



FISHERIES AND OCEANS CANADA

Real Property Safety and Security

REAL PROPERTY SAFETY AND SECURITY – SNOOTLI CREEK HATCHERY-AERATION FACILITY

CONTRACT NO. F1700-21-1944

SPECIFICATIONS

September 2021

- Part 1 General**
- 1.1 Not Used**
- .1 Not Used
- 1.2 Specifications**

Section Number	Section Title	No. of Pages
Division 00 – Procurement and Contracting Requirements		
SECTION 00 01 01	Title Page	1
SECTION 00 01 10	Table of Contents	3
Division 01 – General Requirements		
SECTION 01 11 00	Summary of Work	4
SECTION 01 29 83	Payment Procedures for Testing Laboratory Services	2
SECTION 01 32 16.07	Construction Progress Schedule – Bar (Gantt) Chart	4
SECTION 01 33 00	Submittal Procedures	4
SECTION 01 35 29.06	Health and Safety Requirements	4
SECTION 01 35 43	Environmental Procedures	4
SECTION 01 41 00	Regulatory Requirements	2
SECTION 01 45 00	Quality Control	3
SECTION 01 51 00	Temporary Utilities	4
SECTION 01 52 00	Construction Facilities	4
SECTION 01 56 00	Temporary Barriers and Enclosures	2
SECTION 01 61 00	Common Product Requirements	4
SECTION 01 71 00	Examination and Preparation	2
SECTION 01 73 00	Execution	2
SECTION 01 74 11	Cleaning	2
SECTION 01 74 21	Construction/Demolition Waste Management and Disposal	10
SECTION 01 77 00	Closeout Procedures	2
SECTION 01 78 00	Closeout Submittals	7
SECTION 01 79 00	Demonstration and Training	1
SECTION 01 91 13	General Commissioning (CX) Requirements	10
SECTION 01 91 31	Commissioning (CX) Plan	12
SECTION 01 91 33	Commissioning Forms	4
SECTION 01 91 41	Commissioning Training	4
SECTION 01 91 51	Building Management Manual (BMM)	4
Division 03 – Concrete		
SECTION 03 10 00	Concrete Forming and Accessories	3
SECTION 03 20 00	Concrete Reinforcing	4
SECTION 03 30 00	Cast-in-Place Concrete	8
SECTION 03 35 00	Concrete Finishing	4
SECTION 03 35 05	Concrete Floor Hardening	4
Division 05 – Metals		
SECTION 05 12 23	Structural Steel for Buildings	5
SECTION 05 31 00	Steel Decking	3
SECTION 05 41 00	Structural Metal Stud Framing	4
SECTION 05 50 00	Metal Fabrications	4

Section Number	Section Title	No. of Pages
Division 31 – Earthwork		
SECTION 31 05 10	Corrected Maximum Dry Density for Fill	2
SECTION 31 05 16	Aggregate Materials	4
SECTION 31 11 00	Clearing and Grubbing	3
SECTION 31 22 13	Rough Grading	4
SECTION 31 23 33.01	Excavating, Trenching and Backfilling	11
SECTION 31 32 19.01	Geotextiles	4
Division 33 – Utilities		
SECTION 33 11 16	Site Water Utility Distribution Piping	13
SECTION 33 46 13.01	Foundation and Underslab Drainage	4

1.3 Drawing List

DRAWING NO.	DESCRIPTION	[REVISION NO].
Civil Drawings		
101944-01-0000-C-001	WATER SUPPLY AND DISTRIBUTION GENERAL ARRANGEMENT	0
101944-01-0000-C-002	WATER SUPPLY AND DISTRIBUTION WELL WATER DISTRIBUTION PLAN	0
101944-01-0000-C-003	WATER DISTRIBUTION LARGE TUB AND SMALL TUB PIPING LAYOUTS	B
101944-01-0000-C-004	AERATOR TOWER ISOMETRIC VIEWS AND SECTIONS	0
101944-01-0000-C-005	AERATION TOWER BURIED PIPING PLAN AND WATER WORKS NOTES	0
101944-01-0000-C-006	AERATION TOWER ELEVATIONS SHEET 1	0
101944-01-0000-C-007	AERATION TOWER ELEVATIONS SHEET 2 OF 2	0
101944-01-0000-C-008	AERATION TOWER WELL SUPPLY PIPELINES BURIED MANIFOLD & VALVES	0
101944-01-0000-C-009	AERATION TOWER RISER SUPPLY PIPE EXPANSION AND CONTRACTION JOINT DETAILS	0
101944-01-0000-C-010	AERATION TOWER AERATOR DISTRIBUTOR UNIT & TRAY	0

DRAWING NO.	DESCRIPTION	[REVISION NO].
Structural Drawings		
101944-01-0000-S-001	AERATION TOWER SITE PLAN	0
101944-01-0000-S-002	AERATION TOWER 3D VIEWS	1
101944-01-0000-S-003	AERATION TOWER GENERAL NOTES SHEET 1 OF 2	0
101944-01-0000-S-004	AERATION TOWER GENERAL NOTES SHEET 2 OF 2	0
101944-01-0000-S-005	AERATION TOWER CONCRETE AND STEEL OUTLINE	1
101944-01-0000-S-006	AERATION TOWER CONCRETE STRUCTURE DETAILS SHEET 1 OF 2	1
101944-01-0000-S-007	AERATION TOWER CONCRETE STRUCTURE DETAILS SHEET 2 OF 2	1
101944-01-0000-S-008	AERATION TOWER STEEL STRUCTURE DETAILS	0
101944-01-0000-S-009	AERATION TOWER STAIR DETAILS	0

Part 2 Products

2.1 Not Used

.1 Not Used

Part 3 Execution

3.1 Not Used

.1 Not Used

END OF SECTION

1.1 RELATED REQUIREMENTS

- .1 Divisions 0 and 1.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises general construction of a new Aeration Facility for the Hatchery works on the site, as detailed on the Drawings and Specifications, including immediately adjacent buried piping related to the Aeration Facility construction work, located at Snootli Creek Hatchery, near Bella Coola, BC.
 - .1 Snootli Creek Hatchery is located on Highway 20, approximately 11 km east of Bella Coola, BC., and near the village of Hagensborg.
 - .2 Construct the Aeration Facility, as shown on the Drawings and described in the Specifications, including:
 - .1 The underground piping including excavation and granular backfilling, the well-water supply piping manifold, the distribution piping from the Facility, and the buried ground floor drainage works; all to the limits indicated on Drawing _C-005, Plan.
 - .2 The reinforced concrete lower portion of the Aeration Facility, including:
 - .1 The internal piping, fittings and valves in the lower, reinforced concrete structure portion of the Facility, including the floor drain.
 - .3 The structural steel, including the stairways, grates and miscellaneous steel support components.
 - .4 The Aerator Distributor Tray and Aerator Distributor Outlet Flow Control Units.
 - .5 Coordinating installation of the “aeration pots” supplied by Snootli Creek Hatchery, and installed by Snootli Creek Hatchery personnel.
 - .6 The metal clad walls and roof, including girts, purlins and all other components required to properly construct and complete the upper portion enclosure of the Facility.
 - .7 The ventilation louvers.
 - .8 The exterior use, industrial standard, lockable personnel and equipment doors, including door frames, door jambs, opening and closing equipment, and door hardware.
 - .9 Submitting detailed design shop drawings for the metal clad roof and walls enclosure, and submitting shop drawings and “cut sheets” for the components of the work.
 - .10 Any other incidental work not specifically described but nevertheless required to properly complete the work so that the Snootli Creek Aeration Facility functions fully and properly, as intended
 - .11 All the work shown on the Drawings and described in the Contract documents.
 - .2 The warranty period shall be one (1) year commencing on the date of Substantial Completion of the work. The Contractor shall correct defects and deficiencies in the work that appear prior to and during the period of one year from the date of the Certificate, or declaration, of Substantial Completion.
 - .1 The date of the warranty period for defective works made good after the date of Substantial Completion shall commence when the Departmental Representative accepts the rectified work.

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- .2 Snootli Creek Hatchery will be responsible for, and carry out, the maintenance of the constructed works during that one year long warranty period.
 - .2 Any work that is outside of the scope of the contract documents must be proposed and submitted in writing to the Departmental Representative.
 - .1 All submittals must be in accordance with Section 01 33 00 – Submittal Procedures.
 - .2 All extra work must be approved by the Departmental Representative.
 - .1 If work is done that has not been approved, it will be at the Contractor's expense.
 - .3 The Contract documents, drawings and specifications are intended to complement each other.
 - .4 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.3 PROJECT TIMELINE

- .1 Project must be completed by 30th October 2022.

1.4 CONTRACT METHOD

- .1 Construct Work under a single stipulated price contract.
- .2 Relations and responsibilities between Contractor and subcontractors assigned by Owner are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:
 - .1 Furnish to Contractor bonds covering faithful performance of subcontracted work and payment of obligations there under.
 - .2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide to Departmental Representative.

1.5 WORK BY OTHERS

- .1 Co-operate with Snootli Creek Hatchery personnel in carrying out their respective works and carry out instructions from Departmental Representative.
- .2 Co-ordinate work with that of Snootli Creek Hatchery personnel. If any part of work under this Contract depends for its proper execution or result upon work of the Snootli Creek Hatchery personnel, report promptly to Departmental Representative, in writing, any defects which may interfere with proper execution of Work.
- .3 Work of Project which will be executed during or after completion of Work of this Contract, and which is specifically excluded from this Contract:
 - .1 Supply and installation of the Aeration Units on the floor between the Aeration Distributor Tray and the water storage tank.

1.6 FUTURE WORK

- .1 Ensure that Work avoids encroachment into areas required for future work.

1.7 WORK SEQUENCE

- .1 Construct Work to accommodate Owner's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner during construction.
- .3 Maintain fire access.

1.8 CONTRACTOR USE OF PREMISES

- .1 Unrestricted use of site until Substantial Performance.
- .2 Co-ordinate use of premises under direction of Departmental Representative.
- .3 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .4 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, 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.

1.9 OWNER OCCUPANCY

- .1 Owner will occupy portions of the Snootli Creek Hatchery Site during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.10 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to occupants of the Snootli Creek Hatchery Site and normal use of the site. Arrange with Departmental Representative to facilitate execution of Work.

1.11 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 48 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian and vehicular traffic and DFO operations.
- .3 Provide alternative routes for personnel pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Departmental Representative to maintain critical building and tenant systems.

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- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
 - .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
 - .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
 - .10 Record locations of maintained, re-routed and abandoned service lines.
 - .11 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.12 DOCUMENTS REQUIRED

- .1 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.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used

END OF SECTION

1.1 RELATED REQUIREMENTS

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Departmental Representative are specified under sections as follows:

1.2 APPOINTMENT AND PAYMENT

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

1.3 CONTRACTOR'S RESPONSIBILITIES

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General**1.1 DEFINITIONS**

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

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Departmental Representative 14 within working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.
- .3 Submit Project Schedule to Departmental Representative within 5 working days of receipt of acceptance of Master Plan.

1.4 PROJECT MILESTONES

- .1 Project milestones shall be as per the Project Schedule submitted by the contractor and accepted by the Departmental Representative.

1.5 MASTER PLAN

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

1.6 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, Underground Piping Construction to above ground floor slab, backfilling.
 - .6 Reinforced Concrete Structure: footings and grade wall, ground floor wall, reservoir bottom floor, reservoir walls and ground floor slab.
 - .7 Aboveground Piping, fittings and valves s.
 - .8 Upper Storeys Structural Steel.
 - .9 Metal-clad Siding and Roofing.
 - .10 Testing and Commissioning.
 - .11 Supplied equipment long delivery items.
 - .12 Owner supplied equipment required dates.

1.7 PROJECT SCHEDULE REPORTING

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

1.8 PROJECT MEETINGS

- .1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.
- .2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used

END OF SECTION

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Part 1 General**1.1 ADMINISTRATIVE**

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

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 Refer to CCDC 2 GC 3.11.
- .2 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .3 Submit drawings stamped and signed by professional engineer registered or licensed in Province.
- .4 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.
- .5 Allow 10 days for Departmental Representative's review of each submission.
- .6 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.

- .7 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.
- .8 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .9 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .10 After Departmental Representative's review, distribute copies.
- .11 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.
- .12 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.
- .13 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
 - .2 Testing must have been within 3 years of date of contract award for project.

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- .14 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.
 - .15 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .16 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.
 - .17 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
 - .18 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
 - .19 Delete information not applicable to project.
 - .20 Supplement standard information to provide details applicable to project.
 - .21 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.
 - .22 The review of shop drawings by Departmental Representative is for sole purpose of ascertaining conformance with general concept.
 - .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 for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.
- .2 Deliver samples prepaid to Departmental Representative.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.

- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.4 PHOTOGRAPHIC DOCUMENTATION

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

1.5 CERTIFICATES AND TRANSCRIPTS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 43 Environmental Procedures.

1.2 REFERENCES

- .1 Canada Labour Code, Part 2.
- .2 Canada Occupational Safety and Health Regulations.
- .3 Province of British Columbia:
 - .1 Workers Compensation Act, RSBC 1996 - Updated 2012.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site-specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
- .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 in accordance with Section.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 14 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 14 days after receipt of comments from Departmental Representative.
- .8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Prime Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award.
- .3 Contractor shall agree to install proper site separation and identification in order to always maintain time and space throughout life of project.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 REGULATORY REQUIREMENTS

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

1.8 GENERAL REQUIREMENTS

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

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .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.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Workers Compensation Act, RSBC 1996 - Updated 2012.
- .2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.
- .3 Comply with Occupational Health and Safety Regulations, 1996.
- .4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.
- .5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORSEEN HAZARDS

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

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 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.

1.13 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.

1.14 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.

1.15 WORK STOPPAGE

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

Part 2 Products**2.1 NOT USED**

- .1 Not Used.

Part 3 Execution**3.1 NOT USED**

- .1 Not Used

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 41 00 Regulatory Requirements.

1.2 REFERENCES

- .1 Definitions:
 - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
 - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for materials to be used and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS.
- .3 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Departmental Representative.
- .4 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 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 are in compliance 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 of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
- .14 Pesticide treatment plan to be included and updated, as required
- .15 Some of the Plans described above may each be covered by brief descriptions that are only one or more sentences long, as appropriate.

1.4 FIRES

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

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 are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Storm Water Pollution Prevention Plan (SWPPP) may 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 1.2 m minimum.
- .3 Protect roots of designated trees to drip line 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 indicated.

1.7 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Do not use waterway beds for borrow material.
- .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.
- .7 Blasting is not permitted.

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 indicated 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 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 or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Dispose of all rubbish and waste materials off-site at a location certified to accept such material. Provide recipient receipts if and when requested.
- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .5 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 43 Environmental Procedures.

1.2 REFERENCES AND CODES

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

1.3 BUILDING SMOKING ENVIRONMENT

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

Part 2 Products.

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 29 83 Payment Procedures for Testing Laboratory Services

1.2 INSPECTION

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

1.3 INDEPENDENT INSPECTION AGENCIES

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

1.4 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.

1.5 PROCEDURES

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

1.6 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, Owner 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.

1.7 REPORTS

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

1.8 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.

1.9 MILL TESTS

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

1.10 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 11 00 Summary of Work

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 INSTALLATION AND REMOVAL

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

1.4 DEWATERING

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

1.5 WATER SUPPLY

- .1 Departmental Representative will provide continuous supply of potable water for construction use.

1.6 TEMPORARY HEATING AND VENTILATION

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

- .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct-fired combustion units to outside.
- .7 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.7 TEMPORARY POWER AND LIGHT

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 208 volts 30 amps.
- .2 Arrange for connection with appropriate utility company. Pay costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in excess of above is responsibility of Departmental Representative.
- .4 Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.

1.8 TEMPORARY COMMUNICATION FACILITIES

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

1.9 FIRE PROTECTION

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with Section 01 35 43 Environmental Procedures.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 51 00 Temporary Utilities.

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-0121-M1978(R2003), Douglas Fir Plywood.
 - .3 CAN/CSA-S269.2-M1987(R2003), Access Scaffolding for Construction Purposes.
 - .4 CAN/CSA-Z321-96(R2001), Signs and Symbols for the Occupational Environment.
- .3 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 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 which 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.

1.5 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.

1.6 HOISTING

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

1.7 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.8 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt performance of Work.
- .2 Provide and maintain adequate access to project site.

1.9 SECURITY

- .1 Not Used.

1.10 OFFICES

- .1 Provide office that is heated, lit and ventilated, 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 shall provide their own offices as necessary. Direct location for these offices.

1.11 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.

1.12 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.

1.13 CONSTRUCTION SIGNAGE

- .1 Provide and erect project sign, within three weeks of signing Contract, in a location designated by Departmental Representative.
- .2 Construction sign of wood frame and plywood construction painted with exhibit lettering produced by a professional sign painter.
- .3 Indicate on sign, name of Owner, Consultant Contractor of design style established by Departmental Representative.
- .4 No other signs or advertisements, other than warning signs, are permitted on site.
- .5 Provide project identification site sign comprising foundation, framing, and one 1200 x 2400 mm signboard as detailed and as described below.
 - .1 Foundations: 15 MPa concrete to CSA-A23.1 minimum 200 mm x 900 mm deep.

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- .2 Framework and battens: SPF, pressure treated minimum 89 x 89 mm.
 - .3 Signboard: 19 mm Medium Density Overlaid Douglas Fir Plywood to CSA O121.
 - .4 Paint: alkyd enamel to CAN/CGSB-1.59 over exterior alkyd primer to CAN/CGSB 1.189.
 - .5 Fasteners: hot-dip galvanized steel nails and carriage bolts.
 - .6 Vinyl sign face: printed project identification, self adhesive, vinyl film overlay, supplied by Departmental Representative.
 - .6 Locate project identification sign as directed by Departmental Representative and construct as follows:
 - .1 Build concrete foundation, erect framework, and attach signboard to framing.
 - .2 Paint surfaces of signboard and framing with one coat primer and two coats enamel. Colour white on signboard face, black on other surfaces.
 - .3 Apply vinyl sign face overlay to painted signboard face in accordance with installation instruction supplied.
 - .7 Direct requests for approval to erect Consultant/Contractor signboard to Departmental Representative. For consideration general appearance of Consultant/Contractor signboard must conform to project identification site sign. Wording in both official languages.
 - .8 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
 - .9 Maintain approved signs and notices in good condition for duration of project, and dispose of off-site upon completion of project, or earlier if directed by Departmental Representative.

1.14 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access roads as necessary to maintain traffic.
- .2 Protect travelling public from damage to person and property.
- .3 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .4 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
- .5 Construct access and haul roads necessary.
- .6 Haul roads: constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .7 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .8 Dust control: adequate to always ensure safe operation.
- .9 Location, grade, width, and alignment of construction and hauling roads: subject to approval by Departmental Representative.
- .10 Lighting: where and as necessary to assure full and clear visibility for full width of haul road and work areas during any night work operations.
- .11 Provide snow removal during period of Work.

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- .12 Remove, upon completion of work, haul roads designated by Departmental Representative.

1.15 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily. Dispose of waste material off-site weekly at location certified to receive such waste.
- .2 Clean dirt or mud that has tracked onto paved or surfaced roadways.
- .3 Store materials resulting from demolition activities that are salvageable.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 See Section 01 35 43 Environmental Procedures.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 51 00 Temporary Utilities

1.2 REFERENCES

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

1.3 INSTALLATION AND REMOVAL

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

1.4 HOARDING

- .1 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.5 GUARD RAILS AND BARRICADES

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, and open stair wells.

1.6 WEATHER ENCLOSURES

- .1 Not Used.

1.7 DUST TIGHT SCREENS

- .1 Not Used.

1.8 ACCESS TO SITE

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

1.9 PUBLIC TRAFFIC FLOW

- .1 Not Used.

1.10 FIRE ROUTES

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

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.12 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 Be responsible for damage incurred due to lack of or improper protection.

1.13 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 45 00 Quality Control.

1.2 REFERENCES

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

1.3 QUALITY

- .1 Refer to Section 01 45 00 Quality Control.
- .2 Products, materials, equipment, and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but, rather, is a 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.

1.4 AVAILABILITY

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

1.5 STORAGE, HANDLING AND PROTECTION

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

1.6 TRANSPORTATION

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

1.7 MANUFACTURER'S INSTRUCTIONS

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

1.8 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, of 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.

1.9 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.

1.10 CONCEALMENT

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

1.11 REMEDIAL WORK

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

1.12 LOCATION OF FIXTURES

- .1 Consider and then determine proper location of fixtures, outlets, and mechanical and electrical items whose locations are indicated as approximate.
- .2 Inform Departmental Representative of a conflicting installation. Install as directed.

1.13 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 their individual load limit or shear capacity, and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs, are not acceptable.
- .5 Keep exposed fastenings to a minimum, space them evenly and install them neatly.

- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.14 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, where indicated on the Drawings or elsewhere in the Specifications.
- .3 Bolts may not project more than one diameter beyond nuts.

1.15 PROTECTION OF WORK IN PROGRESS

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

1.16 EXISTING UTILITIES

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 Excavating Trenching and Backfilling

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 three temporary benchmarks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents and protect throughout the construction period.
- .2 Establish lines and levels, locations and lay out, by instrumentation.
- .3 Stake for horizontal location and elevation of the foundation, and stake for the horizontal alignments, positions and elevations of the underground piping.
- .4
- .5 Establish pipe invert elevations.
- .6 Stake batter boards for foundations.
- .7 Establish foundation wall locations and floor elevations.
- .8 Establish lines and levels for mechanical work.

1.5 EXISTING SERVICES

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

1.6 LOCATION OF EQUIPMENT AND FIXTURES

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

1.7 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 survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.8 ACTION AND INFORMATIONAL 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.

1.9 SUBSURFACE CONDITIONS

- .1 Promptly notify Consultant 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.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 33 00 - Submittal Procedures.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

1.3 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.

1.4 PREPARATION

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

1.5 EXECUTION

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete Work.
- .2 Fit several parts together, to integrate with other Work.
- .3 Uncover Work to install ill-timed Work.
- .4 Remove and replace defective and non-conforming Work.
- .5 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
- .6 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
- .7 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- .8 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
- .9 Restore work with new products in accordance with requirements of Contract Documents.
- .10 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- .11 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with fire stopping material in accordance with Section 07 84 00 – Firestopping, full thickness of the construction element.
- .12 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.
- .13 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 01 73 00 – Execution Requirements.

1.2 PROJECT CLEANLINESS

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris including that caused by Departmental Representative or other Contractors.
- .2 Collect waste materials from site at daily regularly scheduled times, and dispose of them off-site regularly at least once per week, or dispose of collected waste 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, and bank/pile snow in designated areas only or remove from site.
- .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.
- .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 at an approved location.
- .8 Clean interior areas prior to start of finishing work and maintain areas free of dust and other contaminants during finishing operations.
- .9 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .10 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .11 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .12 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems – particularly the drains.

1.3 FINAL CLEANING

- .1 Refer to CCDC 2, GC 3.14.
- .2 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .3 Remove waste products and debris other than that caused by others and leave Work clean and suitable for occupancy and use.
- .4 Prior to final review remove surplus products, tools, construction machinery and equipment.
- .5 Remove waste products and debris including that caused by Departmental Representative or other Contractors.

- .6 Remove waste materials from site at regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials on site, unless approved by Departmental Representative.
- .7 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .8 Remove stains, spots, marks and dirt from mechanical fixtures, walls and floors.
- .9 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .10 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .11 Remove dirt and other disfiguration from exterior surfaces.
- .12 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .13 Clean equipment and fixtures to sanitary condition.
- .14 Clean roofs, any downspouts, and drainage systems.
- .15 Remove debris and surplus materials from all the difficult-to-access spaces.
- .16 Remove snow and ice from access to building.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 WASTE MANAGEMENT GOALS

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

1.2 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .3 Inert Fill: inert waste - exclusively asphalt and concrete.
- .4 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .5 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .6 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .7 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .8 Reuse: repeated use of product in same form but not necessarily for same purpose.
Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .9 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .10 Separate Condition: refers to waste sorted into individual types.
- .11 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .12 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .13 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .14 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials.

1.3 DOCUMENTS

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

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare and submit following prior to project start-up:
 - .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
 - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
 - .4 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.
 - .1 Failure to submit could result in hold back of final payment.
 - .2 Provide receipts, scale tickets, waybills, and show quantities and types of materials reused, recycled or disposed of.

1.5 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.
- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.7 DEMOLITION WASTE AUDIT (DWA)

- .1 Prepare DWA prior to project start-up.
- .2 Complete DWA: Schedule C.
- .3 Provide inventory of quantities of materials to be salvaged for reuse, recycling, or disposal.

1.8 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility or to users of material for recycling.
- .8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.
 - .1 Ship materials to site operating under Certificate of Approval.
 - .2 Materials must be immediately separated into required categories for reuse or recycling.

1.9 STORAGE, HANDLING AND PROTECTION

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

1.10 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of any waste into waterways, storm, or sanitary sewers.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Total tonnage generated.
 - .4 Tonnage reused or recycled.
 - .5 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.11 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide temporary security measures approved by Departmental Representative.

1.12 SCHEDULING

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 APPLICATION

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

3.2 CLEANING

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

3.3 DIVERSION OF MATERIALS

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

Material Type	Recommended Diversion %	Actual Diversion %
Acoustic Tile	50	
Acoustical Insulation	100	
Carpet	100	
De-mountable Partitions	80	
Doors and Frames	100	
Electrical Equipment	80	
Furnishings	80	
Marble Base	100	
Mechanical Equipment	100	
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

.4 Construction Waste:

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

3.4 WASTE AUDIT (WA)

.1 Schedule A - Waste Audit (WA):

(1) Material Category	(2) Material Quantity Unit	(3) Estimated Waste %	(4) Total Quantity of Waste (unit)	(5) Generation Point	(6) % Recycled	(7) % Reused
Wood and Plastics Material Description						
Off-cuts						
Warped Pallet Forms						
Plastic Packaging						
Cardboard Packaging						
Other						
Doors and Windows Material Description						
Painted Frames						
Glass						
Wood						
Metal						
Other						

3.5 WASTE REDUCTION WORKPLAN (WRW)

.1 Schedule B:

(1) Material Category	(2) Person(s) Respon- sible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected	Actual	(5) Recycled Amount (unit) Projected	Actual	(6) Material(s) Destina- tion
Wood and Plastics Material Description							
Chutes							
Warped Pallet Forms							
Plastic Packaging							
Card- board Packaging							
Other							
Doors and Windows Material Description							
Painted Frames							
Glass							
Wood							
Metal							
Other							

3.6 CANADIAN GOVERNMENTAL DEPARTMENTS CHIEF RESPONSIBILITY FOR THE ENVIRONMENT

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

Province	Address	General Inquires	Fax
Alberta	Alberta Environmental Protection Petroleum Plaza, South Tower 9915 - 108th Street Edmonton AB T5K 2G8	403-427-2739	
	Alberta Special Waste Management Corporation Pacific Plaza, Suite 610 10909 Jasper Avenue NW Edmonton AB T5J 3L9	403-422-5029	403-428-9627
British Columbia	Ministry of Environment Lands and Parks 810 Blanshard Street, 4th Floor Victoria BC V8V 1X4	604-387-1161	604-356-6464
	Waste Reduction Commission Soils and Hazardous Waste 770 South Pacific Blvd, Suite 303 Vancouver BC V6B 5E7	604-660-9550	604-660-9596
Manitoba	Manitoba Environment Building 2, 139 Tuxedo Avenue, Winnipeg, MB R3N 0H6	204-945-7100	
	The Clean Environment Commission 284 Reimer Avenue, Box 21420 Steinback MB R0A 2T3	204-326-2395	204-326-2472
New Brunswick	Department of the Environment 364 Argyle Street, Box 6000 Fredericton NB E3B 5H1	506-453-3700	506-453-3843
Newfoundland	Department of Environment, Confederation Building, Box 8700 St. John's NF A1B 4J6	709-729-2664	709-729-1930
Northwest Territories	Department of Renewable Resources Scotia Centre Building, Box 21 5102 - 50 Avenue Yellowknife NT X1A 3S8	403-873-7420	403-873-0114

Nova Scotia	Department of the Environment 5151 Terminal Road, 5th Floor, Box 2107 Halifax NS B3J 3B7	902-424-5300	902-424-0503
Nunavut	Department of Sustainable Development Environmental Protection Service, Box 1000, Station 1195 Iqaluit NU X0A 0H0	867-975-5910	
Ontario	Ministry of Environment and Energy, 135 St. Clair Avenue West Toronto ON M4V 1P5	416-323-4321 800-565-4923	416-323-4682
	Environment Canada Toronto ON	416-734-4494	
Prince Edward Island	Department of Environmental Resources 11 Kent Street, 4th Floor, PO Box 2000 Charlottetown PE C1A 7N8	902-368-5000	902-368-5830
Québec	Ministère de l'Environnement et de la Faune, Siège social 150, boul, René-Lévesque Est Québec QC G1R 4Y1	418-643-3127 800-561-1616	418-646-5974
	Conseil de la conservation et de l'environnement 800, place d'Youville, 19e étage Québec QC G1R 3P4	418-643-3818	
Saskatchewan	Saskatchewan Environment and Resource Management 3211 Albert Street Regina SK S4S 5W6	306-787-2700	306-787-3941
Yukon	Yukon Renewable Resources PO Box 2703 Whitehorse YT Y1A 2C6	403-667-5683	403-667-3641

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 78 00 Closeout Submittals.

1.2 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: Contractor: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection and submit verification that corrections have been made.
 - .2 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 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 and fully operational.
 - .4 Operation of systems: demonstrated to Owner's personnel.
 - .5 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements with copies of final Commissioning Report submitted to Departmental Representative.
 - .6 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, 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.
 - .5 Declaration of Substantial Performance: when Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

- .7 Final Payment:
 - .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.4 FINAL CLEANING

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 77 00 – Closeout Procedures
- .2 Section 01 33 00 – Submittal Procedures

1.2 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with contractor's representative, Departmental Representative to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements and manufacturer's installation instructions.
 - .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.

1.4 ACTION AND INFORMATIONAL 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, four final copies of operating and maintenance manuals in English.
- .3 Provide evidence, if requested, for type, source and quality of products supplied.

1.5 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm (8.5" x 11") with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

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- .7 Text: manufacturer's printed data, or typewritten data.
 - .8 Drawings: provide vendor and shop drawings with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
 - .2 Engineering drawings shall be provided by the design engineer of record.
 - .9 Provide engineering drawings CAD files in DWG format on CD. Also provide electronic files in PDF format.
 - .1 Provide vendor and shop drawings in PDF format and, if available, in DWG format.

1.6 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project.
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.

1.7 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 record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.

-
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
 - .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
 - .5 Keep record documents and samples available for inspection by Departmental Representative.

1.8 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

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

1.9 FINAL SURVEY

- .1 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 is not required.

1.10 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shutdown, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .3 Maintenance Requirements: include routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .4 Provide servicing and lubrication schedule, and list of lubricants required.
- .5 Include manufacturer's printed operation and maintenance instructions.
- .6 Include sequence of operation by controls manufacturer.
- .7 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .8 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .9 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

1.11 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .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.

1.12 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Not Used
- .2 Extra Stock Materials:
 - .1 Not Used.
- .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 location as directed, place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.13 DELIVERY, STORAGE AND HANDLING

- .1 Not Used.

1.14 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 principle.
 - .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 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 Listing and status of delivery of Certificates of Warranty for extended warranty items.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Procedure and status of tagging of equipment covered by extended warranties.
 - .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.15 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Departmental Representative.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation in accordance with Section 01 19 13- General Commissioning (Cx) Requirements.
 - .4 Ensure testing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Not Used.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 QUALITY ASSURANCE

- .1 Not Used.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General**1.1 SUMMARY**

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
- .2 Related Requirements
 - .1 Section 01 79 00 – Demonstration and Training
 - .2 Section 01 91 33 – Commissioning Forms
- .3 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

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

1.3 COMMISSIONING OVERVIEW

- .1 Section 01 91 31 - Commissioning (Cx) Plan.
- .2 For Cx responsibilities refer to Section 01 91 31 - Commissioning (Cx) Plan.
- .3 Cx to be a line item of Contractor's cost breakdown.
- .4 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .5 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .6 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components, and systems have been commissioned.
 - .3 O M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

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

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents and confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location, and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up to date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf ready.
 - .5 Understand completely design criteria and intent and special features.

- .6 Submit complete start-up documentation to Departmental Representative.
- .7 Have Cx schedules up to date.
- .8 Ensure systems have been cleaned thoroughly.
- .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

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

1.7 ACTION AND INFORMATIONAL SUBMITTALS

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

1.8 COMMISSIONING DOCUMENTATION

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

1.9 COMMISSIONING SCHEDULE

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

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 01 32 16.06 - Construction Progress Schedule and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage. Section 01 32 16.06 - Construction Progress Schedule, Departmental Representative to call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Departmental Representative, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

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

1.12 WITNESSING OF STARTING AND TESTING

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

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for approval by Departmental Representative
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.

- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:
 - .1 Experienced in design, installation and operation of equipment and systems.
 - .2 Ability to interpret test results accurately.
 - .3 To report results in clear, concise, logical manner.

1.14 PROCEDURES

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

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,
 - .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

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

1.17 TEST RESULTS

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

1.18 START OF COMMISSIONING

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

1.19 INSTRUMENTS / EQUIPMENT

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

1.20 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under accepted simulated operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.21 WITNESSING COMMISSIONING

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

1.22 AUTHORITIES HAVING JURISDICTION

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

1.23 EXTRAPOLATION OF RESULTS

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

1.24 EXTENT OF VERIFICATION

- .1 Laboratory areas:
 - .1 Provide manpower and instrumentation to verify up to 100 % of reported results.
- .2 Elsewhere:
 - .1 Provide manpower and instrumentation to verify up to 30 % of reported results, unless specified otherwise in other sections.
- .3 Number and location to be at discretion of Departmental Representative.
- .4 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .5 Review and repeat commissioning of systems if inconsistencies found in more than 20% of reported results.
- .6 Perform additional commissioning until results are acceptable to Departmental Representative.

1.25 REPEAT VERIFICATIONS

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

1.26 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.27 DEFICIENCIES, FAULTS, DEFECTS

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

1.28 COMPLETION OF COMMISSIONING

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

1.29 ACTIVITIES UPON COMPLETION OF COMMISSIONING

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

1.30 TRAINING

- .1 In accordance with Section 01 91 41 – Commissioning Training.

1.31 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

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

1.32 OCCUPANCY

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

1.33 INSTALLED INSTRUMENTATION

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

1.34 PERFORMANCE VERIFICATION TOLERANCES

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

1.35 OWNER'S PERFORMANCE TESTING

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

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Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Description of overall structure of Cx Plan and roles and responsibilities of Cx team.
- .2 Related Requirements
 - .1 Section 01 91 13 – General Commissioning (Cx) Requirements.

1.2 REFERENCES

- .1 American Water Works Association (AWWA)
- .2 Public Works and Government Services Canada (PWGSC)
 - .1 PWGSC - Commissioning Guidelines CP.4 -3rd edition-03.
- .3 Underwriters' Laboratories of Canada (ULC)

1.3 GENERAL

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

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

1.4 DEVELOPMENT OF 100% CX PLAN

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

1.5 REFINEMENT OF CX PLAN

- .1 During construction phase, revise, refine and update Cx Plan to include:
 - .1 Changes resulting from Client program modifications.
 - .2 Approved design and construction changes.
- .2 Revise, refine and update every 6 months during construction phase. At each revision, indicate revision number and date.
- .3 Submit each revised Cx Plan to Departmental Representative for review and obtain written approval.
- .4 Include testing parameters at full range of operating conditions and check responses of equipment and systems.

1.6 COMPOSITION, ROLES AND RESPONSIBILITIES OF CX TEAM

- .1 Departmental Representative to maintain overall responsibility for project and is sole point of contact between members of commissioning team.
- .2 Project Manager will select Cx Team consisting of following members:
 - .1 PWGSC Design Quality Review Team: during construction, will conduct periodic site reviews to observe general progress.
 - .2 PWGSC Quality Assurance Commissioning Manager: ensures Cx activities are carried out to ensure delivery of a fully operational project including:
 - .1 Review of Cx documentation from operational perspective.
 - .2 Review for performance, reliability, durability of operation, accessibility, maintainability, operational efficiency under conditions of operation.
 - .3 Protection of health, safety and comfort of occupants and O M personnel.
 - .4 Monitoring of Cx activities, training, development of Cx documentation.
 - .5 Work closely with members of Cx Team.
 - .3 Departmental Representative is responsible for:
 - .1 Organizing Cx.
 - .2 Monitoring operations Cx activities.
 - .3 Witnessing, certifying accuracy of reported results.
 - .4 Witnessing and certifying TAB and other tests.
 - .5 Developing BMM.
 - .6 Ensuring implementation of final Cx Plan.
 - .7 Performing verification of performance of installed systems and equipment.
 - .8 Implementation of Training Plan.
 - .4 Construction Team: contractor, sub-contractors, suppliers, and support disciplines, is responsible for construction/installation in accordance with contract documents, including:
 - .1 Testing.
 - .2 TAB.
 - .3 Performance of Cx activities.
 - .4 Delivery of training and Cx documentation.
 - .5 Assigning one person as point of contact with Consultant and PWGSC Cx Manager for administrative and coordination purposes.
 - .5 Contractor's Cx agent implements specified Cx activities including:
 - .1 Demonstrations.
 - .2 Training.
 - .3 Testing.
 - .4 Preparation, submission of test reports.
 - .6 Property Manager: represents lead role in Operation Phase and onwards and is responsible for:
 - .1 Receiving facility.
 - .2 Day-To-Day operation and maintenance of facility.

1.7 CX PARTICIPANTS

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

1.8 EXTENT OF CX

- .1 Cx Structural and Architectural Systems:
 - .1 Architectural and structural:
 - .1 Accessibility and operational safety.
 - .2 Doors, windows, related hardware.
 - .2 Commission mechanical systems and associated equipment:
 - .1 Plumbing systems:
 - .1 Domestic CWS and HWS.
 - .2 Regular sanitary waste systems.
 - .3 Sump pumps.

- .2 HVAC and exhaust systems:
 - .1 HVAC systems.
 - .2 General exhaust systems.
 - .3 Heat recovery systems.
- .3 Fire and life safety systems.
- .3 Commission electrical systems and equipment:
 - .1 Low voltage below 750 V:
 - .1 Low voltage equipment.
 - .2 Electronic data and communications information systems.
 - .2 Lighting systems:
 - .1 Lighting equipment.
 - .2 Distribution systems.
 - .3 Emergency lighting systems, including battery packs.
 - .4 Fire exit emergency signage.
 - .3 Other systems and equipment:
 - .1 Intrusion and access security.
 - .2 Lightning protection systems.

1.9 DELIVERABLES RELATING TO O M PERSPECTIVES

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

1.10 DELIVERABLES RELATING TO THE CX PROCESS

- .1 General:
 - .1 Start-up, testing and Cx requirements, conditions for acceptance and specifications form part of relevant technical sections of these specifications.
- .2 Definitions:
 - .1 Cx as used in this section includes:
 - .1 Cx of components, equipment, systems, subsystems, and integrated systems.
 - .2 Factory inspections and performance verification tests.
- .3 Deliverables: provide:
 - .1 Cx Specifications.
 - .2 Startup, pre-Cx activities and documentation for systems, and equipment.
 - .3 Completed installation checklists (ICL).
 - .4 Completed product information (PI) report forms.
 - .5 Completed performance verification (PV) report forms.
 - .6 Results of Performance Verification Tests and Inspections.
 - .7 Description of Cx activities and documentation.
 - .8 Description of Cx of integrated systems and documentation.
 - .9 Tests of following witnessed by PWGSC Design Quality Review Team:
 - .10 Tests performed by Owner/User.
 - .11 Training Plans.
 - .12 Cx Reports.
 - .13 Prescribed activities during warranty period.
- .4 Departmental Representative to witness and certify tests and reports of results provided to Departmental Representative.
- .5 Departmental Representative to participate.

1.11 PRE-CX ACTIVITIES AND RELATED DOCUMENTATION

- .1 Items listed in this Cx Plan include the following:
 - .1 Pre-Start-Up inspections: by Departmental Representative prior to permission to start up and rectification of deficiencies to Departmental Representative's satisfaction.
 - .2 Departmental Representative to use approved check lists.
 - .3 Departmental Representative will monitor pre-start-up inspections.
 - .4 Include completed documentation with Cx report.
 - .5 Conduct pre-start-up tests: conduct pressure, static, flushing, cleaning, and "bumping" during construction as specified in technical sections. To be witnessed and certified by Departmental Representative and does not form part of Cx specifications.
 - .6 Departmental Representative will monitor these inspections and tests.
 - .7 Include completed documentation in Cx report.

- .2 Pre-Cx activities - ARCHITECTURAL AND STRUCTURAL:
 - .1 Exterior walls: conduct thermographic surveys to ensure appropriate level of tightness after exterior envelope has been completed. Permanent HVAC systems are able to provide appropriate negative or positive pressure, a temperature of at 20 degrees C can be maintained between inside and outside and wind speed is less than 10 kph.
 - .2 Equipment:
 - .1 Kitchen equipment.
 - .2 Laboratory equipment.
 - .3 Doors, windows, related hardware.
- .3 Pre-Cx activities - MECHANICAL:
 - .1 Plumbing systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 Complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .2 HVAC equipment and systems:
 - .1 "Bump" each item of equipment in its "stand-alone" mode.
 - .2 At this time, complete pre-start-up checks and complete relevant documentation.
 - .3 After equipment has been started, test related systems in conjunction with control systems on a system-by-system basis.
 - .4 Perform TAB on systems. TAB reports to be approved by Departmental Representative.
 - .3 EMCS:
 - .1 EMCS trending to be available as supporting documentation for performance verification.
 - .2 Perform point-by-point testing in parallel with start-up.
 - .3 Carry out point-by-point verification.
 - .4 Demonstrate performance of systems, to be witnessed by Departmental Representative prior to start of 30 day Final Acceptance Test period.
 - .5 Perform final Cx and operational tests during demonstration period and 30 day test period.
 - .6 Only additional testing after foregoing have been successfully completed to be "Off-Season Tests".
- .4 Pre-Cx activities - LIFE SAFETY SYSTEMS
 - .1 Include equipment and systems identified above.
 - .2 Reports of test results to be witnessed and certified by Departmental Representative before verification.
- .5 Pre-Cx activities - ELECTRICAL:
 - .1 Low voltage distribution systems under 750 V:
 - .1 Requires independent testing agency to perform pre-energization and post-energization tests.

- .2 Lighting systems:
 - .1 Emergency lighting systems:
 - .1 Tests to include verification of lighting levels and coverage, initially by disrupting normal power.
 - .2 Lightening protection systems.
- .3 Security, surveillance and intrusion alarm systems: to include verification by Departmental Representative.
- .4 Lightning protection systems.
- .5 Watchman's tour systems.

1.12 START-UP

- .1 Start up components, equipment and systems.
- .2 Equipment manufacturer, supplier, installing specialist sub-contractor, as appropriate, to start-up, under Contractor's direction.
- .3 Departmental Representative to monitor start-up activities.
 - .1 Rectify start-up deficiencies to satisfaction of Departmental Representative.
- .4 Performance Verification (PV):
 - .1 Approved Cx Agent to perform.
 - .1 Repeat when necessary, until results are acceptable to Departmental Representative.
 - .2 Use procedures modified generic procedures to suit project requirements.
 - .3 Departmental Representative to witness and certify reported results using approved PI and PV forms.
 - .4 Departmental Representative to approve completed PV reports and provide to Departmental Representative.
 - .5 Departmental Representative reserves right to verify up to 30% of reported results at random.
 - .6 Failure of randomly selected item shall result in rejection of PV report or report of system start-up and testing.

1.13 CX ACTIVITIES AND RELATED DOCUMENTATION

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

1.14 CX OF INTEGRATED SYSTEMS AND RELATED DOCUMENTATION

- .1 Cx to be performed by specified Cx specialist, using procedures developed by Departmental Representative and approved by Departmental Representative.
- .2 Tests to be witnessed by Departmental Representative and documented on approved report forms.
- .3 Upon satisfactory completion, Cx specialist to prepare Cx Report, to be certified by Departmental Representative and submitted to Departmental Representative for review.
- .4 Departmental Representative reserves right to verify percentage of reported results.
- .5 Integrated systems to include:
 - .1 HVAC and associated systems forming part of integrated HVAC systems.
 - .2 Emergency lighting systems.
- .6 Identification:
 - .1 In later stages of Cx, before hand-over and acceptance Departmental Representative and Cx Manager to co-operate to complete inventory data sheets and provide assistance to PWGSC in full implementation of MMS identification system of components, equipment, sub-systems, systems.

1.15 INSTALLATION CHECK LISTS (ICL)

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

1.16 PRODUCT INFORMATION (PI) REPORT FORMS

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

1.17 PERFORMANCE VERIFICATION (PV) REPORT

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

1.18 DELIVERABLES RELATING TO ADMINISTRATION OF CX

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

1.19 CX SCHEDULES

- .1 Prepare detailed Cx Schedule and submit to Departmental Representative for review and approval same time as project Construction Schedule. Include:
 - .1 Milestones, testing, documentation, training and Cx activities of components, equipment, subsystems, systems and integrated systems, including:
 - .1 Design criteria, design intents.
 - .2 Pre-TAB review: 28 days after contract award, and before construction starts.
 - .3 Cx agents' credentials: 60 days before start of Cx.
 - .4 Cx procedures: 3 months after award of contract.
 - .5 Cx Report format: 3 months after contract award.
 - .6 Discussion of heating/cooling loads for Cx: 3 months before start-up.
 - .7 Submission of list of instrumentation with relevant certificates: 21 days before start of Cx.
 - .8 Notification of intention to start TAB: 21 days before start of TAB.
 - .9 TAB: after successful start-up, correction of deficiencies and verification of normal and safe operation.
 - .10 Notification of intention to start Cx: 14 days before start of Cx.
 - .11 Notification of intention to start Cx of integrated systems: after Cx of related systems is completed 14 days before start of integrated system Cx.
 - .12 Identification of deferred Cx.
 - .13 Implementation of training plans.
 - .14 Cx reports: immediately upon successful completion of Cx.
 - .2 Detailed training schedule to demonstrate no conflicts with testing, completion of project and hand-over to Departmental Representative.
 - .3 6 months in Cx schedule for verification of performance in all seasons and wear conditions.
- .2 After approval, incorporate Cx Schedule into Construction Schedule.
- .3 Consultant, Contractor, Contractor's Cx agent, and Departmental Representative will monitor progress of Cx against this schedule.

1.20 CX REPORTS

- .1 Submit reports of tests, witnessed and certified by Departmental Representative to Departmental Representative who will verify reported results.
- .2 Include completed and certified PV reports in properly formatted Cx Reports.
- .3 Before reports are accepted, reported results to be subject to verification by Departmental Representative.

1.21 ACTIVITIES DURING WARRANTY PERIOD

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

1.22 TESTS TO BE PERFORMED BY OWNER/USER

- .1 None is anticipated on this project.

1.23 TRAINING PLANS

- .1 Refer to Section 01 79 00 – Demonstration and Training.

1.24 FINAL SETTINGS

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

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Part 1 General**1.1 SUMMARY**

- .1 Section Includes:
 - .1 Commissioning forms to be completed for equipment, system and integrated system.
- .2 Related Requirements
 - .1 Section 01 91 31 - Commissioning (Cx) Plan.

1.2 INSTALLATION/START-UP CHECK LISTS

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

1.3 PRODUCT INFORMATION (PI) REPORT FORMS

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

1.4 PERFORMANCE VERIFICATION (PV) FORMS

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

1.5 SAMPLES OF COMMISSIONING FORMS

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

1.6 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

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

1.7 COMMISSIONING FORMS

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

-
- .13 Forms to be both hard copy and electronic format with typed written results in Building Management Manual in accordance with Section 01 91 51 - Building Management Manual (BMM).

1.8 LANGUAGE

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

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Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 This Section specifies roles and responsibilities of Commissioning Training.
- .2 Related Requirements
 - .1 Section 01 91 13 - General Commissioning (Cx) Requirements.

1.2 TRAINEES

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

1.3 INSTRUCTORS

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

1.4 TRAINING OBJECTIVES

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

1.5 TRAINING MATERIALS

- .1 Instructors to be responsible for content and quality.
- .2 Training materials to include:
 - .1 "As-Built" Contract Documents.
 - .2 Operating Manual.
 - .3 Maintenance Manual.
 - .4 Management Manual.
 - .5 TAB and PV Reports.
- .3 Project Manager, Commissioning Manager and Facility Manager will review training manuals.
- .4 Training materials to be in a format that permits future training procedures to same degree of detail.
- .5 Supplement training materials:
 - .1 Transparencies for overhead projectors.
 - .2 Multimedia presentations.
 - .3 Manufacturer's training videos.
 - .4 Equipment models.

1.6 SCHEDULING

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

1.7 RESPONSIBILITIES

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

1.8 TRAINING CONTENT

- .1 Training to include demonstrations by Instructors using the installed equipment and systems.
- .2 Content includes:
 - .1 Review of facility and occupancy profile.
 - .2 Functional requirements.
 - .3 System philosophy, limitations of systems and emergency procedures.
 - .4 Review of system layout, equipment, components and controls.

- .5 Equipment and system start-up, operation, monitoring, servicing, maintenance and shut-down procedures.
- .6 System operating sequences, including step-by-step directions for starting up, shut-down, operation of valves, dampers, switches, adjustment of control settings and emergency procedures.
- .7 Maintenance and servicing.
- .8 Trouble-shooting diagnosis.
- .9 Inter-Action among systems during integrated operation.
- .10 Review of O M documentation.
- .3 Provide specialized training as specified in relevant Technical Sections of the construction specifications.

1.9 VIDEO-BASED TRAINING

- .1 Manufacturer's videotapes to be used as training tool with Departmental Representative's review and written approval 3 months prior to commencement of scheduled training.
- .2 On-Site training videos:
 - .1 Videotape training sessions for use during future training.
 - .2 To be performed after systems are fully commissioned.
 - .3 Organize into several short modules to permit incorporation of changes.
- .3 Production methods to be professional quality.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

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Part 1 General**1.1 SUMMARY**

- .1 Section Includes:
 - .1 This section is limited to portions of the Building Management Manual (BMM) provided to Departmental Representative by Contractor.
- .2 Related Requirements
 - .1 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Acronyms:
 - .1 BMM - Building Management Manual.
 - .2 Cx - Commissioning.
 - .3 HVAC - Heating, Ventilation and Air Conditioning.
 - .4 PI - Product Information.
 - .5 PV - Performance Verification.
 - .6 TAB - Testing, Adjusting and Balancing.
 - .7 WHMIS - Workplace Hazardous Materials Information System.

1.2 GENERAL REQUIREMENTS

- .1 Standard letter size paper 216 mm x 279 mm.
- .2 Methodology used to facilitate updating.
- .3 Drawings, diagrams and schematics to be professionally developed.
- .4 Electronic copy of data to be in a format accepted and approved by Departmental Representative.

1.3 APPROVALS

- .1 Prior to commencement, co-ordinate requirements for preparation, submission and approval with Departmental Representative.

1.4 GENERAL INFORMATION

- .1 Provide Departmental Representative the following for insertion into appropriate Part and Section of BMM:
 - .1 Complete list of names, addresses, telephone and fax numbers of contractor, sub-contractors that participated in delivery of project - as indicated in Section 1.2 of BMM.
 - .2 Summary of architectural, structural, fire protection, mechanical and electrical systems installed and commissioned - as indicated in Section 1.4 of BMM.
 - .1 Including sequence of operation as finalized after commissioning is complete as indicated in Section 2.0 of BMM.
 - .3 Description of building operation under conditions of heightened security and emergencies as indicated in Section 2.0 of BMM.
 - .4 System, equipment and components Maintenance Management System (MMS) identification - Section 2.1 of BMM.

- .5 Information on operation and maintenance of architectural systems and equipment installed and commissioned - Section 2.0 of BMM.
- .6 Information on operation and maintenance of fire protection and life safety systems and equipment installed and commissioned - Section 2.0 of BMM.
- .7 Information on operation and maintenance of mechanical systems and equipment installed and commissioned - Section 2.0 of BMM.
- .8 Operating and maintenance manual - Section 3.2 of BMM.
- .9 Final commissioning plan as actually implemented.
- .10 Completed commissioning checklists.
- .11 Commissioning test procedures employed.
- .12 Completed Product Information (PI) and Performance Verification (PV) report forms, approved and accepted by Departmental Representative.
- .13 Commissioning reports.

1.5**CONTENTS OF OPERATING AND MAINTENANCE MANUAL**

- .1 For detailed requirements refer to Section 01 78 00 - Closeout Submittals.
- .2 Departmental Representative to review and approve format and organization within 12 weeks of award of contract.
- .3 Include original manufactures brochures and written information on products and equipment installed on this project.
- .4 Record and organize for easy access and retrieval of information contained in BMM.
- .5 Include completed PI report forms, data and information from other sources as required.
- .6 Inventory directory relating to information on installed systems, equipment and components.
- .7 Approved project shop-drawings, product and maintenance data.
- .8 Manufacturer's data and recommendations relating to manufacturing process, installation, commissioning, start-up, O&M, shutdown and training materials.
- .9 Inventory and location of spare parts, special tools and maintenance materials.
- .10 Warranty information.
- .11 Inspection certificates with expiration dates, which require on-going re-certification inspections.
- .12 Maintenance program supporting information including:
 - .1 Recommended maintenance procedures and schedule.
 - .2 Information to removal and replacement of equipment including, required equipment, points of lift and means of entry and egress.

1.6 LIFE SAFETY COMPLIANCE (LSC) MANUAL

- .1 Samples of LSC Manual will be available from Departmental Representative.
- .2 Content of Manual:
 - .1 All possible Emergency situations modes including presence of fire and smoke, power failure, lose of water or pressure, chemical spills and refrigerant release.
 - .2 Failure of elevators and escalators.
 - .3 HVAC emergencies and fuel supply failures.
 - .4 Intrusion and security breach.
 - .5 Emergency provisions for natural disasters, bomb threats and other disruptive situations.
 - .6 Dedicated emergency generators for high security projects, medical facilities and computer systems.
 - .7 Emergency control procedures for fire, power and major equipment failure.
 - .8 Emergency contacts and numbers.
 - .9 Manual to be readily available and comprehensible to non- technical readers.

1.7 SUPPORTING DOCUMENTATION FOR INSERTION INTO SUPPORTING APPENDICES

- .1 Provide Departmental Representative supporting documentation relating to installed equipment and system, including:
 - .1 General:
 - .1 Finalized commissioning plan.
 - .2 WHMIS information manual.
 - .3 Approved "as-built" drawings and specifications.
 - .4 Procedures used during commissioning.
 - .5 Cross-Reference to specification sections.
 - .2 Architectural and structural:
 - .1 Inspection certificates, construction permits.
 - .2 Roof anchor log books.
 - .3 PV reports.
 - .3 Fire prevention, suppression and protection:
 - .1 Test reports.
 - .2 Smoke test reports.
 - .3 PV reports.
 - .4 Mechanical:
 - .1 Installation permits, inspection certificates.
 - .2 Piping pressure test certificates.
 - .3 Ducting leakage test reports.
 - .4 TAB and PV reports.
 - .5 Charts of valves and steam traps.
 - .6 Copies of posted instructions.

- .5 Electrical:
 - .1 Installation permits, inspection certificates.
 - .2 TAB and PV reports.
 - .3 Electrical work log book.
 - .4 Charts and schedules.
 - .5 Locations of cables and components.
 - .6 Copies of posted instructions.
 - .2 Assist Departmental Representative with preparation of BMM.
- 1.8 LANGUAGE**
- .1 To suit the language profile of the awarded contract.
- 1.9 USE OF CURRENT TECHNOLOGY**
- .1 Use current technology for production of documentation. Emphasis on ease of accessibility at all times, maintain in up-to-date state, compatibility with user's requirements.
 - .2 Obtain Departmental Representative's approval before starting Work.
- Part 2 Products**
- 2.1 NOT USED**
- .1 Not Used.
- Part 3 Execution**
- 3.1 NOT USED**
- .1 Not Used.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

1. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 30 00 - Cast-in-place Concrete.

1.2 REFERENCES

1. Canadian Standards Association (CSA)
 1. CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 2. CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 3. CSA O121, Douglas Fir Plywood.
 4. CSA O151, Canadian Softwood Plywood.
 5. CSA S269.1, Falsework for Construction Purposes.
 6. CAN/CSA-S269.3, Concrete Formwork.

1.3 SUBMITTALS

1. Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, ties, liners, and locations of temporary embedded parts.

Part 2 Products**1.4 MATERIALS**

1. Formwork materials:
 1. For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.
2. Form ties:
 1. For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
 2. For the water reservoir slab and wall concrete, use snap ties complete with plastic cones and light grey concrete plugs.
 3. For infilling of any voids on inside walls or surfaces of the reservoir caused by snap-ties, use cementitious, two-component patching mortar that complies with NSF-ANSI Standard 61, and is designed for use on vertical surfaces.
 1. Acceptable product: SikaTop 122 Plus or equivalent.
 4. For infilling form-tie holes, use non-shrink, cementitious grout designed for below grade and exterior applications.
 1. Acceptable product: SikaGrout 212 or equivalent.

3. Form liner:
 1. Plywood: medium density overlay, 20 mm thickness.
4. Form release agent: chemically active release agents which will not stain, penetrate or discolour the concrete.
5. Falsework materials: to CSA-S269.1.
6. Sealant: to Section 07 92 00 - Joint Sealing.

Part 3 Execution

1.5 FABRICATION AND ERECTION

1. Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
2. Fabricate and erect falsework in accordance with CSA S269.1.
3. Do not place shores and mud sills on frozen ground.
4. Provide site drainage to prevent washout of soil supporting mud sills and shores.
5. Fabricate and erect formwork in accordance with CAN/CSA-S269.3, to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
6. Align form joints and make watertight. Keep form joints to a minimum.
7. Space form-ties uniformly and evenly, in straight horizontal and vertical rows.
8. Use 20 mm chamfer strips on external corners and/or 20 mm fillets at interior corners and joints, unless specified otherwise.
9. Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
10. Built-in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
11. Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

1.6 REMOVAL AND RESHORING

1. Leave formwork in place for following minimum periods of time after placing concrete.
 1. Footings: Two (2) days.
 2. Reservoir Walls: Seven (7) days
 3. Reservoir Slab: Seven (7) days.
 4. Other Walls: Three (3) days.
2. Re-use formwork and falsework subject to requirements of CSA-A23.1A23.2.

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

1. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
2. Section 03 10 00 – Concrete Forming and Accessories.
3. Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

1. American Concrete Institute (ACI)
 1. SP-66-04, ACI Detailing Manual 2004.
2. CSA International
 1. CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 2. CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
 3. CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
3. Reinforcing Steel Institute of Canada (RSIC)
 1. RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1. Submit in accordance with Section 01 33 00 - Submittal Procedures.
2. Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice SP-66.
3. Shop Drawings:
 1. Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
 1. Indicate placing of reinforcement and:
 1. Bar bending details.
 2. Lists.
 3. Quantities of reinforcement.
 4. Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
 5. Indicate sizes, spacings and locations of chairs, spacers and hangers.
 2. Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

Part 2 **Products****2.1** **MATERIALS**

1. Substitute different size bars only if permitted in writing by Departmental Representative.
2. Reinforcing steel: billet steel, grade 400W, deformed bars to CSA-G30.18M-09, unless indicated otherwise.
3. Protective coating as and where indicated: epoxy.
4. Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
5. Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
6. Mechanical splices: subject to approval of Departmental Representative.

2.2 **FABRICATION**

1. Fabricate and detail reinforcing steel in accordance with CSA-A23.3-04, Appendix A.
2. Hooks shall be standard unless noted otherwise on the Drawings. Column or plinth stirrup tie hooks shall be deflected 135° unless noted otherwise.
3. Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
4. Ship bundles of bar reinforcement clearly identified in accordance with bar bending details and lists.
 1. For epoxy-coated bars, bundle and transport in accordance with ASTM-A775/A775M.

2.3 **SOURCE QUALITY CONTROL**

1. Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
2. Upon request inform Departmental Representative of proposed source of material to be supplied.

Part 3 **Execution****3.1** **FIELD BENDING**

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

3.2 **PLACING REINFORCEMENT**

1. Place reinforcing steel as indicated on placing drawings in accordance with CSA-A23.1/A23.2.
2. Place reinforcing steel, chairs and spacers so that cover specified on the Drawings is achieved.

3. Comply with the reinforcing steel lap splice lengths, and locations where shown, indicated in the Drawings.
4. Stagger splices so that no more than 50% of each individual layer of reinforcement is spliced at any particular cross-section location, unless indicated otherwise.
5. Place and fix dowels before placing concrete for footings. Location and size of dowels shall match vertical reinforcing steel.
6. All reinforcing steel at the end of foundation elements shall have ends with standard hooks.
7. Hooks may be installed horizontally or vertically.
8. Prior to placing concrete, obtain Departmental Representative's approval of reinforcing material and placement.
9. Clean all reinforcing steel before placing concrete.
10. Ensure cover to reinforcement is maintained during concrete pour.

3.3

CLEANING

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

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

1. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
2. Section 03 10 00 - Concrete Forming and Accessories.
3. Section 03 20 00 - Concrete Reinforcing.
4. Section 03 35 05 - Concrete Floor Hardeners.

1.2 PRICE AND PAYMENT PROCEDURES

1. Measurement and Payment:
 1. Not Used.

1.3 REFERENCES

1. Abbreviations and Acronyms:
 1. Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
 1. Type GU, GUb and GUL - General use cement.
2. Reference Standards:
 1. ASTM International
 1. ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 2. ASTM C309-07, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 3. ASTM C494/C494M-10a, Standard Specification for Chemical Admixtures for Concrete.
 4. ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 5. ASTM D1751-04(2008), Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 6. ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 2. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 2. CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 3. CSA International
 1. CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 2. CSA A283-06, Qualification Code for Concrete Testing Laboratories.
 3. CSA A3000-08, Cementitious Materials Compendium (A3001

1.4 ADMINISTRATIVE REQUIREMENTS

1. Pre-installation Meetings: in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart convene pre-installation meeting two weeks prior to beginning concrete works.
 1. Ensure key personnel, site supervisor, Departmental Representative, Consultant, speciality contractors – finishing and forming, and concrete producer attend.
 1. Verify project requirements.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

1. Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
2. At least 4 weeks prior to beginning Work, provide Departmental Representative with samples of materials proposed for use as follows:
 1. 0.5 L of curing compound.
 2. 0.5 m length of each type of joint filler.
 3. 0.5 m length of each type of waterstops.
3. Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
4. Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.
5. Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 QUALITY ASSURANCE

1. Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
2. Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
 1. Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
3. Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
 1. Falsework erection.
 2. Hot weather concrete.
 3. Cold weather concrete.
 4. Curing.
 5. Finishes.
 6. Formwork removal.
 7. Joints.
4. Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

5. Sustainability Standards Certification:
 1. Construction Waste Management: provide copy of plan.

1.7 DELIVERY, STORAGE AND HANDLING

1. Delivery and Acceptance Requirements:
 1. Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
 1. Do not modify maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 2. Deviations to be submitted for review by Departmental Representative.
 2. Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.

Part 2 Products

2.1 DESIGN CRITERIA

1. Performance: to CSA A23.1/A23.2.

2.2 PERFORMANCE CRITERIA

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

2.3 MATERIALS

1. Portland Cement: to CSA A3001, Type GU.
2. Water: to CSA A23.1.
3. Aggregates: to CSA A23.1/A23.2.
4. Admixtures:
 1. Air entraining admixture: to ASTM C260.
 2. Chemical admixture: to ASTM C494 and ASTM C1017. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
5. Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
 1. Compressive strength: 50 MPa at 28 days.
 2. Compressive strength: 16 MPa at 24 hours.
 3. Net shrinkage at 28 days: maximum 1%.
6. Non premixed dry pack grout: composition of non-metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
7. Curing compound: to CSA A23.1/A23.2.

8. Waterstops: Ribbed extruded PVC Arctic Grade of sizes indicated with shop welded corner and intersecting pieces with legs not less than 300 mm long:
 1. Tensile strength: to ASTM D412, method A, Die "C".
 2. Elongation: to ASTM D412, method A, Die "C", minimum 275%
 3. Tear resistance: to ASTM D624, method A, Die "B".
9. Premoulded joint fillers:
 1. Bituminous impregnated fiber board: to ASTM D1751.
 2. Sponge rubber: to ASTM D1752, Type I, flexible grade.
 3. Self-expanding cork: to ASTM D1752, Type III.
10. Weep hole tubes: plastic.
11. Dovetail anchor slots: minimum 0.6 mm thick galvanized steel with insulation filled slots.
12. Dampproofing:
 1. Emulsified asphalt, mineral colloid type, unfilled: to CAN/CGSB-37.2, and to Section 07 11 13 - Bituminous Dampproofing.
13. Polyethylene film: minimum thickness to CAN/CGSB-51.34 but not less than 6 mil.

2.4

MIXES

1. Reservoir Concrete: Performance Method for specifying concrete to meet Departmental Representative performance criteria to CSA A23.1/A23.2. See structural drawings for extent of reservoir.
 1. Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 2. Provide concrete mix to meet following hard state requirements:
 1. Cement: Type GU Portland cement.
 2. Minimum compressive strength at 28 days: 30 MPa.
 3. Minimum cement content: 300 kg/m³ of concrete.
 4. Maximum water/cement ratio: 0.55
 5. Class of exposure: F-2.
 6. Nominal size of coarse aggregate: 20 mm.
 7. Slump at time and point of discharge: 60 to 100 mm.
 8. Air content: 4 to 7 %.
 9. Admixtures in accordance with ASTM C494.
 1. Do not use admixtures containing calcium chloride.
 2. For reservoir base slab and walls only, use Kryton KIM waterproofing admixture or approved equivalent as noted on structural drawings. Follow manufacturer application procedure.
 3. Provide quality management plan to ensure verification of concrete quality to specified performance.
 4. Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

2. Footings and Foundation Walls Concrete: Performance Method for specifying concrete to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
 1. Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
 2. Provide concrete mix to meet following hard state requirements:
 1. Cement: Type GU Portland cement.
 2. Minimum compressive strength at 28 days: 30 MPa.
 3. Minimum cement content: 300 kg/m³ of concrete.
 4. Maximum water/cement ratio: 0.55
 5. Durability and class of exposure:
 1. F-2: Foundation Walls
 2. N: Footing and Slab on Grade
 6. Nominal size of coarse aggregate: 20 mm.
 7. Slump at time and point of discharge: 60 to 100 mm.
 8. Air content: 4 to 7 %.
 9. Aggregate size 20 mm maximum.
 10. Volume stability: acceptable volume change range 1% due to shrinkage, creep and freeze thaw cycle.
 3. Provide quality management plan to ensure verification of concrete quality to specified performance.
 4. Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

Part 3 Execution

3.1 PREPARATION

1. Obtain Departmental Representative's written approval before placing concrete.
 1. Provide 72 hours minimum notice prior to placing of concrete.
2. Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
3. During concreting operations:
 1. Development of unintentional cold joints not allowed.
 2. Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
4. Pumping of concrete is permitted only after approval of equipment and mix.
5. Ensure reinforcement and inserts are not disturbed during concrete placement.
6. Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
7. Protect previous Work from staining.
8. Clean and remove stains prior to application for concrete finishes.
9. Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

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

3.2 INSTALLATION/APPLICATION

1. Do cast-in-place concrete work to CSA A23.1/A23.2.
2. Vertical drop of concrete not to exceed 1.5m.
3. Do not exceed 2.75m spacing between control joints in grade slabs.
4. Sleeves and inserts:
 1. Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Departmental Representative.
 2. Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 3. Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Departmental Representative.
 4. Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
 5. Confirm locations and sizes of sleeves and openings shown on drawings.
 6. Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
5. Anchor bolts:
 1. Set anchor bolts to templates in co-ordination with appropriate trade prior to placing concrete.
 2. Grout anchor bolts in preformed holes or holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
 1. Formed holes: 100 mm minimum diameter.
 2. Drilled holes: to manufacturers' recommendations 25 mm minimum diameter larger than bolts used.
 3. Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 4. Set bolts and fill holes with epoxy grout.
 5. Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
 6. Ensure nuts can turn freely after pouring of concrete.
6. Drainage holes and weep holes:
 1. Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
 2. Install weep hole tubes and drains as indicated.
7. Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

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8. Finishing and curing:
 1. Finish concrete to CSA A23.1/A23.2.
 2. Use procedures as noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 3. Use curing compounds compatible with applied finish on concrete surfaces.
 4. Finish concrete floor to CSA A23.1/A23.2.
 5. Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.
 9. Waterstops:
 1. Install waterstops to provide continuous water seal.
 2. Do not distort or pierce waterstop in way as to hamper performance.
 3. Do not displace reinforcement when installing waterstops.
 4. Use equipment to manufacturer's requirements to field splice waterstops.
 5. Tie waterstops rigidly in place.
 6. Use only straight heat-sealed butt joints in field.
 7. Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
 10. Joint fillers:
 1. Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
 2. When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 3. Locate and form isolation, construction and expansion joints as indicated.
 4. Install joint filler.
 5. Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 SURFACE TOLERANCE

1. Concrete tolerance to CSA A23.1 Straightedge Method FF = 25: FL = 20 Waviness Index Method to tolerance schedule as indicated.

3.4 FIELD QUALITY CONTROL

1. Site tests: conduct tests as follows in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 1. Concrete pours
 2. Slump
 3. Air content
 4. Compressive strength at 7 and 28 days
 5. Air and concrete temperature

2. Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Departmental Representative for review to CSA A23.1/A23.2.
 1. Ensure testing laboratory is certified to CSA A283.
3. Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Departmental Representative.
4. Departmental Representative will pay for costs of tests as specified in Section 01 29 83 - Payment Procedures for Testing Laboratory Services.
5. Departmental Representative will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
6. Non-Destructive Methods for Testing Concrete: to CSA A23.1/A23.2.
7. Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

3.5

CLEANING

1. Clean in accordance with Section 01 74 11 - Cleaning.
2. Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 1. Divert unused concrete materials from landfill to local quarry after receipt of written approval from Departmental Representative.
 2. Provide appropriate area on job site where concrete trucks can be safely washed.
 3. Do not dispose of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 4. Prevent admixtures and additive materials from entering drinking water supplies or streams.
 5. Using appropriate safety precautions, collect liquid or solidify liquid with inert, non-combustible material and remove for disposal.
 6. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
2. Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

1. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-25.20-95, Surface Sealer for Floors.
2. CSA International
 1. CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction//Methods of Test for Concrete.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1. Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
2. Product Data:
 1. Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.
 1. Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements and 01 35 43 - Environmental Procedures. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.
 2. Include application instructions for concrete floor treatments.

1.4 ENVIRONMENTAL REQUIREMENTS

1. Electrical power:
 1. Provide sufficient electrical power to operate equipment normally used during construction.
2. Work area:
 1. Make work area watertight protected against rain and detrimental weather conditions.
3. Temperature:
 1. Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
4. Moisture:
 1. Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

5. Safety:
 1. Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

1.5 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
2. Delivery and Acceptance Requirements:
 1. Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

1. Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.
2. Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

2.2 CHEMICAL HARDENERS

1. Type 1 - Sodium silicate
2. Water: potable

2.3 SEALING COMPOUNDS

1. Surface sealer: to CAN/CGSB-25.20, Type 1 - solvent-based clear.
2. Sealants: maximum VOC limit 250 g/L.
3. Surface sealers are not manufactured or formulated with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium and their compounds.

2.4 CURING COMPOUNDS

1. Select low VOC, water-based, organic-solvent free curing compounds.

2.5 CONCRETE STAINS

1. Select low VOC, water-based concrete stains.

2.6 MIXES

1. Mixing ratios in accordance with manufacturer's written instructions.

Part 3 Execution

3.1 EXAMINATION

1. Verify that slab surfaces are ready to receive work and elevations are as recommended by manufacturer's written instructions indicated on shop drawings.

3.2 PREPARATION OF EXISTING SLAB

1. Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.
2. Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

3.3 APPLICATION

1. Apply concrete finishing floor hardener in accordance with manufacturer's written instructions.
2. After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
3. Apply floor treatment in accordance with Sealer manufacturer's written instructions.
4. Clean over spray. Clean sealant from adjacent surfaces.

3.4 CLEANING

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

3.5 PROTECTION

1. Protect finished installation in accordance with manufacturer's instructions.

3.6 SCHEDULE

1. Table:

Surface Sealer	Location
CAN/CGSB-25.20, Type 1 – solvent-based	Concrete SOG only

END OF SECTION

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Part 1 General

1.1 RELATED REQUIREMENTS

1. Section 01 33 00 - Submittal Procedures.
2. Section 01 51 00 - Temporary Utilities.
3. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
4. Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1. Submit in accordance with Section 01 33 00 - Submittal Procedures.
2. Product Data:
 1. Submit manufacturer's instructions, printed product literature and data sheets for concrete hardener and curing compound and include product characteristics, performance criteria, physical size, finish and limitations.
 2. Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures.
3. Sustainable Design Submittals:
 1. Construction Waste Management:
 1. Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.4 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
3. Storage and Handling Requirements:
 1. Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 2. Replace defective or damaged materials with new.
4. Develop Construction Waste Management Plan related to Work of this Section.

1.5 AMBIENT CONDITIONS

1. Temporary lighting:
2. Electrical power:
 1. Sufficient electrical power to operate equipment normally used during construction.
3. Work area:
 1. Watertight protection against rain and detrimental weather conditions.
4. Temperature:
 1. Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of Work and maintain relative humidity not higher than 40% during same period.
 2. Maintain substrate temperature at 10 degrees C minimum.
5. Moisture:
 1. Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
6. Ventilation:
 1. Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 2. Provide continuous ventilation during and for 48 hours minimum after coating application.

Part 2 Products

2.1 FLOOR HARDENER

1. Non-metallic hardener: premixed, aggregate type, dry shake surface hardener, cement to hardener ratio 2 to 1, cement colour.

2.2 SLIP RESISTANT ABRASIVE AGGREGATE

1. Emery aggregate: crushed emery, minimum 50% aluminum oxide.
2. Homogeneous aluminum oxide, minimum 95%.
3. Ferric oxide, minimum 25%.
4. Silicon carbide.

2.3 COLOURING AGENT

1. Non-metallic type cement colouring agent, colour selected by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

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

3.2 HARDENING

1. Apply floor hardener aggregate at rate in accordance with manufacturer's written instructions.
2. Apply slip resistant coating on floor surfaces as scheduled.
3. Apply in accordance with manufacturer's written instructions.

3.3 CLEANING

1. Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 1. Leave Work area clean at end of each day.
2. Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
3. Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 1. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

1. Protect finished installation until floor treatment has completely cured.
2. Repair damage to adjacent materials caused by concrete floor hardener installation.

END OF SECTION

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Part 1 General**1.1 RELATED SECTIONS**

1. Section 01 33 00 - Submittal Procedures.
2. Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
3. Section 05 31 00 - Steel Decking.
4. Section 05 50 00 - Metal Fabrications.
5. Section 09 91 13 - Exterior Painting.
6. Section 09 91 23 - Interior Painting.

1.2 REFERENCES

1. Canadian Standards Association (CSA)
 1. CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 2. CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 3. CAN/CSA-S16, Limit States Design of Steel Structures.
 4. CAN/CSA-S136, Cold Formed Steel Structural Members.
 5. CSA-S136.1, Commentary on CSA Standard S136.
 6. CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 7. CSA W48, Filler Metals and Allied Materials for Metal Arc Welding of Structural Steel.
 8. CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 9. CSA W59, Welded Steel Construction (Metal Arc Welding) Metric.
2. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-85.10, Protective Coatings for Metals.
3. American Society for Testing and Materials International (ASTM)
 1. ASTM A36/A36M, Specification for Structural Steel.
 2. ASTM A325M, Specification for High-Strength Bolts for Structural Steel Joints Metric.
4. Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 1. CISC/CPMA 1, Quick-Drying, One Coat Paint for Use on Structural Steel.
 2. CISC/CPMA 2, Quick-Drying, Primer for use on Structural Steel.

5. The Society for Protective Coatings (SSPC)
 1. SSPC SP 1, Solvent Cleaning.
 2. SSPC SP 7, Brush-Off Blast Cleaning.

1.3 SHOP DRAWINGS

1. Submit shop drawings including fabrication and erection documents and materials list.
2. On erection drawings: indicate details and information necessary for assembly and erection purposes such as, description of methods, sequence of erection, type of equipment used in erection and temporary bracings. Show detail of all non-standard connections such as bracing connections, truss connections, moment connections and hanger assemblies and other non-standard connections as requested by the Departmental Representative.
3. Erection drawings to be stamped by a qualified professional Engineer licensed to practice in the Province of British Columbia, Canada. The erection drawings are to contain a clause stating that the professional Engineer who stamped the erection drawings is responsible for all fabricator designed assemblies, components and connections required for this project.
4. Drawings for all fabricator designed assemblies, components and connections are to be stamped and signed by the professional Engineer who stamped the erection drawings.

1.4 DESIGN REQUIREMENTS

1. Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.
2. Unless noted otherwise on the drawings or in the specifications, connection design is the responsibility of the structural steel fabricator.
3. Fully detailed connections shown on the contract drawings including bolt and weld sizes are for conceptual demonstration only. Structural steel fabricator to fully design and show connection details on shop drawings to be approved by the Departmental Representative prior to procurement or fabrication.
4. Steel fabricator to design connections for the loads given on structural drawings.
5. If connection for shear only (standard connection is required):
 1. Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction".
 2. If shears are not indicated, select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam.
6. For non-standard connections, submit sketches and design calculations stamped and signed by qualified professional Engineer licensed in the Province of British Columbia, Canada.

1.5 SOURCE QUALITY CONTROL

1. If requested submit one certified copy of mill reports covering chemical and physical properties of steel used in this work.

1.6 QUALITY ASSURANCE

1. At least 2 weeks prior to fabrication of structural steel submit to Departmental Representative a letter from the fabricator's Welding engineer stating the Welding engineer is responsible for welding procedures and practices for this project as outlined in CSA S47.1
2. Provide certificate of Quality Compliance from steel fabricator upon completion of structural steel fabrication stating that the work has been designed and fabricated in accordance with the requirements of the contract documents.
3. If requested, submit to the Departmental Representative one copy of all approved welding procedures for this project.

Part 2 Products**1.7 MATERIALS**

1. Structural steel: to CAN/CSA-G40.20/G40.21 Grade as indicated on structural drawings.
2. Cold formed structural members: to CAN/CSA S-136.
3. Anchor bolts: to ASTM F1554 Galvanized or Type 304 stainless steel.
4. Bolts, nuts and washers: to ASTM F3125 Grade A325 Hot Dip Galvanized.
5. Welding materials: to CSA W59 and certified by Canadian Welding Bureau as indicated on structural drawings.
6. Shop paint primer:
 1. To CISC/CPMA 1 for interior steel.
 2. To CISC/CPMA 2 for exterior steel.
7. Hot dip galvanizing: galvanize all steels to CAN/CSA-G164, minimum zinc coating of 600 g/m².

1.8 FABRICATION

1. Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with approved reviewed shop drawings.
2. Install shear studs in accordance with CSA W59.
3. Continuously seal members by continuous welds where indicated.

1.9 SHOP PAINTING

1. Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16 except where members to be encased in concrete.
2. Clean members and remove loose mill scale, rust, oil, dirt and other foreign matter. Prepare surface by solvent cleaning to SSPC SP 1, followed by brush-off blast cleaning to SSPC SP 7.
3. Apply one coat of Zinc-rich primer in shop to steel surfaces except:
 1. Surfaces to be encased in concrete.
 2. Surfaces to receive field installed stud shear connections.
 3. Surfaces and edges to be field welded.
 4. Faying surfaces of friction-type connections.
 5. Below grade surfaces in contact with soil.
4. Apply paint under cover, on dry surfaces when surface and air temperatures are above 5° C.
5. Maintain dry condition and 5° C minimum temperature until paint is thoroughly dry.
6. Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution**1.10 GENERAL**

1. Structural steel work: in accordance with CAN/CSA-S16.
2. Welding: in accordance with CSA W59.
3. Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

1.11 CONNECTION TO EXISTING WORK

1. Verify dimensions and condition of existing work, report discrepancies and potential problem areas to Departmental Representative for direction before commencing fabrication.

1.12 MARKING

1. Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
2. Match marking: shop mark bearing assemblies and splices for fit and match.

1.13 ERECTION

1. Erect structural steel, as indicated and in accordance with CAN/CSA-S16 and in accordance with approved reviewed erection drawings.
2. Field cutting or altering structural members: only when cannot be avoided and to approval of Departmental Representative.
3. Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
4. Continuously seal members by continuous welds where indicated. Grind smooth.
5. Do not field burn base plate holes or connection bolt holes. If bolt holes are misaligned, inform Departmental Representative.

1.14 FIELD PAINTING

1. Paint in accordance with Section 09 91 13 – Exterior Painting.
 1. Touch up damaged surfaces and surfaces without shop coat with primer to SSPC SP 7 except as specified otherwise. Apply in accordance with CAN/CGSB 85.10.

1.15 FIELD QUALITY CONTROL

1. Inspection and testing of materials and workmanship will be carried out by an Inspection and Testing company designated by Departmental Representative.
2. The Inspection and Testing Company will carry out vertical and horizontal alignment checks, torque testing and inspection of representative connection welds.
3. Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
4. Submit test reports to Departmental Representative within 2 weeks of completion of inspection.
5. Owner will pay costs of inspection and testing. Costs for any reinspection and/or re-testing as a result of deficient work will be paid for by the contractor, by credit change order.
6. Prior to inspection & testing by the Inspection and Testing company the structural steel erection contractor will carry out an inspection of the work and make the inspection results available to the Departmental Representative and the Inspection and Testing company. The inspection report will identify the areas of work inspected, deficiencies identified, and measures taken to correct the deficiencies.
7. Test shear studs in accordance with CSA W59.
8. Copies of test reports and inspections to be included in Commissioning Manual.

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

1. Section 01 33 00 - Submittal Procedures.
2. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
3. Section 05 12 23 - Structural Steel for Buildings.
4. Section 05 21 00 - Steel Joist Framing.
5. Section 05 50 00 – Metal Fabrications.
6. Section 07 92 00 – Joint Sealants.
7. Section 09 91 13 - Exterior Painting.
8. Section 09 91 23 – Interior Painting.

1.2 REFERENCES

1. Canadian Standards Association (CSA)
 1. CSA C22.2 No.79, Cellular Metal and Cellular Concrete Floor Raceways and Fittings.
 2. CAN/CSA-S16, Design of Steel Structures.
 3. CSA-S136, North American Specification for the Design of Cold Formed Steel Structural Members.
 4. CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
 5. CSA W55.3, Certification for Companies for Resistance Welding of Steel and Aluminum.
 6. CSA W59, Welded Steel Construction, (Metal Arc Welding) Metric.
2. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
3. American Society for Testing and Materials, (ASTM)
 1. ASTM A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
4. Canadian Sheet Steel Building Institute (CSSBI)
 1. CSSBI 10M, Standard for Steel Roof Deck.
 2. CSSBI 12M, Standard for Composite Steel Deck.

1.3 DESIGN REQUIREMENTS

1. Design steel deck using limit states design in accordance with CSA S136 and CSSBI 10M and CSSBI 12M.
2. Steel deck and connections to steel framing to carry dead, live and other as indicated.
3. Deflection under specified live load not to exceed 1/240 of span.
4. Where vibration effects are to be controlled as indicated, dynamic characteristics of decking system to be designed to be in accordance with CAN/CSA-S16.

1.4 SHOP DRAWINGS

1. Submit drawings stamped and signed by qualified professional Engineer registered or licensed in the Province of British Columbia, Canada.
2. Submit design calculations if requested by Departmental Representative.
3. Indicate deck plan, profile, dimensions, base steel thickness, metallic coating designation, connections to supports and spacings, projections, openings, reinforcement details and accessories.

Part 2 Products**2.1 MATERIALS**

1. Zinc-iron Alloy (ZF) coated steel sheet: to ASTM A653/A653M structural quality Grade 230, 255, with ZF75 coating, for interior surfaces not exposed to weather, minimum base steel thickness as indicated on the drawings.
2. Decks to be painted: zinc-iron alloy coated decks suitable for finish painting.
3. Closures: as indicated in accordance with manufacturer's recommendations.
4. Cover plates, cell closures and flashings: steel sheet with minimum base steel thickness of 0.635 mm. Metallic coating same as deck material.
5. Primer: zinc rich, ready mix to CAN/CGSB-1.181.
6. Caulking: to Section 07 92 00 – Joint Sealants.
7. Painting: to Section 09 91 23 – Interior Painting.

2.2 TYPES OF DECKING

1. Steel roof deck: non-cellular, interlocking side laps. Minimum base steel thickness as indicated on the drawings.

Part 3 Execution**3.1 GENERAL**

1. Structural steel work: in accordance with CAN/CSA-S136 and CSSBI 10M and CSSBI 12M.
2. Welding: in accordance with CSA W59, except where specified otherwise.
3. Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel and/or CSA W55.3 for resistance welding.

3.2 ERECTION

1. Erect steel deck as indicated and in accordance with CSA S136 CSSBI 10M and CSSBI 12M and in accordance with approved reviewed erection drawings.
2. Steel deck lap ends to 50 mm minimum.
3. Immediately after deck is permanently secured in place, touch up metallic coated top surface with compatible primer where burned by welding.

3.3 CLOSURES

1. Install closures in accordance with approved details.

3.4 OPENINGS AND AREAS OF CONCENTRATED LOADS

1. Frame deck openings with any one dimension between 150 to 300 mm as recommended by manufacturer, except as otherwise indicated.
2. For deck openings with any one dimension greater than 300 mm and for areas of concentrated load, reinforce in accordance with structural framing details, except as otherwise indicated.

3.5 CONNECTIONS

1. Install connections in accordance with CSSBI recommendations as indicated on the drawings whichever is the most stringent.

3.6 PROTECTION

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

END OF SECTION

Part 1 General**1.1 RELATED SECTIONS**

1. Section 01 33 00 - Submittal Procedures.
2. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
3. Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

1. American Society for Testing and Materials (ASTM)
 1. ASTM A653/A653 M- Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 2. ASTM A792/A792M- Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
2. Canadian Standards Association (CSA)
 1. CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 2. CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 3. CSA W59, Welded Steel Construction (Metal Arc Welding) (Metric Version).
 4. CAN/CSA S136, North American Specification for the Design of Cold-Formed Steel Structural Members.
3. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-1.181-Ready-Mixed Organic Zinc-Rich Coating.
4. Canadian Sheet Steel Building Institute (CSSBI)
 1. CSSBI 52M- Lightweight Steel Framing Binder.
 2. CSSBI 55-04, Guide Specification for Wind Bearing Steel Studs.

1.3 SUBMITTALS

1. Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.
2. Indicate locations, dimensions, openings and requirements of related work.
3. Indicate welds by welding symbols as defined in CSA W59.
4. Submit samples of framing components and fasteners to Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

1. Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
2. Handle and protect galvanized materials from damage to zinc coating.

Part 2 Products**2.1 MATERIALS**

1. Steel: to CSA S136, fabricated from ASTM A653/A653M, Grade 230 steel.
2. Zinc coated steel sheet: quality to A653M, with Z275 designation zinc coating.
3. Aluminum-zinc alloy coated steel sheet: to ASTM A792M, commercial quality, grade 37 with AZ180 coating, regular spangle surface, chemically treated for unpainted finish.
4. Welding materials: to CSAW59 and certified by Canadian Welding Bureau.
5. Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI, (minimum coating thickness of 0.008 mm of zinc), length to suit application, but not less than 5.0 mm longer than twice the thickness of steel.
6. Anchors: concrete expansion anchors or other suitable drilled type fasteners.
7. Bolts, nuts, washers: hot dipped galvanized to CAN/CSA-G164, 600 g/m² zinc coating.
8. Touch up primer to repair damaged or cut metallic coatings: zinc rich, to CAN/CGSB 1-GP-181.

2.2 STEEL STUD DESIGNATIONS

1. Colour code steel studs in accordance with CSSBI Technical Bulletin Vol. 7, No.2.

2.3 METAL FRAMING

1. Steel studs: to CSA S136, fabricated from zinc coated steel, depth as indicated. Minimum steel thickness of 1.52 mm.
2. Stud tracks: fabricated from same material and finish as steel studs, depth to suit.
 1. Bottom track: single piece.
 2. Top track: single piece track **or** double track **or** slotted single top track. (double track or slotted single top track to accommodate deflection).
3. Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.22 mm minimum thickness.
4. Angle clips: fabricated from same material and finish as studs, 38 x 38mm x depth of steel stud, 1.22 mm minimum thickness.

5. Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

1. Prior to commencement of work, submit:
 1. Two certified copies of mill reports covering material properties.

Part 3 Execution

3.1 GENERAL

1. Do welding in accordance with CSA W59.
2. Companies and their personnel shall perform welding in compliance with Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55. 3 for resistance welding of structural components.
3. Do work in accordance with CSSBI S5.

3.2 ERECTION

1. Erect components to requirements of reviewed shop drawings.
2. Anchor tracks securely to structure at 800 mm oc maximum, unless lesser spacing prescribed on shop drawings.
3. Erect studs plumb, aligned and securely attached with two screws minimum, or welded in accordance with manufacturer's recommendations.
4. Seat studs into bottom tracks and top tracks. Gap between end of stud and web of track not to exceed 4.0 mm. Secure studs with two (2) screws minimum (in top and bottom tracks), or in accordance with manufacturer's recommendations.
5. Allow minimum deflection gap of 16.5 mm for double track or slotted single top track.
6. Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
7. Brace steel studs with horizontal internal bridging at 1200 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.
8. Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
9. Touch up welds with coat of zinc rich primer.

3.3 ERECTION TOLERANCES

1. Plumb: not to exceed 1/500th of member length.
2. Camber: not to exceed 1/1000th of member length.
3. Spacing: not more than 3.0 mm from design spacing.
4. Gap between end of stud and track web: not more than 4.0 mm.

3.4 CUTOUTS

1. Maximum size of cut-outs for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

2. Limit distance from centerline of last unreinforced cut-out to end of member to less than 300 mm.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

1. Division 1 – General Requirements

1.2 REFERENCES

1. ASTM International
 1. ASTM A53/A53M-07, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
2. CSA International
 1. CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 2. CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
3. Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 1. Material Safety Data Sheets (MSDS).
4. The Master Painters Institute (MPI)
 1. Architectural Painting Specification Manual - current edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1. Submit in accordance with Section 01 33 00 - Submittal Procedures.
2. Product Data:
 1. Submit manufacturer's instructions, printed product literature and data sheets for all shapes, and include product characteristics, performance criteria, physical size, finish and limitations.
 2. Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
3. Shop Drawings:
 1. Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia, Canada.
 2. Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

1. Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
3. Storage and Handling Requirements:
 1. Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 2. Replace defective or damaged materials with new.
4. Develop Construction Waste Management Plan related to Work of this Section.
5. Packaging Waste Management: remove for reuse of pallets, crates, padding, packaging materials, as specified in Construction Waste Management Plan, in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products**2.1 MATERIALS**

1. Steel sections and plates: to CSA G40.20/G40.21. with Grade as specified on structural drawings.
2. Steel pipe: to ASTM A53/A53M standard weight, galvanized finish.
3. Welding materials: to CSA W59.
4. Welding electrodes: to CSA W48 Series.
5. Anchor bolts: to ASTM F1554 Galvanized or Type 304 stainless steel.
6. Bolts, nuts and washers: to ASTM F3125 Grade A325 Hot Dip Galvanized.
7. Stainless steel tubing: to ASTM A269, Type 302 commercial grade.
8. Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

1. Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
2. Where possible, fit and shop assemble work, ready for erection.
3. Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

1. Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.
2. Shop coat primer: in accordance with chemical component limits and restrictions requirements and VOC limits of CCD-047a.
3. Zinc primer: zinc rich, ready mix to MPI-EXT 5.2C.

2.4 SHOP PAINTING

1. Primer: VOC limit 250 g/L maximum to GS-11.
2. Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
3. Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.
4. Clean surfaces to be field welded; do not paint.

2.5 PIPE RAILINGS

1. Steel pipe: 40 mm nominal outside diameter, formed to shapes and sizes as indicated.
2. Galvanize exterior and interior pipe railings after fabrication.

Part 3 Execution

3.1 EXAMINATION

1. Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications installation in accordance with manufacturer's written instructions.
 1. Visually inspect substrate in presence of Departmental Representative.
 2. Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 3. Proceed with installation only after unacceptable conditions have been remedied and approved by Departmental Representative.
2. Do welding work in accordance with CSA W59 unless specified otherwise.
3. Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
4. Provide suitable means of anchorage acceptable to Departmental Representative.
5. Exposed fastening devices to match finish and be compatible with material through which they pass.
6. Supply components for work by other trades in accordance with shop drawings and schedule.
7. Deliver items for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.
8. Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion.
9. Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 PIPE RAILINGS

1. Install pipe railings as indicated.

3.3 CLEANING

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

3.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33.01 Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - .2 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - .3 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.3 DEFINITIONS

- .1 Corrected maximum dry density is defined as:
 - .1 For free draining aggregates, determine D1 (maximum dry density) to ASTM D 4253 dry method when directed by Departmental Representative.

Part 2 Products (Not Applicable)

Part 3 Execution (Not Applicable)

END OF SECTION

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Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

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

1.3 SOURCE QUALITY CONTROL

- .1 Source of materials to be incorporated into work or stockpiles requires approval.
- .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .3 If, in opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .4 Should a change of material source be proposed, advise Departmental Representative 4 weeks in advance of proposed change to allow sampling and testing.
- .5 Acceptance of material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if its field performance is found to be satisfactory.

1.4 SAMPLES

- .1 Aggregate will be subject to continual sampling by Departmental Representative during production.
- .2 Provide Departmental Representative with access to source and processed material for sampling and testing.
- .3 Bear the cost of sampling and testing of aggregates which fail to meet specified requirements.

Part 2 Products

1.5 MATERIALS

- .1 Aggregate quality: sound, hard, durable mineral material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.

- .2 Flat and elongated particles of coarse aggregate: shall be tested according to ASTM D4791.
 - .1 Greatest dimension to exceed five times least dimension.

- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock or slag.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.

Part 3 Execution

1.6 TOPSOIL STRIPPING

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure would be adversely affected.

- .2 Commence topsoil stripping of areas as indicated after area has been cleared and debris removed from site.

- .3 Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil.

- .4 Stockpile topsoil in locations as directed by Departmental Representative. Stockpile height not to exceed 2.0 m.

1.7 DEVELOPMENT OF AGGREGATE SOURCE

- .1 Contractor to obtain aggregates from off-site source licensed to supply aggregate.

- .2 Contractor shall prevent contamination of aggregates that are temporarily stockpiled.

1.8 PROCESSING

- .1 The aggregate supplier shall process aggregate uniformly using methods that prevent contamination, segregation and degradation.
- .2 The supplier shall blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Departmental Representative.
- .3 Wash aggregates, if required, to meet specifications. Use only equipment approved by Departmental Representative.
- .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous, uncontaminated aggregate.

1.9 HANDLING

- .1 Handle and transport aggregates to avoid segregation, contamination and degradation.

1.10 STOCKPILING

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 h of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.0 m for coarse aggregate and base course materials.
 - .2 Max 2.0 m for fine aggregate and sub-base materials.
 - .3 Max 1.5 m for other materials.
- .8 Complete each layer over entire stockpile area before beginning next layer.
- .9 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .10 Do not cone piles or spill material over edges of piles.

- .11 Do not use conveying stackers.
- .12 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

1.11 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33 01 Excavating Trenching and Backfilling.

1.2 REFERENCES

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 DEFINITIONS

- .1 Clearing consists of cutting off trees, brush and vegetative growth to not more than a specified height above ground, and disposing of felled trees, previously uprooted trees and stumps, brush, underbrush and surface debris.
- .2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Not Used
- .2 Not Used..
- .3 Not Used.
- .4 Not Used.

1.5 QUALITY ASSURANCE

- .1 Fulfill construction occupational health and safety requirements in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Safety Requirements: worker protection.
 - .1 Workers must wear appropriate personal protective equipment including but not limited to hard hat, safety-toed boots, high visibility vest, gloves, respirators, eye protection, ear-protection and protective clothing.
 - .2 Workers must not eat, drink or smoke while working.
 - .3 Clean up spills immediately with absorbent material or other effective appropriate method, and safely discard waste to landfill.

1.6 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, benchmarks, existing buildings, existing pavement, utility lines, site appurtenances, water courses, and root systems of trees which are to remain.
 - .1 Repair damaged items to the approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 MATERIALS

- .1 Bituminous based paint of standard manufacture that has been specially formulated for tree wounds.
- .2 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reuse, if and as directed by the Departmental Representative.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the sediment and erosion control plan.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during clearing and grubbing.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during clearing and grubbing work.

3.2 PREPARATION

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

3.3 APPLICATION

- .1 Not Used.

3.4 CLEARING

- .1 Clear as indicated, by cutting trees and brush at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.
- .2 Cut off branches overhanging area cleared as directed by Departmental Representative.
- .3 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.5 ISOLATED TREES

- .1 Cut off isolated trees as indicated by Departmental Representative at height of not more than 300 mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.6 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.
- .4 Fill depressions made by grubbing with suitable soil material and to make new surface conform to existing adjacent surface of ground.

3.7 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site.

3.8 FINISHED SURFACE

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

3.9 CLEANING

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33 01 Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
- .2 Underwriters' Laboratories of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 EXISTING CONDITIONS

- .1 Subsurface investigations have not been conducted for this project. The site has been developed extensively and soils conditions are known to be sands and gravels of various particle sizes.
- .2 Known underground and surface utility lines and buried objects are partially shown on site plan, Contractor shall verify depths and locations of existing utilities and objects prior to construction.
- .3 Refer to dewatering in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 2 Products

2.1 MATERIALS

- .1 Fill material: Types 1, 2, or 3, or named types of aggregate materials indicated on the drawings, in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that the existing conditions of substrate are acceptable for rough grading installation in accordance with this and the other related specifications.
 - .1 Visually inspect substrate in presence of Departmental Representative
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 STRIPPING OF TOPSOIL

- .1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected, as determined by Departmental Representative.
- .2 Commence topsoil stripping of areas as indicated after area has been cleared and grubbed.

3.3 GRADING

- .1 Rough grade to design levels, profiles, and contours, allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finish grades:
 - .1 As shown on the drawings.
- .3 Slope rough grade away from building as indicated.
- .4 Grade ditches to depth as and where indicated.
- .5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .6 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
 - .1 85% under landscaped areas.
 - .2 95% under paved and walk areas.
- .7 Do not disturb soil within branch spread of trees or shrubs that shall remain.

3.4 TESTING

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

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.6 PROTECTION

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

END OF SECTION

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Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 16 - Aggregate Materials.

1.2 MEASUREMENT PROCEDURES

- .1 Excavation, except for rock excavation, shall be classified as common.
 - .1 Common excavation quantities shall not be measured and will be included in the Contractors total bid price.
 - .2 Rock quantities measured will be actual volume removed within following limits:
 - .1 Width for trench excavation as indicated.
 - .2 Width for excavation for structures to be bounded by vertical planes up to 500 mm outside of and parallel to neat lines of footings as indicated.
 - .3 Depth from rock surface elevations immediately prior to excavation, to elevation as indicated.
 - .4 Where design elevation is less than 300 mm below original rock surface, depth will be considered to be 300 mm below original rock surface.
 - .5 Volume of individual boulders and rock fragments will be determined by measuring three maximum mutually perpendicular dimensions.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C117, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422, Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN-m/m³).
 - .6 ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.
 - .2 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

- .4 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.4 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: solid mineral material in excess of 1.00 m³ and which cannot be removed by means of heavy-duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of unnatural deposits of whatever character encountered in Work.
- .3 Topsoil:
 - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of aggregate fill areas.
- .7 Unsuitable materials:
 - .1 Weak, friable, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422: Sieve sizes to CAN/CGSB-8.2.
 - .2 Table:

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

- .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
 - .8 Unshrinkable fill: very weak mixture of cement, mineral aggregate suitable for batching concrete, and water, that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
 - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.
 - .2
 - .3 Submit to Departmental Representative written notice at least seven (7) days prior to excavation work.
 - .4 Submit to Departmental Representative written notice when bottom of excavation is reached.
 - .5 Submit to Departmental Representative testing results as described in PART 3 of this Section.
- .3 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating location plan of existing utilities as found in field and clearance record from utility authority.
- .4 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative at least four (4) weeks prior to beginning Work, of proposed source of materials and provide access for sampling.
 - .3
 - .4 Deliver samples to Departmental Representative in tightly closed containers to prevent contamination and exposure to elements.

1.6 QUALITY ASSURANCE

- .1 Do not use soil material until written report of soil test results are approved by Departmental Representative.
- .2 Health and Safety Requirements:
 - .1 Fulfill construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse or recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Divert excess aggregate materials from landfill to local quarry for reuse as directed by Departmental Representative.

1.8 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify location of buried services and process piping on and adjacent to site. Design drawings of existing facilities will be made available to the Contractor.
 - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .3 Remove obsolete buried services and process piping within 2 m of foundations: cap cut-offs.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Prior to beginning excavation Work, notify applicable Departmental Representative establish location and state of use of buried utilities, piping, and structures. Departmental Representative to clearly mark such locations to prevent disturbance during Work.
 - .6 Confirm locations of buried utilities by careful test excavations.
 - .7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
 - .8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .9 Record location of maintained, re-routed and abandoned underground lines.
 - .10 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey benchmarks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.

Part 2 Products**2.1 MATERIALS**

- .1 Type 1 and Type 2 fill: to meet the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 or ASTM C117. Sieve sizes to CAN/CGSB.

Table:

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

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Crushed Granular Base shall meet the following requirements:
 - .1 Clean, well-graded. crushed, durable, inert, sound igneous mineral aggregate gravel and sand.
 - .2 Gradations, blended as required, to be within limits specified when tested to ASTM C136 or ASTM C117. Sieve sizes to CAN/CGSB.

Sieve Designation	% Passing
25 mm	100
19 mm	80-100
9.5 mm	50-85
4.75 mm	35-70
2.36m	25-50
1.18 mm	15-35
0.300 mm	-5-20
0.075 mm	0-5

- .4 Crushed Granular Sub-base shall meet the following requirements:
 - .1 Clean, well-graded. crushed, durable, inert, sound, igneous mineral aggregate gravel and sand.

- .5 Gradations, blended as required, to be within limits specified when tested to ASTM C136 or ASTM C117. Sieve sizes to CAN/CGS

Sieve Designation	% Passing
75 mm	100-
37.5 mm	60-100-
19 mm	35-80
9.5 mm	26-60
4.75 mm	20-40
2.36 mm	15-30-
1.18 mm	10-20
0.600 mm	5-15
0.300 mm	3-10
0.075 mm	0-5

- .6 Select Granular Sub-base shall meet the following requirements:

- .1 Clean, well-graded. durable, inert, sound, igneous mineral aggregate gravel and sand.

- .7 Gradations, blended as required, to be within limits specified when tested to ASTM C136 or ASTM C117. Sieve sizes to CAN/CGS

Sieve Designation	% Passing
75 mm	100-
25 mm	50-85-
0.150 mm	0-15
0.075 mm	0-8

- .8 Drain Rock, Fine, shall meet the following requirements:

- .1 Clean, durable, inert, sound, igneous mineral aggregate round stone or crushed rock.

- .7 Gradations, blended as required, to be within limits specified when tested to ASTM C136 or ASTM C117. Sieve sizes to CAN/CGS

Sieve Designation	% Passing
9.5 mm	100-
4.75 mm	50-100-
2.36 mm	10-35
1.18 mm	5-15
0.600 mm	0-8
0.300 mm	0-5
0.150 mm	0-2
0.075 mm	0

- .9 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum cement content of 25 kg/m³ to CSA-A3001, Type GU.
 - .3 Minimum strength of 0.07MPa at 24 h.
 - .4 Concrete aggregates: to CSA-A23.1/A23.2.
 - .5 Cement: Type GU.
 - .6 Slump: 160 to 200 mm.
- .10 Shearmat: honeycomb type bio-degradable cardboard 100 mm thick, treated to provide sufficient structural support for poured concrete until concrete cured.
- .11 Geotextiles: to Section 31 32 19.01 - Geotextiles.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

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

3.3 PREPARATION/PROTECTION

- .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative approval.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

3.4 STRIPPING OF TOPSOIL

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

3.5 STOCKPILING

- .1 Stockpile fill materials in areas designated by Departmental Representative.
 - .1 Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.
- .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.6 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Not Used.

3.7 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Avoid excavation below groundwater table if quick condition or heave is likely to occur.
 - .1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.
- .3 Protect open excavations against flooding and damage due to surface run-off.
- .4 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures and in manner not detrimental to public and private property, or portion of Work completed or under construction.
 - .1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.
- .5 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

3.8 EXCAVATION

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

3.9 FILL TYPES AND COMPACTION

- .1 Use types of fill indicated on the drawings or as specified below. Compaction densities are percentages of maximum densities obtained from ASTM D1557 in accordance with Section 31 05 10 - Corrected Maximum Dry Density for Fill.
 - .1 Exterior side of perimeter walls: use Select Granular Sub-base to base level, then Crushed Granular Base. Compact to 95% of corrected Modified Proctor maximum dry density.
 - .2 Within building area: use Select Granular Sub-base, or use Crushed Granular Sub-base if directed by the Departmental representative, to underside of base course for floor slabs. Compact to 95 % of corrected Modified Proctor maximum dry density.
 - .3 Under concrete slabs: provide 150 mm compacted thickness base course of Crushed Granular Base fill to underside of slab. Compact base course to 95 % Modified Proctor maximum dry density.
 - .4 Retaining walls: use Select Granular Sub-based, or Crushed Granular Sub-base, as indicated on the drawings, to subgrade level on high side for minimum 500 mm from wall, and compact to 95 % Modified Proctor maximum dry density. For remaining portion, use Crushed Granular Sub-base or Crushed Granular Base fill, as indicated on the drawings, compacted to 95 % Modified Proctor maximum dry density.
 - .5 Place unshrinkable fill in areas as indicated.

3.10 BEDDING AND SURROUND OF UNDERGROUND SERVICES

- .1 Place and compact Crushed Granular Base granular material for bedding and surround of underground services in 150 mm lifts compacted to 95% Modified Proctor maximum dry density, as indicated.
- .2 Place lifts of bedding and surround material uniformly and evenly in unfrozen condition.

3.11 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved installations.
 - .2 Departmental Representative has inspected and approved of construction below finish grade.
 - .3 Inspection, testing, approval, and recording location of underground utilities.
 - .4 Removal of concrete formwork.
 - .5 Removal of shoring and bracing; backfilling of voids with satisfactory soil material.
- .2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

- .5 Backfilling around installations:
 - .1 Place bedding and surround material as specified elsewhere.
 - .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
 - .3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.5 m.
 - .4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure for minimum fourteen (14) days or until it has sufficient strength to withstand earth and compaction pressure and approval has been obtained from Departmental Representative:
 - .2 If approved by Departmental Representative, erect bracing or shoring to counteract any unbalance, and leave in place until removal is approved by Departmental Representative.
- .6 Place unshrinkable fill in areas as indicated.
- .7 Consolidate and level unshrinkable fill with internal vibrators.
- .8 Install drainage system in backfill as indicated.

3.12 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 21 - Construction/Demolition Waste Management and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated.
- .3 Reinstate affected ground surface to nature and elevation which existed before excavation.
- .4 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .5 Use temporary plating to support traffic loads over unshrinkable fill for initial twenty-four (24) hours.
- .6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33 01 Excavating, Trenching and Backfilling

1.2 MEASUREMENT AND PAYMENT

- .1 Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - .3 ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - .4 ASTM D4716, Standard Test Method for Determining the (In-Plane) Flow Rate Per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - .5 ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB No. 11.2, Textile Test Methods - Bursting Strength - Ball Burst Test.
 - .2 CAN/CGSB, Methods of Testing Geotextiles and Complete Geomembranes.
 - .1 No.2, Methods of Testing Geosynthetics - Mass per Unit Area.
 - .2 No.3, Methods of Testing Geosynthetics - Thickness of Geotextiles.
 - .3 No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
 - .4 No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.
 - .5 No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.
- .3 CSA International
 - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .4 Master Municipal construction Documents (MMCD)
 - .1 Section 31 32 19, Geosynthetics.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for geotextiles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
 - .1 Submit following samples four (4) weeks prior to beginning Work.
 - .1 Minimum length of 2 m of roll width of geotextile.
 - .2 Methods of joining.
- .4 Test and Evaluation Reports:
 - .1 Submit copies of mill test data and certificate at least four (4) weeks prior to start of Work.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Storage and Handling Requirements:
 - .1 Store materials off ground in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect geotextiles from direct sunlight and UV rays.
 - .3 Replace defective or damaged materials with new.

Part 2 Products**2.1 MATERIAL**

- .1 Geotextile filter fabric, where required to separate and/or envelope drain rock, as shown on the drawings, shall be:
 - .1 Nilex 4551, Maccaferri MX225S or Layfield LP6 geotextile filter fabric, or approved equivalent, with
 - .1 Grab Strength: >710 Newtons
 - .2 Water Flow Rate: >4480 l/min/m²
 - .3 Trapezoidal Tear: >266 Newtons
- .2 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
 - .1 Width: 1.8 m minimum.
 - .2 Composed of minimum 85% by mass of polypropylene or polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for sixty (60) days.

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- .3 Physical properties:
 - .1 Thickness: to CAN/CGSB-148.1, No.3.
 - .2 Mass per unit area: to CAN/CGSB-148.1, No.2
 - .3 Tensile strength and elongation to ASTM D4595.
 - .1 Tensile strength: minimum 300 Min ARV, wet condition.
 - .2 Elongation at break: maximum 70%.
 - .4 Grab tensile strength and elongation: to CAN/CGSB-148.1, No.7.3.
 - .5 Trapezoidal strength: to ASTM D 4533 54 kg Min ARV.
 - .6 Water Flow Rate: to ASTM D4491
 - .4 Hydraulic properties:
 - .1 As stated in article 2.1.1.1.2
 - .5 Securing pins and washers: to CSA G40.2, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m² to ASTM A123/A123M.
 - .6 Factory seams: sewn in accordance with manufacturer's recommendations.
 - .7 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Join successive strips of geotextile by sewing.
- .6 Pin successive strips of geotextile with securing pins at 300mm interval at mid point of lap.
- .7 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.

- .8 After installation, cover with overlying layer within four (4) hours of placement.
- .9 Replace damaged or deteriorated geotextile to approval of Departmental Representative.
- .10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.3 CLEANING

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

3.4 PROTECTION

- .1 Vehicular traffic not permitted directly on geotextile.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section [_____]

1.2 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

.1 Not Used.

1.3 MEASUREMENT PROCEDURES

.1 Not Used.

1.4 REFERENCE STANDARDS

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-[10], Standard for Hypochlorites.
 - .2 ANSI/AWWA B301-[10], Standard for Liquid Chlorine.
 - .3 ANSI/AWWA B303-[10], Standard for Sodium Chlorite.
 - .4 ANSI/AWWA C104/A21.4-[08], Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - .5 ANSI/AWWA C105/A21.5-[10], Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - .6 ANSI/AWWA C110/A21.10-[08], American National Standard for Ductile-Iron and Grey Iron Fittings for Water.
 - .7 ANSI/AWWA C111/A21.11-[07], American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
 - .8 ANSI/AWWA C150/A21.50-[08], Standard for Thickness Design of Ductile-Iron Pipe.
 - .9 ANSI/AWWA C151/A21.51-[09], Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - .10 ANSI/AWWA C153/A21.53-[11], Standard for Ductile-Iron Compact Fittings.
 - .11 ANSI/AWWA C200-[05], Standard for Steel Water Pipe - 6 Inch (150 mm) and Larger.
 - .12 ANSI/AWWA C205-[07], Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 Inch (100 mm) and Larger - Shop Applied.
 - .13 ANSI/AWWA C206-[11], Standard for Field Welding of Steel Water Pipe.
 - .14 ANSI/AWWA C207-[07], Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
 - .15 ANSI/AWWA C208-[07], Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
 - .16 ANSI/AWWA C500-[09], Standard for Metal-Seated Gate Valves for Water Supply Service.
 - .17 ANSI/AWWA C504-[10], Standard for Rubber-Seated Butterfly Valves.

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- .18 ANSI/AWWA C509-[10], Resilient-Seated Gate Valves For Water Supply Service.
 - .19 ANSI/AWWA C600-[09], Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.
 - .20 ANSI/AWWA C602-[11], Standard for Cement-Mortar Lining of Water Pipelines - 4 Inch (100 mm) and Larger.
 - .21 ANSI/AWWA C651-[05], Standard for Disinfecting Water Mains.
 - .22 ANSI/AWWA C800-[05], Standard for Underground Service Line Valves and Fittings.
 - .23 ANSI/AWWA C900-[07], Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
- .2 ASTM International
- .1 ASTM A53/A53M-[10], Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
 - .2 ASTM A123/A123M-[09], Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A307-[10], Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .4 ASTM B88M-[05(2011)], Standard Specification for Seamless Copper Water Tube [Metric].
 - .5 ASTM C117-[04], Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .6 ASTM C136-[06], Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .7 ASTM C478M-[11], Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric].
 - .8 ASTM D698-[12e2], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³)).
 - .9 ASTM D1557-[07], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 956,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - .10 ASTM D2241-[20], Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
 - .11 ASTM D2310-[06], Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
 - .12 ASTM D2657-[07], Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
 - .13 ASTM D2992-[06], Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.
 - .14 ASTM D2996-[01(2007)e1], Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
 - .15 ASTM F477-[14], Standard Specification for Elastomeric Seals (Gaskets) for Joining Pipe

- .16 ASTM F593-[17], Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- .17 ASTM F594 –[09(2020)], Standard Specification for Stainless Steel Nuts
- .18 ASTM C618-[08a], Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- .19 ASTM F714-[10], Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .3 American Water Works Association (AWWA)/Manual of Practice
 - .1 AWWA M9-[2008], Concrete Pressure Pipe.
 - .2 AWWA M11-[2004], Steel Pipe - A Guide for Design and Installation.
- .4 Standards Council of Canada
 - .1 CAN/CSA-B137.3-M90, Rigid Poly(Vinyl chloride) (PVC) Pipe for Pressure Applications
- .5 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations (including Addendum [2007]).
 - .2 LEED Canada-NC-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
 - .3 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Commercial Interiors.
 - .4 LEED Canada-EB: O&M-[2009], LEED (Leadership in Energy and Environmental Design): Green Building Rating System for Existing Buildings: Operations and Maintenance 2009.
- .6 Canadian General Standards Board (CGSB)
 - .1 Not Used
- .7 CSA International
 - .1 Not Used
- .8 The Master Painters Institute (MPI)
 - .1 Not Used
- .9 Underwriters' Laboratories of Canada (ULC)
 - .1 Not Used

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section [01 33 00- Submittal Procedures].
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for [distribution piping materials]and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Pipe certification to be on pipe.
- .3 Shop Drawings:
 - .1 Submit drawings for only non-standard fittings, materials and/or equipment.
 - .2
- .4 Samples:
 - .1 Inform Departmental Representative] [of proposed source of bedding materials and provide access for sampling at least 4weeks prior to commencing work.
 - .2 Submit manufacturer's test data and certification that pipe materials meet requirements of this section 4weeks minimum prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .5 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.6 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section [01 78 00- Closeout Submittals].
- .2 Submit data to produce record drawings, including details of pipe material, location of valves.
 - .1 Include top of pipe, horizontal and vertical location of fittings and type, valves, and valve boxes.
- .3 Operation and Maintenance Data: submit operation and maintenance data for valves and valve boxes or incorporation into manual.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section [01 61 00- Common Product Requirements with manufacturer's written instructions].
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer's recommendations.
 - .2 Store and protect water distribution piping from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.

1.8 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of [24]hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 4 hours unless otherwise authorized.
- .5 Notify fire department of accidental interruption of water supply to hydrants.
- .6
- .7 Advise local police department of anticipated interference with movement of traffic.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section [01 78 00- Closeout Submittals].

Part 2 Products**2.1 PIPE, JOINTS AND FITTINGS**

- .1 Ductile iron pipe: to AWWA C151, pressure class 350, cement-mortar-lined to AWWA C104/A21.4.
- .2 Joints and fittings for [ductile iron]pipe.
 - .1 Joints:
 - .1 Push-on joints: to AWWA C111.
 - .2 Rubber gasket (nitrile or NBR), with layer of cotton on both sides, for flange pipe joints 3.175 mm thick: to [AWWA C111].
 - .3 Bolts, nuts, hex head with washers: to ASTM A307, heavy series, zinc-plated to ASTM B633, or, where indicated, Type 304 stainless steel.
 - .2 Fittings:
 - .1 Flanged ductile iron fittings NPS 3 and larger: to [AWWA C110].
 - .2 Compact Fittings: Not permitted.
- .3 Polyvinyl chloride pressure pipe: to [AWWA C900, pressure class 150, DR 18, cast iron outside diameter].
 - .1 CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket.
 - .2 Ductile iron fittings: to AWWA C110, and for pipe diameters larger than NPS 4 cement mortar lined to AWWA C104/A21.4.

2.2 PIPE PROTECTION

- .1 Not Used.

2.3 VALVES AND VALVE BOXES

- .1 Valves to open counter-clockwise.
- .2 Gate valves: to AWWA C509,
 - .1 Above-ground valves: ductile iron body, EPDM coated ductile iron wedge, outside screw & yoke (OS&Y), flanged joints.
 - .2 Below-ground valves: cast iron body, rubber encapsulated cast iron wedge, non-rising stem, push-on joints.
- .3 Cast iron valve boxes: telescoping, cast iron, top flange type “Nelson Box” service box complete with PVC riser tube.
 - .1 Nominal 200 mm diameter lid and nominal 300 mm diameter flange
 - .2 Top of box to be marked "WATER"/"EAU".

2.4 VALVE CHAMBERS

- .1 Not Used.

2.5 SERVICE CONNECTIONS

- .1 Not Used.

2.6 HYDRANTS

- .1 Not Used. PIPE BEDDING AND SURROUND MATERIAL
- .2 Granular material to: Section 31 05 16- Aggregate Materials, Section 31 23 33.01, Excavating, Trenching and Backfilling, and following requirements:
 - .1 Clean, well-graded, crushed durable, inert, sound, igneous mineral aggregate screened stone, gravel and sand.
 - .2 Gradations to be within limits specified when tested to [ASTM C117] [ASTM C136]. Sieve sizes to [CAN/CGSB-8.2] [CAN/CGSB-8.1].
 - .3 Table

Sieve Designation	% Passing
Crushed Granular Base	
25 mm	[100]
19 mm	80-100
9.5 mm	50-85
4.75 mm	35-70
2.36 mm	25-50
1.18 mm	15-35
0.300 mm	5-20
0.075 mm	0-5

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

2.7 BACKFILL MATERIAL

- .1 As indicated in Section 31 23 33.01- Excavating, Trenching and Backfilling .]

2.8 PIPE DISINFECTION

- .1 Sodium hypochlorite to AWWA B303 to disinfect water mains.
- .2 Disinfect water mains in accordance with AWWA C651.

Part 3 Execution**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied to the satisfaction of the Departmental Representative.

3.2 PREPARATION

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

3.3 TRENCHING

- .1 Perform trenching work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe as indicated.

3.4 CONCRETE BEDDING AND ENCASEMENT

- .1 Not Used.

3.5 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding [150]mm compacted thickness [to depth as indicated mm below bottom of pipe].
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to 95 % corrected maximum dry density to ASTM D1557.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling with compacted granular pipe bedding material].

3.6 PIPE INSTALLATION

- .1 Lay ductile iron pipes to AWWA C600 and lay PVC pipes to AWWA C605. Comply with manufacturer's standard instructions and specifications.
 - .1 Do not use blocks except as specified.
- .2 Join pipes in accordance with manufacturer's recommendations.
- .3 Bevel or taper ends of PVC pipe to match fittings.
- .4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .5 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10mm in 3m.
- .6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
- .7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Position and join pipes with equipment and methods approved by Departmental Representative.
- .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .11 Align pipes before jointing.
- .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
- .14 Complete each joint before laying next length of pipe.
- .15 Minimize deflection after joint has been made.
- .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

- .17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by [Departmental Representative] [DCC Representative] [Consultant].
- .18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .20 Do not lay pipe on frozen bedding.
- .21 Perform hydrostatic and leakage test and have results approved by Departmental Representative.
- .22 Backfill remainder of trench.

3.7 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes by means of the same graded, shaped and compacted Crushed Base Granular Pipe Bedding as adjacent graded and compacted pipe granular . Valves shall not to be supported just by the .
- .3 Install underground post-type indicator valves as indicated.

3.8 VALVE CHAMBERS

- .1 Not Used.

3.9 UNDERCROSSING

- .1 Not Permitted. Construct waterworks in a sequence that does not require an undercrossing.
- .2 Construct waterworks in a sequence that does not require an undercrossing.

3.10 SERVICE CONNECTIONS

- .1 Not Used.

3.11 HYDRANTS

- .1 Not Used

3.12 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 All joints shall be restrained by means of using joint restraint devices or tie-rods.
- .2 Tie-rods shall be continuously threaded, quenched and tempered alloyed steel complying with ASTM A354, Grade C, zinc-plated to ASTM B633; minimum diameter 19 mm or greater as shown on the drawings.
- .3 Joint Restraint Devices shall be the devices named on the drawings or equivalents approved by the Departmental Representative.
 - .1 Ductile iron casting to ASTM A536.
 - .2 Anti-corrosion coating of ductile iron castings to AWWA C219, AWWAC210, AWWA C213 or AWWA C550, as applicable.

-
- .3 Bolts and nuts shall be high strength low alloy steel to AWWA C111, Stainless steel to ASTM F593 or ASTM F738 for bolts and ASTM F594 or ASTM F836M for heavy hex nuts. Rolled threads, fit and dimensions shall comply with AWWA C111.
 - .4 Supply and install the restraints for the joints as indicated on the drawings.

3.13 HYDROSTATIC AND LEAKAGE TESTING

- .1 Perform tests in accordance with ANSI/AWWA [C600].
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative at least 48 hours in advance of proposed tests.
 - .1 Perform tests in presence of Departmental Representative.
- .4 Test pipeline in appropriate sections unless otherwise authorized by Departmental Representative.
- .5 Upon completion of pipe laying and/or installation, and after Departmental Representative has inspected Work in place, complete surrounding and covering pipes with approved granular material.
- .6 When testing is done during freezing weather, protect all the waterworks from freezing.
- .7 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .8 Open valves.
- .9 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .10 Conduct pressure testing in accordance with MMCD Section 33 11 01, sub-section 3.19.
- .11 Apply hydrostatic test pressure of 1550 kPa (225 psi) for 2 hours.
- .12 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .13 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .14 Repeat hydrostatic test until defects have been corrected.
- .15 Define leakage as amount of water supplied from water [storage tank] [metre] in order to maintain test pressure for [2] hours.
- .16 Do not exceed allowable leakage of 1.179 l/day/km/mm of nominal diameter. [_____]
- .17 Locate and repair defects if leakage is greater than amount specified.
- .18 Repeat test until leakage is within specified allowance for full length of water main.

3.14 PIPE SURROUND

- .1 Upon completion of pipe laying, and after Departmental Representative has inspected Work in place, complete surrounding and covering pipes as indicated.
- .2 Place surround material in uniform layers not exceeding [150]mm compacted thickness as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to [mid height]of pipe to at least 95 % maximum density to ASTM D1557.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95 % of corrected maximum dry density to ASTM D1557].

3.15 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding [150]mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Compact backfill to at least 95% maximum density to ASTM D1557.
 - .1 In other areas, compact to at least 95% corrected maximum dry density to ASTM D1557.

3.16 HYDRANT FLOW TESTS

- .1 Not Used.

3.17 PAINTING OF HYDRANTS

- .1 Not Used.

3.18 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: Departmental Representative shall witness flushing and disinfection.
 - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 2 hours, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves and service connections to ensure thorough flushing.
- .6 When flushing has been performed for a minimum of 2 hours and completed to Departmental Representative approval, take water samples at the service connections, in suitable sequence, to test for bacteriological content.
- .7 Water from the existing distribution system, isolated by reduced-pressure-principle backflow prevention device or other approved source of supply, shall be made to flow at a constant, measured rate into the newly laid watermain. In the absence of a meter, the rate may be approximated by methods such as placing a Pitot gauge in the discharge, measuring the time to fill a container of known volume, or measuring the trajectory of the discharge and using the formula presented in AWWA C651.
- .8 Perform bacteriological tests on water main, after the prolonged flushing has been completed.
 - .1 Take samples daily for minimum of 2 days.
 - .2 Should contamination remain or recur during this period, repeat disinfection-flushing procedure described above, and then retest from samples taken daily for 2 days.
- .9 Upon completion of disinfection and flushing, Contractor to remove test and bleed point apparatus and backfill and complete any other work required for placing of waterworks system in service.

3.19 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface in accordance with the design drawings, or to original condition, as directed by Departmental Representative.

3.20 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11- Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11- Cleaning.
- .3 Waste Management: separate waste materials for recycling and/or reuse in accordance with Section 01 74 21- Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

Part 1 General**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 Excavating Trenching and Backfilling.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM D 1557, Modified Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-34.22-94, Asbestos-Cement Drainpipe.
- .3 CSA International
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA B1800-11, Thermoplastic Non-Pressure Pipe Compendium (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8, B182.11 and B182.13).
 - .1 CSA B182.2-11, PSM Type Polyvinylchloride (PVC) Sewer Pipe and Fittings.
 - .3 CAN/CSA-G401-07, Corrugated Steel Pipe Products.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for drainage material and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

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 Delivery and Acceptance Requirements: deliver materials to site in original factory or vendor packaging, labelled with manufacturer's and/or vendor's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in a safe, designated area.
 - .2 Store and protect from damage.
 - .3 Replace defective or damaged materials with new.

- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.5 SITE CONDITIONS

- .1 Visually examine nature, conditions and particulars of the site.
- .2 Known underground utility lines and buried objects are as indicated on plans.
- .3 A sub-surface investigation report is not available.

Part 2 Products

2.1 BEDDING AND SURROUND MATERIALS

- .1 Coarse filter aggregate: to in accordance with CSA A23.1/A23.2, Group 1 20-5 mm.
- .2 Fine filter aggregate: Drain rock, Fine in accordance to Section 31 23 33.01 Excavating Trenching and Backfilling
- .3 Flexible plastic tubing and fittings: not permitted.
- .4 Rigid plastic pipe and fittings: to CSA B182.2, size per drawings, complete with fittings.

2.2 BACKFILL MATERIAL

- .1 In accordance with materials identified on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling as indicated.
- .2 Select excavated or graded material existing on site may be suitable to use if approved by Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate are acceptable for drainage materials installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .2 Make sure graded base conforms with required drainage pattern before placing bedding material.
- .3 Make sure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Departmental Representative.

3.2 BEDDING PREPARATION

- .1 Cut trenches in subgrade or sub-base and place bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .3 Shape transverse depressions, as required, to suit joints.
- .4 Compact each layer full width of bed to at least 95% of corrected Modified Proctor maximum dry density.
- .5 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.3 PIPE OR TUBING INSTALLATION

- .1 Make sure pipe interior and coupling surfaces are clean before laying.
- .2 Lay perforated pipe as indicated to slope indicated on drawings ,or of 1:100. Orient pipe face perforations and coupling slots downward.
- .3 Lay non-perforated pipe as indicated to slope indicated on drawings, or of 1:50 from perforated pipe to disposal area. Make joints watertight.
- .4 Grade bedding to establish pipe slope.
- .5 Install end plugs at ends of collector drains to protect pipe ends from damage and ingress of foreign material.
- .6 Connect non-perforated pipe to drain by appropriate fittings and adapters manufactured for this purpose.
- .7 Provide cleanouts on non-perforated pipe at changes of pipe direction and in runs greater than 15 m.
- .8 Provide flush cleanouts where directed by Departmental Representative.
- .9 Daylight drainage system as indicated.

3.4 PIPE OR TUBING SURROUND MATERIAL

- .1 Upon completion of pipe laying and after Departmental Representative has inspected and approved Work in place, surround and cover pipe and install geotextile filter as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer from pipe invert to mid-height of pipe to at least 95% of corrected Modified Proctor maximum dry density.
- .5 Compact each layer from mid-height of pipe to underside of backfill to at least 90% of corrected maximum dry density.
- .6 Place low strength unshrinkable fill where compaction cannot be achieved using mechanical methods.

3.5 BACKFILL MATERIAL

- .1 Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Compact backfill to at least 95% corrected Modified Proctor maximum dry density.
- .3 Use appropriate compaction equipment.
 - .1 Conduct hand tamping around confined areas of pipe.
 - .2 Do not use water or other hydraulic means to place or consolidate backfill material.

3.6 FOUNDATION

- .1 Make penetrations through foundation structures only after receipt of written approval from Departmental Representative.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION