INSPECTOR K. RUNTZ


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DATE 2/5/18

CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 9
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,698,685
 E 486,496

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL %
	1		CLAY FILL - Brown, moist, very stiff, medium plastic, silty, some sand, trace gravel	43					
	5		CLAY TILL (CI) - Brown, moist, stiff, medium plastic, silty, some sand, trace gravel	44					
	2		SAND (SM) - Brown, wet, compact, poorly graded, fine to coarse grained, some silt, trace clay, trace gravel, seepage	45					
	3		END OF TEST HOLE AT 3 m	46					
	4		Notes: 1. Open with trace water immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface						
	15								
	20								
	25								
	30								
	35								
	40								
	45								
	50								
	55								
	60								
	65								
	70								
	75								
	80								
	85								
	90								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
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DATE 2/5/18

CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 10
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,699,322
 E 487,440

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft Δ	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL % 20 40 60 80
	1		SAND (SM) - Brown, moist, compact, poorly graded, fine to coarse grained, some silt, trace clay	47					
	5			48					
	2		CLAY TILL (CI) - Grey, moist, stiff, medium to highly plastic, silty, some sand, trace gravel, oxide staining - Saturated sand lenses, seepage below 1.8 m	49					
	3			50					
	10		END OF TEST HOLE AT 3 m						
	4		Notes: 1. Dry and open immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface						
	15								
	5								
	6								
	20								
	7								
	25								
	8								
	9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting INSPECTOR K. RUNTZ


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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 11
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,696,127
E 489,740

ELEVATION (m)	DEPTH (m)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL % 20 40 60 80
	1		<u>SILT (MI)</u> - Dark brown, moist, firm, medium plastic, silty, some sand - Brown below 0.6 m	58					
	5			59					
	2		<u>CLAY TILL (CI)</u> - Brown, moist, very stiff, medium plastic, silty, some sand, trace gravel, oxide staining - Saturated sand lenses, seepage below 1.8 m	60					
	3		END OF TEST HOLE AT 3 m	61					
	4		Notes: 1. Dry and open immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface						
	15								
	5								
	6								
	20								
	7								
	25								
	8								
	9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ


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CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 12
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,686,421
E 484,826

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL %
	1		CLAY TILL (Cl) - Brown, moist, very stiff, medium plastic, silty, some sand, trace gravel, oxide staining	68					
	5		- Moist, oxide staining below 1.5 m	69					
	2			70					
	3		END OF TEST HOLE AT 3 m	71					
	4		Notes:						
	15		1. Dry and open immediately after drilling						
	5		2. Backfilled with auger cuttings and bentonite at surface						
	6								
	20								
	7								
	25								
	8								
	9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ


APPROVED 

DATE 2/5/18


CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 13
DRILLING METHOD 150 mm Ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,684,816
 E 486,060

ELEVATION (m)	DEPTH	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
	(m) (ft)									
									20 40 60 80	
									PL MC LL	
									%	
							20 40 60		20 40 60 80	
			CLAY TILL (CI) - Brown, damp, very stiff, medium plastic, silty, some silt, some sand, trace gravel, oxide staining		72					
			- Moist below 1.8 m		73					
			- Firm below 1.5 m		74					
					75					
			END OF TEST HOLE AT 3 m							
			Notes:							
			1. Dry and open immediately after drilling							
			2. Backfilled with auger cuttings and bentonite at surface							

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ

APPROVED 

DATE 2/5/18


CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 14
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,683,183
 E 484,790

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL
			SILT (Ml) - Brown, moist, stiff, medium plastic, clayey, some sand	76					
			CLAY TILL (Ci) - Brown, moist, stiff, medium plastic, silty, some sand, trace gravel, oxide staining	77					
			- Very stiff below 1.5 m	78					
			END OF TEST HOLE AT 3 m	79					
			Notes:						
			1. Dry and open immediately after drilling						
			2. Backfilled with auger cuttings and bentonite at surface						

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting INSPECTOR K. RUNTZ


APPROVED 

DATE 2/5/18


CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Site 15
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,681,569
E 484,813

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft ▲	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LL % 20 40 60 80
	1		SAND (SM) - Brown, moist, compact, poorly graded, fine to coarse grained, silty, trace clay	80					
	5		- Fine grained, some silt below 1.2 m	81					
	2		CLAY TILL (CI) - Grey, moist, stiff, medium to highly plastic, silty, some sand, trace gravel, oxide staining	82					
	3		END OF TEST HOLE AT 3 m	83					
	4		Notes: 1. Dry and open immediately after drilling 2. Backfilled with auger cuttings and bentonite at surface						
	15								
	20								
	25								
	8								
	9								

SAMPLE TYPE  Auger Grab

CONTRACTOR Cross Borders Consulting
INSPECTOR K. RUNTZ

APPROVED 

DATE 2/5/18

CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Tower 1
DRILLING METHOD 150 mm ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/4/2017
UTM (m) N 5,696,135
 E 483,496

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								20 40 60 80	PL MC LI
								20 40 60 80	20 40 60 80
			SAND (SM) - Dark brown, moist, compact, poorly graded, fine to medium grained, trace silt, trace gravel	1					
	1		- Grey below 1 m	2					
	5		- Brown, wet, seepage below 1.5 m	3					
	2			4					
	3		- Sloughing below 3 m	5					
	4			6					
	5			7					
	6		- Oxide staining below 6 m	8					
	7			9					
	8			10					
	9			11					
	10			12					
	15			13					
	20			14					
	25		END OF TEST HOLE AT 7.5 m	15					
			Notes:						
			1. Sloughed to 2 m immediately after drilling.						
			2. Backfilled with auger cuttings and sealed at surface with bentonite.						

SAMPLE TYPE ☒ Auger Grab ☐ Split Spoon

CONTRACTOR **Cross Borders Consulting** INSPECTOR **K. RUNTZ**

APPROVED 

DATE 2/5/18

CLIENT Republic Architecture
PROJECT National Conservation Plan Investments Bundle Design Services
SITE Last Mountain Lake National Wildlife Area
LOCATION Tower 2
DRILLING METHOD 150 mm Ø Solid Stem Auger

JOB NO. 17-2215-002
GROUND ELEV.
TOP OF CASING ELEV.
WATER ELEV.
DATE DRILLED 12/5/2017
UTM (m) N 5,688,412
 E 484,743

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
			TOPSOIL - Black, moist, organic, rootlets						
			CLAY TILL (CI) - Brown, damp, stiff, medium plastic, silty, sandy, trace gravel, oxide staining	62					
	1			63					
	5		- Moist, firm below 1.5 m						
	2			64					
	3		- Very stiff, sand lenses, seepage below 3						
	4		- SO ₄ = 0.775% at 3.5 m	65					
	5			66					
	15		SAND (SM) - Brown, moist, dense, poorly graded, fine to coarse grained, some silt, trace gravel						
	6			67					
	20		CLAY TILL (CI) - Grey, moist, hard, medium plastic, silty, sandy, trace gravel, oxide staining						
	7		- SO ₄ = 0.083% at 6.2 m						
	25		END OF TEST HOLE AT 6.2 m						
	8		Notes:						
			1. Auger refusal encountered on cobble/boulder at 6.2 m						
			2. Sloughed to 5.6 m immediately after drilling						
			3. Backfilled with auger cuttings and bentonite at surface						

SAMPLE TYPE ☒ Auger Grab ☒ Split Spoon

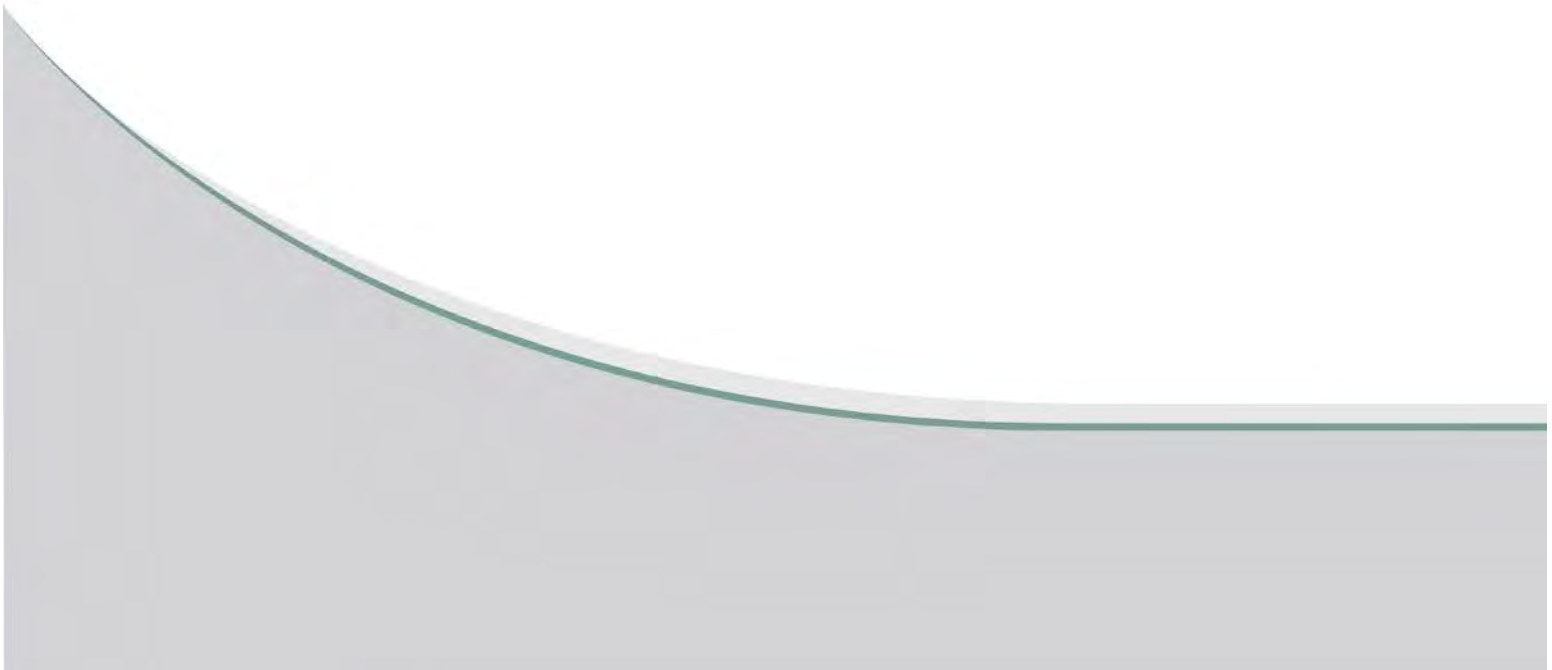
CONTRACTOR Cross Borders Consulting INSPECTOR K. RUNTZ

APPROVED

DATE 2/5/18

APPENDIX B

LABORATORY TEST RESULTS





KGS Group Consultants (Regina)
ATTN: Kai Runtz
Suite 200
4561 Parliament Avenue
Regina SK S4W 0G3

Date Received: 11-DEC-17
Report Date: 18-DEC-17 15:24 (MT)
Version: FINAL

Client Phone: 306-757-9681

Certificate of Analysis

Lab Work Order #: L2033423
Project P.O. #: NOT SUBMITTED
Job Reference: 17-2215-002
C of C Numbers:
Legal Site Desc: LAST MOUNTAIN BIRD SANCTUARY

Brian Morgan, B.Sc. Hons.
Client Services Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-1 T1 2 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI)	 12.9 23 17 5		 0.10 1 1 1	 % % % %	 13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17	 13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17	 R3914314 R3914135 R3914135 R3914135
L2033423-2 T1 3 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Grain Size by Hydrometer Grain Size Curve Gravel (4.75mm - 3in.) Coarse Sand (2.0mm - 4.75mm) Medium Sand (0.425mm - 2.0mm) Fine Sand (0.075mm - 0.425mm) Silt (0.005mm - 0.075mm) Clay (<0.005mm)	 14.8 SEE ATTACHED 1.0 1.0 1.0 4.4 81.6 6.3 6.6		 0.10 1.0 1.0 1.0 1.0 1.0 1.0	 % % % % % % %	 13-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	 13-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	 R3914314 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504
L2033423-3 T1 4 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 16.8		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491
L2033423-4 T1 5 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 17.6		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491
L2033423-5 T1 6 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 15.1		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491
L2033423-6 T2 62 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 8.56		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491
L2033423-7 T2 63 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 8.68		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491
L2033423-8 T2 64 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 14.0		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-8 T2 64 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL							
L2033423-9 T2 65 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Water Soluble Sulfate Grain Size by Hydrometer Grain Size Curve Gravel (4.75mm - 3in.) Coarse Sand (2.0mm - 4.75mm) Medium Sand (0.425mm - 2.0mm) Fine Sand (0.075mm - 0.425mm) Silt (0.005mm - 0.075mm) Clay (<0.005mm)	 8.90 0.775 SEE ATTACHED <1.0 5.4 18.3 35.1 27.0 13.9		 0.10 0.010 1.0 1.0 1.0 1.0 1.0 1.0	 % % % % % % % % %	 13-DEC-17 16-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	 13-DEC-17 16-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	 R3914314 R3914591 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504
L2033423-10 T2 66 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	 8.89		 0.10	 %	 14-DEC-17	 14-DEC-17	 R3913491
L2033423-11 T2 67 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Water Soluble Sulfate	 9.92 0.083		 0.10 0.010	 % %	 13-DEC-17 16-DEC-17	 13-DEC-17 16-DEC-17	 R3914314 R3914591
L2033423-12 D1 24 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	 6.89 74.3 Coarse		 0.10 1.0	 % %	 13-DEC-17 12-DEC-17 12-DEC-17	 13-DEC-17 12-DEC-17 12-DEC-17	 R3914314 R3911890 R3911890
L2033423-13 D2 28 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) Note: Sandy % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	 6.97 21 16 5 69.6 Coarse	 SANDY	 0.10 1 1 1 1.0	 % % % % %	 13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	 13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	 R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-14 D2 29 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-14 D2 29 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL % Moisture Grain Size by Hydrometer Grain Size Curve Gravel (4.75mm - 3in.) Coarse Sand (2.0mm - 4.75mm) Medium Sand (0.425mm - 2.0mm) Fine Sand (0.075mm - 0.425mm) Silt (0.005mm - 0.075mm) Clay (<0.005mm)	8.00 SEE ATTACHED 1.1 2.0 12.2 58.3 8.3 18.1		0.10 1.0 1.0 1.0 1.0 1.0 1.0	% % % % % % %	13-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	13-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	R3914314 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504
L2033423-15 D2 30 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	9.61		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-16 L1 16 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) Note: Sandy % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	8.54 22 15 7 54.9 Coarse		0.10 1 1 1 1.0	% % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-17 L3 8 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	13.5 30 15 15 28.6 Fine		0.10 1 1 1 1.0	% % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-18 L5 51 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	8.61 23 17 6 66.4 Coarse		0.10 1 1 1 1.0	% % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-18 L5 51 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL							
L2033423-19 L5 52 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Grain Size by Hydrometer Grain Size Curve Gravel (4.75mm - 3in.) Coarse Sand (2.0mm - 4.75mm) Medium Sand (0.425mm - 2.0mm) Fine Sand (0.075mm - 0.425mm) Silt (0.005mm - 0.075mm) Clay (<0.005mm)	10.1 SEE ATTACHED 2.7 5.3 16.8 34.5 22.3 18.4		0.10 1.0 1.0 1.0 1.0 1.0 1.0	% % % % % % %	13-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	13-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17 14-DEC-17	R3914314 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504 R3913504
L2033423-20 L5 53 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	9.43		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-21 L5 54 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	11.0		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-22 L5 55 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	13.0		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-23 L5 56 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	15.6		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-24 L5 57 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	14.0		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-25 L6 31 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	10.5		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-26 L6 32 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	3.59		0.10	%	14-DEC-17	14-DEC-17	R3913491

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-27 L6 33 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	2.47		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-28 L8 39 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	8.40		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-29 L8 40 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	14.6		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-30 L8 41 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	10.7		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-31 L9 43 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	9.54 23 15 8 47.8 Fine		0.10 1 1 1 1.0	% % % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-32 L9 44 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	14.5		0.10	%	14-DEC-17	14-DEC-17	R3913491
L2033423-33 L9 45 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	16.1		0.10	%	18-DEC-17	18-DEC-17	R3915382
L2033423-34 L10 47 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	7.51 85.1 Coarse		0.10 1.0	% %	13-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3911890 R3911890

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-35 L11 58 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	13.0 31 14 18 40.6 Fine		0.10 1 1 1 1.0	% % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-36 L11 59 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	17.6		0.10	%	18-DEC-17	18-DEC-17	R3915382
L2033423-37 L11 60 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	12.9		0.10	%	18-DEC-17	18-DEC-17	R3915382
L2033423-38 L12 68 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	12.6 33 15 18 38.8 Fine		0.10 1 1 1 1.0	% % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-39 L14 76 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture Atterberg limits Liquid Limit (LL) Moisture at Plastic Limit Plasticity Index (PI) % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	12.0 23 18 5 27.4 Fine		0.10 1 1 1 1.0	% % % % %	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 15-DEC-17 15-DEC-17 15-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3914135 R3914135 R3914135 R3911890 R3911890
L2033423-40 L14 77 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	11.7		0.10	%	18-DEC-17	18-DEC-17	R3915382

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2033423-41 L14 78 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture	12.1		0.10	%	18-DEC-17	18-DEC-17	R3915382
L2033423-42 L15 80 Sampled By: CLIENT on 04-DEC-17 @ 12:00 Matrix: SOIL Miscellaneous Parameters % Moisture % Particles > 75um (Coarse/Fine) MUST PSA % > 75um General Texture Class	9.09 41.2 Fine		0.10 1.0	% %	13-DEC-17 12-DEC-17 12-DEC-17	13-DEC-17 12-DEC-17 12-DEC-17	R3914314 R3911890 R3911890

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ATTERBERG-SK	Soil	Atterberg limits	CARTER CSSS 58
<p>The liquid limit (or upper plastic limit) is the point at which the soil becomes semifluid, like softened butter. In operational terms, the liquid limit is defined as the water content at which a trapezoidal groove cut in moist soil is closed after 25 taps on a hard rubber plate (ASTM D-18, 1958).</p> <p>The plastic limit (or lower plastic limit) is defined as the water content at which soil begins to crumble on being rolled into a thread 1/8 inch (or 3 mm) in diameter. It represents the lowest water content at which soil can be deformed readily without cracking.</p> <p>The plastic index (which is the difference between the liquid and plastic limits) gives an indication of the "clayeyiness" or plasticity of a clay and is employed in engineering classification systems for soils.</p> <p>This method is equivalent to ASTM D4318-10.</p>			
GRAIN SIZE-HYD-SK	Soil	Grain Size by Hydrometer	ASTM D422-63
Particle size curve is generated from dry sieving (particles > 2 mm), wet sieving (particles 2 mm-75 um and hydrometer readings (particles < 75 um)			
MOIST-SK	Soil	Moisture Content	ASTM D2216-80
The weighed portion of soil is placed in a 105°C oven overnight. The dried soil is allowed to cooled to room temperature, weighed and the % moisture is calculated.			
PSA-MUST-SK	Soil	% Particles > 75um (Coarse/Fine)	ASTM D422-63-SIEVE
<p>An air-dried sample is reduced to < 2 mm size and mixed with a dispersing agent (Calgon solution). The sample is washed through a 200 mesh (75 µm) sieve. The retained mass of sample is used to determine % sand fraction.</p> <p>Reference: ASTM D422-63</p>			
SO4-WATER-SOL-SK	Soil	Water Soluble Sulfate (6 hour 1:10)	CSA A23.2-3B (CONCRETE)

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L2033423

Report Date: 18-DEC-17

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PSA-MUST-SK		Soil						
Batch	R3911890							
WG2681957-1	DUP	L2033423-17						
MUST PSA % > 75um		28.6	28.6	J	%	0.0	5	12-DEC-17
WG2681957-2	IRM	2017-PSA						
MUST PSA % > 75um			42.9		%		39.2-49.2	12-DEC-17
SO4-WATER-SOL-SK		Soil						
Batch	R3914591							
WG2683730-3	IRM	NA2SO4_SOIL						
Water Soluble Sulfate			82.3		%		70-130	16-DEC-17
WG2683730-2	MB							
Water Soluble Sulfate			<0.010		%		0.01	16-DEC-17

Quality Control Report

Workorder: L2033423

Report Date: 18-DEC-17

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

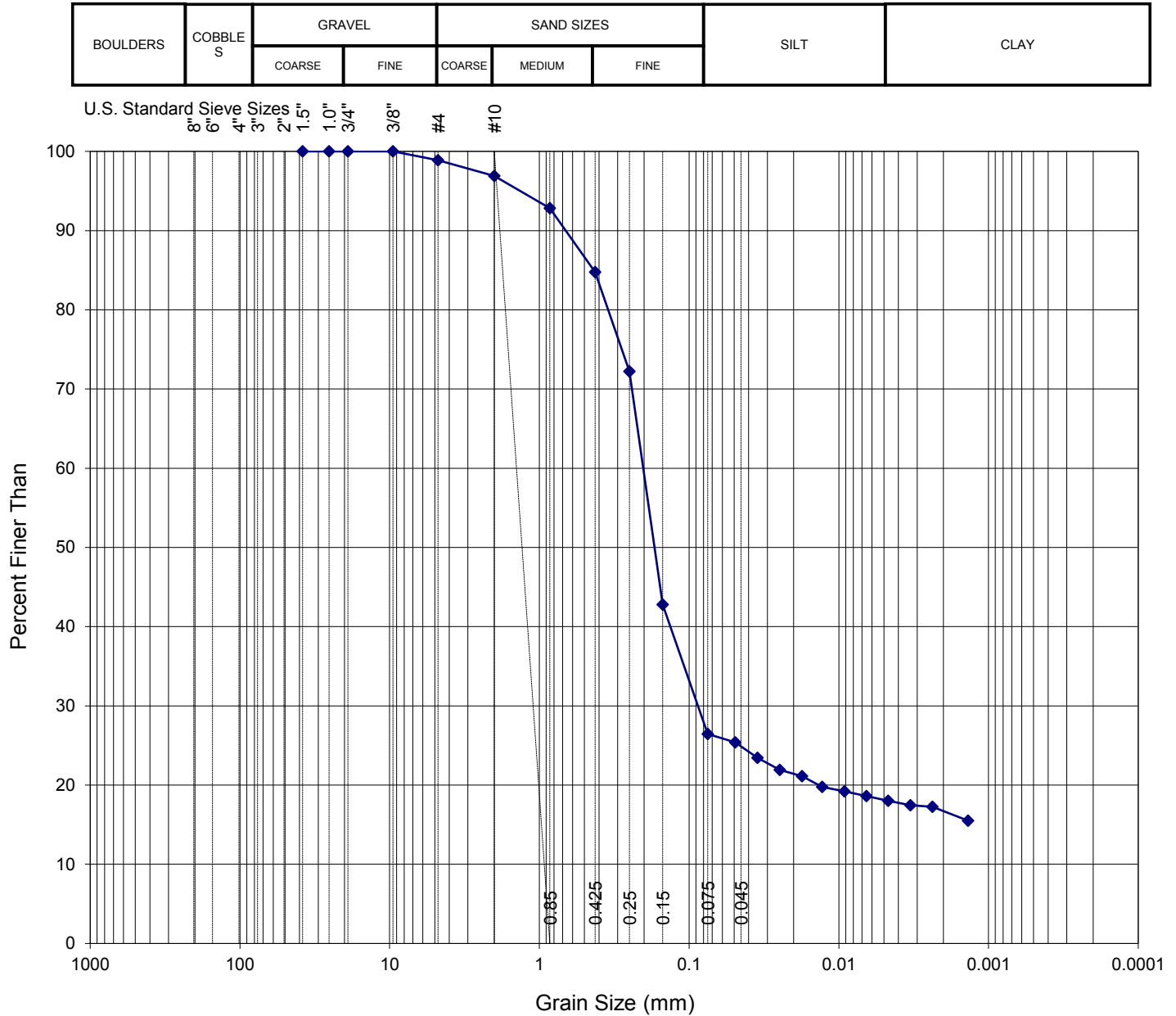
ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

819-58th Street, Saskatoon,SK

Client Name: KGS Group Consultants (Regina)
Project Number:
Client Sample ID D2 29
Lab Sample ID L2033423-14
Date Sample Received 11-Dec-17
Test Completion Date: 14-Dec-17
Analyst: SHC



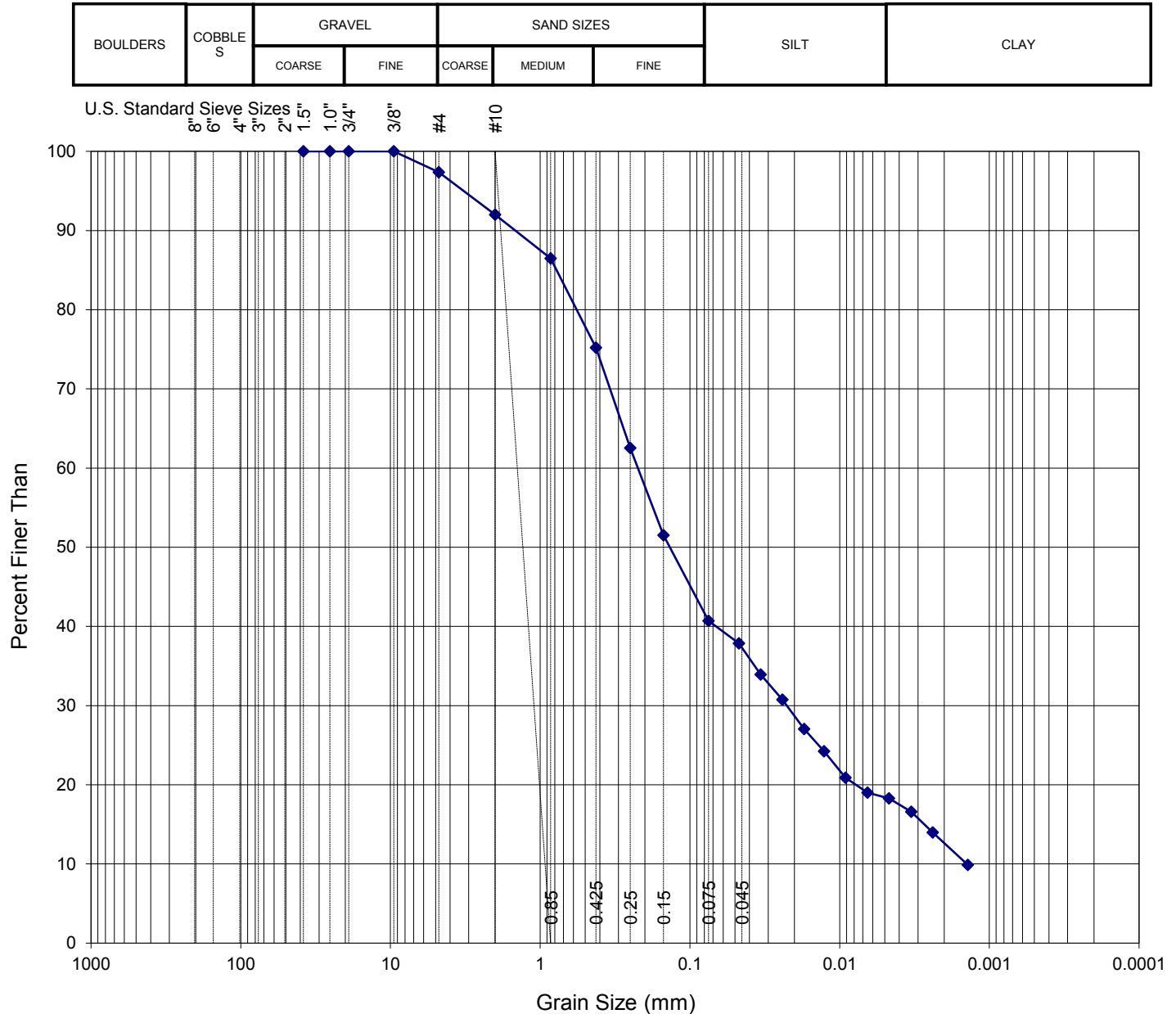
% CLAY :	18.14	< 0.005
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ALS Laboratory Group

819-58th Street, Saskatoon, SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: KGS Group Consultants (Regina)
Project Number:
Client Sample ID L5 52
Lab Sample ID L2033423-19
Date Sample Received 11-Dec-17
Test Completion Date: 14-Dec-17
Analyst: SHC



METHOD DESCRIPTION

Method Reference: ASTM D 422 - 63 (2002)

Dispersion method: Mechanical

Dispersion period: 1 minute cm/s

Soil classification system used: ASTM D422-63 Classification

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	2.65	> 4.75
% COARSE SAND :	5.34	2.0 - 4.75
% MEDIUM SAND :	16.83	0.425 - 2.0
% FINE SAND :	34.49	0.075 - 0.425
% SILT :	22.27	0.075 - 0.005
% CLAY :	18.42	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:KGS Group Consultants (Regina)

Project Number:

Client Sample IDT1 3

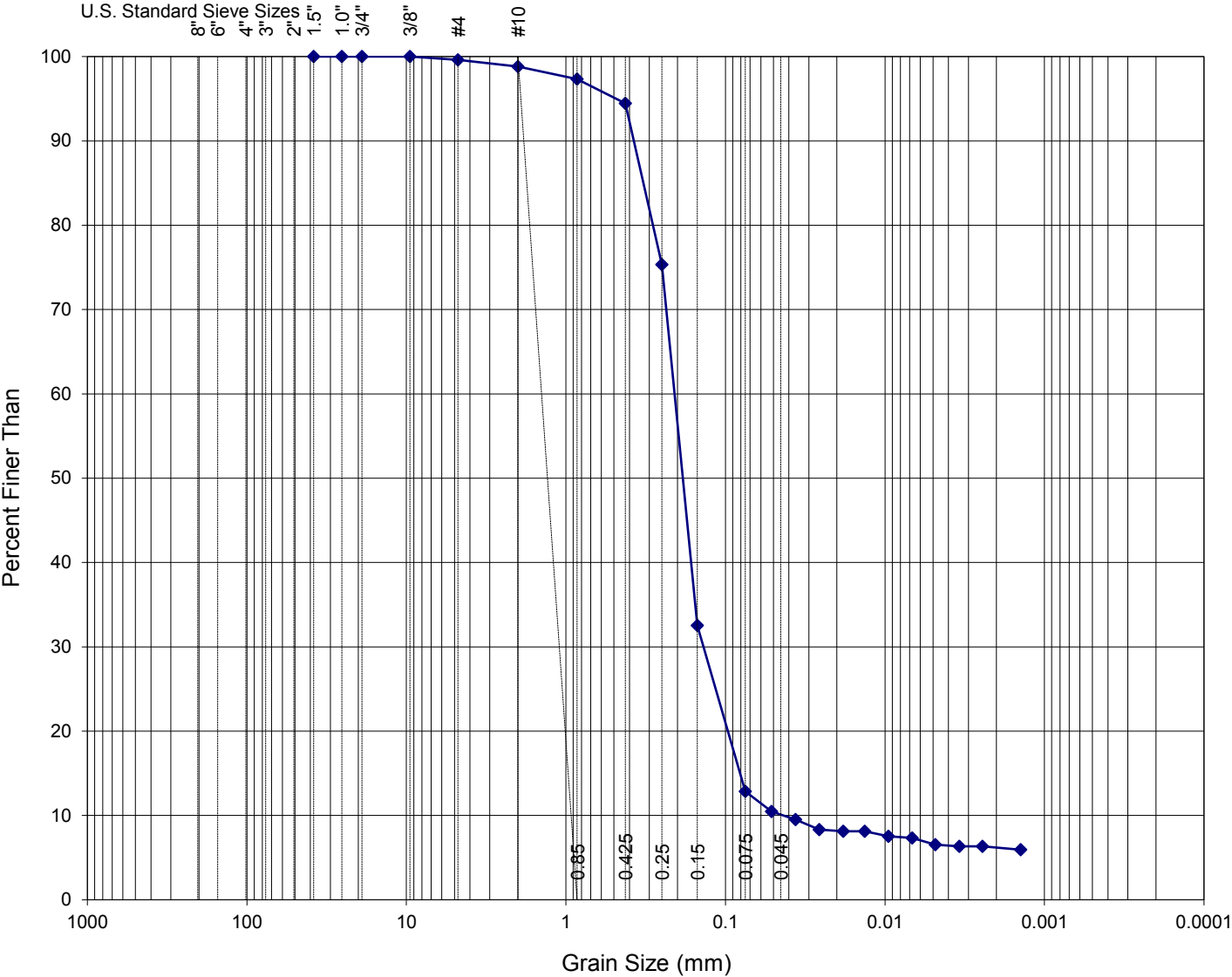
Lab Sample IDL2033423-2

Date Sample Received11-Dec-17

Test Completion Date:14-Dec-17

Analyst:SHC

BOULDERS	COBBLES	GRAVEL		SAND SIZES			SILT	CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE		



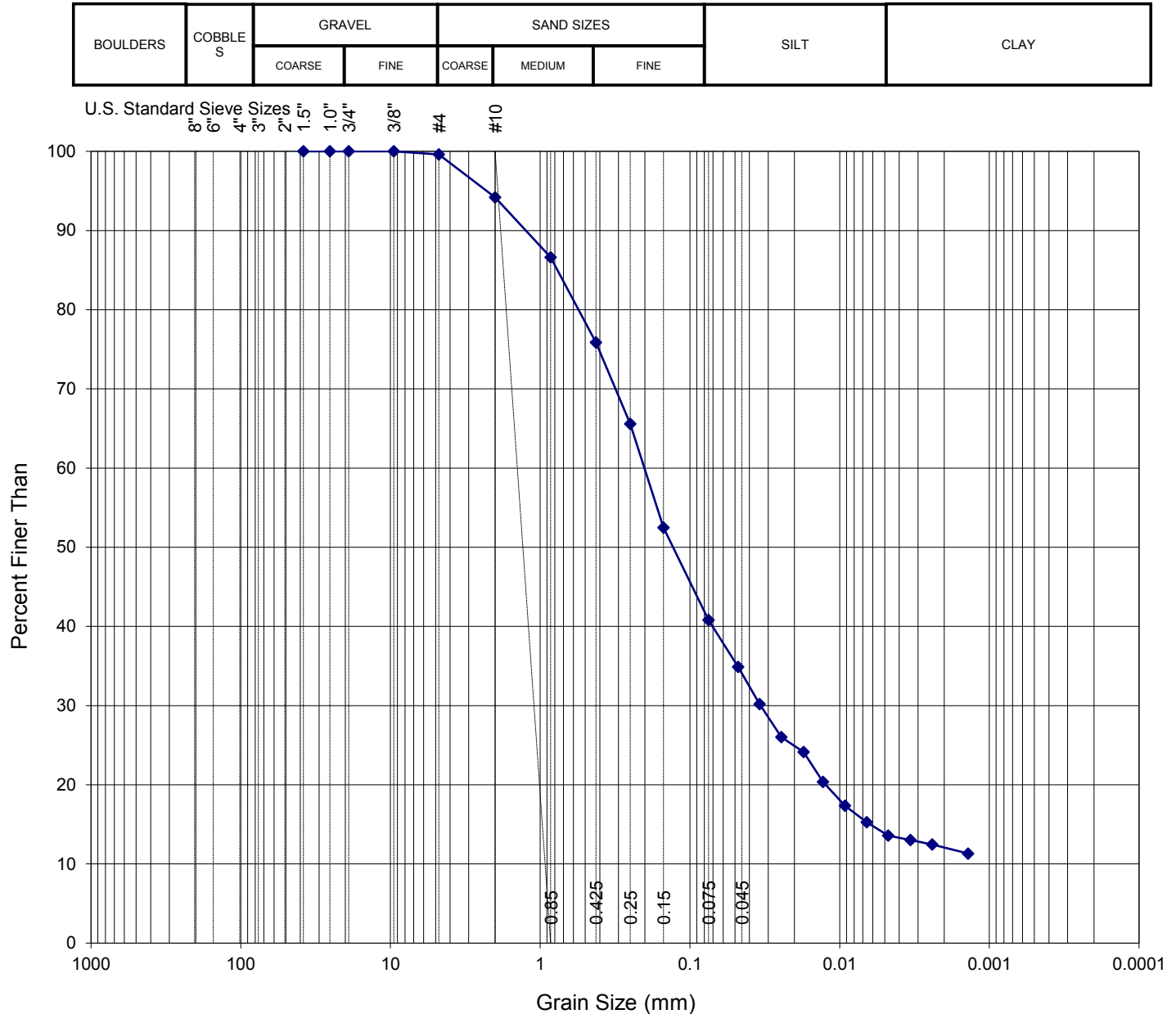
METHOD DESCRIPTION		SUMMARY OF RESULTS		
Method Reference: ASTM D 422 - 63 (2002)		GRAIN SIZE	WT %	DIA. RANGE (mm)
Dispersion method: Mechanical		% GRAVEL :	<1	> 4.75
Dispersion period: 1 minute		% COARSE SAND :	<1	2.0 - 4.75
Soil classification system used: ASTM D422-63 Classification		% MEDIUM SAND :	4.37	0.425 - 2.0
DESCRIPTION OF SAND AND GRAVEL PARTICLES		% FINE SAND :	81.59	0.075 - 0.425
Shape: Angular		% SILT :	6.25	0.075 - 0.005
Hardness: Hard		% CLAY :	6.61	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon, SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: KGS Group Consultants (Regina)
Project Number:
Client Sample ID T2 65
Lab Sample ID L2033423-9
Date Sample Received 11-Dec-17
Test Completion Date: 14-Dec-17
Analyst: SHC



METHOD DESCRIPTION

Method Reference: ASTM D 422 - 63 (2002)

Dispersion method: Mechanical

Dispersion period: 1 minute cm/s

Soil classification system used: ASTM D422-63 Classification

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	5.40	2.0 - 4.75
% MEDIUM SAND :	18.33	0.425 - 2.0
% FINE SAND :	35.06	0.075 - 0.425
% SILT :	26.96	0.075 - 0.005
% CLAY :	13.85	< 0.005

Project	Proposed Pavilion, Observation Towers and Parking Lots										File No.	17-2215-002		
Location	Test Hole	Sample No.	Depth	Type	Water (%)	Last Mountain Bird Sanctuary					Atterberg Limits	Date Sampled		Other Types of Tests
						U	Unit Wt	Hydrometer	Washed Sieve	Sulfate		P200		
	T1	1	0.5	✓										
	T1	2	1.0							✓				
	T1	3	2.0	✓				✓						
	T1	4	3-3.4											
	T1	5	4.5	✓										
	T1	6	6.0	✓										
	T1	7	7.5											
	T2	62	0.5	✓										
	T2	63	1.0	✓										
	T2	64	2.0	✓										
	T2	65	3-3.5	✓				✓			✓			
	T2	66	4.5	✓							✓			
	T2	67	6.0	✓							✓			
	D1	24	0.5	✓										
	D1	25	1.0									✓		
	D1	26	2.0											
	D1	27	3.0											
	D2	28	0.5	✓							✓			
	D2	29	1.0	✓				✓						
	D2	30	1.8	✓										
	L1	16	0.5	✓							✓			
	L1	17	1.0											
	L1	18	2.0											
	L1	19	3.0											
	L2	12	0.5											
	L2	13	1.0											
	L2	14	2.0											
	L2	15	3.0											
	L3	8	0.5	✓							✓			
	L3	9	1.0											
	L3	10	2.0											
	L3	11	3.0											
	L4	20	0.5											
	L4	21	1.0											
	L4	22	2.0											
	L4	23	3.0											
	L5	52	0.5	✓							✓			
	L5	53	1.0	✓				✓						
	L5	53	1.5-2	✓										
	L5	54	3.0	✓										
	L5	55	4.5-5	✓										
	L5	56	6.0	✓										
	L5	57	7.5	✓										
	L6	31	0.5	✓										
	L6	32	1.0	✓										
	L6	33	2.0	✓										
	L6	34	3.0											
	L7	35	0.5											
	L7	36	1.0											
	L7	37	2.0											
	L7	38	3.0											
	L8	39	0.5	✓										
	L8	40	1.0	✓										
	L8	41	2.0	✓										
	L8	42	3.0											
	L9	43	0.5	✓							✓			
	L9	44	1.0	✓										
	L9	45	2.0	✓										
	L9	46	3.0											
	L10	47	0.5	✓									✓	
	L10	48	1.0											
	L10	49	2.0											
	L10	50	3.0											



L2033423-COFC

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L2033423-COFC

ly (COC) / Analytical
est Form

tel: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 14 - 425524

Page of

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REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

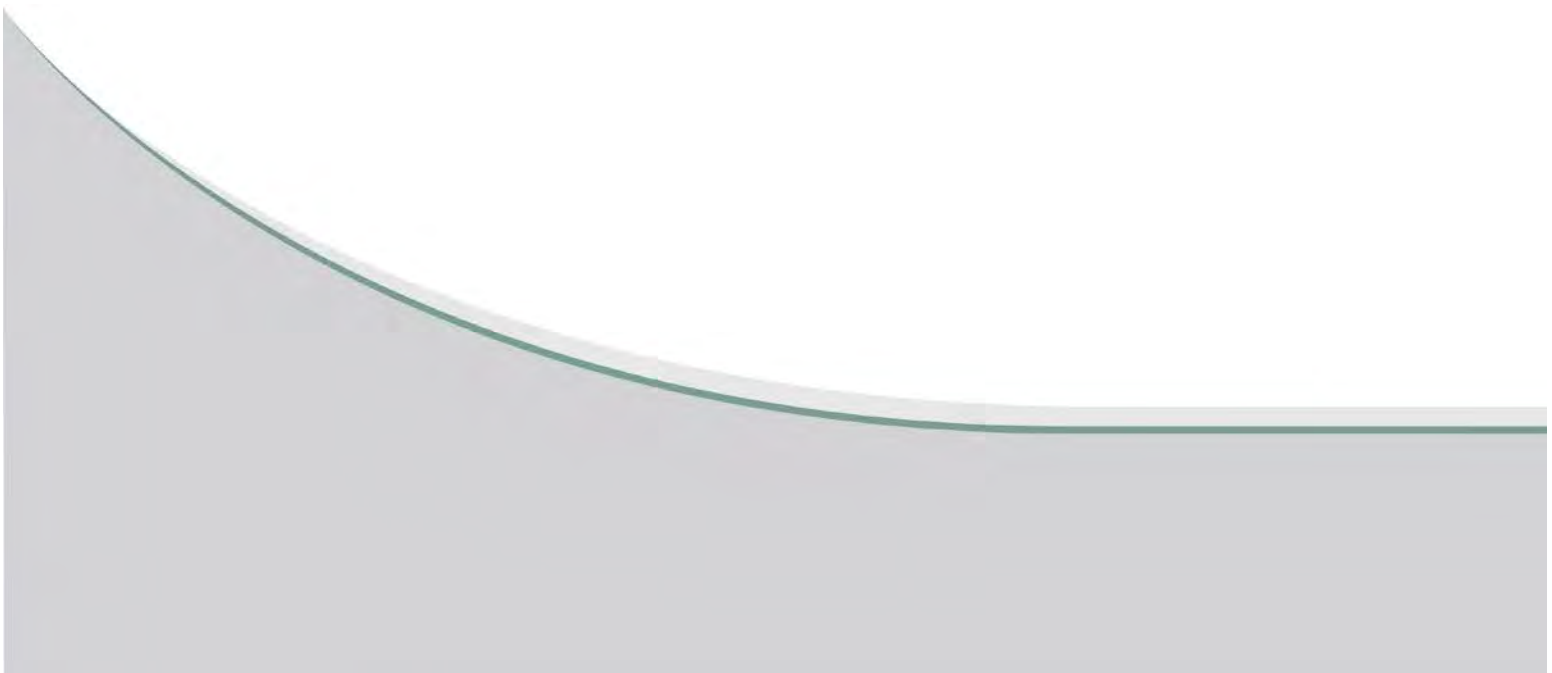
912-614-0103 • 800 Graduate Catalog 914

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

APPENDIX C

GRANULAR MATERIAL SPECIFICATIONS





3500 — SPECIFICATION FOR BASE AGGREGATE AND BASE MIX

3500.1 DESCRIPTION

3500.1.1 The work shall consist of crushing and stockpiling base aggregate. When specified, the work shall also consist of pugmilling base aggregate and stockpiling base mix.

3500.1.2 The following definitions shall apply:

3500.1.2.1 Base Aggregate is the aggregate before pugmilling.

3500.1.2.2 Base Mix is the mix after pugmilling.

3500.1.2.3 Mean is the arithmetic average of a set of 'n' test results constituting the sample.

3500.1.2.4 Moving Average is the arithmetic mean of 3 consecutive test results.

3500.2 MATERIALS

3500.2.1 Aggregate

3500.2.1.1 Base Aggregate shall be composed of sound, hard and durable particles of sand, gravel and rock free from injurious quantities of elongated, soft or flaky particles, shale, loam, clay balls and organic or other deleterious material.

3500.3 CONSTRUCTION

3500.3.1 General

3500.3.1.1 Base Aggregate and Base Mix shall comply with the requirements listed in Table 3500.3.T1.

Table 3500.3.T1 - Base Aggregate and Base Mix Properties

Sieve Designation	Percent By Weight Passing Canadian Metric Sieve Series		
	Type 31	Type 33	Type 35
31.5 mm	100.0		
18.0 mm	75.0 - 90.0	100.0	100.0
12.5 mm	65.0 - 83.0	75.0 - 100.0	81.0 - 100.0
5.0 mm	40.0 - 69.0	50.0 - 75.0	50.0 - 85.0
2.0 mm	26.0 - 47.0	32.0 - 52.0	32.0 - 65.0
900 µm	17.0 - 32.0	20.0 - 35.0	20.0 - 43.0
400 µm	12.0 - 22.0	15.0 - 25.0	15.0 - 30.0
160 µm	7.0 - 14.0	8.0 - 15.0	8.0 - 18.0
71 µm	6.0 - 11.0	6.0 - 11.0	7.0 - 12.0
Plasticity Index	0 - 7.0	0 - 6.0	0 - 5.0
Fractured Face %	50.0 Minimum		
Lightweight Pieces %	5.0 Maximum		
All Other Deleterious Material % *	2.0 Maximum		

* Deleterious material includes all other injurious material other than lightweight pieces.

- 3500.3.1.1.1 A tolerance of 3% in the percent by weight passing the maximum size sieve will be permitted providing 100% of the oversize passes the 40.0 mm sieve for Type 31 and the 22.4 mm sieve for Types 33 and 35.
- 3500.3.1.2 The following will apply to Department-owned or controlled aggregate sources shown on the plans or as described in the Special Provisions:
 - 3500.3.1.2.1 Overburden shall be removed from material deposits in accordance with Specification 2260 For Removal Of Overburden.
 - 3500.3.1.2.2 Rock passing a 610mm square opening screen and larger than the maximum specified size shall be crushed and incorporated simultaneously throughout the crushing operation.
 - 3500.3.1.2.3 Stockpiles shall be constructed in accordance with Specification 3600 For Stockpiling Aggregates.
- 3500.3.1.3 Binder, filler, and blender sand shall be provided in accordance with Specification 3400 For Binder, Filler And Blender Sand.
 - 3500.3.1.3.1 Binder, filler and blender sand shall be added using a separate conveyor system.
 - 3500.3.1.3.2 Binder, filler and blender sand feeds shall be accurately controlled and coordinated.

3500.3.2 Processing

- 3500.3.2.1 Base Mix production shall comply with the following requirements:
 - 3500.3.2.1.1 The Contractor shall cease operations if the Moving Average for any sieve does not comply with the specified requirements listed in Table 3500.3.T1.
 - 3500.3.2.1.1.1 Failure to cease operations shall subject all subsequent materials to the requirements of General Provision 1400-7 Unacceptable and Unauthorized Work.
 - 3500.3.2.1.2 Upon recommencement of operations, the specified requirements shall be met on each of the initial 2 tests prior to the Department accepting any product.
 - 3500.3.2.1.3 Frequency of testing will be at the discretion of the Engineer.
- 3500.3.2.2 When Base Aggregate is the final product specified, production shall be in accordance with the production requirements for Base Mix.
- 3500.3.2.3 Base Aggregate shall be stockpiled after the crushing operation and prior to pugmilling.
- 3500.3.2.4 During pugmilling operations, the Contractor shall have sufficient Base Aggregate in the stockpile for at least 24 hours of pugmilling operation until crushing is completed.
- 3500.3.2.5 Pugmilling shall be performed in a stationary mixing plant. The mixing unit shall be designed to ensure complete mixing of the materials.
- 3500.3.2.6 The pugmill shall be equipped with spray bars for the addition of water.
- 3500.3.2.7 The moisture content of the Base Mix shall not be greater than 5 % by weight when it leaves the pugmill.

3500.4 MEASUREMENT

3500.4.1 Base Aggregate and Base Mix will be measured in tonnes.

3500.5 PAYMENT

3500.5.1 Payment for Base Aggregate will be at the applicable contract unit price per tonne. The unit price will be full compensation for completing the work except for those activities for which specific provision for payment is made in this section.

3500.5.2 Payment for Base Mix will be at the applicable contract unit price per tonne. The unit price will be full compensation for completing the work except for those activities for which specific provision for payment is made in this section.

3500.5.3 If the Contract includes a bid item for:

3500.5.3.1 Removal Of Overburden; payment will be made in accordance with Specification 2260 For Removal Of Overburden.

3500.5.3.2 Hauling Aggregate; payment will be made in accordance with Specification 2405 For Hauling On The Basis Of The Kilometre.



3300 - 1 DESCRIPTION

1.01 The work shall consist of spreading and compacting screened or crushed aggregate on a prepared surface.

1.02 The following definitions shall apply for this specification:

(a) Mean:

The arithmetic average of a set of 'n' test results constituting the sample.

(b) Moving average:

The arithmetic mean of 3 consecutive test results.

(c) Sub-base aggregate:

The aggregate before mixing, when binder is to be added or the aggregate before spreading and compacting, when no binder is to be added.

(d) Sub-base mix:

The sub-base aggregate after mixing with binder and water but before spreading and compacting.

(e) Sub-base course:

The sub-base aggregate or sub-base mix in place on the road during and after spreading and compacting.

3300 - 2 MATERIALS

Aggregate

2.01 Sub-base aggregate shall be composed of sound, hard, and durable particles of sand, gravel and rock free from injurious quantities of soft or flaky particles, shale, loam, clay balls and organic or other deleterious material.

3300 - 3 CONSTRUCTION

General

3.01 (a) Sub-base course shall comply with the requirements listed in Table 1:

TABLE 1

Sieve Designation	Percent By Weight Passing Canadian Metric Sieve Series		
	TYPE		
	6	8	10
50.0 mm	100.0	100.0	100.0
2.0 mm	0 - 80.0	0 - 90.0	
400 um	0 - 45.0	0 - 60.0	
160 um	0 - 20.0	0 - 25.0	
71 um	0 - 6.0	0 - 15.0	0 - 20.0
Plasticity Index (all types)	0 - 6.0		

- (b) A tolerance of 3% in the percent by weight passing the maximum size sieve shall be permitted providing 100% of the oversize passes the 63.0 mm sieve.
- 3.02 The following shall apply to Department owned or controlled aggregate sources shown on the plans or as described in the Special Provisions:
 - (a) Overburden shall be removed from material deposits in accordance with Specification 2260 For Removal Of Overburden.
 - (b) Stockpiles shall be constructed in accordance with Specification 3600 For Stockpiling Aggregates.
- 3.03 Binder, filler and blender sand shall be provided in accordance with Specification 3400 For Binder, Filler And Blender Sand.
- 3.04 Sub-base aggregate shall be pushed to a trap or into a stockpile prior to screening.

Processing

- 3.05 The production of sub-base course shall comply with the following:
 - (a) The Contractor shall cease operations if the moving average for any sieve does not comply with the specified requirements listed in Table 1.
 - (b) Operations shall not recommence until the specified requirements are met.
 - (c) Upon recommencement of operations, the specified requirements shall be met on each of the initial 2 tests.
 - (d) Failure to cease operations shall subject all subsequent materials to the requirements of General Provision 1400-7 (Unacceptable and Unauthorized Work).

Spreading and Compacting

- 3.06 The thickness of a compacted lift of sub-base course shall not exceed 120 mm. The lift thickness may be increased if the Contractor can demonstrate that with the use of vibratory compaction equipment and construction procedures, the compaction requirements can be achieved for lifts greater than 120 mm.
- 3.07 Sub-base courses shall be compacted until no further settlement is apparent and the particles are well keyed into place. The sub-base course shall be free from any rutting or deformations before the placement of the next course.
- 3.08 If excess moisture originating from external causes including but not limited to precipitation and/or Contractor's operation is present in the sub-base course and/or underlying material prior to the acceptance of the completed surfacing structure; the Contractor shall dry the sub-base course and/or the underlying material to the optimum moisture content and compact the sub-base and/or the underlying material to not less than the specified density or the optimum density in accordance with the requirements for Moisture-Density Proctor (STP 205-5).

Stabilizing

- 3.09 If the sub-base course proves to be unstable, the Engineer shall require the Contractor to stabilize the sub-base aggregate by one or a combination of the following methods:
 - (a) By the addition of binder or filler at the aggregate source or at the screening plant. The binder or filler shall be added and thoroughly distributed throughout the aggregate until a homogeneous mixture is obtained.
 - (b) By the addition of crushed aggregate on the road.
 - (c) By the addition of emulsified asphalt to the compaction water in the proportions designated by the Engineer. The Department shall supply the asphalt.
 - (d) Any other method proposed by the Contractor and approved by the Engineer.

Seasonal Shutdown

- 3.10 If work must be carried over from one construction season to the next, there shall be no exposed sub-base aggregate, mix or sub-base course remaining on the road unless covered by a lift of base course.

3300-4 SAMPLING AND TESTING

General

- 4.01 Unless otherwise specified, test procedures shall be in accordance with Saskatchewan Highways and Transportation's Standard Test Procedures Manual.
- 4.02 The test procedures in effect on the closing date of the tenders shall apply.

3300 - 5 MEASUREMENT

- 5.01 Sub-base course shall be measured in tonnes.

3300 - 6 PAYMENT

- 6.01 Payment for Sub-base Course shall be at the contract unit price per tonne. The contract unit price shall be full compensation for completing the work except for those activities for which specific provision for payment is made in this section.
- 6.02 If the contract includes a bid item for:
- (a) Hauling Sub-base Course and Hauling Binder, Filler And Blender Sand; payment shall be made in accordance with Specification 2405 For Hauling On The Basis Of The Kilometre.
 - (b) Watering; payment shall be made in accordance with Specification 2500 For Watering.
 - (c) Binder, Filler And Blender Sand; payment shall be made in accordance with Specification 3400 For Binder, Filler And Blender Sand.
 - (d) Granular Base Course; payment for Granular Base Course used as stabilizing agent shall be at the contract unit price For Granular Base Course.
 - (e) Prime, Tack or Flush Coat; payment for emulsified asphalt used as stabilizing agent shall be the contract unit price for Prime, Tack and Flush Coat.

