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Government of Nunavut
P Lake Sewage Lagoon

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PART 1 GENERAL

1.1 Section Includes

- .1 Cape Dorset P-Lake Sewage Lagoon.
- .2 Work Covered by Contract Documents.
- .3 Contract Method.
- .4 Work by Others.
- .5 Contractor use of premises.

1.2 Work Covered by Contract Documents

- .1 Work of this Contract comprises general construction, located at Cape Dorset, Nunavut Territory; and further identified as:
 - .1 Site Clearing;
 - .2 Road Works;
 - .3 Berm Construction;
 - .4 Culvert supply and Installation.
 - .5 Discharge flume supply and installation
 - .6 Discharge piping and control structure supply and installation
 - .7 Road guardrails and delineators, supply and installation

1.3 Contract Method

- .1 Construct the Work under a single fixed price contract.
- .2 Payment will only be made for actual work completed and on materials complete and delivered to site in Cape Dorset NU.
- .3 Work to be completed prior to October 2006. Atmospheric temperatures in the winter months are expected to remain around minus forty degrees Celsius (-40°C).

1.4 Contractor Use of Premises

- .1 Contractor has unrestricted use of site.

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 Section Includes

- .1 Product Installation Alternatives to Agreement.

1.2 Requirements

- .1 Referenced specification Sections stipulate pertinent requirements for products and methods to achieve the Work stipulated under each Alternative.
- .2 Coordinate affected related Work and modify surrounding Work to integrate the Work under each Alternative.

1.3 Award/Selection of Alternatives

- .1 Indicate variation of Bid Price for Alternatives described below and listed in Bid Form. Note that this form requests a 'difference' in Bid Price by adding to or deducting from the base Bid price.
- .2 Bids shall be evaluated on 'Base Bid' price. After determination of lowest Bidder, consideration will be given to Alternatives and Bid Price adjustments.

1.4 Alternatives

- .1 Further to Clause 8 of the Instructions to Tenderers:
 - .1 No substitutions will be permitted without prior written approval of Engineer.
 - .2 Proposals for substitution may only be submitted after award of contract. Such request must include statements of respective costs of items originally specified and the proposed substitution.
 - .3 Proposals may be considered by Engineer if:
 - .1 materials selected by tenderer from those specified, are not available;
 - .2 delivery date of materials selected from those materials specified would unduly delay completion of contract, or
 - .3 alternative material to those specified, which are brought to the attention of and considered by Engineer as equivalent to the material specified and will result in a credit to the Contract amount.
 - .4 Should proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on project. Pay for design or drawing changes required as result of substitution.
 - .5 Amounts of all credits arising from approval of substitutions will be determined by Engineer and Contract Price will be reduced accordingly.

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 Section Includes

- .1 Coordination Work with other contractors.
- .2 Scheduled preconstruction and progress meetings.

1.2 Related Sections

- .1 Section 01110 - Summary of Work
- .2 Section 01810 - Commissioning.

1.3 Description

- .1 Coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities, and construction Work, with progress of Work of other contractors under instructions of Engineer.
- .2 The following persons have been designated by the Department of Community and Government Services: Mr. Todd Parsons, Project Officer, Capital Projects, Iqaluit, Nunavut, Ph: (867) 975-5314.

1.4 Construction Organization and Start-up

- .1 Within 15 days after award of Contract, attend a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the Owner, Engineer, Contractor, Consultant, major Subcontractors, field inspectors and supervisors will be in attendance.
- .3 Meeting will be held in a location deemed suitable to all parties.
- .4 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling.
 - .3 Schedule of submission of shop drawings, samples.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences.
 - .5 Delivery schedule of specified equipment.
 - .6 Site security in accordance with Section 01520 - Construction Facilities.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements (GC).
 - .8 Record drawings in accordance with Section 01770 - Closeout Procedures.
 - .9 Maintenance in accordance with Section 01770 - Closeout Procedures.

- .10 Take-over procedures, acceptance, and warranties in accordance with Section 01770 - Closeout Procedures.
- .11 Monthly progress claims, administrative procedures, photographs, and holdbacks (GC).
- .12 Appointment of inspection and testing agencies or firms in accordance with Section 01450 - Quality Control.
- .13 Insurances and transcript of policies (GC).
- .5 Comply with Engineer's allocation of mobilization areas of site; for field offices and sheds, for access, and parking facilities.
- .6 During construction coordinate use of site and facilities through Engineer's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .7 Comply with instructions of Engineer for use of temporary utilities and construction facilities.
- .8 Coordinate field engineering and layout work with Engineer.

1.5 On-Site Documents

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field test reports.
 - .8 Copy of approved Work schedule.
 - .9 Manufacturers' installation and application instructions.
 - .10 Labour conditions and wage schedules.
 - .11 Approvals / Permits

1.6 Schedules

- .1 Submit preliminary construction progress schedule to Engineer coordinated with Engineer's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work revise and resubmit as directed by Engineer.

1.7 Construction Progress Meetings

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

1.8 Closeout Procedures

- .1 Notify Engineer when Work is considered ready for Substantial Completion inspection.
- .2 In the event the facility is not ready for inspection or cannot be successfully commissioned on the date set for commissioning and the Contractor has not notified the Engineer in sufficient time to prevent unnecessary travel, the Contractor shall pay for travel and accommodation costs for subsequent trips by the Engineer and Owner and all of their agents and representatives.

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 Section Includes

- .1 Schedule, form, content.
- .2 Scheduled revisions.
- .3 Critical path scheduling.

1.2 Related Sections

- .1 Section 01770 - Closeout Procedures.

1.3 Schedules Required

- .1 Submit schedules as follows:
 - .1 Construction Progress Schedule.
 - .2 Submittal Schedule for Shop Drawings and Product Data.
 - .3 Submittal Schedule for Samples.
 - .4 Submittal Schedule for timeliness of Owner furnished Products.
 - .5 Product Delivery Schedule.
 - .6 Cash Allowance Schedule for purchasing Products.
 - .7 Shutdown or closure activity.
 - .8 Within ten working days after each March 31 and September 30 occurring between commencement of Work and final completion, and within ten working days after final completion, provide to Engineer:
 - .1 Statement of total person days of labour used on site in performance of Contract, including labour provided under sub-contracts, as of dates identified in General Conditions 23.1.
 - .2 Estimate of total value in dollars of material delivered to site and installed, including material provided and installed under sub-contracts, as of dates identified in General Conditions 23.1.

1.4 Format

- .1 Prepare schedule in form of a horizontal Gant bar chart.
- .2 Provide a separate bar for each major item of work trade or operation.
- .3 Split horizontally for projected and actual performance.
- .4 Provide horizontal time scale identifying first work day of each week.
- .5 Format for listings: chronological order of start of each item of work.

- .6 Identification of listings: By Systems description.

1.5 Submission

- .1 Submit initial format of schedules within 15 working days after award of Contract.
- .2 Submit schedules in electronic format, forward through e-mail as pdf files.
- .3 Submit 2 copies to be retained by Engineer.
- .4 Engineer will review schedule and return review copy within 10 days after receipt.
- .5 Resubmit finalized schedule within 7 days after return of review copy.
- .6 Submit revised progress schedule with each application for payment.
- .7 Distribute copies of revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Other concerned parties.
- .8 Instruct recipients to report to Contractor within 10 days, any problems anticipated by timetable shown in schedule.

1.6 Critical Path Scheduling

- .1 Include complete sequence of construction activities.
- .2 Include dates for commencement and completion of each major element of construction as follows.
 - .1 Site survey and layout
 - .2 Granular source permitting and development
 - .3 Site clearing.
 - .4 Road Works.
 - .5 Berm Construction.
 - .6 Culvert supply and Installation.
 - .7 Discharge flume supply and installation
 - .8 Discharge piping and control structure supply and installation
 - .9 Road guardrails and delineators, supply and installation
 - .10 Training and commissioning
- .3 Show projected percentage of completion of each item as of first day of month.
- .4 Indicate progress of each activity to date of submission schedule.
- .5 Show changes occurring since previous submission of schedule:

- .1 Major changes in scope.
- .2 Activities modified since previous submission.
- .3 Revised projections of progress and completion.
- .4 Other identifiable changes.
- .6 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and impact on schedule.
 - .2 Corrective action recommended and its effect.
 - .3 Effect of changes on schedules of other prime contractors.

1.7 Progress Photographs

- .1 Sizes: Prints 100 x 150 mm.
- .2 Type: semi-matt colour with binding margin at one end.
- .3 Paper: single weight, mounted.
- .4 Number of prints required: 2 sets.
- .5 Identification: typewritten name and number of project and date of exposure on 25 x 50 mm white patch, reverse side.
- .6 Viewpoints: interior and exterior locations: viewpoints determined by Engineer.
- .7 Frequency: monthly with progress statement.
- .8 Submit all negatives of before final acceptance.
- .9 Insert negatives in envelopes and identify with name and number of project. Indicate exposure dates and view points of each frame of 35 mm film strips.

1.8 Submittals Schedule

- .1 Include schedule for submitting shop drawings, product data, samples.
- .2 Indicate dates for submitting, review time, resubmission time, last date for meeting fabrication schedule.
- .3 Include dates when delivery will be required for Owner-furnished products.
- .4 Include dates when reviewed submittals will be required from Consultant.

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 Section Includes

- .1 Shop drawings and product data.
- .2 Samples.
- .3 Certificates and transcripts.

1.2 Related Sections

- .1 Section 01450 - Quality Control.

1.3 Administrative

- .1 Submit to Engineer submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by submittal shall not proceed 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 Engineer. 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 shall be considered rejected.
- .6 Notify Engineer, 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 coordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Engineer review.
- .10 Keep one reviewed copy of each submission on site.

1.4 Shop Drawings and Product Data

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

- .2 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 coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow 5 working days for Engineer's review of each submission.
- .4 Adjustments made on shop drawings by Engineer are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Engineer prior to proceeding with Work.
- .5 Make changes in shop drawings as Engineer may require, consistent with Contract Documents. When resubmitting, notify Engineer in writing of any revisions other than those requested.
- .6 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.
- .7 Submissions shall 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.
- .8 After Engineer's review, distribute copies.
- .9 Submit 8 prints of shop drawings for each requirement requested in specification Sections and as consultant may reasonably request.
- .10 Submit 8 copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Engineer where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Delete information not applicable to project.
- .12 Supplement standard information to provide details applicable to project.
- .13 If upon review by Engineer, 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.
- .14 The review of shop drawings by the Engineer is for sole purpose of ascertaining conformance with general concept. This review shall not mean that the Engineer 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 all requirements of construction and Contract Documents. 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 all sub-trades.

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 Requirements and Procedures

- .1This section specifies general requirements and procedures for contractor's submissions of shop drawings, product data, samples and mock-ups to Engineer for review. Additional specific requirements for submissions are specified in individual sections of Divisions 2 to 16.
- .2Do not proceed with work until relevant submissions are reviewed by Engineer.
- .3Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4Where items or information is not produced in SI Metric units converted values are acceptable.
- .5Contractor's responsibility for errors and omissions in submission is not relieved by Engineer's review of submissions.
- .6Notify Engineer, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7Make any changes in submissions, which Engineer may require, consistent with Contract Documents and resubmit as directed by Engineer.

1.2 Submission Requirements

- .1Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .2Allow 5 working days for Engineer's review of each submission.
- .3Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address, and subcontractor (if applicable)
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Name, address and telephone numbers of supplier and manufacturer.
 - .6 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

1.3 Shop Drawings

- .1The term "Shop Drawings" shall mean any of the following:
 - .1 Original drawings or modified standard drawing prepared by the Contractor, or any of his subcontractors or equipment suppliers.

- .2 Manufacturer's catalogue sheets, brochures, literature, performance charts and diagrams and similar documentation used to illustrate manufactured products.
- .2Shop drawings shall clearly indicate details of construction of the work, including:
 - .1 Layout, showing dimensions, including identified field dimensions and clearances
 - .2 Setting or erection details
 - .3 Capacities
 - .4 Performance characteristics
- .3Submit a minimum of eight (8) copies of all shop drawings. After review, Engineer will distribute:
 - .1 Two (2) copy to Engineer's files.
 - .2 Six (6) Copies to be returned to the Contractor for inclusion within O&M manuals.
 - .3 The submissions of Shop Drawings to the Contractor is intended to supplement the O&M Manual and are not the sole intent of the six (6) copies. O&M Manual data and information shall conform to the requirements of Section 1731 – Operations and Maintenance Manual.

PART 2 PRODUCTS

2.1 Not Used

- .1Not used.

PART 3 EXECUTION

3.1 Not Used

- .1Not used.

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 References and Codes.

1.2 References and Codes

- .1 Perform Work in accordance with National Building Code of Canada (NBC) including all 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 NU Public Health Act.
 - .3 Municipal Bylaws.
 - .4 Canadian Standards Association (CSA).
 - .5 Cold Regions Utilities Monograph.
 - .6 Water Supply for Public Fire Protection (Fire Underwriter's Survey).
 - .7 Nunavut Water Board
 - .8 Department of Fisheries and Oceans Canada (DFO)
 - .9 Indian and Northern Affairs Canada (INAC)

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 Section Includes

- .1 Inspection and testing, administrative and enforcement requirements.

1.2 Related Sections

- .1 Section 01330 - Submittal Procedures.

1.3 Inspection

- .1 Allow Engineer 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 Engineer 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 Engineer may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents.

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 Engineer 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 an orderly sequence so as not to cause delay in Work.
- .3 Provide labor 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 Engineer as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

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

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 Section Includes

- .1 Temporary utilities.

1.2 Related Sections

- .1 Section 01520 - Construction Facilities.
- .2 Section 01560 - Temporary Barriers and Enclosures.

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 Temporary Power and Light

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

1.6 Fire Protection

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by federal/municipal/territorial regulators and insurance companies having jurisdiction.

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 Section Includes

- .1 Construction aids.
- .2 Parking.
- .3 Project identification.

1.2 Related Sections

- .1 Section 01510 - Temporary Utilities.
- .2 Section 01560 - Temporary Barriers and Enclosures.

1.3 Installation and Removal

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 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 a weight or force that will endanger the Work.

1.5 Construction Parking

- .1 Provide and maintain adequate access to project site.
- .2 Build and maintain temporary roads where required and provide snow removal during period of Work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractors' use of roads.

1.6 Sanitary Facilities

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

1.7 Construction Signage

- .1 If required, erect Owner supplied project sign in a location designated by Engineer.

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 Construction Safety Measures

- .1 Observe construction safety measures of the National Building Code 1995 Part 8, Territorial Government, Nunavut Territory Workers' Compensation Board and Municipal authority provided that in any case of conflict or discrepancy more stringent requirements shall apply.
- .2 Comply with the requirements of the Safety Act of the Nunavut Territory.

1.2 Overloading

- .1 Ensure no part of Work is subjected to loading that will endanger its safety or will cause permanent deformation.

1.3 WHMIS

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, and storage, of hazardous materials; and regarding labeling of containers and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada and Health and Welfare Canada.
- .2 Deliver copies of MSDS sheets to Engineer on delivery of materials.

1.4 Sheeting and Shoring

- .1 Provide sheeting and shoring as required for installation of underground works to provide construction safety for workmen in accordance with National and Territorial regulations.

1.5 Propane Cylinders

- .1 Propane cylinders shipped to site must be provided with a locked, tamper proof, closure cap for the operating valve.
- .2 Propane to be stored in accordance with Territorial regulations.
- .3 Propane cylinders and containers of other flammable materials to be stored in a locked and well ventilated area to prevent theft, vandalism etc.

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 Section Includes

- .1 Barriers.
- .2 Environmental Controls.

1.2 Related Sections

- .1 Section 01510 - Temporary Utilities.
- .2 Section 01520 - Construction Facilities.

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 Guard Rails and Barricades

- .1 Provide secure, rigid guard rails and barricades around excavations and open ice areas.

1.5 Access to Site

- .1 Provide and maintain access roads as may be required for access to Work.

1.6 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.

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 Fires

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

1.2 Disposal of Wastes

- .1 Do not bury rubbish and waste materials on site unless approved by Engineer.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .3 All waste material is to be disposed of at the community landfill site. The Contractor is responsible to obtain all permits.

1.3 Drainage

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with municipal and territorial requirements.

1.4 Work Adjacent to Waterways

- .1 Do not operate construction equipment in waterways without proper silt containment measures in place.
- .2 Use borrow material from watercourse beds when approved by Engineer.
- .3 Do not dump excavated fill, waste material or debris in waterways, except as authorized.

1.5 Pollution Control

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Use of silt curtain is required when excavating in waterways.
- .3 Control emissions from equipment and plant to municipal and Territorial emission requirements.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 General

- .1 Use new material and equipment unless otherwise specified.
- .2 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
- .3 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.

1.2 Manufacturers Instructions

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify Engineer in writing of any conflict between these specifications and manufacturers instructions. Engineer will designate which document is to be followed.

1.3 Delivery and Storage

- .1 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.
- .2 Prevent damage, adulteration and soiling of material and equipment during delivery, handling and storage. Immediately remove rejected material and equipment from site.
- .3 Store material and equipment in accordance with supplier's instructions.
- .4 Touch-up damaged factory finished surfaces to Engineer's satisfaction. Use primer or enamel to match original..

PART 2 PRODUCTS

2.1 Materials

- .1 Quality:
 - .1 Refer to GC 22.
 - .2 Unless otherwise stipulated elsewhere in the Contract Documents, the Contractor shall provide and pay for labour, products, tools, construction machinery and equipment, water, heat, light, power, transportation and other facilities and services necessary for the performance of the work in accordance with the Contract.
 - .3 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

- .4 Defective products, whenever identified prior to the completion of work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but 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.
- .5 Should any dispute arise as to the quality or fitness of products, the decision rests strictly with the Engineer based upon the requirements of the Contract Documents.
- .6 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item.
- .2 Availability:
 - .1 Immediately upon signing Contract, review product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of products are foreseeable, notify the Engineer 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 the event of failure to notify the Engineer at commencement of work and should it subsequently appear that work may be delayed for such reason, the Engineer reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.
- .3 Transportation:
 - .1 Pay costs of transportation and handling of products required in the performance of work.

PART 3 EXECUTION

3.1 Not Used

- .1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 References

- .1 Labour Standards Act of the Nunavut Territory, Canada Occupational Safety and Health Regulations.
- .2 Canadian Standards Association (CSA)
- .3 Nunavut Territory
 - .1 Safety Act, R.S.N.W.T. 2003.

1.2 Work Permit

- .1 Obtain all permits related to project prior to commencement of Work.

1.3 Safety Assessment

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

1.4 Meetings

- .1 Pre-construction meetings: attend health and safety pre-construction meeting.

1.5 Regulatory Requirements

- .1 Comply with specified standards and regulations to ensure safe operations at site containing hazardous or toxic materials.

1.6 Responsibility

- .1 Be responsible for safety of persons and property on site and for protection of persons off 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, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 Unforeseen Hazards

- .1 Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of Work, immediately stop work and advise Engineer verbally and in writing.

1.8 Correction of Non-Compliance

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

1.9 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.
- .2 Assign responsibility and obligation to Contractor's Health and Safety Officer to stop or start Work when, at Health and Safety Officer's discretion, it is necessary or advisable for reasons of health or safety. Engineer may also stop Work for health and safety considerations.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not used.

PART 3 EXECUTION

3.1 Not Used

- .1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 References

- .1 Labour Standards Act of the Nunavut Territory, Canada Occupational Safety and Health Regulations.
- .2 Canadian Standards Association (CSA)
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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 Record Drawings

- .1 Engineer will provide two (2) sets of white prints for record drawing purposes.
- .2 Maintain project record drawings and record accurately deviations from Contract documents.
- .3 Record changes in red. Mark on one set of prints and at completion and prior to final inspection, neatly transfer notations to second set and submit both sets to Engineer.
- .4 Record following information:
 - .1 Depths of various elements of culvert installation in relation to project benchmark.
 - .2 Horizontal and vertical location of utilities and appurtenances referenced to project benchmark.
 - .3 Location of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by Change Order or Field Instruction.
- .5 Redlined drawings:
 - .1 Redlined drawings must be completed by the Contractor and submitted to Engineer. Engineer will update electronic copies of drawings.
 - .2 Provide reduced copies of as-built drawings received from Engineer for inclusion in Operations and Maintenance Manuals.

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 Operations and Maintenance Manual

- .1 Operations and Maintenance Manuals for the project will be produced by the Contractor, as outlined in Section 2.1.2.
- .2 Manuals are to cover all installed items requiring or likely to require operating, maintenance, or repairs.
- .3 The Contractor's work includes: the complete authoring, organization, and supply of O&M manual material as detailed in this section.
- .4 All work described in this section is the Contractor's work except where specifically indicated otherwise.
- .5 The number of copies required is six (6).
- .6 The draft Operation and Maintenance manual is to be submitted for review by the Engineer a minimum of four (4) weeks prior to requesting Substantial Completion.
- .7 The final approved and completed Operation and Maintenance Manuals are to be delivered to the Engineer at least 14 days before the Substantial Completion inspection. The data is to be separated into individual manual sets, organized into applicable categories of work parallel to the specification sections and each chapter in order and identified.

1.2 Reference Standards

- .1 The Contractor's Operation and Maintenance manual submissions are to conform to the current edition of "Specifications for Operations and Maintenance Manuals", Department of Public Works and Services, Government of Northwest Territories.

PART 2 FORMAT

2.1 Organization

- .1 The provision of Binders and Dividers are the responsibility of the Contractor.
- .2 The completed manual will contain 10 chapters. The responsibility for production of each chapter is indicated below:
 - .1 Introduction (by Consultant)
 - .2 Index (by Contractor)
 - .3 Background, Design Data (by Consultant)

- .4 Schematic, Functional Data (by Consultant)
- .5 Components Details (by Contractor)
- .6 Operating Procedures (by Consultant and Contractor)
- .7 Maintenance Procedures (by Contractor)
- .8 Testing and Certification Data (part by Contractor)
- .9 Manufacturer Data and Service Information (by Contractor)
- .10 Appendices (by Contractor)
- .3 Group information logically by system within chapters to the greatest possible extent. Organize the information on each system in the most logical fashion, for example, from supply point through to point of use.

2.2 Language

- .1 English for all information.

2.3 Testing and Certification Data (Chapter 8)

- .1 List all items that require periodic inspection by independent inspectors. List the frequency of inspection, the inspection agency to contact, including address and current phone number.
- .2 Include a photocopy of each certificate issued by the independent inspectors who make inspections pursuant to health, safety, and other regulations of a similar nature. Indicate where the original of each such certificate is filed and where it is to remain displayed.
- .3 Include the originals of manufacturer's warranties and certificates issued by the independent inspectors in Copy 1 of the manual.
- .4 Include clear, legible photocopies of manufacturers' warranties and certificates issued by the independent inspectors in copies 2 through 6.
- .5 Group warranties together to form a section in Chapter 8.

2.4 Manufacturer's Information (Chapter 9)

- .1 This chapter of the Operation and Maintenance manual provides a collection of all manufacturer's service manuals, parts lists, operating and maintenance instructions, and other applicable data that may be required in future years.

- .2 Include information needed for operation, maintenance and repair of every system component , and any other system requiring or likely to require operation or routine maintenance.
- .3 Preface this section with an index. List in order each item by the manufacturer's name and the pieces of equipment to which it refers. Include supplier's name, address, and phone number.
- .4 Include:
 - .1 Maintenance instructions for finished surface and materials.
- .5 Include all service manuals, data sheets, and other manufacturer's information for each component.
- .6 Manufacturer's information is to be original in all copies of the manual. Photocopies are not acceptable.
- .7 On the first page of each inclusion, identify the piece of equipment to which it refers.
- .8 Remove pages from manufacturer's information that are irrelevant to the equipment provided to this project.
- .9 Where tables and curves are given for the full range of sizes, underline in red in all copies the data that refers to the installed equipment. If more than one size or type in the same table was used, add the identification for each in the margin to assist positive identification. Draw a thick diagonal black line across all data not applicable to equipment provided.
- .10 If any warning instructions are included which, if ignored, could significantly affect the equipment, mark these with red arrows in all copies, to draw to the operator's attention.
- .11 Service manuals must be the operating and maintenance type, which gives parts lists, preferably including an exposed or sectioned drawing for guidance in assembling, installation details, lubrication, and operations details. Sales types of brochures, which give only a very general description and few details, are not acceptable.
- .12 Mount any items that are smaller than 8½"x 11", on a full page, for inclusion in the manual.
- .13 Include all wiring diagrams complete with wire coding.

PART 3 EXECUTION

3.1 Not Used

- .1 Not Used

END OF SECTION

PART 1 GENERAL

1.1 Section Includes

- .1 Administrative procedures preceding preliminary and final inspections of Work.

1.2 Related Sections

- .1 Section 01810 - Commissioning.

1.3 Inspection and Declaration

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
 - .2 Request Engineer's Inspection.
- .2 Engineer's Inspection: Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Operation of systems have been demonstrated to Owner's personnel.
 - .5 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Engineer and Contractor. If Work is deemed incomplete by Owner and Engineer, complete outstanding items and request re-inspection.
- .5 Declaration of Substantial Completion: when Owner and Engineer consider deficiencies and defects have been corrected and final Operations and Maintenance Manuals are ready for submission, make application for certificate of Substantial Completion by way of GN form.
- .6 Commencement of Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be dated for commencement for warranty period.
- .7 Final Payment: When Owner and Engineer agree that final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, Contractor shall apply for Final Inspection. If Work is deemed incomplete, complete outstanding items and request re-inspection.

PART 2 PRODUCTS

2.1 Not Used

.1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

Approved: 2002-12-04

Part 1 General

1.1 SECTION INCLUDES

- .1 Includes general requirements for commissioning facilities and facility systems.

1.2 RELATED SECTIONS

- .1 Section 01210 - Allowances.
- .2 Section 01450 - Quality Control.

1.3 QUALITY ASSURANCE

- .1 Provide testing organization services under provisions specified in Section 01450 - Quality Control.
- .2 Comply with applicable procedures and standards of the certification sponsoring association.
- .3 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

1.4 SUBMITTALS

- .1 Prior to start of Work, submit name of Contractor personnel proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
- .2 Submit documentation to confirm personnel compliance with quality assurance provision.
- .3 Submit 3 preliminary specimen copies of each of report forms proposed for use.
- .4 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.
- .5 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.5 PROCEDURES - GENERAL

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Notify Engineer 7 days prior to beginning of operations.
- .3 Accurately record data for each step.
- .4 Report to Engineer any deficiencies or defects noted during performance of services.

1.6 FINAL REPORTS

- .1 Organization having managerial responsibility shall make reports.
- .2 Ensure each form bears signature of recorder, and that of supervisor of reporting organization.
- .3 Identify each instrument used, and latest date of calibration of each.

1.7 CONTRACTOR RESPONSIBILITIES

- .1 Prepare each system for testing and balancing.
- .2 Cooperate with testing organization and provide access to equipment and systems.
- .3 Provide personnel and operate systems at designated times, and under conditions required for proper testing, adjusting, and balancing.
- .4 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

1.8 PREPARATION

- .1 Provide instruments required for testing, adjusting, and balancing operations.
- .2 Make instruments available to Engineer to facilitate spot checks during testing.
- .3 Retain possession of instruments and remove at completion of services.
- .4 Verify systems installation is complete and in continuous operation.

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 Section Includes

- .1 Procedures for demonstration and instruction of equipment and systems to Owner's personnel.

1.2 Related Sections

- .1 Section 01770 - Closeout Procedures
- .2 Section 01810 - Commissioning.

1.3 Description

- .1 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.4 Quality Control

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.5 Submittals

- .1 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Engineer's approval.
- .2 Give time and date of each demonstration, with list of persons present.

1.6 Preparation

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 Verify that designated personnel are present.

1.7 Demonstration and Instructions

- .1 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .2 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

PART 2 PRODUCTS

2.1 Not Used

- .1 Not Used.

PART 3 EXECUTION

3.1 Not Used

.1 Not Used.

END OF SECTION

SECTION 2 CONTENTS

Section 02072	Geotextiles	1 to 5
Section 02315	Excavating, Trenching and Backfilling	1 to 6
Section 02316	Rock Removal	1 to 2
Section 02317	Roadway Excavation, Embankment and Compaction	1 to 4
Section 02371	Rip-Rap	1
Section 02379	Preservation of Water Courses	1
Section 02631	Manholes and Catch Basins	1 to 4
Section 02641	Pipe Culverts	1 to 4
Section 02661	Sewage Storage Lagoons	1 to 5
Section 02701	Aggregates: General	1 to 3
Section 02721	Granular Base	1 to 4
Section 02723	Granular Sub-Base	1 to 3
Section 02842	Steel Post Delineators	1 to 2
Section 02844	Steel W-Beam Guide Rail	1 to 2

PART 1 GENERAL

1.1 Related Work

- .1 Section [01330 - Submittal Procedures].
- .2 Section [01355 - Waste Management Disposal].
- .3 Section [02315 - Excavating, Trenching and Backfilling].
- .4 Section [02317 - Roadway Excavation Embankment and Compaction].
- .5 Section [02393 - Revetments].
- .6 Section [02620 - Sub-Drainage].
- .7 Section [02622 - Foundation and Underslab Drainage].
- .8 Section [02071 - Geogrid Soil Reinforcement].

1.2 References

- .1 Construction Quality Assurance (CQA) Plan.
- .2 American Society for Testing and Materials (ASTM):
 - .1 ASTM D 5084, Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 - .2 ASTM D 5890, Standard Test Method for Water Absorption of Bentonite by the Porous Plate Method, Swell Index Test.
 - .3 ASTM D 4354, Standard Practice for Sampling of Geosynthetics for Testing.
 - .4 ASTM D 5993 Test Method for Measuring Mass per Unit Area of Geotextiles
 - .5 ASTM D 5891 Fluid Loss in Bentonite ClaysAmerican Society for Testing and Materials (ASTM)

1.3 Quality Control Certificates

- .1 At least two (2) weeks prior to start of work, furnish CQA Consultant with copies of mill test data and certificate that GCL delivered to job site meets requirements of this Section.

The certificate shall include:
 - Roll numbers and identification,
 - Sampling procedures, and
 - Results of quality control tests, including a description of test methods used.
- .2 Remove and replace uncertified material and replace with new material at no cost to the Owner.

1.4 Material Warranty

- .1 Provide the Owner with a written warranty against manufacturing defects for period of twenty (20) years from the date of installation.

1.5 Guarantee

- .1 Provide the Owner with a written guarantee against defects in installation and workmanship for a period of five (5) years from the date of final acceptance, including the services of qualified technicians and materials necessary to make repairs, at no cost to the Owner.

1.6 Measurement for Payment

- .1 Measurement for payment will be in square metres of area covered. The unit price quoted shall include the supply and installation of the GCL, all labour, materials, equipment necessary for the proper execution of the works.
- .2 No allowance will be made for fabric overlap at joints or seams and wastage.
- .3 All testing required for quality control certificates to be included in Contractor's cost at no cost to the Owner.
- .4 Testing of field samples ordered by Engineer and conducted by testing company to be at Owner's cost, except that costs of "failed" tests shall be deducted from monies owing to the Contractor.

PART 2 PRODUCTS

2.1 Material

- .1 The geotextile component to be non-woven, needle punched polypropylene or polyester material with Minimum Average Roll Values meeting or exceeding the criteria specified Table 1523-3-1.
- .2 Provide test results from the Manufacturer for the product, as well as a certification that the material properties meet or exceed the specified values, at the frequency indicated in Table 1523-3-2.
- .3 Synthetic material to be manufactured from inert polymeric materials which retain their structure during handling, placement and long-term service, have satisfactory resistance to acid and alkali action, are indestructible by micro-organisms and insects and are ultra violet light resistant.
- .4 GCL to be manufactured by either adhesive /glue bonding or the mechanical bonding of the needlepunch process. Bentonite to consist of montmorillonite (sodium bentonite).
- .5 If manufactured by needle punch process, verify that the geotextile component has been inspected continuously for the presence of broken needles using an in-line metal detector. Employ a method acceptable to the CQA Consultant for removal of broken needles.

- .6 Verify that the proper mass per unit area of bentonite has been added to the product as specified in Table 1523-3-1.
- .7 Test all material in accordance with the Manufacturer's quality control program. Samples not satisfying the Manufacturer's specifications shall result in the rejection of the applicable rolls. At the Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify the non-complying rolls and/or qualify individual rolls.
- .8 GCL to be supplied in rolls of minimum 3.6 metre continuous width.
- .9 Minimum roll length to equal Manufacturer's standard minimum length.
- .10 During shipping and on-site storage, protect the GCL at all times against exposure from sun; moisture, contamination by mud, dust, dirt; puncture; tearing and any other damaging or deleterious conditions. Contaminated GCL may require removal as directed by Engineer.

2.2 Labeling

- .1 Each GCL roll to have a waterproof label which contains the following information:
 - Manufacturer's name
 - Production Identification
 - Lot Number
 - Roll Number
 - Roll Weight; and
 - Roll Dimensions

PART 3 EXECUTION

3.1 Installation

- .1 Place/Handle all GCL in such a manner as to ensure it is not damaged in any way.
- .2 In the presence of wind, sufficiently weight all GCL's with sandbags or the equivalent. Install such sandbags during placement and maintain in place until replaced with cover material.
- .3 Cut GCL using an utility blade in a manner recommended by the Manufacturer and exercise due care to prevent damage to any underlying or adjacent liner system components during cutting.
- .4 Take care during placement not to entrap stones or moisture under the GCL and not to walk on or drag equipment across the exposed GCL.
- .5 Replace or properly repair any GCL damaged by stones or other foreign objects, or installation activities at no additional cost to Owner.

- .6 If white coloured geotextile is used to encapsulate the bentonite, take precautions against "snowblindness" of personnel.
- .7 Do not install the GCL on standing water. Install the GCL in a way that reduces the potential for hydration of the mat prior to completion of construction of the overlying liner system.
- .8 Do not install the GCL during precipitation, high winds or other conditions that may cause rapid hydration of or damage to the GCL.
- .9 Install the GCL as indicated by the Manufacturer or Engineer.
- .10 Place soil layers (clay liner, granular sub-liner sampler blanket) or geomembrane overlying the geosynthetic clay liner, immediately following the installation of the GCL. Remove the GCL and replace if it becomes hydrated before the overlying soil layer or geomembrane is placed, at Contractor's expense.
- .11 Remove and replace all hydrated GCL with new material at no additional cost to Owner.

3.2 Overlaps

- .1 Overlap all GCL panels. Along the length of the mat, the overlap shall be a minimum of 150 mm or as specified by the Manufacturer. Along the width of the mat, the overlap shall be a minimum of 0.3 m, as specified by the Manufacturer or Engineer. The edges of the GCL panels should be adjusted to smooth out any wrinkles, creases, or "fishmouths" in order to maximize contact with the underlying panel.
- .2 Do not nail or staple the overlaps to the underlying materials.
- .3 Place panels from the highest to the lowest elevation within the area to be lined. Up-slope panels to be shingled over down-slope panels in order that flow is over the seam and not into the seam.
- .4 After panels are placed establish proper overlap orientation and pull back the edge of the panel to expose the overlap zone. Remove any soil or other deleterious material present in the overlap zone.
- .5 Place or pour a fillet of granular bentonite, Volclay®, or other sealing material acceptable to the Engineer, in a continuous manner along the overlap zone at a rate of at least 1800 grams per lineal metre (0.25 pound per lineal foot) to seal the overlaps.
- .6 No vehicles permitted directly on geotextile.

3.3 Repair

- .1 Repair any holes or tears in the GCL by placing a GCL patch over the hole, overlapping the edges of the hole or tear by at least 0.3 m in all directions. The patch may be secured with a water-based adhesive approved by the Manufacturer.
- .2 Take care to remove any soil or other material which may have penetrated the torn GCL.

- .3 Make all repairs at no additional cost to Owner.
- .4 Do not nail or staple patches.

3.4 Placement of Overlaying Materials

- .1 Place materials above the GCL in such a manner as to ensure that the GCL is not damaged.
- .2 Do not drive equipment used for placing other materials directly on the GCL. In areas of heavy vehicle traffic, such as access ramps, the soil thickness should be at least 1.0 m.
- .3 Ensure that the GCL is not damaged while working around the appurtenances and ensure that connections of the GCL to appurtenances are properly sealed, including using bentonite if required.

3.5 Product Protection

- .1 Protect all prior work and materials.
- .2 In the event of damage, immediately make all repairs and replacements necessary, to the approval of Engineer and at no additional cost to the Owner.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 02701 - Aggregates: General.

1.2 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 117- 03, Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136- 01, Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 422- 63(2002), Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D 698- 00, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN-m/m³).
 - .5 ASTM D 4318- 00, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1- 88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2- M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1- 94, Concrete Materials and Methods of Concrete Construction.
- .4 Contractor is to complete his work in compliance with the Department of Fisheries Authorization. A letter of authorization has been applied for by the Owner. The Contractor shall be responsible to meet the terms and conditions of the letter of Authorization from DFO. The cost to provide a silt curtain around the excavation throughout the underwater section shall be included in the contract price.

1.3 Definitions

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock : any solid material in excess of 0.25 m³ and which cannot be removed by means of duty mechanical excavating equipment having a 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 Waste material: excavated material unsuitable for use in work or surplus to requirements.

- .3 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.
 - .4 Unsuitable materials:
 - .1 Weak and compressible materials under excavated areas.
 - .2 Frost susceptible materials under excavated areas.
 - .3 Frost susceptible materials:
 - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 : Sieve sizes to CAN/CGSB-8.1.
 - .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.
 - .5 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.4 Samples

- .1 Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2 Inform Engineer at least four (4) weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.
- .3 Submit 70 kg samples of type of fill specified.
- .4 Ship samples prepaid to Ottawa, in tightly closed containers to prevent contamination.

1.5 Protection of Existing Features

- .1 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Prior to commencing excavation work, notify applicable owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
 - .3 Confirm locations of buried utilities by careful test excavations.
 - .4 .

- .2 Existing buildings and surface features:
 - .1 Conduct, with Engineer, condition survey of existing buildings, service poles, wires, survey bench marks and monuments which may be affected by work.
 - .2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Engineer.

1.6 Shoring, Bracing and Underpinning

- .1 Protect existing features in accordance with Section 01560 - Temporary Barriers and Enclosures and applicable local regulations.
- .2 Engage services of qualified professional engineer who is registered or licensed in the Nunavut Territory, Canada in which work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for work.
- .3 Submit design and supporting data at least two (2) weeks prior to commencing work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Nunavut Territory, Canada.

PART 2 PRODUCTS

2.1 Materials

- .1 Type 1 and Type 2 fill: properties to section 02701 - Aggregates: General and the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.
 - .3 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 Engineer for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

- .3 Unshrinkable fill: proportioned and mixed to provide:
 - .1 Maximum compressive strength of 0.4 MPa at 28 days.
 - .2 Maximum Portland cement content of 25 kg/m³.
 - .3 Minimum strength of 0.07 MPa at 24 h.
 - .4 Concrete aggregates: to CAN/CSA-A23.1.
 - .5 Portland cement: Type 10.
 - .6 Slump: 160 to 200 mm.
- .4 Silt Curtian
 - .1 The silt curtain to be constructed of a woven geo-textile. Standard of Acceptance: Typar 3401.
 - .2 Curtain to be weighted using standard heavy gage chain, or similar stable material. Weights to be free of all grease or other soluble materials.

PART 3 EXECUTION

3.1 Site Preparation

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Install silt curtain prior to any excavation of riverbed materials below the water elevation. Silt curtain to extend from the top of the ice surface to the top of the riverbed. Gaps in the silt curtain are not permitted.

3.2 Stockpiling

- .1 Stockpile fill materials in areas designated by Engineer. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

3.3 Excavation

- .1 Advise Engineer at least seven (7) days in advance of excavation operations for initial cross sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions as indicated Engineer.
- .3 For trench excavation, unless otherwise authorized by Engineer 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.
- .4 Dispose of surplus and unsuitable excavated material off site.
- .5 Do not obstruct flow of surface drainage or natural watercourses.

- .6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .7 Notify Engineer when bottom of excavation is reached.
- .8 Obtain Engineer approval of completed excavation.
- .9 Remove unsuitable material from trench bottom to extent and depth as directed by Engineer.
- .10 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with fill concrete.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 95 % of corrected maximum dry density.
- .11 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Engineer.

3.4 Fill Types and Compaction

- .1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
 - .1 Exterior side of perimeter walls: use Type 3 fill to subgrade level. Compact to 95%.
- .2 Place bedding and surround material in unfrozen condition.

3.5 Backfilling

- .1Do not proceed with backfilling operations until Engineer has inspected and approved installations.
- .2Areas 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 unshrinkable fill in areas as indicated. Consolidate and level unshrinkable fill with internal vibrators.
- .5 Vibratory compaction equipment: Use a hand compactor in trench.
- .6 Shape bed true to grade to provide continuous uniform bearing surface for pipe using type I material.
- .7 Shape transverse depressions in bedding as required to suit joints.
- .8 Compact each layer full width of bed to at least 95% maximum density to ASTM D698.

- .9 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

3.6 Restoration

- .1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects as directed by Engineer.
- .2 Clean and reinstate areas affected by work as directed by Engineer.

END OF SECTION

Approved: 2001-12-04

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01330 - Submittal Procedure.
- .2 Section 01560 - Temporary Barriers and Enclosures.
- .3 Section 01705 - Health and Safety.
- .4 Section 02315 - Excavating, Trenching and Backfilling.

1.2 MEASUREMENT PROCEDURES

- .1 Quantities will be taken from cross section showing original rock surface and actual grade line set by Engineer, except that minimum depth of rock required to be excavated to be considered as 50 mm.

1.3 DEFINITION

- .1 Rock: any solid material in excess of 0.25 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 PPV: peak particle velocity.

1.4 SUBMITTALS

- .1 Blasting Operation
 - .1 Submit to Engineer and local authorities having jurisdiction for approval, written proposal of operations for removal of rock by blasting, in accordance with Section 01330 - Submittal Procedures.
 - .2 Indicate proposed method of carrying out work. Include details on protective measures, time of blasting and other pertinent details.
 - .3 Submit records to Engineer at end of each shift. Maintain complete and accurate record of drilling and blasting operations.

1.5 QUALIFICATIONS

- .1 Retain licensed explosives expert to program and supervise blasting work, and to determine precautions, preparation and operations techniques.

1.6 BLASTING SURVEY AND MONITORING

- .1 Engineer will visit property holders of adjacent buildings and structures to determine existing conditions and describe blasting and seismic recording operations.

1.7 BLASTING AND VIBRATION CONTROL

- .1 Reduce ground vibrations to avoid damage to structures or remaining rock mass.

Part 2 Products

2.1 MATERIALS

- .1 Not used.

Part 3 Execution

3.1 PROTECTION

- .1 Prevent damage to surroundings and injury to persons in accordance with Section 01560 - Temporary Barriers and Enclosures. Erect fencing, post guards, sound warnings and display signs when blasting to take place.

3.2 ROCK REMOVAL

- .1 Co-ordinate this Section with Section 01705 - Health and Safety.
- .2 Remove rock to alignments, profiles, and cross sections as indicated.
- .3 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.
- .4 Excavate trenches to lines and grades to minimum of 50 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- .5 Cut trenches to widths as indicated.
- .6 Use pre-shearing, cushion blasting or other smooth wall drilling and blasting techniques or directed by Engineer.
- .7 Remove boulders and fragments which may slide or roll into excavated areas.
- .8 Correct unauthorized rock removal at no extra cost, in accordance with Section 02315 - Excavating, Trenching and Backfilling.

3.3 ROCK DISPOSAL

- .1 Dispose of surplus removed rock off site.
- .2 Do not dispose removed rock into landfill. Material must be sent to appropriate location as approved by the Engineer.

END OF SECTION

Part 1 GENERAL

1.1 References

- .1 ASTM D698-98, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).

1.2 Definitions

- .1 Rock Excavation: excavation of:
 - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort from Caterpillar D9L or equivalent to be considered integral with parent mass.
 - .2 Boulder or rock fragments measuring in volume one (1) cubic meter or more.
- .2 Common Excavation: excavation of materials that are not Rock Excavation or Stripping.
- .3 Unclassified Excavation: excavation of whatever character other than stripping encountered in the work.
- .4 Stripping: excavation of organic material covering original ground.
- .5 Over Haul: authorized hauling in excess of free haul distance that excavated material is moved.
- .6 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to top of subgrade.
- .7 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
- .8 Borrow Material: material obtained from areas outside right-of-way and required for construction of embankments or for other portions of work.

1.3 Requirements of Regulatory Agencies

- .1 Adhere to regulations of authority having jurisdiction if blasting is required.
- .2 Adhere to Territorial and National Environmental requirements if potentially toxic materials are involved.

Part 2 PRODUCTS

2.1 Materials

- .1 Embankment materials require approval by Engineer.
- .2 Borrow material:
 - .1 Obtain from borrow pit to be approved by Engineer.

Part 3 EXECUTION

3.1 Compaction Equipment

- .1 Compaction equipment must be capable of obtaining required densities in materials on project. Equipment that does not achieve specified densities must be replaced or supplemented.
- .2 Operate minimum equivalent of one 12 tonne vibratory packer continuously in each embankment when placing material.

3.2 Excavating

- .1 General:
 - .1 Notify Engineer whenever waste materials are encountered and remove to depth and extent directed.
 - .2 Subcut 500 mm below subgrade in cut sections unless otherwise directed. Compact top 150 mm below subcut to minimum 95% maximum dry density, ASTM D698 (AASHTO T99). Replace with approved embankment material and compact.
 - .3 Where subgrade is on transition from excavation to embankment treat ground slopes at grade points as directed by Engineer.
- .2 Drainage:
 - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
 - .2 Provide ditches as work progresses to provide drainage.
 - .3 Construct interceptor ditches as shown on plans or as directed before excavating or placing embankment in adjacent area.
- .3 Rock excavation:
 - .1 If, during excavation, material appearing to conform to classification for rock is encountered, notify Engineer and provide sufficient time to enable measurements to be made to determine volume of rock.
 - .2 Shatter rock to 300 mm below subgrade elevation as indicated on plans.

- .3 Reduce overbreak and increase stability of all rock faces by using smooth blasting techniques, such as pre-shearing, cushion blasting, buffer blasting, perimeter blasting and line drilling.
- .4 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.
- .5 Control blasting to minimize flying particles.
- .4 Borrow Excavation:
 - .1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
 - .2 Obtain embankment materials in excess of what is available from cut areas from designated borrow areas.
 - .1 Engineer to designate extent of borrow areas and allowable depth of excavation.
 - .2 Remove waste and stripping material from borrow pits to designated locations.
 - .3 Slope edges of borrow areas to minimum 3:1 and provide drainage as directed.
 - .4 Trim and leave borrow pits in condition to permit accurate measurement of material removed.

3.3 Embankments

- .1 When directed, scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces. Method used to be subject to prior approval of Engineer.
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized.
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
 - .1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Engineer may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .6 Where material consists of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.
 - .2 Carefully distribute rock material to fill voids with smaller fragments to form compact mass.

- .3 Fill surface voids at subgrade level with rock spalls or selected material to form an earth-tight surface.
- .4 Do not place boulders and rock fragments with dimensions exceeding 150 mm within 300 mm of subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

3.4 Subgrade Compaction

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Compact each layer to minimum 95% maximum dry density, ASTM D698 (AASHTO T99) except top 150 mm of subgrade. Compact top 150 mm to 100% maximum dry density.
- .3 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

3.5 Finishing

- .1 Shape entire roadbed to within 50 mm of design elevations.
- .2 Finish slopes, ditch bottoms and borrow pits to neat condition, true to lines, grades and drawings where applicable.
- .3 Remove rocks over 150 mm in any dimension from slopes and ditch bottoms.
- .4 Hand finish slopes that cannot be finished satisfactorily by machine.
- .5 Round top of backslope 1.5 m both sides of top of slope.
- .6 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

3.6 Protection

- .1 Maintain finished surfaces in condition conforming to this section until acceptance by Engineer.

END OF SECTION

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01561 - Environmental Protection.

1.2 Environmental Requirements

- .1 Operation of construction equipment in water is prohibited.
- .2 Use borrow material from watercourse beds when approved by Engineer.
- .3 Design and construct temporary crossings to minimize environmental impact to watercourse.
- .4 Constructing temporary crossings of watercourses when spawning beds are indicated is prohibited.
- .5 Placing material in watercourse is to be completed in accordance with the Department of Fisheries and Oceans requirements.

PART 2 PRODUCTS

2.1 Preparation

- .1 Obtain work permits from governing Federal, Territorial and/or Municipal authorities.

PART 3 EXECUTION

3.1 Existing Conditions

- .1 Maintain existing flow pattern in natural watercourse systems.

3.2 Site Clearing

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

3.3 Drainage

- .1 Pumping water containing suspended materials into watercourse is prohibited.

END OF SECTION

.....1996-06-30

PART 1 GENERAL

1.1 Related Work

- .1 Section 02701- Aggregates: General
- .2 Section 02315 - Excavating, Trenching and Backfilling

1.2 References

- .1 ASTM D1759 Standard Practice for Design of HDPE Manholes for Subsurface Applications.
- .2 ASTM F894 Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.
- .3 ASTM F714 Standard Practice for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .4 ISO 9001:2000 Quality management systems - Requirements

1.3 Material Certification

- .1 Submit manufacturer's test data and certification at least four (4) weeks prior to commencing work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.4 Measurement for Payment

- .1 Excavation and backfill will be measured in accordance with Section 02315- Excavating Trenching and Backfilling.
- .2 Manholes will be measured in units within depth classifications as follows, measured from top of cover or grating to top of base slab:
 - .1 2 m or less.
 - .2 Greater than 2 m but not more than 2.5 m.
 - .3 Greater than 2.5 m but not more than 3 m.
 - .4 Greater than 3 m but not more than 3.5 m.
 - .5 Further stages in increments of 0.5 m.
- .3 Outfall structures will be measured in units.
- .4 Gratings will be measured in units supplied and installed.

PART 2 PRODUCTS

2.1 Materials

- .1 The riser pipe shall only be manufactured from a closed profile high density polyethylene pipe that conforms to the requirements of section 5.1 'Base Materials' of ASTM F894, and that no materials other than the approved base materials shall be used to manufacture the pipe. When requested to do so, the manufacturer shall certify that the materials used to manufacture the riser pipe meets these requirements.
- .2 All solid wall pipe used in the manhole fabrication shall meet the requirements of ASTM F714 and shall conform to the OD and DR requirements specified on the contract documents.
- .3 The polyethylene raw material for riser pipe and solid wall pipe shall contain a minimum of 2%, well dispersed finely divided carbon black for UV stabilization. Additives that can be conclusively proven not to be detrimental to the pipe may also be used provided that the pipe produced meets or exceeds all of the requirements of this specification.
- .4 The pipe shall contain no recycled compound except that generated in the manufacturers' own plant.
- .5 The pipe manufacturers Quality System shall be certified as meeting the requirements of an ISO 9001:2000 Quality management system, by a qualified independent body.
- .6 The riser pipe material and all solid wall pipe shall be resistant to corrosion resulting from the presence of Hydrogen Sulfide and to pH values between 2 and 13.
- .7 The riser pipe shall be manufactured with dimensions and tolerances in accordance with the manufacturer's internal manufacturing standard. The pipe must meet the requirements of ASTM F894 when the pipe is marked as such. The nominal inside diameter of the pipe shall be true to the specified pipe size. The pipe shall be manufactured by the continuous winding of a closed profile onto suitably sized mandrels. It shall be produced to constant internal diameters.
- .8 When more than 1 length of riser pipe is used to fabricate the riser, the termination of the helically wound profile that forms the pipe shall be manufactured with a 30° plated end cut.
- .9 The pipe shall have a minimum Ring Stiffness Class of ____ Lb./Ft as defined in ASTM F894.
- .10 The pipe shall be manufactured in such a manner that the pipe is available in lengths from 3-60 feet. A variety of lengths are available to accommodate installation, storage or varying ground conditions. Unless otherwise stated, the standard laying length shall be 50 feet (15 meters). Each standard and random

length of pipe in compliance with ASTM F894 shall be clearly marked as such as required by the standard.

- .11 The pipe shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects. The pipe shall be as uniform as commercially practical in color, opacity, density and other physical properties.
- .12 Manholes shall be designed in accordance with the requirements of ASTM D1759. The design shall be based on the site conditions identified on the project drawings and / or as identified by the owner.

PART 3 EXECUTION

3.1 Excavation and Backfill

- .1 Excavate and backfill in accordance with Section 02315 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Engineer before installing outfall structures and manhole.

3.2 Installation

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Dewater excavation to approval of Engineer and remove soft and foreign material before placing base.
- .3 Set manhole base on 150 mm minimum of granular bedding compacted to 100% maximum density to ASTM D 698.
- .4 Compact granular backfill to [95]% maximum density to ASTM D 698.
- .5 Place unshrinkable backfill in accordance with Section 02315 - Excavating, Trenching and Backfill.
- .6 Place frame and cover on top section to elevation as indicated. If adjustment required use mandhole riser ring.
- .7 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
- .8 Install safety platforms in manholes having depth of five (5) m or greater, as indicated.
- .9 Manholes shall be factory fabricated to ensure consistency in product assembly.
- .10 All joints in riser pipe sections shall be formed by extrusion welding along the helical 'profile cut' joints. Unless otherwise specifically noted on the contract documents, the

profile winding shall be cut and sealed at a 30 ° angle, prior to extrusion welding of adjacent sections, to prevent flow along the pipe wall helix.

- .11 All joints in solid wall pipe shall be by fusion welding unless specifically stated otherwise on the contract documents.
- .12 All joints between the HDPE base plate, manhole base slope sections, manhole riser pipe, and mainline pipe extensions, shall be by extrusion welding. All extrusion welds shall conform to the requirements of the contract documents and WPS KWH01 (or equivalent).
- .13 Connection of solid wall (ASTM F714) manhole stub extensions to HPDE mainline pipe meeting the same specification may be by mechanical connection, or by fusion welding.
- .14 All fusion welds must be made following the fusion equipment manufacturers recommendations or the pipe manufacturers' butt fusion procedures.

3.3 Leakage Test

- .1 Install watertight plugs or seals on inlets and outlets of each new manhole and fill manhole with water. Leakage not to exceed 0.3% per hour of volume of manhole.
- .2 If permissible leakage is exceeded, correct defects. Repeat until acceptable to Engineer.
- .3 Engineer will issue Test Certificate for each manhole passing test.
- .4 Leak Testing: Installed sections of the fabricated HDPE manhole shall be examined for leaks by in-filtration where the ground water is 'high', or by ex-filtration where the ground water is 'low'.
- .5 In-filtration Testing: The ground water table around the manhole must be at least 1 foot above the highest fabrication weld elevation of the section being examined. The joints may be examined visually for leaks. **No leaks should be observed.** If a leak is observed, it will be necessary to lower the water table below the area of the leak, and to completely dry and clean the area prior to undertaking a repair weld.
- .6 Ex-filtration Testing: Establish a water level within the manhole that is at least 1 foot above the highest fabrication weld. Allow to stand for a minimum of 12 hours. *(The profile wall PE pipe will 'relax' due to the imposed internal pressure by minor deflection of the inside surface of the profile wall, increasing the volume inside the pipe.)* Add additional water as required to return the height of water to the original level. Let stand for 1 hour and measure the amount of water required to return the standing head to the initial level. Repeat three (3) times. The volume of 'make-up' water required in each subsequent step should be less than the preceding step. The values of 'make-up' water over time should trend to zero (0).

END OF SECTION

..... 1999-12-16

PART 1 GENERAL

1.1 Related Sections

- .1 Section 02315 - Excavating, Trenching and Backfilling.
- .2 Section 02317 - Roadway Excavation, Embankment and Compaction.
- .3 Section 02701- Aggregates: General
- .4 Section 01330 - Submittal Procedures
- .5 Section 01355 - Waste Management and Disposal
- .6 Section 01610 - Basic Product Requirements

1.2 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 117-95, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 698-91(1998), Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
 - .4 ASTM D 1248-98, Standard Specification for Polyethylene Plastics Molding and Extrusion Materials for Wire and Cable.
 - .5 ASTM F 667-97, Standard Specification for 8, 10, 12, and 15 inch Corrugated Polyethylene Tubing and Fittings.
- .2 Canadian Standards Association (CSA)
 - .1 CAN3-G401-93, Corrugated Steel Pipe Products.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire.
 - .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 Samples

- .1 Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2 Inform Engineer at least four (4) weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling.

1.4 Material Certification

- .1 Submit manufacturer's test data and certification at least four (4) weeks prior to commencing work.
- .2 Certification to be marked on pipe.

1.5 Delivery, Storage and Handling

- .1 Deliver, store and handle materials in accordance with Section 01610 - Basic Product Requirements.

PART 2 PRODUCTS

2.1 Corrugated Steel Pipe

- .1 Corrugated steel pipe: to CAN3-G401.
- .2 Water-tight cut-off collars: as indicated.
- .3 Prefabricated end sections: as indicated.
- .4 Corrugated fluming: to CAN3-G401.

2.2 Granular Bedding and Backfill

- .1 Granular bedding and backfill material to Section 02701- Aggregates: General and following requirements:
 - .1 Crushed pit run or screened stone, gravel or sand.

PART 3 EXECUTION

3.1 Trenching

- .1 Do trenching work in accordance with Section 02315- Excavating Trenching and Backfilling.
- .2 Obtain Engineer's approval of trench line and depth prior to placing bedding material or pipe.

3.2 Bedding

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry.
- .2 Place minimum thickness of 200 mm of approved granular material on bottom of excavation and compact to minimum 95% maximum density to ASTM D 698.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Engineer, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.3 Laying Corrugated Steel Pipe Culverts

- .1 Commence pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.
- .5 Do not allow water to flow through pipes during construction except as permitted by Engineer.

3.4 Joints: Corrugated Steel Culverts

- .1 Corrugated steel pipe:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .3 Insert and tighten bolts.
 - .4 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved by Engineer or two coats of zinc rich epoxy paint.
- .2 Structural plate:
 - .1 Erect in final position by connecting plates with bolts at longitudinal and circumferential seams.
 - .2 Drift pins may be used to facilitate matching of holes.
 - .3 Place plates in sequence recommended by manufacturer with joints staggered so that not more than three plates come together at any one point.
 - .4 Draw bolts up tight, without overstress, before beginning backfill.
 - .5 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint or two coats of zinc rich epoxy paint approved by Engineer.

3.5 Backfilling

- .1 Backfill around and over culverts as indicated or as directed by Engineer.
- .2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .3 Compact each layer to 95% maximum density to ASTM D 698 taking special care to obtain required density under haunches.

- .4 Protect installed culvert with minimum 900 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
- .5 Place backfill in unfrozen condition.

3.6 Fluming

- .1 Assemble and install fluming as indicated.
- .2 Set top edges of fluming flush with side slope.

END OF SECTION

..... 1996-06-30

PART 1 GENERAL

1.1 Related Work

- .1 Section 01330 - Submittal Procedures
- .2 Section 02231- Clearing and Grubbing
- .3 Section 02371- Rip-Rap
- .4 Section 02631- Manholes and Catch Basins.
- .5 Section 02701- Aggregates: General

1.2 References

- .1 ASTM C117-90, Test Method for Material Finer Than 0.075mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C136-84a, Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600kN-m/m³).
- .4 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire.
- .5 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 Samples

- .1 Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2 Submit to Engineer for testing, samples of following materials at least four (4) weeks prior to commencing work:
 - .1 Two samples 3600mm square of flexible lining including joint or intersecting joints if included in work.
 - .2 Two samples 600mm long of flexible lining including joint or intersecting joints if included in work.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.
- .2 Indicate following items:
 - .1 Liner panels, details of anchoring panels, material, thickness and reinforcement.
 - .2 Projections through liner and method of sealing.
 - .3 Piping.

.4 Sluice or slide gates.

.5 Valves.

1.5 Classification of Excavation

- .1 General: excavation of rock, common and unclassified materials shall include placing of suitable excavated materials in embankment fills or dikes, and disposal of unsuitable material.
- .2 Rock excavation: excavation of material from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass, and boulders or rock fragments having individual volume in excess of Jm^3 .
- .3 Common excavation: excavation of all materials of whatever nature, which are not included under definition of rock excavation, including dense tills, hardpan and frozen materials.
- .4 Unclassified excavation: excavation of deposits of whatever character encountered in work.

1.6 Measurement for Payment

- .1 Construction of sewage lagoon: lump sum payment.

PART 2 PRODUCTS

2.1 Materials

- .1 Rip-rap: to Section 02371- Rip-Rap.
- .2 Granular material to Section 02701- Aggregates: General and following requirements:
 - .1 Stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .3 Table

Sieve Designation	% Passing	
	Stone and Gravel	Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	-	-
19 mm	[100]	-
12.5 mm	-	-
9.5 mm	-	-
4.75 mm	[40-70]	[100]
2.00 mm	-	[50-100]
0.425 mm	[0-3]	[10-50]
0.180 mm	-	-

Sieve Designation	% Passing	
	Stone and Gravel	Sand
0.075 mm	-	[0-5]

PART 3 EXECUTION

3.1 Stripping of Topsoil

- .1 Commence topsoil stripping of area as directed by Engineer after area has been cleared and grubbed.
- .2 Strip topsoil to depths as directed by Engineer. Avoid mixing topsoil with subsoil.
- .3 Stockpile in locations as directed by Engineer.
- .4 Dispose of unused topsoil as directed by Engineer.

3.2 Excavation

- .1 Excavate effluent ditches, by-pass ditches or re-routed surface drainage ditches as indicated.
- .2 Remove unsuitable materials from dike foundation to depth as indicated.
- .3 Excavate basin for lagoon to lines and elevations indicated.

3.3 Dike Construction

- .1 Construct dikes as indicated.
- .2 Place dike material in unfrozen condition.
- .3 Place dike materials in layers of 150mm compacted thickness. Compact each layer to 95% maximum density to ASTM D 698.
- .4 Hand finish or grade slopes and top of completed dike to remove stones over 25 mm in size and other debris.
- .5 Finish slopes and top of dike as indicated.
- .6 Rip-rap areas indicated in accordance with Section 02454- Rip-Rap.

3.4 Installation of Sewers

- .1 Construct and install required manholes in accordance with Section 02631- Manholes and Catch Basins.
- .2 Install valves, sluice gates, and slide gates in accordance with manufacturer's recommendations.

3.5 Flexible Lining

- .1 Place compacted layer of granular material in unfrozen condition on bottom and sides of lagoon as indicated.
- .2 Check surface on which flexible liner is to be placed and remove projections that may puncture lining.
- .3 Place liner panels as directed by Engineer or as indicated. Anchor panels temporarily using sand bags or other weights that will not damage liner.
- .4 Excavate anchor trenches at locations as indicated.
- .5 Place and secure liner in anchor trenches.
- .6 Backfill and compact anchor trenches.
- .7 Clean edges of panels to be spliced and join as outlined in manufacturer's recommendations.
- .8 Complete anchoring of panels at base of slope.
- .9 Cut liner sheets to fit accurately around inlets, outlets, sleeves, concrete structures and other projections through lining.
- .10 Complete flashing and sealing of penetrations as indicated.
- .11 Place cover blanket as indicated.

3.6 Rip-Rap

- .1 Place rip-rap in accordance with Section 02371- Rip-Rap and as indicated.

3.7 Leakage Testing

- .1 Fill lagoon with water to depth of approximately 450mm.
- .2 Mark level of water surface at minimum of 3 points approximately 50m apart.
- .3 Check and record levels of water surface daily for two weeks to accuracy of 1mm.
- .4 Fill watertight pan of at least 1m² area to depth of 200mm in location near lagoon and exposed to weather.
- .5 If, during two (2) week period, there is loss of water in lagoon in excess of water loss in test pan of more than 25mm, locate leaks and repair.
- .6 Repeat above test if repairs were made.
- .7 Perform test and repairs at no cost to Owner.
- .8 When test results are acceptable to Engineer, proceed with clean up of site.

3.8 Clean Up

- .1 Remove surplus material and debris from site.

END OF SECTION

Part 1 GENERAL

1.1 Related Sections

- .1 Section 02315 – Excavating, Trenching and Backfilling
- .2 Section 03302 – Cast-In-Place Concrete.
- .3 Section 01330 - Submittal Procedures.

1.2 References

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

1.3 Samples

- .1 Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2 Allow continual sampling by Engineer during production.
- .3 Provide Engineer with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor, to allow Engineer to obtain representative samples of items being produced.
- .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

Part 2 PRODUCTS

2.1 Materials

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.
 - .2 Manufactured sand.
 - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

- .1 Crushed rock.
- .2 Gravel and crushed gravel composed of naturally formed particles of stone.
- .3 Light weight aggregate, including slag and expanded shale.

2.2 Source Quality Control

- .1 Inform Engineer of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in opinion of Engineer, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.
- .3 Advise Engineer 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 EXECUTION

3.1 Preparation

- .1 Aggregate source preparation
 - .1 Prior to excavating materials for aggregate production, clear area to be worked, and strip unsuitable surface materials. Dispose of cleared and unsuitable materials as directed by Engineer.
 - .2 When excavation is completed dress sides of excavation to nominal [1.5:1] slope, and provide drains or ditches as required to prevent surface standing water.
 - .3 Trim off and dress slopes of waste material piles and leave site in neat condition.
- .2 Processing
 - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
 - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Engineer.
 - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Engineer.
 - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .3 Handling
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .4 Stockpiling

- .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Engineer.
- .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 Engineer within 48 h of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Max 1.5 m for coarse aggregate and base course materials.
 - .2 Max 1.5 m for fine aggregate and sub-base materials.
 - .3 Max 1.5 m for other materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

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

END OF SECTION

..... 1996-06-30

PART 1 GENERAL

1.1 Related Sections

- .1 Section 02317 - Roadway Excavation, Embankment and Compaction.
- .2 Section 02701- Aggregates General
- .3 Section 02722- Granular Sub-base

1.2 References

- .1 ASTM C117-90, Test Method for Material Finer Than 0.075mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C131-89, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136-92, Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .5 ASTM D1557-91, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
- .6 ASTM D1883-92, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- .7 ASTM D4318-84, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .8 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
- .9 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.3 Delivery, Storage, and Handling

- .1 Deliver and stockpile aggregates in accordance with Section 02701- Aggregates General. Stockpile minimum 50% of total aggregate required prior to commencing operation.
- .2 Store cement in weathertight bins or silos that provide protection from dampness and easy access for inspection and identification of each shipment.

PART 2 PRODUCTS

2.1 Materials

- .1 Granular base: material to Section 02701- Aggregates: General and following requirements:
 - .1 Crushed stone or gravel.

- .2 Gradations to be within limits specified when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.1.

- .1 Gradation to:

Sieve Designation	% Passing		
	(1)	(2)	(3)
100 mm	-	-	-
75 mm	-	-	-
50 mm	[100]	-	-
37.5 mm	[70-100]	-	-
25 mm	-	[100]	-
19 mm	[50-75]	-	[100]
12.5 mm	-	[65-100]	[70-100]
9.5 mm	[40-65]	-	-
4.75 mm	[30-50]	[35-60]	[40-70]
2.00 mm	-	[22-45]	[23-50]
0.425 mm	[10-30]	[10-25]	[7-25]
0.180 mm	-	-	-
0.075 mm	[3-8]	[3-8]	[3-8]

- .2 Material to level surface depressions to meet gradation (2) limits in accordance with 2.1.1.2.1.
- .3 Liquid limit: to ASTM D4318, maximum 25
- .4 Plasticity index: to ASTM D4318, maximum 6
- .5 Los Angeles degradation: to ASTM C131. Max. % loss by weight: 45
- .6 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least 1 freshly fractured face. Material to be divided into ranges using methods of ASTM C136.

Passing		Retained on
[50] mm	to	[25] mm
[25] mm	to	[19.0] mm
[19.0] mm	to	[4.75] mm

- .7 Soaked CBR: to ASTM D1883, min 80, when compacted to 100% of ASTM D1557.

PART 3 EXECUTION

3.1 Sequence of Operation

- .1 Place granular base after sub-base surface is inspected and approved by Engineer.
- .2 Placing
- .1 Construct granular base to depth and grade in areas indicated.
- .2 Ensure no frozen material is placed.
- .3 Place material only on clean unfrozen surface, free from snow and ice.
- .4 Begin spreading base material on crown line or on high side of one-way slope.

- .5 Place material using methods which do not lead to segregation or degradation of aggregate.
- .6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .7 Place material to full width in uniform layers not exceeding 150mm compacted thickness. Engineer may authorize thicker lifts (layers) if specified compaction can be achieved.
- .8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .9 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment
 - .1 Compaction equipment to be capable of obtaining required material densities.
 - .2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Engineer before use.
 - .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compacting
 - .1 Compact to density not less than 100% maximum dry density in accordance with ASTM D1557.
 - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
 - .3 Apply water as necessary during compacting to obtain specified density.
 - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Engineer.
 - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .5 Proof rolling
 - .1 For proof rolling use standard roller of 45400kg gross mass with four pneumatic tires each carrying 11350kg and inflated to 620kPa. Four tires arranged abreast with centre to centre spacing of 730mm.
 - .2 Obtain approval from Engineer to use non standard proof rolling equipment.
 - .3 Proof roll at level in granular base as indicated. If use of non standard proof rolling equipment is approved, Engineer to determine level of proof rolling.
 - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
 - .5 Where proof rolling reveals areas of defective subgrade:
 - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Engineer.

- .2 Backfill excavated subgrade with common material and compact in accordance with Section 02317 - Roadway Excavation, Embankment and Compaction.
- .3 Replace sub-base material and compact in accordance with Section 02317 - Roadway Excavation, Embankment and Compaction.
- .4 Replace base material and compact in accordance with this section.
- .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Engineer and replace with new materials in accordance with Section 02722- Granular Sub-base and this section at no extra cost.

3.2 Site Tolerances

- .1 Finished base surface to be within plus or minus 10mm of established grade and cross section but not uniformly high or low.

3.3 Protection

- .1 Maintain finished base in condition conforming to this section until succeeding material is applied or until acceptance by Engineer.

END OF SECTION

Approved: 2002-12-04

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01355 - Waste Management and Disposal.
- .2 Section 02701 - Aggregates: General.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-63(1998), Standard Test Method for Particle-Size Analysis of Soils.
 - .4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
 - .5 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft³) (2,700kN-m/m³).
 - .6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

Part 2 Products

2.1 MATERIALS

- .1 Granular sub-base material: in accordance with Section 02701 - Aggregates: General and following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

Table					
Sieve Designation	% Passing				
100 mm	-	-	-	-	-
75 mm	[100]	[100]	[100]	-	-
50 mm	-	-	-	[100]	-
37.5 mm	-	-	-	-	-
25 mm	[55-100]	-	-	-	[60-100]
19 mm	-	-	-	-	-

Sieve Designation	% Passing			
12.5 mm	-	-	-	[38-70]
9.5 mm	-	-	-	-
4.75 mm	[25-100]	[25-85]	-	[22-55]
2.00 mm	[15-80]	-	-	[13-42]
0.425 mm	[4-50]	[5-30]	[0-30]	[5-28]
0.180 mm	-	-	-	-
0.075 mm	[0-8]	[0-10]	[0-8]	[2-10]

.4 Other Properties as follows:

- .1 Liquid Limit: to ASTM D4318, Maximum 25.
- .2 Plasticity Index: to ASTM D4318, Maximum 6.
- .3 Particles smaller than 0.02 mm: to ASTM D422, Maximum 3%.
- .4 Soaked CBR: to ASTM D1883, Min 40 when compacted to 100% of ASTM D1557.

Part 3 Execution

3.1 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Engineer.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Engineer may authorize thicker lifts (layers) if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.

- .2 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Engineer.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 SITE TOLERANCES

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

3.4 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Engineer.

END OF SECTION

..... 2000-12-05

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01330 - Submittal Procedures.

1.2 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM B209-96, Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 62-GP-11M-78, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.
- .3 Manual of Uniform Traffic Control Devices for Canada

1.3 Samples

- .1 Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2 Submit to Engineer at least four (4) weeks prior to commencing work, following samples of materials proposed for use:
 - .1 Reflective markers.
 - .2 Galvanized steel posts.

PART 2 PRODUCTS

2.1 Reflective Markers

- .1 200 x 100 mm with 20 mm radius corners aluminum base panel with permanently attached reflective sheeting:
 - .1 Aluminum base panel: to ASTM B209M, 1.6 mm thick, degreased and etched or treated with light amorphous chromate type coating.
 - .2 Reflective sheeting: to CGSB62-GP-11M, type I, class I, reflectivity level I. Colour: yellow.

2.2 Steel Posts

- .1 Steel posts: galvanized steel sign standards 3.2 m long, flanged, "U" shaped in cross section, measuring 65 mm wide by 30 mm deep. Metal thickness: 4.5 mm. Pre-drill bolt holes in locations as indicated.
- .2 Bolts: 65 mm long galvanized steel, 9 mm minimum diameter. Each bolt to be complete with two nylon washers, cast block spacer and galvanized steel nut.

PART 3 EXECUTION

3.1 Assembly

- .1 Fasten reflective markers to steel posts using bolts, washers, spacers and nuts. Use two bolts for each delineator unit, centered and spaced at 150 mm.
- .2 Fasten two reflective markers back to back to each steel post for delineator units installed on two-way roads. Attach single reflective marker to each post for delineator units installed on one-way roads.

3.2 Installation

- .1 Do work in accordance with "Manual of Uniform Traffic Control Devices for Canada", (MUTCDC) except where specified otherwise.
- .2 Install posts vertically and as indicated and in no case more than 4.0 m nor less than 1.2 m from edge of pavement.
- .3 Locate centre of reflective marker 2.4 m above elevation of outside edge of adjacent lane in accordance with MUTCDC and at right angles to road centreline.
- .4 On straight alignment, space delineator units at 60 m.
- .5 On curves, space delineator units as follows:

Radius of Curve in Metres	Spacing in Metres on Curve	Spacing in Metres in Advance and Beyond		
		First Space	Second Space	Third Space
1500	42	60	60	60
1000	35	60	60	60
500	24	45	60	60
350	20	38	60	60
250	17	32	52	60
200	15	29	46	60
150	13	25	40	60
100	11	20	33	60
75	9	18	28	57
60	8	16	25	51
40	7	13	21	42

- .6 Five markers to be always visible to the right of the road on approaches to and throughout horizontal curves.

END OF SECTION

..... 1996-06-30

PART 1 GENERAL

1.1 Related Work

- .1 Section 01330 - Submittal Procedures

1.2 References

- .1 ASTM A307-91, Specification for Carbon Steel Bolts and Studs, 60,000psi Tensile.
- .2 CAN/CSA-O80 Series-M89, Wood Preservation.
- .3 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
- .5 CAN/CGSB-1.181-92, Ready Mixed Organic Zinc-Rich Coating.
- .6 CGSB 31-GP-107Ma-90, Non-inhibited, Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .7 AASHTO M180-79, Corrugated Sheet Steel Beams for Highway Guardrails.

1.3 Samples

- .1 Submit samples in accordance with Section 01330 - Submittal Procedures.
- .2 Inform Engineer at least four (4) weeks prior to commencing work, of proposed sources of guide rail and components.

PART 2 PRODUCTS

2.1 Materials

- .1 Steel W-beam guide rail as indicated and to following requirements:
 - .1 Steel rail and terminal sections: to AASHTO M180, class A Type 1 zinc coated.
 - .2 Bolts, nuts and washers: to ASTM A307, hot dip galvanized to CSA G164.
- .2 Organic zinc-rich coating: to CAN/CGSB-1.181.
- .3 Metal conditioner, and paints:
 - .1 Metal conditioner: to CGSB 31-GP-107Ma.
 - .2 Primer paint for galvanized steel: to CAN/CGSB-1.40.
- .4 Sawn timber posts and offset blocks:
 - .1 Species: SPF
 - .2 Type: pressure treated in accordance with CAN/CSA-O80 Series.
 - .3 Grade: 1.

.4 Dimensions: as indicated.

PART 3 EXECUTION

3.1 Erection

- .1 Set posts by instrument for alignment, and locations as indicated and as directed by Engineer.
- .2 Excavate post holes to depths as indicated and to diameter of 360mm plus or minus 20mm. Compact bottom to provide firm foundation. Set post plumb and square in hole.
- .3 Backfill around posts using excavated material and compact in uniform layers not exceeding 150mm compacted thickness.
- .4 Leave or make depression approximately 150mm deep around posts until painting is completed, then fill and compact to ground elevation.
- .5 Cut off tops of posts as indicated, with tops parallel to grade of pavement edge.
- .6 Treat cut tops with two coats of wood preservative.
- .7 Construct anchorages to details as indicated. Place and compact backfill for anchors as directed by Engineer.
- .8 Erect steel W-beam components to details as indicated. Lap joints in direction of traffic. Tighten nuts to 100N.m torque. Maximum protrusion of bolt 12mm beyond nut.

3.2 Painting Touch up

- .1 Galvanized steel-touch up:
 - .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas. Pre-treat damaged surfaces according to manufacturer's instructions for zinc-rich paint.

END OF SECTION

SECTION 3 CONTENTS

Section 03302	Cast-in-place Concrete	1 to 2
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1.0 General

.1 STANDARD

- .1 Concrete materials and methods of construction: to CAN/CSA-A23.1 unless otherwise specified.

.2 INSPECTION

- .1 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by Engineer, including on site storage and shipping. Contractor to provide access to the site. Engineer will complete at least 1 set of 3 cylinders for each pour that they inspect. Cost associated with production of the concrete for testing will be the responsibility of the contractor.
- .2 Give Engineer minimum 48 hours notice before each concrete pour.

.3 TESTING

- .1 The contractor to complete 1 set of 3 cylinders for all concrete pours on the reservoir. This testing is in addition to the testing completed by the engineer.
- .2 Concrete testing: to CAN/CSA-A23.2 by testing laboratory designated and paid for by contractor, including on site storage and shipping.

2.0 Products

.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A5, Type 50.
- .2 Reinforcing bars: to CAN/CSA-G30.18, Grade 400.
- .3 Waterstops: extruded ribbed PVC strips, 12 MPa tensile strength, minimum 350% elongation, minus 45 C to plus 80 C working temperature, sizes as indicated. Contractor to provide shop drawings for waterstop.
- .4 All other concrete materials: to CAN/CSA-A23.1.
- .5 Crystallization concrete waterproofing: Xypex Concentrate C-Series Admixture.

.2 MIX PROPORTIONS

- .1 Method: Alternative (1) of CAN/CSA-A23.1, Table 11.
- .2 Cement type: as specified under 2.1.

- .3 Minimum 28 day compressive strength shall be 32 MPa and exposure classification S-2.
- .4 Nominal size of coarse aggregate: Clause 14 of CAN/CSA-A23.1.
- .5 Slump: to Table 6 of CAN/CSA-A23.1. Slump to be 80 mm +/- 20 mm
- .6 Air content: all concrete to contain purposely entrained air in accordance with category 2, Table 9 of CAN/CSA-A23.1. Air Content to be 5 to 8 %
- .7 Admixtures: to Clause 6 of CAN/CSA-A23.1.

3.0 Execution

.1 INSERTS

- .1 Cast in sleeves, anchors, reinforcement, frames, conduit, bolts and other inserts required to be built-in.

.2 FINISHES

- .1 Formed surfaces shall receive a rough-form finish in accordance with CAN/CSA-A23.1.

.3 CURING

- .1 Cure and protect concrete in accordance with CAN/CSA-A23.1, except that curing compounds shall not be used.

END OF SECTION

SECTION 5 CONTENTS

Section 05500	Metal Fabrications	1 to 4
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..... 2000-12-05

PART 1 GENERAL

1.1 Related Sections

- .1 Section 01330 - Submittal Procedures
- .2 Section 01610 - Basic Product Requirements
- .3 Section 03300 - Cast-in-Place Concrete: Installation of anchors.

1.2 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A53/A53M-99b, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A269-98, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - .3 ASTM A307-97, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.
 - .3 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .2 CSA W59-M1998, Welded Steel Construction (Metal Arc Welding).

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01330 - Submittal Procedures.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 Protection

- .1 Deliver, store, handle and protect materials in accordance with Section 01610 - Basic Product Requirements.
- .2 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
- .3 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

PART 2 PRODUCTS

2.1 Materials

- .1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade[300W] [350W].
- .2 Steel pipe: to ASTM A53/A53M [standard weight] [extra strong] [double extra strong], black, galvanized finish.
- .3 Bolts and anchorbolts: to ASTM A307.
- .4 Stainless steel tubing: to ASTM A269, Type [302] [Commercial grade] [Seamless welded with AISI No[4] finish].
- .5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 Fabrication

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

2.3 Finishes

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.
- .2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.
- .3 Shop coat primer: to CAN/CGSB-1.40.
- .4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.
- .5 Bituminous paint: to CAN/CGSB-1.108.

2.4 Isolation Coating

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

2.5 Shop Painting

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

2.6 Access Ladders

- .1 Stringers: [] x [] x [] mm thick, [steel] [angle].
- .2 Steel Rungs: [] x [] x [] mm thick, angle, welded to stringers at [] mm oc.
- .3 Brackets: sizes and shapes as indicated, weld to stringers at [] mm o.c., complete with fixing anchors.
- .4 Galvanize finish for exterior, prime paint for interior.
- .5 Galvanize exterior ladders after fabrication.

2.7 Trench Covers and Frames

- .1 Steel fabricate from 6 mm thick raised pattern plate set in L 55 x 55 x 6 frame. Include anchors at 1200 mm oc for embedding in concrete. Supply trench covers in 1200 mm removable lengths.
- .2 Finish: [galvanized] [prime coat painted].

PART 3 EXECUTION

3.1 Erection

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Engineer such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

- .7 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .8 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 Access Ladders

- .1 Install access ladders in locations as indicated.
- .2 Erect ladders [____] mm clear of wall on bracket supports.

3.3 Trench Covers

- .1 Install trench covers in locations as indicated.

END OF SECTION

SECTION 6 CONTENTS

Section 06101	Rough Carpentry Short Form	1 to 2
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..... 1997-11-07

PART 1 GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA B111-1974, Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-M1978, Douglas Fir Plywood.
 - .4 CAN/CSA-O141-91, Softwood Lumber.
 - .5 CSA O151-M1978, Canadian Softwood Plywood.
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 1991.

1.2 Quality Assurance

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

PART 2 PRODUCTS

2.1 Lumber Material

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.

2.2 Accessories

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

2.3 Wood Preservative

- .1 Surface-applied wood preservative: coloured or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.

- .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.3 .

PART 3 EXECUTION

3.1 Preparation

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

END OF SECTION

SECTION 15 CONTENTS

Section 15011	High-Density Polyethylene Piping	1 to 2
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PART 1 GENERAL

1.1 Related Work

Section 02315 Excavating, Trenching and Backfilling

1.2 References

- .1 ASTM C518- 91, Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- .2 ASTM D638M- 89, (D638-90), Test Method for Tensile Properties of Plastics.
- .3 ASTM D1248- 84(1989), Specification for Polyethylene Plastics Molding and Extrusion Materials.
- .4 ASTM D1505- 90, Test Method for Density of Plastics by the Density-Gradient Technique.
- .5 ASTM D1621- 73(1979), Test Method for Compressive Properties of Rigid Cellular Plastics.
- .6 ASTM D1622- 88, Test Method for Apparent Density of Rigid Cellular Plastics.
- .7 ASTM D2657- 90, Practice for Heat Joining of Polyolefin Pipe and Fittings.
- .8 ASTM D2837- 90, Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
- .9 ASTM D2856- 87, Test Method for Open Cell Content of Rigid Cellular Plastics by the air Pycnometer.
- .10 ASTM F714- 90, Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
- .11 ASTM G14- 83, Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test).
- .12 CAN/CSA-B137.1- M89, Polyethylene Pipe, Tubing and Fittings for Cold Water Pressure Services.

1.3 Product Data

- .1 Submit product data in accordance with Section 01330 - Submittal Procedures.

1.4 Material Certification

- .1 At least 4 weeks prior to commencing work submit manufacturer's test data and certification that materials meet requirements of this section.

- .2 Record Drawings
- .3 Provide data necessary to produce record drawings on project completion in accordance with the following requirements:
 - .1 Give details of pipe material, location of fittings, maintenance and operating instructions.

PART 2 PRODUCTS

2.1 Carrier Core Pipe

- .1 Polyethylene pressure pipes to CSAB137.1 ASTM F714:
 - .1 Type PE3408 for ASTM F714, DR 17.
 - .2 Pressure rating:
 - .1 DR 17 for ASTM F714.
- .2 Polyethylene to polyethylene joints: thermal butt fusion joined to ASTM D2657.
- .3 Polyethylene fittings: to AWWA C906 for pipe sizes NPS4 to NPS63.

2.2 Factory Applied Insulation

- .1 Pipes to be cleaned of surface dust or dirt and treated if necessary to ensure positive bond of foam to entire pipe surface.
- .2 Material: rigid polyurethane foam factory applied.
- .3 Insulation thickness: 50 mm.
- .4 Density: to ASTM D1622, 0.032 to 0.048 g/cm³.
- .5 Closed cell content: to ASTM D2856, 90 % minimum.
- .6 Water absorption: to ASTM D2842, 4.0 g/1000 cm³, maximum 4.25% by volume.
- .7 Compressive strength: to ASTM D1621, up to 240 kPa.
- .8 Thermal conductivity: to ASTM C518, 0.022 to 4 W/m C°.
- .9 Service Temperature: minus 45°C to plus 120°C.
- .10 Centering of pipe within insulation: no more than plus or minus 6mm off center.
- .11 Protect insulation on both ends of pipe from moisture and sunlight by 3mm thick continuous concentration of black asphalt mastic compound.

2.3 Outer Jacket for Buried Applications

- .1 Material: factory applied high-density polyethylene jacket, black in colour (UV inhibited).
- .2 Density of HDPE jacket: to ASTMD1505, 0.940 g/cm³ minimum.
- .3 Sealant: synthetic polymers or modified rubber mastic.
- .4 Jacket thickness: 1.14 mm minimum.
- .5 Elongation: to ASTMD638, 400 % maximum 6 month test.
- .6 Service temperature: minus 45 °C to plus 120 °C maximum.
- .7 Water vapour transmission rate: 3 g/m²/24 h average.
- .8 Tensile strength: 25 kg/cm width minimum.
- .9 Impact strength: to ASTMG14, 7.79 N/m at minus 40 °C minimum.

2.4 Pipe Bedding and Surround Materials

- .1 granular material to following requirements:
 - .1 Crushed or screened stone or sand consisting of hard, durable, particles, free from clay lumps, cementation, organic material and other deleterious materials to Section 02315.
 - .2 ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

2.5 Backfill Materials

- .1 Backfill material in accordance with Section 02315 Excavating, Trenching and Backfilling.

PART 3 EXECUTION

3.1 Unloading and Handling of Polyethylene Pipe

- .1 Unload from trucks or containers by hand or by lifting apparatus with fabric slings. Do not use cables or chains.
- .2 Once removed, store on smooth surface. Lay pipes flat. Where sleepers are desired use several lengths of wide planks to provide broad bearing surface.
- .3 Lift, do not drag, insulated pipes from storage area to job site.
- .4 Follow manufacturer's recommendations.

3.2 Repairing Damaged Pipe

- .1 Repair any damage to outer jacket by applying heat shrink sleeve to approval of Engineer or cover using heated HDPE UV resistant adhesive backed tape.

3.3 Trenching

- .1 Do trenching work in accordance with Section 02315 - Excavating, Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1 m from finished grade.
- .3 Trench alignment and depth require Engineer's approval prior to placing bedding material or pipe.

3.4 Granular Bedding and Surround

- .1 Place bedding and surround material in unfrozen condition.
- .2 Place materials in uniform layers not exceeding 150 mm compacted thickness up to 300 mm above top of pipe. Compact each layer before placing succeeding layer. Avoid compaction directly over pipe with less than 300 mm of cover.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.
- .4 Shape transverse depressions in bedding as required to make joints.
- .5 Compact each layer full width of bed to at least 90 % maximum density to ASTM D698.
- .6 Fill authorized excavation or unauthorized over excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.5 Pipe Installation

- .1 On dry ground, assemble shipping lengths of pipe into suitable installation lengths by heat butt-fusion.
- .2 Provide trained personnel and jointing machine approved by pipe manufacturer for butt-fusion jointing of polyethylene pipe. Obtain services of trained technician from pipe manufacturer to certify and/or train Contractor's personnel on jointing procedures and inspect jointing machine. Obtain letter from manufacturer certifying that Contractor's representative(s) who will perform jointing, is/are qualified and that jointing equipment has been inspected and is suitable for pipe supplied.
- .3 Follow manufacturer's instructions in butt-fusion of joints.
- .4 Join pipes at flanged ends in accordance with manufacturer's recommendations.
- .5 Recheck pipe joints assembled above ground after placing in trench to ensure no movement of joints has taken place.

- .6 Complete installation of rigid polyurethane halves on joints after laying pipe in trench and after successful pressure testing of pipe.
- .7 Install heat shrink sleeves using large broad flame propane torch to produce 600 mm flame.
 - .1 Peel back release liner 12 cm from end, centre sleeve over joint and press firmly down. Wrap sleeve around pipe, removing release liner as it is wrapped. If corner on underlap is not precut, then cut off about 25 mm from each corner.
 - .2 Before completing overlap wrapping, warm underlap area approximately 12 cm until adhesive starts to appear at edge. Smooth out any wrinkles with gloved hand.
 - .3 Remove remaining release liner and complete wrapping.
 - .4 Remove release paper from closure seal, prewarm adhesive slightly, centre seal over overlap and press down until well bonded. Heat closure seal, and press down with gloved hand to remove any bubbles and wrinkles.
 - .5 With torch, start at centre of sleeve and shrink it all around joint. Keep torch moving using broad circumferential strokes to avoid burning. continue shrinking sleeve toward one end until about 50mm is left. Then aim torch inward towards centre and shrink edges. Repeat this operation on other end of sleeve. Finish off by applying long horizontal strokes of torch all around sleeve.
 - .6 Pay special attention to sleeve overlap area, ensuring no void remains along underlap edge. Use roller, or gloved hand to firmly and thoroughly press down along underlap edge. Start in centre and work outwards.
 - .7 Allow joint and sleeve to cool for at least 30 min before lowering pipe into trench.
 - .8 Lay pipes on prepared bed, true to line and grade as indicated. No deviations to be made without written approval of Engineer. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take out and replace defective pipe. Correct pipe that is not in true alignment or grade, or pipe that shows undue settlement after installation. Change method or equipment for setting alignment or grade if requested by Engineer.
 - .9 Do not lay pipe on frozen bedding.
 - .10 Do not let rocks or other foreign material, which might damage insulation jacket, fall on pipe.
 - .11 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Install removable watertight bulkhead at open end of pipe to prevent entry of foreign materials.

3.6 Pipe Backfilling

- .1 Do backfilling work in accordance with Section 02315 - Excavating Trenching and Backfilling.
- .2 Lay continuous runs of warning tape on top of surround material 300 mm directly above water mains.

- .3 Upon completion of pipe laying and after Engineer has inspected work in place, surround and cover pipes between joints.
- .4 Protect pipe from freezing if temperatures lower than minus 5°C.
- .5 When Engineer accepts testing results, surround and cover joints and fittings with surround material placed and compacted as specified.
- .6 Place backfill material above pipe surround, in uniform layers not exceeding 150 mm compacted thickness.
- .7 Mechanically compact each layer to at least 90 % maximum density to ASTM D698.

3.9 Testing

1. Give five (5) days written notice of date for tests.
2. Insulated or conceal work only after testing and approval by Engineer.
3. Engineer reserves the right to be present during testing.
4. Bear costs including retesting and making good.
5. Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.
6. Hydrostatically test the high density polyethylene piping systems prior to installation in accordance with the following procedures, as recommended by the pipe manufacturer:
 - .1 Over a period of three (3) hours, slowly raise the pressure in the pipe to 1.5 times the rated pressure of the pipe.
 - .2 During the next 1 hour, maintain the required test pressure.
 - .3 Start the test after the above described initial "pipe stretch" period.
 - .4 Observe and record the hydrostatic pressure in the pipe over the next 3 hour period at ½ hour intervals.
 - .5 At the end of the 3 hour test period, measure the amount of makeup water required to be added to the system to return the pipe to the test pressure.
 - .6 An acceptable test is one for which the amount of makeup water does not exceed the following:

<u>Nominal Pipe Size</u>	<u>Maximum Allowable Makeup Water @ 23°C.</u>
100	5.0
250	7.8

300

12.6

Correction (Multiplication) factor to be applied to make up water.

<u>Pipe Testing Temperature</u>	<u>Allowance in Table Above</u>
23°C	1.0
22°C	0.875
20°C	0.75
18°C	0.66
16°C	0.60
14°C	0.53
12°C	0.47
10°C	0.42
8°C	0.36
6°C	0.325

For pipe testing temperatures between those listed above, interpolate correction factor.

For pipe testing temperatures above or below limits tabulated, contact Engineer.

- .7 Allow a minimum of 8 hours between successive polyethelene pipe tests to allow pipe to “relax”.
- .8 Hydrostatically test steel piping system by pressurizing with water to 860kPa, and maintaining this pressure for a period of 4 hours without leakage.
- .9 Flush out all new piping with fresh, clean water for a period of one (1) hour following final pressure test.
- .10 Provide written documentation of all test results, for acknowledgement by Engineer.

3.10 Flushing and Disinfecting Water Lines

- .1 Flushing and disinfection operations shall be carried out by the Contractor and must be witnessed by the Public Works Representative, or Engineer. Notify the Engineer at least five (5) days in advance of the proposed date when disinfecting operation will commence.
- .2 Complete all leakage procedures, standards and tests before flushing and disinfection.

- .3 Before being placed into service, all new process piping shall be flushed and disinfected.
- .4 Flush all piping through available outlets with a sufficient flow to produce a velocity of 1.5 m/s, within the pipe for thirty (30) minutes, or until all foreign materials have been removed and the flushed water is clear. This includes the intake casings and is to be completed prior to final installation.
- .5 Supply materials and test kits to carry out disinfection tests for total and fecal coliforms; and total and residual chlorine at no additional cost to the Owner.
- .6 Disinfect immediately after flushing. Disinfect all potable water pipes. Use either Method A or B as indicated:

Method A

- .1 Fill piping system with chlorine/water solution with a strength of at least 50mg/L. Ensure pipe is full and no air pockets remain.
- .2 Leave solution in piping system for 24 hours, while maintaining a pressure of 175 kPa.
- .3 After 24 hours sample and test the chlorine solution for total and fecal coliform (FC) levels. If the chlorine residual is at least 25 mg/L and the FC levels are within acceptable limits, the disinfection will be considered successful. Flush chlorine solution from the piping system. Protect against contamination of the disinfected system.
- .4 If the chlorine residual is less than 25 mg/L or the total and FC levels are unacceptable, flush the piping system, clean any deleterious material, reflush and disinfect again. Repeat until satisfactory.

Method B

- .1 Introduce chlorine solution into the intake casing to achieve a chlorine residual of 50 mg/L in the discharge pipe, which is to be recirculated back to the pump.
- .2 Operate the pump and allow the chlorine solution in the intake casing. Operate continuously for 2 hours.
- .3 After 2 hours sample and test the chlorine solution and the total and fecal coliform (FC) levels. If the chlorine residual is at least 25mg/L and the total and FC levels are within acceptable limits, the disinfection will be considered successful. Flush chlorine

solution from the piping system. Protect against contamination of the disinfected system.

- .4 If the chlorine residual is less than 25mg/L or the total and FC levels are unacceptable, flush the piping system, clean any deleterious material, reflush and disinfect again. Repeat until satisfactory.
- .7 The Contractor shall collect two (2) samples of disinfectant solution for bacteriological testing. The Contractor is responsible for submitting the samples to an accredited laboratory for total and fecal coliform testing for verification of field tests. The results are to be sent to the Engineer for confirmation.
- .8 If, in the opinion of the Engineer, any component of the potable water system becomes contaminated after disinfection, it shall be flushed and disinfected again at no additional cost to the Owner.
- .9 Do not discharge flush water or disinfection solution to the Mackenzie River. Flush water is to be disposed of at the community sewage lagoon.SPEC NOTE: Re 3.11. Delete where not applicable.

END OF SECTION