Fisheries and Oceans Canada

Conuma Hatchery Rearing Tub Project

Specifications

F1700-140647/A

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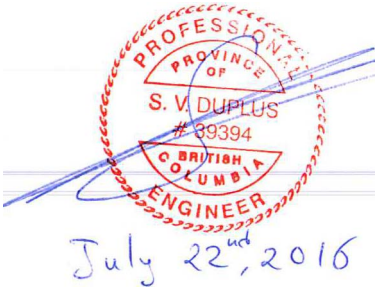
Drawings:
Refer to drawing package under separate cover.



Division 01 - General Requirements

1. General

.1 Not used

2. Documents Required

.1 Maintain at job site, one (1) copy of 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. All reference standards required by this contract.

3. Work Schedule

.1 Submit with Tender, a construction schedule on the "Construction Schedule" form included in the Tender Documents, showing anticipated progress stages and final completion of work within time period required by Contract Documents. The schedule is to be updated monthly or as required by the Departmental Representative.

4. Contractor's Use of Site

.1 Do not unreasonably encumber site with materials or equipment.

.2 Move stored products or equipment which interfere with operations of Departmental Representative or other contractors.

.3 Obtain and pay for use of additional storage or work areas needed for operations.

.4 Maintain reasonable access.

.5 Maintain a reasonably clean and safe site.

5. Codes and Standards

.1 Perform work in accordance with National Building Code of Canada, latest edition, and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.

.2 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Provincial Government, WorkSafeBC, Workplace Hazardous Materials Information System Requirements, including training of all workers on the job site, and municipal status and authorities.

.3 Meet or exceed requirements of specified standards, codes and referenced documents.

.4 Where work is situated on land managed by different legislative bodies the contractor will meet the requirements set out by the authorities responsible. In any case of conflict between the requirements set out by the authorized body and these contract documents, the more stringent requirements shall apply.

6. Project Meetings

.1 Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.

7. Existing Conditions

.1 Inspect surfaces and conditions before commencing work and report defects to the Consultant. No work to commence until conditions are acceptable. Commencement of work will indicate acceptance of surfaces and conditions.

8. Setting out of Work

.1 Locate and preserve general reference points.

.2 Employ competent person to lay out work in accordance with control lines and grades provided by Departmental Representative.

.3 Supply stakes and other survey markers required for this work.

.4 The detailed layout is the responsibility of the Contractor.

9. Location of Equipment and Fixtures

.1 Location of equipment, fixtures and outlets indicated or specified is to be considered as approximate.

10. Additional Drawings

.1 Departmental Representative may furnish additional drawings to assist proper execution of work. These drawings will be issued for clarification only. Such drawings shall have same meaning and intent as if they were included with plans referred to in Article 1 of Articles of Agreement.

11. Relics and Antiquities

.1 Relics and antiquities such as cornerstones and similar objects found on site or in buildings to be demolished, shall remain property of the Owner. Protect such articles and request directives from Departmental Representative.

.2 Give immediate notice to Departmental Representative if evidence of archaeological finds are encountered during

construction, and await his written instructions before proceeding with work in that area.

12. Site Maintenance and Clean-up

.1 Maintain the working area in an orderly manner and not encumbered with equipment, materials, or debris.

.2 Clean-up to be a continuing process from the start of the work to final acceptance of the project. At all times, and without further order, keep property on which work is in progress free from accumulations of waste materials or rubbish caused by employees or by the work. Accumulations of waste materials which might constitute a fire hazard will not be permitted. Spillage from the Contractor's hauling vehicles on traveled public or private roads to be promptly cleaned up. On completion of construction, remove all temporary structures, rubbish, and waste materials resulting from construction operations.

13. Ambiguities

.1 In the event of discrepancies and ambiguity in the contract document, manufacturers guidelines and relevant provincial and federal regulations the Contractor shall notify the Departmental Representative for clarification. The more stringent requirement shall apply unless otherwise instructed in writing by the Departmental Representative.

END OF SECTION

Part 1 General

1.1 Work Covered by Contract Documents

.1 Work of this Contract comprises and shall be further identified as “the Work” and shall include the following:

.1 Install eight 16 foot diameter circular fiberglass rearing tubs and all appurtenances as indicated in the contract drawings and specifications.

.2 Install supply water mains and drain pipes as indicated in the contract drawings and specifications.

1.2 Work Sequence

.1 Construct Work in a single stage to accommodate Owner's continued use of premises during construction.

.2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction.

.3 Maintain fire access/control.

1.3 Contractor Use of Premices

.1 Unrestricted use of site until Substantial Performance.

.2 Co-ordinate use of premises under direction of.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.4 Owner Occupancy

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.5 Existing Services

.1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 72 hours’ notice for necessary interruption of mechanical

or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to vehicular traffic and tenant operations.

.3 Provide alternative routes for personnel and vehicular traffic.

.4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.

.5 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Provide temporary services when directed by Departmental Representative to maintain critical building and tenant systems.

.7 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.

.8 Protect, relocate or Departmental Representative maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

.9 Record locations of maintained, re-routed and abandoned service lines.

.10 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.6 Documents Required

.1 Maintain at job site, one copy each document as follows:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Reviewed Shop Drawings.
- .5 List of Outstanding Shop Drawings.
- .6 Change Orders.
- .7 Other Modifications to Contract.
- .8 Field Test Reports.
- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 Administrative

.1 Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not produced in SI Metric units converted values are acceptable.

.5 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.6 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.7 Verify field measurements and affected adjacent Work are co-ordinated.

.8 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

1.2 Shop Drawings and Product Data

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

.2 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia of Canada.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 15 days for Departmental Representative review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Departmental Representative review, distribute copies.

.10 Submit electronic copy and 6 prints of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit 6 electronic copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit 6 copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within 3 years of date of contract award for project.

.13 Submit 6 copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit 6 copies of manufacturers instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit 6 copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit 3 copies and electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.3 Photographic Documentation

.1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement as directed by Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

1.4 Certificates and Transcripts

.1 Immediately after award of Contract, submit Workers' Compensation Board status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

PART 1 - GENERAL

1.1 General

.1 Submit to the Departmental Representative, for review, shop drawings, product data and samples specified.

.2 Until submission is reviewed, work involving relevant product may not proceed.

1.2 Shop Drawings

.1 Drawings to be originals prepared by Contractor, Sub-Contractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate Sections.

.2 Identify details by reference to sheet and detail numbers shown on Contract Drawings.

.3 Maximum sheet size 860 mm x 1120 mm.

.4 Reproductions for submissions: opaque diazo prints, photocopies and original manufacturers' information.

.5 Shop Drawings are to be sealed before submission by a Professional Departmental Representative registered in British Columbia.

1.3 Product Data

.1 Certain Specification Sections, specify that manufacturer's standard schematic drawings, catalogue sheets, diagram, schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings.

.2 Above will only be accepted if they conform to the following:
- .1 Delete information which is not applicable to project.
- .2 Supplement standard information to provide additional information applicable to project.
- .3 Show dimensions and clearances required.
- .4 Show performance characteristics and capacities.
- .5 Show wiring diagrams and controls.

1.4 Coordination of Submissions

.1 Review shop drawings, product data and samples prior to submission.

.2 Verify:
- .1 Field measurements.
- .2 Field construction criteria.
- .3 Catalogue numbers and similar data.

.3 Coordinate each submission with requirements of work and Contract Documents.

.4 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review of submission, unless Departmental Representative gives written acceptance of specified deviations.

.5 Notify Departmental Representative, in writing at time of submission of deviations from requirements of Contract Documents.

.6 After Departmental Representative's review, distribute copies.

1.5 Submission Requirements

.1 Schedule submissions at least 14 days before dates reviewed submissions will be needed.

.2 Accompany submissions with transmittal letter, in duplicate, containing:
- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Number of each shop drawing, product data and sample submitted.
- .5 Other pertinent data.

.3 Submission shall include:
- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name of:
  - .1 Contractor
  - .2 Sub-Contractor
  - .3 Supplier
  - .4 Manufacturer
  - .5 Separate detailer when pertinent.

.4 Identification of product or material.
.5 Relation to adjacent structure or materials.
.6 Field dimensions, clearly identified as such.
.7 Specification Section number.
.8 Applicable standards, such as CSA or CGSB numbers.
.9 Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract Documents.

.10 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.

1.6 Samples and Mock-ups

.1 Submit samples in sizes and quantities specified.

.2 Where colour, pattern or texture is criterion, submit full range of samples.

.3 Construct field samples and mock-ups at locations acceptable to Departmental Representative.

.4 Construct each sample or mock-up complete, including work of all trades required to finish work.

.5 Reviewed samples or mock-ups will become standards of workmanship and material against which, installed work will be checked on project.

1.7 Distribution of Submittals After Review

.1 Distribute copies of shop drawings and product data which carry Departmental Representative's stamp to:

.1 Job site file.
.2 Record documents file.
.3 Other prime Contractors.
.4 Sub-Contractor.
.5 Supplier.
.6 Fabricator

.2 Distribute samples as directed.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Related Requirements Specified Elsewhere

.1 The particular requirements for Inspection and Testing required under this contract is detailed throughout the contract document.

1.3 Contractor's Responsibilities

.1 All Inspection and Testing required by the contract document and/or relevant provincial and federal regulations shall be completed by the Contractor at his cost. All inspections and testing shall be carried out by an independent certified testing agency.

.2 Supply certifications for all independent testing agencies to the Departmental Representative prior to commencement of work.

.3 The Contractor shall promptly provide copies of all inspection and tests to the Departmental Representative.

.4 The Contractor shall notify the Departmental Representative at least 48 hours in advance of all testing, for an opportunity to be present.

.5 All subsequent work and testing required due to unsatisfactory work shall be completed by the Contractor at his cost.

.6 The contractor shall provide access and assistance when additional sampling / testing is required by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Access

.1 Provide and maintain adequate access to project site.

.2 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.3 Departmental Representative's Site Office

Not Required.

1.4 Storage Sheds

.1 Provide adequate weather tight sheds with raised floors, for storage of materials, tools, and equipment which are subject to damage by weather.

1.5 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 areas and premises in sanitary condition.

1.6 Power

.1 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.

1.7 Water Supply

.1 Arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances.

1.8 Heating and Ventilating

.1 Maintain minimum temperature of 10°C or higher where specified as soon as finishing work is commenced and maintained until acceptance of structure by Departmental Representative.

.2 Maintain ambient temperature and humidity levels as required for comfort of office personnel.

1.9 Drainage

.1 Refer to Section 01575 for site drainage and pumping requirements.

END OF SECTION

Part 1 General

1.1 Related Requirements

.1 Section 01 33 00 – SUBMITTAL PROCEDURES.

1.2 Reference Standards

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Province of British Columbia

.1 Workers Compensation Act, RSBC 1996 - Updated 2012.

1.3 Action and Informational Submittals

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

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.

.3 Submit 1 weekly submittal to Departmental Representative.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit pies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets.

.7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 3 days.

.8 Departmental Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Departmental Representative.

.10 SPEC NOTE: If there are specific emergency response procedures for the Building, Facility or Site, then the Departmental Representative/DCC Representative or Consultant must provide the Contractor with the details for consideration of

incorporation into the Contractor's on-site Contingency and Emergency Plan as a component of the site specific health and safety plan.

.11 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 Filing of Notice

.1 File Notice of Project with WorkSafeBC authorities prior to beginning of Work.

.2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award. Contractor to submit written acknowledgement to CSST along with Ouverture de Chantier Notice.

.3 Work zone locations include:

.1 Conuma Hatchery - PO Box 247
Tahsis, B.C.
V0P 1X0

.4 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 Safety Assessment

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

1.6 Meetings

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

1.7 Regulatory Requirements

.1 Not used.

1.8 Project Site Conditions

.1 Work at site will involve contact with:

.1 Departmental Representative.

1.9 General Requirements

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.10 Responsibility

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

.2 SPEC NOTE: Use the following paragraph for Construction Projects in the Province of Ontario: N/A

.3 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.11 Compliance Requirements

.1 Comply with Workers Compensation Act, B.C.

.2 Comply with R.S.Q., c. S-2.1, an Act respecting Health and Safety, and c. S-2.1, r.4 Safety Code for the Construction Industry.

.3 Comply with Occupational Health and Safety Regulations, 1996.

.4 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.

.5 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.12 Unforeseen Hazards

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

.2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise WorkSafeBC and follow procedures in accordance with Acts and Regulations of BC having jurisdiction and advise Departmental Representative verbally and in writing.

1.13 Health and Safety Co-Ordinator

.1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:

.1 Have site-related working experience specific to activities associated with the site.

.2 Have working knowledge of occupational safety and health regulations.

.3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.

.4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

.5 Be on site during execution of Work and report directly to Departmental Representative and be under direction of the site supervisor.

1.14 Posting of Documents

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

1.15 Correction of Non Compliance

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative

.2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.16 Blasting

.1 Not used.

1.17 Powder Actuated Device

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

1.18 Work Stoppage

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Traffic Management

.1 Traffic management shall comply with the requirements of British Columbia's Ministry of Transport and Infrastructure over the entire contract period, specifically the latest edition of "Traffic Control Manual for Work on Roadway".

.2 The Contractor shall be responsible for acquiring and compiling with all required permitting required by British Columbia's Ministry of Transport and Infrastructure.

.3 During progress of the Works, make adequate provision to accommodate normal traffic along streets and highways immediately adjacent to or crossing the Works so as to minimize inconvenience to the general public.

.4 Inform all owners or occupants of properties where access is affected in advance of proposed works.

.5 When working on travelled ways:

1. Place equipment in such position as to present a minimum of interference and hazard to the travelling public.
2. Keep equipment units as close together as working conditions will permit and preferably on same side of travelled way.
3. Do not leave equipment on travel led way overnight.
4. Do not close any lanes of road or highway without prior approval of the Departmental Representative. Before re-routing traffic erect suitable signs and devices as approved by the Departmental Representative.
5. Provide and maintain reasonable road access and egress to property fronting along or in vicinity of work under contract unless approved otherwise by the Departmental Representative.

**** END of SECTION ****

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Disposal of Wastes

.1 All waste and rubbish materials shall be disposed to an approved landfill. Disposal of waste or rubbish material to land or burning will NOT be accepted.

.2 Discharge of water containing chlorine or other chemical compounds into waterways is prohibited.

1.3 Drainage

.1 Provide temporary drainage and pumping as necessary to keep excavations and site free from surface water and groundwater.

.2 Pumping of water containing silt in suspension into waterways, sewer or drainage systems prohibited.

.3 The Contractor shall control disposal or runoff of water containing sususpeded materials or harmfull substances in accordance with this contract document and applicable Federal and Provincial standards.

1.4 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Minimize stripping of topsoil and vegetation.

.3 Restrict tree removal to those areas designated by Departmental Representative.

1.5 Work Adjacent to Waterways

.1 Prohibit operation of construction equipment in waterways without Departmental Representative's approval and approval of Fisheries authorities.

.2 Do not use waterway beds for borrow material.

.3 Do not dump excavated fill, waste material or debris in waterways.

.4 Design and construct temporary crossings so that minimum erosion is caused to waterways.

.5 Do not skid logs or construction materials across waterways.

.6 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.7 Blasting under water or within 100 m of indicated spawning beds not permitted.

1.6 Erosion and Sedimentation Control

.1 The Contractor must prepare Erosion and Sedimentation Control Plan and implement siltation control measures for all excavation to minimise siltation of ditches, watercourses and storm water systems.

.2 Siltation control shall include but not be limited to installation of silt fences and construction of sedimentation ponds as shown in the contract documents. Siltation control shall meet the standards described in Land Development Guidelines for the Protection of Aquatic Habitat published jointly by the BC Ministry of Environment and Department of Fisheries and Oceans. Siltation control measures shall remain in place until completion of construction. Contractor shall implement erosion and sedimentation control measures during the construction process.

.3 Contractor shall ensure that all works is performed to prevent release of sediment laden or hydrocarbon contaminated (e.g. oil, grease, hydraulic fluid, or fuel) water from the site boundary. This includes ensuring no water flows are pumped or channeled to bypass the sediment control facilities.

.4 Erosion and sedimentation control measures shall include but not be limited to retention of existing vegetation, installation of silt fences, and construction of settlement ponds. Sedimentation control measures shall remain in place until completion of construction.

.5 Contractor shall ensure that sediment and hydrocarbon control facilities are frequently visually inspected and repaired as necessary.

1.7 Hazardous Materials Handling and Storage

.1 Hazardous materials including, but not limited to, fuels, bitumens, cement, paints, solvents, cleaners, dust suppressants, used fuel and oil filters, and other construction materials shall be stored and handled to minimize lose and to allow containment and recovery in the event of a spill.

.2 The Contractor shall designate area(s) for the transfer and temporary storage of hazardous materials and wastes. The designated area(s) shall be used by the Contractor as a transfer and temporary storage area for potentially hazardous materials and wastes. The area(s) shall be clearly labeled and appropriately controlled.

.3 The Contractor shall maintain proper Workplace Hazardous Material Information Systems (WHMIS) labels and Material Safety Data Sheets (MSDS) for all hazardous materials used and stored on site.

.4 Discharge of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers is prohibited.

.5 Discharge of water containing chlorine or other chemical compounds into waterways is prohibited.

1.8 Special and General Waste, Rubbish and Garbage

.1 Special Waste generated in the course of the construction activities shall be handled and disposed of in compliance with the British Columbia Special Waste Regulation. As defined by these regulations, Special Wastes include, but are not limited to, such things as waste asbestos, oils, greases, lubricants, solvents, batteries, polychlorinated biphenyls (PCBs), paints and used spill cleanup materials.

.2 When handling, storing, and removing Special Wastes, the Contractor shall maintain the following records: Inventories of types and quantities of Special Wastes generated, stored, or removed; manifests identifying Special Waste haulers and disposal destinations; MSDS and disposal certification documents.

.3 Non-hazardous solid wastes, such as but not limited to, waste wood, asphalt, concrete, and metals shall be disposed of at an approved and licensed disposal facility in compliance with the British Columbia Waste Management Act.

.4 The Contractor shall establish regular clean up and disposal programs so as to prevent the unnecessary accumulation of excessive solid waste and contain all garbage related to the project.

1.9 Equipment Operation

.1 Contractor shall maintain construction equipment in good condition and free of excess oil and grease.

.2 Waste oils and other materials related to equipment shall be removed from site upon completion of project.

.3 Maintenance of equipment shall be confined to specific areas such that spills can be contained and collected before contaminants reach ditches, watercourses, and storm water systems.

.4 There shall be no discharge of wash water to ditches, watercourses or storm water systems from trucks and equipment related to concrete supply, pumping, or placing equipment.

.5 Equipment operation shall be limited to hours acceptable to the community.

.6 Any fuel spills shall be absorbed immediately.

.7 Contractor shall have fuel absorbents on site and shall deal with any spills which should occur immediately.

1.10 Work Adjacent to Drainage Courses and Waterways

.1 Contractor shall implement siltation control measures for all excavation. Siltation shall include but not be limited to installation of silt fences and construction of sedimentation ponds. Siltation control measures shall remain in place until completion of construction.

.2 The Contractor must develop and implement an Erosion and Sediment Control Plan and have this plan reviewed by the Departmental Representative prior to site preparation and construction of works involving excavation and fill placement. These facilities must be maintained by the Contractor and be working effectively to control discharges from the site.

.3 Prohibit operation of construction equipment in waterways without Departmental Representative's approval and approval of Fisheries authorities.

.4 Do not use waterway beds for borrow material.

.5 Do not dump excavated fill, waste material or debris in waterways.

.6 Design and construct temporary crossings so that minimum erosion is caused to waterways.

.7 Construction and excavation wastes, overburden, soil, or other substances deleterious to aquatic life must be disposed of or placed in such a manner so as to prevent their entry into any ditch, watercourse, or storm water system.

.8 All excavated material is to be side-cast as far as possible from ditches, trenches, or storm water systems to prevent its re-entry into the watercourse. Spoil must be removed offsite or spread out, levelled and seeded to promote re-vegetation and reduce surface erosion.

.9 Do not skid logs or construction materials across waterways.

.10 Avoid indicated spawning beds when constructing temporary crossings of waterways.

.11 Blasting under water or within 100 m of indicated spawning beds not permitted.

.12 Contractor shall remove any equipment from near watercourse area if not required, or broken down.

1.11 Revegetation and Site Restoration

.1 Disturbed areas adjacent to ditches, watercourses and storm water systems shall be re-seeded to prevent surface erosion and/or downstream water quality impacts.

.2 Ditches and newly constructed diversion channels shall be seeded and planted with grasses and/or native vegetation, to reduce surface erosion.

1.12 Spill Prevention and Emergency Response

.1 The Contractor shall develop a Spill Prevention and Emergency Response Plan and distribute it to the Consultant and Owners of the project prior to commencing any work.

.2 The Contractor shall complete a daily visual inspection of all hazardous material and equipment for signs of leakage. Daily visual inspection will include, among other things ensuring that all personal protective equipment and other emergency response equipment is in its place.

.3 The Contractor shall maintain a readily available supply of spill emergency response material and equipment on site at all times in effective working condition appropriate to the scale of the project.

.4 The Contractor shall deal with any spills which occur immediately.

.5 The Contractor shall report any environmental incident or spill/release of a substance to the Departmental Representative and to the Provincial Emergency Program of the Ministry of Attorney General in accordance with the Spill Reporting Regulations of the Waste Management Act.

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 equipment or material of some type or classification unless otherwise specified.

1.2 Manufacturers' Instructions

.1 Unless otherwise specified, comply with manufacturers' latest printed instructions for materials and installation methods.

.2 Notify Departmental Representative in writing of any conflict between these Specifications and manufacturers' instructions. Departmental Representative will designate which document is to be followed.

1.3 Delivery and Storage

.1 Deliver, store, and maintain package material and equipment with manufacturers' 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 Departmental Representative's satisfaction. Use primer or enamel to match original. Do not paint over name plates.

1.4 Conformance

.1 When material or equipment is specified by standard or performance specifications, upon request of Departmental Representative, obtain from manufacturer an independent testing laboratory report, stating that material or equipment meets or exceeds specified requirements.

1.5 Substitution

.1 Proposals for substitution may be submitted only after award of Contract. Such requests must include statements of respective costs of items originally specified and proposed substitutions.

.2 Proposals will be considered by Departmental Representative if:

.1 Products selected by Tenderer from those specified are not available; or

.2 Delivery date of products selected from those specified would unduly delay completion of Contract; or

.3 Alternative products to those specified, which are brought to attention of, and considered by, Departmental Representative as equivalent to those specified and will result in credit of Contract amount.

.3 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 drawing changes required as result of substitution.

.4 All credits arising from approval of substitutions will be credited to Contract in such amounts as may be determined by Departmental Representative and Contract price will be adjusted accordingly. No substitutions will be permitted without prior written approval of Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Documents Required

.1 Maintain at job site, one (1) copy of 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 records.

.2 Maintain documents in clean, dry legible condition.

.3 Make documents available at all times for inspection by Departmental Representative.

1.3 Workmanship Standards

.1 Make available on site one (1) copy of each workmanship standard called for under "Reference Standards" in project Specifications.

1.4 Record Drawings

.1 Departmental Representative will provide two (2) sets of white prints for record drawing purposes.

.2 Maintain project "as-built" record drawings and record accurately significant deviations from Contract Documents caused by site conditions and changes ordered by Departmental Representative.

.3 Mark "as-built" changes in red.

.4 Record following information:
- .1 Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvement.
- .2 Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
- .3 Field changes of dimension and detail.
- .4 Changes made by Change Order or Field Order.
- .5 At completion of project and prior to final inspection, neatly transfer "as-built" notations to second set and submit both sets to Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Maintenance Manual

.1 On completion of project, submit to Departmental Representative four (4) copies of Operations Data and Maintenance Manual in English made up as follows:

- .1 Bind data in vinyl hard covered, 3-ring loose leaf binder for 215 x 280 mm size paper.
- .2 Enclose title sheet, labeled "Operation Data and Maintenance Manual", project name, date, and list of contents.
- .3 Organize contents into applicable Sections of work to parallel project specification break-down. Mark each Section by labeled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.2 Include following information plus data specified.

- .1 Maintenance instruction for finished surface and materials.
- .2 Copy of hardware and paint schedules.
- .3 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.
- .4 Names, addresses and phone numbers of sub-contractors and suppliers.
- .5 Guarantees, warranties and bonds showing:
  - .1 Name and address of projects.
  - .2 Guarantee commencement date of Final Certificate of Completion.
  - .3 Duration of guarantee.
  - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
  - .5 Signature and seal of Contractor.
  - .6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.

.3 Neatly type lists and notes. Use clear Drawings, diagrams or manufacturers' literature.

.4 Include one complete set of final shop Drawings bound separately indicating corrections and changes made during fabrication and installation.

1.3 Maintenance Materials

.1 Where supply of maintenance materials is specified, deliver to Departmental Representative as follows:

.1 Materials in unbroken cartons, or if not supplied in cartons, they shall be strongly packaged.

.2 Clearly mark as to content.

.3 If applicable give colour, room number or area where material used.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 Commissioning includes the start-up of individual systems and equipment, the start-up of the entire system as a cohesive unit, and the training of operators and turnover of the operating water treatment plant.

.2 Commissioning shall include the General Contractor and all necessary Sub-contractors and/or Suppliers involved in equipment or systems installation.

1.3 Related Work Specified Elsewhere

.1 Operations and Maintenance Section 01730

1.4 Owners Operators

.1 The contractor shall have the owners operators in attendance at all system start-ups.

.2 The contractor is to facilitate the training of owners operator in accordance with Section 3.4 System Operation.

PART 2 - PRODUCTS

1.1 General

.1 Contractor to supply all required equipment and material for startup, commissioning and hand over period of the water supply infrastructure.

PART 3 – EXECUTION

3.1 Power Supply

.1 Where modifications and/or additions to existing electrical equipment or apparatus are required, ensure that all changes are made in accordance to CSA 22.2. Obtain CSA re-certification of the modified electrical equipment.

3.2 Treatment System

.1 Retain and pay for the services of the authorized manufacturers' representatives to be on-site for the startup of both mechanical and electrical/control systems and operator training.

3.3 Supply and distribution

.1 After sterilization of the supply pipe open valve on new supply line to fill storage tank.

.2 Take records of operation of storage tank sensors at low and high water level.

.3 Take records of booster pump, pressure tank and water treatment equipment functioning.

.4 Take records of pressure in system before and after treatment.

.5 Departmental Representative to be informed if any component is not working as intended.

3.4 Maintenance Manual

.1 Refer to Section 01730. These manuals to be prepared and reviewed and approved and distributed to the Owner, prior to turn-over.

3.5 System Operation

.1 The System shall be handed over during a minimum two week period in which the contractor is to facilitate the authorized training of the proposed operator(s) and oversee the initial operation of the system. Ensuring that the system is operating as designed.

.2 Substantial Completion under the terms of the contract may be granted after, but not before, the two week hand over period with the owners operators.

***** END OF SECTION *****

Division 02 – Civil Works

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This section specifies requirements for supplying, producing and placing gravel or quarried stone as a granular sub-base to lines, grades and typical cross-sections indicated on plans or as directed.

1.3 Related Work Specified Elsewhere

.1 Excavation, Trenching and Backfilling Section 02223

.2 Granular Base Section 02233

PART 2 - PRODUCTS

2.1 Materials

.1 Granular sub-base material to Section 02225 and following requirements:

.1 Gradation to be within following limits when tested to ASTM C136-76 and ASTM C117-80, (AASHDTO T11-78 and T27-78) and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-70 (1977).

ASTM Sieve Designation		% Passing
75	mm	- 100
25	mm	55 - 100
4.75	mm	25 - 100
2.00	mm	15 - 80
0.425	mm	4 - 50
0.075	mm	0 - 8

.2 Other properties as follows:

.1 Liquid Limit: ASTM D423-66(1972) (AASHTO T89-70) Maximum 25

.2 Plasticity Index: ASTM D424-59(1971) (AASHTO T90-70) Maximum 6

.3 Los Angeles Abrasion: ASTM C131-76 (AASHTO T96-77) Gradation 'A' Max % Loss by Weight 50

PART 3 - EXECUTION

3.1 Inspection of Existing Sub-grade Surface

.1 Do not place granular sub-base until finished sub-grade is inspected and approved.

3.2 Placing

.1 Place material only on a clean, unfrozen surface, properly shaped and compacted and free from snow or ice.

.2 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.3 Place material in uniform layers not exceeding 200 mm when compacted or to such other depth as approved.

.4 Shape each layer to a smooth contour and compact to specified density before the succeeding layer is placed.

.5 Remove and replace portion of a layer in which material has become segregated during spreading.

3.3 Compacting

.1 Compact to a density of not less than 95% maximum dry density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted sub-base.

.3 Apply water as necessary during compaction to obtain specified density. If sub-base is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment compact to specified density with approved mechanical tampers.

3.4 Finish Tolerances

.1 Finish compacted surface to within + 25 mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Proof Rolling

.1 For proof rolling, use a fully loaded tandem dump truck.

.2 DFO representative may authorize use of other acceptable proof rolling equipment.

.3 Proof roll at level in sub-base indicated. If alternative proof rolling equipment is authorized, DFO representative will determine level of proof rolling.

.4 Make passes as directed by DFO representative.

.5 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.6 Maintenance

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

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.

1.2 Related Work Specified elsewhere

.1 Watermains — Section 02555

1.3 Definitions

.1 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation including dense tills, hardpan, frozen materials and partially cemented materials which can be ripped and excavated with heavy construction equipment.

.2 Over-excavation: excavation below design elevation of bottom of specified bedding, and including backfilling of resultant excavation with specificed materal, as authorized by the Departmental Representative.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

1.4 Protection of Existing Features

Existing Utility Services

.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 any excavation work, notify applicable owner or authorities, establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations and/or radio detection equipment.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain direction of Departmental Representative before moving or otherwise disturbing utilities or structures.

.5 Record location of maintained, re-routed and abandoned underground lines.

.6 Any damage to existing utility services caused by the Contractor shall be rectified by the Contractor at his or her own cost.

Existing Bulding and Surface Features:

.1 The Contractor and Departmental Representative shall perform a condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features which may be affected by work from damage while work is in progress and repair damage resulting from work.

.3 Where excavation necessitates root or branch cutting, do so only with written approval of the Departmental Representative.

1.5 Shoring, Bracing and Underpinning

.1 Comply with Section 01545 - Safety Requirements and applicable local regulations and to protect existing features.

.2 Engage services of qualified professional Departmental Representative who is registered in province or territory in which work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for work.

.3 At least 2 weeks prior to commencing work, submit design and supporting data.

.4 Design and supporting data submitted to bear the stamp and signature of qualified professional Departmental Representative registered in the Province of British Columbia.

.5 Professional Departmental Representative responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where Departmental Representative is employee of contractor, in which case contractor shall submit proof that work by professional Departmental Representative is included in contractor's insurance coverage.

1.6 Submission of Imported Material Specifications

.1 At least one week prior to commencing work, inform the Departmental Representative of proposed source of fill materials, proposed use/location within the contract and provide associated specifications/grading curves for review by the Departmental Representative.

PART 2 - PRODUCTS

2.1 Materials

.1 **Approved Trench/Native Material:**

.1 Approved trench/native material is selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials

.2 **Bedding Material:**

.1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136-84a and ASTM C117-84. Sieve sizes to CAN/CGSB-8.1-87 rather than ASTM E11-81.

Sieve Designation		% Passing		
25 mm	[100]	-	-	-
19 mm	[75-100]	-	-	-
12.5 mm	-	-	-	-
9.5 mm	[50-100]	-	-	-
4.75 mm	[30-70]	-	-	-
2.00 mm	[20-45]	-	-	-
0.425 mm	[10-25]	-	-	-
0.180 mm	-	-	-	-
0.075 mm	[3-8]	-	-	-

.3 **Imported Granular Fill:**

.1 Crushed, pit run or screened stone, gravel or sand consisting of hard durable particles free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136-84a and ASTM C117-84. Sieve sizes to CAN/CGSB-8.1-87 rather than ASTM E11-81.

Sieve Designation

200 mm	-	-	-	-
75 mm	[100]	-	-	-
50 mm	-	-	-	-
37.5 mm	-	-	-	-
25 mm	[45-100]-	-	-	-
19 mm	-	-	-	-
12.5 mm	-	-	-	-
9.5 mm	-	-	-	-
4.75 mm	[25-70]	-	-	-
2.00 mm	-	-	-	-
0.425 mm	[5-25]	-	-	-
0.180 mm	-	-	-	-
0.075 mm	[0-10]	-	-	-

PART 3 - EXECUTION

3.1 Site Preparation

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

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.2 Stripping of Topsoil

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

.2 Commence topsoil stripping of areas as directed by the Departmental Representative after area has been cleared of brush, weeds, and grasses and removed from site.

.3 Strip topsoil to depths as directed by the Departmental Representative. Avoid mixing topsoil with subsoil.

.4 Stockpile in locations as directed by the Departmental Representative. Stockpile height not to exceed 2 m.

.5 Dispose of unused topsoil as directed by the Departmental Representative.

3.3 Stockpiling

.1 Stockpile fill materials in areas designated by the Departmental Representative. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.4 Cofferdams, Shoring, Bracing and

Underpinning

.1 Construct temporary works to depths, heights and locations as indicated or approved by .

.2 During backfill operation:
- .1 Unless otherwise indicated or directed by the Departmental Representative, remove sheeting and shoring from excavations.
- .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
- .3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 300 mm above toe of sheeting.

.3 When sheeting is required to remain in place, cut off tops at elevations indicated or directed by the Departmental Representative.

.4 Upon completion of substructure construction:
- .1 Remove cofferdams, shoring and bracing.
- .2 Remove excess materials from site and restore water courses to conditions indicated or as directed by the Departmental Representative.

3.5 Excavation

.1 Excavate to lines, grades, elevations and dimensions as directed by the Departmental Representative.

.2 Remove concrete, masonry, paving, walks, demolished foundations and rubble, and other obstructions encountered during excavation.

.3 Excavation must not interfere with normal 45° splay of bearing from bottom of any footing.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

.5 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Dispose of surplus and unsuitable excavated material off site.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify Departmental Representative when soil at bottom of excavation appears unsuitable and proceed as directed by Departmental Representative.

.10 Obtain Departmental Representative approval of completed excavation.

.11 Remove unsuitable material from trench bottom to extent and depth directed by Departmental Representative.

.12 Where required due to unauthorized over- excavation, correct as follows:
- .1 Fill under bearing surfaces and footings with concrete specified for footings.
- .2 Fill under other areas with Imported fill compacted to at least 95% maximum density.
- .3 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 Departmental Representative.

3.6 Backfilling

.1 Do not proceed with trench backfilling operations until Departmental Representative has inspected installations.

.2 Do not place backfill in freezing weather without written permission of Departmental Representative.

.3 Backfilling around pipe and installation:
- .1 Place bedding and surround material as specified by contract drawings and manufacurers instruction.
- .2 Place layers simultaneously on sides of installed work to equalize loading.
- .3 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.4 Place backfill material in uniform layers not exceeding 300 mm in thickness up to restoration zone in traveled areas or top of trench in untraveled areas. Compact each layer before placing succeeding layer.

.5 Compact backfill materials to the following Modified Proctor densities in accordance with ASTM D1557
  .1 In untraveled areas, to a density at least equal to density of adjacent undisturbed soil.
  .2 Where any part of the neat trench width is under a traveled area, to a minimum of 95% of maximum laboratory density obtained using ASTM Method D698-70, Method D.
  .3 Use caution in the pipe bedding zone to avoid damage to the pipeline. Compaction of bedding material to be in accordance with manufacturer's instructions.

3.8 Inspection and Testing

.1 Testing of materials and compaction will be carried out by a independent testing laboratory, at the cost of the Contractor.
.2 Perform nuclear densitometer test minimum every 150m length of installed pipe or conduit within road or travelled areas.
.3 Contractor to pay all costs of testing and re-testing if compaction is below standard.

3.9 Restoration

In untraveled areas:

  .1 Reinstate subbase in accordance with 02222 Granular Subbase specification
  .2 Reinstate base in accordance with 02233 Granular Base specification
  .3 Reinstate pavement to match existing or as otherwise stated on the contract drawings.

In gravel surfaced traveled areas:

  .1 Reinstate sub-base course with approved excavated material similar to the original road surface, or use imported pit-run gravel, as directed by Departmental Representative.
  .2 Gravel or approved material to be 75 mm minus, uniformly graded gravel.
  .3 Gravel sub-base to be 200 mm deep.
  .4 Provide a 100 mm minimum course of 20 mm minus, crushed, base material on the surface.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This section specifies requirements for supplying, producing and placing crushed gravel or quarried stone as a granular base to lines, grades and typical cross-sections indicated, or as directed.

1.3 Related Work Specified Elsewhere

.1 Excavation, Trenching and Backfilling Section 02223

.2 Granular Sub-Base Section 02222

PART 2 - PRODUCTS

2.1 Materials

.1 Granular base material to Section 02225 and following requirements:

.1 Gradation to be within following limits when tested to ASTM C136-76 and ASTM C117-80 (AASHTO T11-78 and T27-78) and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart.

ASTM Sieve Designation		% Passing	
19.0	mm		100
9.5	mm	60	- 100
4.75	mm	40	- 80
2.36	mm	30	- 60
1.18	mm	20	- 40
0.30	mm	8	- 20
0.075	mm	2	- 7

.2 Liquid Limit:
ASTM D423-66(1972) (AASHTO T89-76) Maximum 25

.3 Plasticity Index
ASTM D424-59(1971) (AASHTO T90-70) Maximum 6

.4 Los Angeles Abrasion
ASTM C131-76 (AASHTO T96-77) Gradation 'A' Max. % loss by weight 45

.5 Crushed fragments: at least 60% of fragments within the following size range to have at least 1 freshly fractured face.

Passing			Retained on	
19.0	mm	to	4.75	mm

PART 3 - EXECUTION

3.1 Inspection of Underlying Sub-Base or Sub-Grade

.1 Do not place granular base until finished sub-base surface is inspected and approved.

3.2 Placing

.1 Place material only on a clean, unfrozen surface, properly shaped and compacted and free from snow and ice.

.2 Place using methods which do not lead to segregation or degradation of aggregate.

.3 Place material in uniform layers not exceeding 200 mm when compacted or to such other depth as approved by DFO representative.

.4 Shape each layer to a smooth contour and compact to specified density before succeeding layer is placed.

.5 Remove and replace that portion of a layer in which material becomes segregated during spreading.

3.3 Compacting

.1 Compact to a density not less than 100% maximum dry density in accordance with ASTM D698.

.2 Shape and roll alternately to obtain a smooth, even and uniformly compacted base.

.3 Apply water as necessary during compacting to obtain specified density. If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.4 In areas not accessible to rolling equipment, compact to specified density with approved mechanical tampers.

3.4 Finish Tolerances

.1 Finished base surface shall be within +/- 10 mm of established grade but not uniformly high or low.

.2 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.5 Proof Rolling

.1 For proof rolling, use a fully loaded tandem axle dump truck.

.2 DFO representative may authorize use of other acceptable proof rolling equipment.

.3 Proof roll top of base upon completion of fine grading and compaction.

.4 Make passes as directed by DFO representative.

.5 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent directed and replace with new materials in accordance with Section 02222 and Section 02233 at no extra cost.

3.6 Maintenance

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

END OF SECTION

1.0 GENERAL .1 Section 02271 refers to those portions of the work that are unique to the supply and placement of riprap. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

1.1 Related Work .1 Gravity Sewer 02517

1.2 References .1 NA

1.3 Samples .1 Samples may be required

1.4 Inspection and Testing .1 Refer to General Conditions, Clause 2.3, Review and Inspection of the Work.

2.0 PRODUCTS

2.1 Riprap .1 Hard, durable quarry stone, free from seams, cracks or other structural defects, with specific gravity not less than 2.65, to meet following size distribution:

.1 Uniform riprap:

.1 Size gradation for uniform riprap.

Note: Percent Heavier Than and Percent Lighter Than may be interpreted as the percentage of riprap by weight with individual rocks respectively Heavier or Lighter than the corresponding mass or weight specified.

Percent Heavier Than	Percent Lighter Than	Mass (kg)	Weight (N)	Equivalent Diameter (mm)
0	100			As specified
50	50			in
100	50			Contract Document

.2 Maximum dimension of any riprap piece to not be more than 2.5 times its least dimension.

.2 Graded riprap:

.1 Size gradation for graded riprap.

Percent Heavier Than	Percent Lighter Than	Mass (kg)	Weight (N)	Equivalent Diameter (mm)
0	100			

0 – 40	60 – 80	As specified
20 – 50	50 – 80	
50 – 70	30 – 50	in
60 – 85	15 – 40	
>85	<15	Contract Documents
100	0	

.2 Maximum dimension of any riprap piece to not be more than 2.5 times its least dimension.

2.2 Filter Materials

.1 Stone Filter:

Hard durable graded stone or quarry tailings with specific gravity not less than 2.65 to meet following size distribution:

Size Gradation for Filter Material		
Percent Coarser Than	**Percent Finer Than**	**Equivalent Diameter (mm)**
0	100	As
15	85	Specified
50	50	in Contract
85	15	Documents

2.3 Geosynthetics

.1 Section 02498 - Geosynthetics or as specified in Contract Documents.

2.4 Cement Mortar

.1 Cement: to CAN3-A5 Type 10.

.2 Sand for mortar: to CSA A82.56.

.3 Mortar mix: 1 part cement to 3 parts sand, to consistency suitable for placement.

3.0 EXECUTION

3.1 Surface Preparation

.1 Where required, excavate trench at toe of slope to elevations and dimensions shown on Contract Drawings or as directed by Contract Administrator.

.2 Grade area to be rip-rapped to uniform, even surface. Fill depressions with approved material and compact to provide firm bed.

.3 Grade out wave or surface water induced erosion of prepared bed prior to filter material and riprap placement.

3.2 Placement

.1 Commence placing riprap at toe of slope and continue placement working up slope.

.2 Do not drop riprap if placed above water.

.3 Place riprap in accordance with thickness, elevation and surface tolerance details as shown on Contract Drawings.

.4 Dress all riprap by reworking surface at least once so that voids are filled and riprap surface is well keyed, dense and uniform.

.5 Hand placed riprap:

.1 Use larger stones for lower courses and as headers for subsequent courses.

.2 Stagger vertical joints and fill voids with rock spalls or cobbles.

.3 Finish surface even, free of large openings and neat in appearance.

.6 Machine placed riprap:

.1 Place riprap using suitable equipment.

.2 Do not run equipment on finished riprap surfaces.

.7 Mortar:

.1 Use mortar within one hour after water has been added. Do not add additional water after initial mixing.

.2 Commence applying mortar at bottom courses (above low water line) and work upwards completely filling voids and leaving outer faces of stones exposed. Remove excess mortar to expose faces of stones.

.3 Cure and protect mortar in accordance with CAN3-A23.1 using absorptive mats or fabric kept continuously wet.

3.3 Finished Tolerances

.1 Ensure finished riprap within +100 mm to -100 mm of specified grade.

.2 Ensure stone filter thickness within +50 mm to -50 mm of specified thickness.

.3 Ensure riprap slope within +2 degrees to - 2 degrees of specified slope in degrees.

**** END OF SECTION ****

PART 1 - GENERAL

1.1 General .1 Not used

1.2 Intent .1 This Section covers the work of fencing and gates.

1.3 Related Work Specified Elsewhere .2 Poured concrete in fence post footings as described in Section 02831

PART 2 - PRODUCTS

2.1 Height .1 Erect fences 1.8 m above grade.

2.2 Fabric .1 Fencing: Frost Fencing Company or equal. Chain link hot dipped galvanized 3.75 mm thick (#9 gauge) steel wire woven into 50 mm mesh.

.2 Premium grade galvanized fabric to an average of 500 grams of zinc per square meter of area.

.3 Provide the top selvage of the fabric with a twisted finish, the bottom selvage with a knuckled finish. Tensile strength of individual pickets to stand a test of 550 MPa.

2.3 Line Posts .1 60 mm outside diameter standard buttweld Schedule 40 pipe galvanized. Length of line posts: 840 mm longer than the height of the fabric.

.2 Minimum weight per meter of line posts: 5.5 kg. Tubing, conduit or open seam material not permitted.

2.4 Terminal Posts .1 End, corner and straining posts 90 mm OD standard buttweld, Schedule 40 pipe galvanized.

.2 Length of end posts 1.067 m longer than the height of fabric. Minimum weight per meter 11.3 kg.

.3 Tubing, conduit or open seam material not permitted.

2.5 Top Rail .1 42 mm OD galvanized pipe, plain ends, random lengths, standard weld, Schedule 40 pipe or high strength hollow structure section 2.5 wall section with mechanical properties similar to ASTM Specification A36.

.2 Tubing, conduit or open seam material not permitted.

2.6 Braces .1 42 mm OD galvanized to same Specification as top rail.

2.7 Fittings

.1 Hot dipped galvanized steel, aluminum or non-metallic mouldings of sufficient strength to ensure the integrity of the fence.

2.8 Tension Wire

.1 5 mm thick (#6 gauge) single strand 600 gm/m2 electrogalvanized wire, stretch taut.

2.9 Gates

.1 Gate frames made of 42 mm OD galvanized pipe, hot dipped, or high strength hollow structural section 2.5 wall with mechanical properties similar to ASTM Specification A36.

.1 Supply gates complete with galvanized malleable iron hinges, latch and latch catch.

.2 Weld frames at all joints.

.3 Supply gates with centre rests and iron bolt for closed position and chain hold open, when open.

.4 Provide suitable gate latches for a padlock which may be attached and operated from either side of gate.

.5 Hinges must permit gate to swing back against fence through 180°. Gate braces shall be 33 mm OD galvanized steel pipe.

.6 The keying system to the gate padlocks will suit the master key system for the building on the site.

2.10 Gate Posts

.1 Gate opening single, including man gates. Post OD 90 mm 10 kg per linear meter.

.2 Gate opening double. Gate post OD 90 mm 10 kg per linear meter.

2.11 Standard Details

.1 Do not paint fence or gates.

2.12 Concrete Footings

.1 Minimum 14 MPa concrete to the following minimum dimensions.

.1 Line Post Top 250 mm Base 250 mm. Depth concrete 1.050 m.

.2 Terminal Post 300 mm. Base 300 mm. Depth 1.200 m.

PART 3 - EXECUTION

3.1 Top Rail

.1 Galvanized couplings of the outside sleeve type at minimum 150 mm in length use to join the top rail. Pass the top rail through the line post top to form a continuous brace for each stretch of fence. Secure the top rail to each terminal post with receptable fittings.

3.2 Bases

.1 End and gated posts: one brace.
Corner and straining posts: two braces.

3.3 Fabric Bonds

.1 Fasten the fabric to the top rail and braces with suitable tie wire approximately 450 mm intervals between the line posts.

.2 Secure the fabric to line posts at approximately 150 mm centres.

.3 Provide galvanized or of non-ferrous material for the tie wire.

3.4 Line Posts

.1 Space the line posts no farther apart than three (3) linear meters.

3.5 Tension Wire

.1 Stretch the tension wire taut along the bottom of the fabric and fasten at intervals of 450 mm centres.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This Section covers asphalt concrete pavement for car park areas, driveways to buildings and walks or play areas.

1.3 Related Work Specified Elsewhere

.1	Roadway Excavation, Embankment and Compaction	Section 02230
.2	Granular Base	Section 02233
.3	Granular Sub-Base	Section 02222
.4	Aggregates: General	Section 02225

1.4 Reference Specifications

.1 Do all work in accordance with the Specifications, and specifically as noted below.

PART 2 - PRODUCTS

2.1 Materials

.1 Crushed Aggregate:
Hard, sound, angular crushed stone, gravel, and fine aggregate. At least 70% by numerical count of all aggregate particles retained on 4.75 mm sieve to have two fractured faces. Conform to following gradation limits when tested in accordance with ASTM C136.

Sieve Size (mm)		Percent Passing by Mass		
13.2	mm			100
9.5	mm	80	-	100
4.75	mm	55	-	75
2.36	mm	35	-	50
1.8	mm	26	-	40
0.60	mm	18	-	29
0.30	mm	13	-	23
0.15	mm	8	-	16
0.075	mm	4	-	10

.2 Asphalt Cement:
85 - 100 Penetration Grade.

.3 Asphalt Concrete Mix: Conform to the following requirements based on the Marshall method of design.
.1 Number of flows of each face of test specimen: 35
.2 Minimum % of voids in mineral aggregate: 15

.3 % air voids in compacted mixture: 3 - 5

.4 Minimum modified Marshall Stability, N, @ 60° C: 2250

.5 Flow index in mm: 2 - 5

.6 Minimum index of retained stability after immersion in water @ 60°C for 24 hours:

COMPLETE PLEASE

PART 3 - EXECUTION

3.1 Execution

.1 Prime Coat: Apply at rate of 1.8 l/sq.m.

.2 Do not place asphalt concrete during rain or upon a base which has free water showing or when air temperature is below 10°C.

.3 Spread mix using paving machine. Compact mix using tandem, three wheel, pneumatic tire and vibrating rollers capable of exerting contact pressures of from 3.5 to 7.5 kg/mm of width.

.4 Start rolling as soon as pavement will bear the roller without checking or undue displacement, working until no roller marks are left in the finished surface and no further compaction is possible. Use hand tampers and plate compactor where not accessible to rollers.

.5 Finished surface to be true to required profile and cross-section with a maximum tolerance of 15 mm and maximum variation of 6 mm under a 3 m straightedge.

.6 The density of the samples of the finished pavement shall equal at least 97% of the maximum density obtained in the laboratory. Obtain a minimum of 3 specimens.

3.2 Testing

.1 Prior to use, submit sample of asphalt concrete aggregate to approved laboratory for testing of gradation limits.

.2 Retain services of approved laboratory to obtain and test one Marshall briquette and 3 field density samples.

.3 Pay for all costs of sampling and testing.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This section specifies requirements for constructing manholes, catch basins, and valve chambers shown on the Drawings or as directed by the DFO representative.

1.3 Related Work Specified Elsewhere

.1 Trenching, Backfilling and Restoration — Section 02221

.2 Sanitary Sewers — Section 02517

.3 Concrete — Section 03010

1.4 Certification

.1 Provide DFO representative with certified copy of test results showing materials supplied meet specified requirements.

1.5 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by the DFO representative and adhere to interruption schedule as approved by the DFO representative.

.3 Notify building occupants a minimum of 24 hours in advance of any interruption in services.

.4 Do not interrupt water service for more than three (3) hours and confine this period between 10:00 and 16:00 hours local time, unless otherwise authorized.

1.6 Alternatives

.1 To promote development and use of new proprietary products to increase efficiency in installation and provide better service life, alternative materials to those specified will be considered if full descriptive data is submitted to the DFO representative in ample time to permit approval without delaying work.

.2 Such data must fully document description and specifications met by such alternative materials including certification from manufacturer that materials meet or exceed requirements for use intended and history, if any, of service in other installations.

.3 Variations to tendered unit price, if any, to be proposed when requesting use of alternative materials.

PART 2 - PRODUCTS

2.1 Manholes, Catch Basins and Valve Chambers

.1 Concrete and reinforcing steel to: Section 03010

.2 Precast concrete sections: to ASTM C478-75. Ladder rungs to be cast integral with unit; field installation not permitted unless otherwise specified. Monolithic bases not acceptable unless approved by DFO representative.

.3 Jointing Materials:
- .1 Manufacturer's rubber ring gaskets;
- .2 Mastic joint filler;
- .3 Cement mortar; or
- .4 Combination of above types.

.4 Mortar: aggregate to CSA A82.56M-1976, masonry cement to CSA A8-1970.

.5 Ladder runs: 20 mm diameter deformed billet bars to CSA G30.12M-1977 and CSA G30.13-1972 respectively, hot dipped galvanized after fabrication to CSA G164-1965. Rungs to be safety pattern.

.6 Frames, gratings, covers: to plan dimensions and to following requirements:
- .1 Metal gratings and covers to bear evenly on frames.
- .2 Gray iron castings to AASHTO M105-76, minimum tensile strength.
- .3 Castings to be sand blasted or cleaned and ground to eliminate surface imperfections and coated with two applications of approved asphalt coatings.
- .4 Manhole frames and covers: minimum 215 kg per set. Design and dimensions as shown on Drawings.
- .5 Covers to be marked as specified or shown on Drawings.

.7 Brick: to CSA A82.1-1965, Type 1, Class B.

.8 Drop manhole pipe to be same as sewer.

.9 Bituminous caulking compound: to CGSB 56-GP-4a.

PART 3 - EXECUTION

3.1 Excavation, Backfilling and Restoration

.1 Excavation, backfilling and restorations to: Section 02221

.2 Excavation requires approval prior to installing manholes, catch basins or valve chambers.

3.2 Concrete Works

.1 Do concrete work to Section 03010.

.2 Position metal inserts to dimensions and details shown.

3.3 Installation

.1 Construct units as indicated, plumb and true to alignment and grade.

.2 Units not to rest upon pipe.

.3 Pump manhole excavation dry and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed ground or when permitted by DFO representative, set precast concrete slab on 150 mm minimum of well compacted granular material.

.5 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab. Make each successive joint watertight with approved rubber ring gaskets, mastic joint filler, cement mortar, or combination thereof.

.6 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.7 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.8 For sanitary sewers:

- .1 Place stub outlets and bulkheads at elevations and in positions indicated.
- .2 Bench to provide a smooth U-shaped channel. Side height of channel to be full diameter of sewer. Adjacent floor to be sloped at 1 vertically to 10 horizontally. Channels to be curved smoothly. Slope invert to establish sewer grade.

.9 Installing units in existing systems:

- .1 Where a new unit is to be installed within an existing run of pipe, carefully remove that portion of existing

pipe to dimensions required and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.10 Set frame and cover to required elevation on at least four and not more than six courses of brick. Make brick joints and joint brick to frame with cement mortar, parge and make smooth and watertight.

.11 Clean units of debris and foreign materials; remove fins or sharp protuberances.

3.4 Adjusting Tops of Existing Units

.1 Remove existing gratings and frames and store for re-use at locations designated by DFO representative.

.2 Sectional units:

.1 Raise or lower straight walled sectional units by adding or removing precast sections as required.

.2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.

.3 Monolithic units:

.1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with:

.1 Mortared brick course for 150 mm or less alteration.

.2 Cast-in-place concrete.

.2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.

.3 Install additional manhole ladder rungs in adjusted portion of units as required.

.4 Re-use existing gratings and frames.

.5 Reset gratings and frames to required elevation on at least four and not more than six courses of brick. Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.

.6 Reset gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

END OF SECTION

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This section specifies requirements for supplying and installing gravity sanitary sewer, storm sewer and culverts, fittings, appurtenances and services with bedding material to lines, grades and dimensions indicated on Drawings or as directed by DFO representative.

1.3 Related Work Specified Elsewhere

.1 Excavating, Trenching, and Backfilling — Section 02223

1.4 Scheduling of Work

.1 Schedule work to minimise interruptions to existing services.

.2 Maintain existing sewage flows during construction.

.3 Submit schedule of expected interruptions for approval by DFO representative and adhere to interruption schedule as approved by the DFO representative.

.4 Notify building occupants a minimum of 24 hours in advance of any interruption in services.

.5 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorised.

PART 2 - PRODUCTS

2.1 Gravity Sewer Pipe and Fittings

.1 Latest revision of all reference specifications to govern.

.2 PVC gravity sewer pipe and fittings 120 to 250mm: to ASTM D3034 and CSA B182.1 or B182.2.

- .1 Standard Dimensional Ratio (SDR) 35.
- .2 Elastomeric gasket and integral bell system, unless otherwise shown.
- .3 Nominal lengths, 4.0 meters.
- .4 Perforated pipe shall be same, with 12.7 - 19 mm diameter holes to provide 2% total open area, i.e., 50 x 12.7 mm holes/m to 22 x 19.0 mm holes/m.

.3 Service connections:

- .1 PVC pipe to ASTM D3034 and CSA B182.1 with rubber ring joints.

.2 Standard Dimensional Ratio (SDR) 28.

.4 Storm sewer pipe 300mm to 600mm:
- .1 PVC Ultrarib: to CSA B182.4
- .2 Elastomeric gasket and integral bell system.
- .3 Nominal lengths, 4.0 meters.

.5 Storm sewer pipe larger than 1200mm C.S.P. to CSA-G401-01, Armtec Hel-Cor or approved alternate, 68 mm x 13 mm profile, 2.8mm galvinized complete with one piece H330 coupler as required.

2.2 Culvert

.1 Culvert to be C.S.P. to CSA-G401-01, Armtec Hel-Cor or approved alternate, 68 mm x 13 mm profile, complete with one piece H330 coupler as required.

2.3 Pipe Bedding Materials

.1 Granular Material - General:
- .1 Gradation to be within specified limits when tested to ASTM C136-71 and giving a smooth curve without sharp breaks when spotted on a semi-log grading chart.

.2 Bedding Stone:
- a) Crushed stone or crushed gravel to following grading requirements:

ASTM Sieve Size		Percent Passing		
25.00	mm		-	100
19.00	mm	70	-	100
12.50	mm	55	-	100
9.50	mm	30	-	80
4.75	mm	0	-	40
2.00	mm	0	-	10

.3 Concrete required for cradles, encasement, supports, reaction backing: to Section 03010.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean pipes and fittings of accumulated debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

3.2 Trenching, Backfilling and Restoration

.1 Trenching, backfilling and restoration to Section 02223.

3.3 Concrete Bedding and Encasement

.1 Do concrete work to Section 03010. Place concrete to details indicated or directed by DFO representative.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placement.

3.4 Pipe Bedding

.1 Place and compact granular bedding to dimensions indicated and provide continuous even support beneath and around the pipe.

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe exterior. Do not use blocks in bedding pipe.

.3 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.

.4 Provide 50 mm minimum bedding material beneath and around pipe couplings.

.5 Compact full width of bed to at least 95% standard proctor density.

.6 Under wet laying conditions use bedding stone.

.7 Use crushed stone to fill excavation below bottom of specified bedding adjacent to manholes or structures.

3.5 Pipe Installation

.1 Lay and join pipes in accordance with manufacturer's recommendations.

.2 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes true to line and grade. Take up and replace defective pipe. Relay pipe which shows undue settlement after installation.

.4 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends upgrade.

.5 Joint deflection to be not more than the pipe manufacturer's recommended maximum deflection.

.6 Protect installed pipes from ingress of dirt and water or other foreign materials. Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.

.8 Cut pipes as required for specials, fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

.9 Align pipes carefully before jointing.

.10 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimise lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.11 Maintain pipe joints clean and free from foreign materials.

.12 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated and replaced before jointing is attempted.

.13 Complete each joint before laying next length of pipe.

.14 Minimise deflection after joint has been made to avoid damage.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.16 Block pipes when stoppage of work occurs, in an approved manner to prevent creep during downtime.

.17 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.18 Do not lay pipes when conditions are such that water may enter pipe.

.19 Do not lay pipe on frozen bedding.

.20 At rigid structures, install a pipe joint not more than 1.2 m from side of structure.

.21 Plug lifting holes with approved prefabricated plugs in non-shrink grout.

.22 Make watertight connections to manholes with non-shrink grout.

.23 Use prefabricated saddles for connecting pipes to existing sewer pipes and seal edges with non-shrink grout.

3.6 Service Connections

.1 Install pipe to CSA B182.11, and manufacturer's standard instructions and specifications.

.2 Maintain grade for 100 mm and 125 mm diameter sewers at 1 vertically to 50 horizontally unless directed otherwise.

.3 Service connections to main sewer to be standard tee or wye fittings or approved saddles. Do not use break-in and mortar patch-type joints.

.4 Service connection pipe not to extend into interior of main sewer.

.5 Make up required horizontal and vertical bends from 45 degree bends or less, separated by a straight section of pipe with a minimum length of four pipe diameters. Use long sweep bends where applicable.

.6 Plug service laterals with watertight caps or plugs as approved by DFO representative.

.7 Place temporary location marker at ends of plugged or capped unconnected sewer lines. Each marker shall consist of a 38 mm x 89 mm stake extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion in stake red with designation "SANITARY SERVICE LINE" in black.

3.7 Field Testing

.1 Repair or replace pipe, pipe joint or bedding material found defective.

.2 When directed by DFO representative, draw a tapered wooden plug with a diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration or air testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Do infiltration or air testing as directed. Perform tests in presence of DFO representative. Notify DFO representative 24 hours in advance of proposed tests.

.6 Carry out tests on each section of sewer between successive manholes including service connections.

.7 Infiltration Tests:

.1 Conduct infiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.

.2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.

.3 Install a watertight plug at upstream end of pipeline test section.

.4 Discontinue any pumping operations for at least 3 days before test measurements are to commence and during this time keep thoroughly wet at least 1/3 of pipe invert perimeter.

.5 Prevent damage to pipe and bedding material due to flotation and erosion.

.6 Place a 90 degree V-notch weir, or other measuring device approved by DFO representative in invert of sewer at each manhole.

.7 Measure rate of flow over a minimum of 1 hour, with recorded flows for each 5 minute interval.

.8 Infiltration not to exceed following limits in litres per hour per 100 meters of pipe, including service connections:

Pipe Diameter	L/s
100 mm	3.88
125 mm	4.62
150 mm	5.51
200 mm	7.45

.9 Repair and re-test sewer line as required, until test results are within limits specified.

.10 Repair visible leaks regardless of test results.

.11 Testing procedure shall be considered a normal part of the pipe laying or other installation work. All costs incurred in testing shall be included in the price bid for installing all pipe, fittings and appurtenances.

*** END of SECTION ***

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This section specifies requirements for supplying and installing watermains, fittings, services and appurtenances to lines, grades and dimensions shown on the Drawings or as directed by the Departmental Representative.

1.3 Related Work Specified Elsewhere

.1 Trenching, Backfilling and Restoration — Section 02223

.2 Concrete — Section 03010

1.4 Certification

.1 Provide Departmental Representative with certified copy of pipe tests, showing that pipe and gaskets meet specified requirements.

.2 Include manufacturer's drawings and pertinent information and Shop Drawings where required.

1.5 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by the Departmental Representative and adhere to interruption schedule as approved by the Departmental Representative.

.3 Notify building occupants a minimum of 24 hours in advance of any interruption in services.

.4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.

.5 Notify the fire department of any planned or accidental interruption to hydrants.

1.6 Alternatives

.1 To promote development and use of new proprietary products to increase efficiency in installation and provide better service life, alternative materials to those specified will be considered if full descriptive data is submitted to the Departmental Representative in ample time to permit approval without delaying work.

.2 Such data must fully document description and specifications met by such alternative materials including certification from manufacturer that materials meet or exceed

requirements for use intended and history, if any, of service in other installations.

.3 Variations to tendered unit price, if any, to be proposed when requesting use of alternative materials.

PART 2 - PRODUCTS

2.1 Pipe and Fittings

.1 Latest revision of all referenced specifications to govern.

.2 Ductile iron pipe: to AWWA C151 (latest edition), cement mortar lined to AWWA C104 (latest edition).

.1 Joints:

.1 Mechanical, rubber gaskets with lead tip and double duck backing.

.2 Push-on joint with continuous rubber molded ring gasket.

.3 Grooved type coupling joint with malleable iron couplings and gaskets.

.4 Ensure electrical conductivity across joints.

.2 Fittings: to AWWA C110 (latest edition).

.3 Polyvinylchloride pressure pipe:

.1 Polyvinylchloride class rated pipe: to AWWA C900 (latest edition).

.2 Polyvinylchloride series rated pipe: to CSA B137.3 (latest edition).

.3 Ductile iron fittings: to AWWA C153 (latest edition).

.4 Joints: to be of the elastomeric gasket form.

.4 Polyethylene pressure pipe: nominal diameter less than 90 mm to CSA B137.1 (latest edition). Nominal diameter 90 mm or greater to CGSB 41-GP-25M.

.1 Polyethylene pipe sizes to be Iron Pipe Size (IPS) outside diameter.

.2 Insulation where called for to be 50 mm thick. Insulation to be jacketed in HDPE suitable for continuous exposure to sunlight.

.3 Polyethylene to polyethylene joints: to be thermal butt fusion or to AWWA C207 (latest edition) flanged with steel backing flanges.

.4 Cast iron fittings with flanged ends: to AWWA C110 (latest edition) for pipe size above 90 mm. Ends flanged to meet ANSI B16.1 (latest edition), 1 725 kPa flanges do not match AWWA C110

(latest edition) flanges and special order must be made if a match to ANSI B16.1 (latest edition), 1 725 kPa flange is required. AWWA C110 (latest edition) flanges are rated for 1 725 kPa water service working pressure.

.5 Polyethylene fittings: to CSA B137.1 (latest edition) for pipe sizes less than 90 mm.

.5 Steel water pipe: to AWWA C200 (latest edition).

.1 Exterior finish: to AWWA C203 (latest edition), hot applied coal tar enamel.

.2 Interior finish: to AWWA C205 (latest edition), cement mortar lined, or coal-tar epoxy to AWWA C210.

.3 Pipe joints: to be mechanical joints, field welded slip joints, butt welded joints, field welded butt straps, flanged joints, threaded joints and grooved victaulic couplings.

.4 Flanges: to AWWA C207(latest edition).

.5 Pipe fittings: to AWWA C208 (latest edition), cement mortar lined to AWWA C205 (latest edition), and exterior protected with hot applied coal tar enamel to AWWA C203-89.

2.2 Valves and Valve Boxes

.1 Gate valves: iron body, bronze mounted, to AWWA C500 (latest edition).

.1 Valves to be solid wedge gate with non-rising stems.

.2 Ends to be flanged at junctions with cast iron fittings.

.3 Ends to be bell or mechanical at junctions with pipe. Joints to be formed with a mechanical seal equivalent to pipe joint.

.4 Position of the valve in line to be vertical.

.5 Stem seal: O-ring or stuffing box type.

.6 Valves to open on counter-clockwise rotation of the wrench nut.

.7 Extension pieces to be used where valve bury is deeper than 1.5 m.

.8 Thrust blocking to be provided on all valves.

.2 Valves: to open in direction corresponding to local standard. Counter-clockwise where no local standard.

.3 Cast iron valve boxes: Nelson type adjustable over a minimum of 450 mm, complete with valve operating extension rod, 30 mm diameter, of such length that when set on valve operating nut top of rod will not be more than 300 mm below cover. Provide stone ring beneath operating nut.

Base to be large round type with minimum diameter of 300 mm. Top of box to be marked "WATER".

.4 Underground type indicator valve where required by Departmental Representative. Indicator post to accurately indicate position of valve.

.5 Air release valves: air release valves employing direct acting kinetic principle. Valves to be fabricated of cast iron body and cover with bronze trim, stainless steel floats with shockproof synthetic seat. Ends to be flanged to AWWA C110 (latest edition).

2.3 Service Connections

.1 Copper tubing: To CSA Hc7.6 (latest edition), Type K, annealed, for 1 MPa working pressure.

.2 Copper pipe joints: To be of compression type suitable for 1 MPA working pressure.

.3 Brass corporation stops: red brass to ASTM B62 (latest edition), compression type, having threads to AWWA C800 (latest edition).

.4 Brass inverted key-type curb stops: red brass to ASTM B62 (latest edition) compression type without drains. Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury. Mark top of cast iron box "WATER".

.5 Double strap service clamps.

.6 Appropriate sized "tee" connections for services larger than sizes permitted for direct tap or service clamps. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and have ends matching pipe to which they are joined.

.7 Pressure Reducing Valves to be Watts No. 5U with inlet and outlet threaded to suit individual services applications, if called for on the Drawings.

2.4 Hydrants

.1 Post type hydrants: to AWWA C502 (latest edition) with 65 mm threaded hose outlets, and 150 mm connection for main. Depth of bury as shown on Standard Detail.

.1 Hydrants to be painted red above ground.

.2 Hydrants to be Terminal City C-71 with pumper port as manufactured by Terminal City Ironworks with

clockwise opening and standard pentagon operating nut, or equal.

2.5 Granular Bedding

.1 Shall be in accordance with 02223 Excavation, Trenching and Backfilling specification.

.2 Concrete required for cradles, encasement, supports, reaction backing: to Section 03010.

2.6 Chlorine

.1 Disinfection of watermain shall conform to AWWA C601 (latest edition). Granular hypochlorite shall not be used for disinfection of PVC with solvent welded joints as there may be a potentially explosive reaction.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, valves, hydrants and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 Trenching, Backfilling and Restoration

.1 Trenching, Backfilling and Restoration to Section 02221.

3.3 Concrete Bedding and Encasement

.1 Do concrete work to Section 03010. Place as indicated or directed.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipes to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placement.

3.4 Pipe Bedding

.1 Place and compact granular bedding to dimensions indicated and provide continuous even support beneath and around the pipe.

.2 Use bedding material as pipe support during laying and jointing.

.3 Provide 100 mm (150 mm on rock) minimum bedding material beneath, 200 mm minimum around both sides of pipe and 300 mm above top of pipe as standard trench detail.

.4 Under wet laying conditions use bedding stone.

.5 Compact full width of pipe zone to at least 95% maximum density as per ASTM Standard D698 (latest edition), Method D.

3.5 Pipe Installation

.1 Lay pipes to AWWA C600 (latest edition) for cast iron and ductile iron pipe, and/or manufacturer's standard instructions and specifications. Do not use blocks except as permitted in 3.3.2. Contract bedding details shall govern.

.2 Joint pipes to AWWA C600 (latest edition), AWWA C603 (latest edition), AWWA C206 (latest edition), and/or manufacturer's recommendations.

.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

.4 Lay pipes true to line and grade. Take up and replace defective pipe. Relay pipe which shows undue settlement after installation.

.5 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends upgrade.

.6 Joint deflection to be not more than half the pipe manufacturer's recommended maximum deflection.

.7 Protect installed pipes from ingress of dirt and water or other foreign materials. Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Position and joint pipes with approved equipment. Do not use excavating equipment to force pipe sections together.

.9 Cut pipes as required for special fittings or closure pieces, in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

.10 Align pipes carefully before jointing.

.11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize

lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.12 Maintain pipe joints clean and free from foreign materials.

.13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed to be removed, cleaned, lubricated and replaced before jointing is attempted.

.14 Complete each joint before laying next length of pipe.

.15 Minimize deflection after joint has been made to avoid damage.

.16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.17 Block pipes when stoppage of work occurs, in an approved manner to prevent creep during downtime.

.18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.19 Do not lay pipes when conditions are such that water may enter pipe.

.20 Do not lay pipe on frozen bedding.

.21 Protect pipework, hydrants, valves and appurtenances from freezing.

.22 Upon completion of pipe laying and after the Departmental Representative has inspected work in place, surround and cover pipes with specified material placed to dimensions indicated or directed.

3.6 Valve Installation

.1 Mount valves to manufacturer's recommendations in locations indicated.

.2 Support valves located in valve boxes or valve chambers by means of a concrete block, located between valve and solid ground. Valves not to be supported by pipe.

.3 Install 100 mm x 100 mm x 240 mm pressure treated wood post to mark location of valve box, if required by drawings. Align front face of post toward valve box and write distance to valve box on front face, using white enamel paint. Set post into concrete, 600 mm deep.

3.7 Service Connections

.1 Construct service connections at right angles to watermain unless otherwise directed. Locate curb stops 300 mm from all existing houses, or as shown on the Drawings.

.2 Tappings on cast iron or ductile iron pipe may be threaded without service clamps. Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used. Tappings to conform to the following:

Pipe Tap Diameter	Maximum Tap Without Clamp	Maximum With Clamp
100 mm	20 mm	25 mm
150 mm	20 mm	40 mm
200 mm	25 mm	50 mm
250 mm	25 mm	50 mm
300 mm	40 mm	75 mm

.3 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps. Service clamps shall have maximum outlet size 25 mm for pipe diameter 100 mm, 40 mm for pipe diameter 150 mm and 50 mm for pipe diameter 200 mm and greater. For larger services use valve tees.

.4 Tappings for PE pipe shall be PE tapping tees.

.5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.6 Tap main at 2:00 o'clock or 10:00 o'clock position only, not closer to a joint nor closer to adjacent service connections than recommended by manufacturer, or 1000 mm, whichever is greater.

.7 Leave corporation stop valves fully open.

.8 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.9 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

.10 Install curb stop with corporation box on services 50 mm or less in diameter. Equip larger services with a gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.

.11 Place temporary location marker at ends of plugged or capped unconnected waterlines. Each marker to consist of a 50 mm by 100 mm stake extending from pipe end at pipe level to 60 mm above grade. Paint exposed portion of stake blue with designation "WATER SERVICE LINE".

3.8 Hydrants

.1 Install hydrants at locations indicated or directed.

.2 Install hydrants in accordance with AWWA Manual of Practice M-17 (latest edition).

.3 Install gate valve and cast iron valve box on hydrant service leads as indicated.

.4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation 75 mm above final grading in paved areas and 150 mm in unpaved areas.

.5 Place concrete reaction backing as indicated and specified herein, ensuring that drain holes are unobstructed.

.6 To provide proper draining for each hydrant, excavate a pit measuring not less than 1 meter by 1 meter by 50 mm deep and backfill with coarse gravel or crushed rock to a level 150 mm above drain holes, unless indicated otherwise on drawings.

.7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.9 Thrust Blocks

.1 Do concrete work to Section 03010.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and solid ground as shown on Drawings or as directed by the Departmental Representative.

.3 Keep joints and couplings free of concrete.

3.10 Undercrossing

.1 Excavate working pit outside right-of-way to be crossed.

.2 Excavate working pit to a minimum of 50 mm below lowest invert of encasing pipe or structure.

.3 Dewater excavation.

.4 Dewater area of undercrossing.

.5 Install heavy timber or steel frame backstop.

.6 Place encasing pipe to exact line and grade indicated. Where practical, use 90 degree crossing. Crossing shall never be less than 45 degrees. When encasement pipe not required, delete 3.11.7 to 3.11.9 and 3.11.11 to 3.11.13.

.7 Install encasing pipe by jacking, boring or tunneling as indicated on Drawings.

.8 Encasing pipe not to be in tension.

.9 Joints for encasing pipe to be welded type.

.10 Provide Shop Drawings showing proposed method of installation for carrier pipe.

.11 Use approved blocking method to guide carrier pipe in true alignment.

.12 Clearance between blocks and encasement pipe to be maximum 10 mm when carrier pipe is in position.

.13 Join carrier pipe one length at a time outside encasement pipe. Push or pull carrier pipe into position.

3.11 Hydrostatic and Leakage Testing

.1 Upon completion of construction of any section, which shall be defined as that pipeline and appurtenances located between any two adjacent line valves, make section ready for testing. Carry out testing in accordance with point 2 of this Section .

. 2 Before pipe is fil led with water, pipe bedding, concreting of all valves and fittings and backfi lling to be completed as requ i red i n this specification. Fill each section of pipe and allow to remain full of water for a period of at least 24 hours prior to commencement of any pressu re tests. Submit pipeline to a test of 1.5 x working pressure applied at highest elevation in

each section, with a minimum of 1380 kPa applied at lowest point of test section. Ensure that test pressure does not exceed pipe or thrust restraint design pressures. Maximum allowable leakage rate at test pressure to not exceed 1.25 litres per millimetre diameter of pipe per kilometre per 24 hour period . Minimum duration of test period to be 2 hours. Maximum test pressures should not exceed those specified in CSA B137.3.

. 3 Perform pressure and leakage testing of ductile iron piping to AWW C600 and AWWA M41.

.4 Perform pressure and leakage testing of polyvinyl chloride (PVC) piping to AWWA M23 and AWWA C605

. 5 Perform testing of welded steel piping to AWWA C206 no leakage allowed .

. 6 Should any test disclose excessive leakage, repai r or replace defect and retest section until specified testing requirement is achieved .

3.12 Flushing and Disinfection

.1 Do in accordance with AWWA-C601-81 or latest revision.

.2 Flushing and disinfection operations to be under direct control of Departmental Representative. Notify Departmental Representative at least four (4) days in advance of proposed date when disinfection operations to commence.

.3 Flush water mains through outlets as directed by Departmental Representative. Use sufficient flow to produce a velocity of 1.5 m per second, for 10 min., or until foreign materials have been removed and flushed water is clear.

.4 Flushing flows to be as follows:

Pipe Size (mm)	Flow (L/s) Minimum
150 and below	38
200	75
250	115
300	150

.5 Provide connections and pumps required.

.6 Open and close valves, hydrants, and service connections to ensure thorough flushing.

.7 When flushing has been completed to satisfaction of Departmental Representative, introduce a strong solution of chlorine into watermain and ensure that it is distributed throughout entire system.

.8 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.9 After free chlorine residual not less than 25 mg/l has been obtained, leave system charged with chlorine solution for 24 hours. Further samples to be taken to ensure that there is still not less than 10 mg/l of chlorine residual throughout system.

.10 After chlorination, thoroughly flush system at discharge locations directed by Departmental Representative, avoiding environmental damage.

.11 After flushing, take at least one sample at the end of each main and branch. Samples to be taken from main stop and copper service line or blow-off. Do not take samples from hydrants or hoses of any kind.

.12 Samples to be taken in sterilized sample bottles in accordance with the instructions of the Environmental Health Officer, Medical Services, Health & Welfare Canada. Submit for analysis to approved testing laboratory. Samples to show absence of coliform bacteria.

.13 If sample results are unsatisfactory, flush, chlorinate and sample system until results are satisfactory, or until approved by the Environmental Health Officer.

END OF SECTION

1.0	**GENERAL**	.1	Section refers to those portions of the work that are unique to the supply and installation of storm sewer pipe culverts. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.	
1.1	**Related Work**	.1	Excavating, Trenching and Backfilling	Section 02223
		.2	Gravity Sewers	Section 0257
		.3	Manholes and Catchbasins	Section 02725
		.4	Cast-in-Place Concrete	Section 03300
1.2	**References**	.1	The abbreviated standard specifications for testing, materials, fabrication and supply, referred to herein, are fully described in Section 02000 – Reference Specifications - Site and Infrastructure.	
1.3	**Samples**	.1	Samples may be required.	
1.4	**Material Certification**	.1	Products having CSA certification to be used where readily available. Product to be certified to.CSA standard{s) by an approved independent third party certification body accredited by the Standards Council of Canada and that is acceptable to the DFO representative. Products to be marked with certification body logo and CSA standard markings.	
		.2	At least 14 days prior to commencing work, submit to DFO representative the manufacturer's recent test data and certification that materials to be incorporated into works are representative and meet requirements of this section. Include manufacturer's drawings where pertinent.	
1.5	**Inspection and Testing**	.1	Refer to General Conditions, Clause 4.12, Inspections	
2.0	**PRODUCTS**			
2.1	**Corrugated Steel Pipe**	.1	Corrugated steel pipe: to CAN3-G401.	
		.2	Water-tight cut-off collars: as shown on Contract Drawings.	
		.3	Prefabricated end sections: as shown on Contract Drawings.	
		.4	Corrugated fluming: to CAN3-G401.	

.5 Steel Spiral Rib Pipe: To CAN3-G401 specification except that the external helical corrugation pattern shall be 19mmx19mmx 190mm, as described in AASHTO M 36 or ASTM A760.

.6 Steel Spiral Rib Pipe Material: Galvanized or Aluminized Steel Type II to CAN3-G401.

2.2 Concrete Pipe

.1 Non-reinforced circular concrete pipe and fittings: to ASTM C14M maximum diameter 900 mm, strength class as shown on Contract Drawings, designed for flexible rubber gasket joints to ASTM C443M.

.2 Reinforced circular concrete pipe and fittings: to ASTM C76M for all pipe greater than 900 mm diameter, strength class as shown on Contract Drawings, designed for flexible rubber gasket joints to ASTM C443M.

.3 Reinforced concrete arch pipe: ASTM C506M.

.4 Reinforced concrete elliptical pipe: to ASTM C507M

.5 Reinforced concrete box culverts to ASTM C1433M.

.6 Lifting holes:

.1 Pipe 900 mm or less: no lift inserts required.

.2 Pipe greater than 900 mm diameter: engineered lift insert systems designed for the weight of the pipe cast into the pipe walls during manufacture. Not to exceed two in each piece of pipe.

.3 Manufacturer to provide properly rated lifting clutches to be used with lift insert cast into pipe.

.4 Lift insert opening not required to be grouted provided it does not extend beyond the depth of the engineered design.

.5 At request of the DFO representative or the Owner, manufacturer shall supply design information confirming suitability of lift insert system used.

2.3 Plastic Pipe, Smooth

.1 Polyvinyl chloride pipe up to 1200 mm in diameter,

Profile

DR35. Pipe to have minimum pipe stiffness (F/Y) of 320 kPa at 5.0% deflection, ASTM D2412. Pipe to be manufactured to specification for pipe size ranges as follows:

100 mm dia. - 375 mm dia. to ASTM D3034.
450 mm dia. - 1200 mm dia. to ASTM F679.

Pipes to be certified toCSA B182.2 for pipe size diameter 100 mm to 1200 mm

.2 Joints: pipe to include integral bell and spigot ends with stiffened wall section and formed groove for a rubber gasket, gasket to ASTM F477, joints to conform to all requirements of ASTM D3212 elastomeric gaskets to conform to ASTM F477.

.3 Normal pipe length joint to joint to be 4.0 m.

.4 Maximum short term installed deflection not to exceed 5.0% of the base inside diameter.

2.4 PVC Pipe Profile

.1 PVC Profile Pipe: PVC profile pipes and fittings conforming to ASTM F794 and certified to CSA B182.4, 200 mm to 1200 mm diameters. Fittings to be certified to CSA B182.2 and conform to ASTM D3034 and ASTM F679.

.2 Pipe to have a minimum pipe stiffness of 320 kPa at 5.0% deflection, when tested in accordance with ASTM D2412. Pipe to be marked to clearly indicate class rating as required under ASTM F794.

.3 Pipe to have factory assembled spigot gaskets and integral bell joint features.

.4 Gaskets to meet requirements of ASTM F477.

.5 Normal pipe laying length joint to joint to be 4.0 m.

.6 Maximum short term installed deflection not to exceed 5.0% of base inside diameter.

2.5 HDPE Plastic Pipe, Open Profile

.1 HDPE Open Profile Pipe {Corrugated Exterior, Smooth Inner Wall) and Fittings certified to CSA B182.8, 100mm to 900mm diameter.

.2 Pipe to have minimum pipe stiff ness of 320 kPa at 5.0% deflection, when tested in accordance with ASTN D2412. Exterior pipe corrugation to be embossed with stiffness rating as required by CSA B182.8.

.3 Pipe to have factory assembled spigot gaskets and integral bell joint features certified to CSA 182.8.

.4 Gaskets to meet requirements of ASTM F477.

.5 Maximum short term installed deflection not to exceed 5.0% of base inside diameter.

2.6 Concrete

.1 Concrete mixes and materials required for bedding cradles, encasement, and incidental uses: to Section 03300- Cast-in-Place Concrete.

.2 Concrete to be minimum 20 MPa.

2.7 Granular Pipe Bedding and Surround Material

.1 As shown on Contract Drawings.

.2 Refer to Section 02226 - Aggregates and Granular Materials for material specifications.

2.8 Backfill Material

.1 As shown on Contract Drawings.

.2 Refer to Section 02226 - Aggregates and Granular Materials for materials specifications.

3.0 EXECUTION

3.1 Excavation, Trenching, and Backfilling

.1 Do excavating, trenching and backfilling work to Section 02223 - Excavating, Trenching and Backfilling.

.2 Obtain DFO representative's approval of trench line and depth prior to placing bedding material or pipe.

.3 Do not backfill until pipe grade and alignment checked and accepted by DFO representative.

3.2 Bedding

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry.

.2 Place minimum thickness of 100 mm of approved granular material on bottom of excavation and compact to minimum

95% Modified Proctor density in compliance with ASTM D1557.

.3 Bedding requirements in accordance with pipe manufacturer's recommendations.

.4 Shape bedding to fit lower segment of corrugated steel pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as shown on Contract Drawings free from sags or high points.

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 centre line of paved segment coinciding with flow line.

.5 Do not allow water to flow through pipes during construction except as permitted by DFO representative.

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 DFO representative or two coats of zinc rich paint as applicable, to match pipe coating.

.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 approved by DFO representative or two coats of zinc rich epoxy paint as applicable to match pipe coating.

3.5 Laying Concrete Pipe Culverts

.1 In general compliance with Section 02721 - Storm Sewers.

.2 Begin at downstream end of culvert with female end of first pipe section facing upstream.

.3 Ensure barrel of each pipe is in contact with shaped bed throughout its length.

.4 Do not allow water to flow through pipes during construction except as permitted by DFO representative.

3.6 Joints: Concrete Culverts

.1 In general compliance with Section 02721 – Storm Sewers.

.2 Use rubber gaskets installed in accordance with manufacturer's recommendations.

3.7 Installation, Other Approved Materials

.1 Lay and join culverts utilizing other approved materials as specified in this Section in accordance with respective manufacturer's recommendations.

3.8 Backfill

.1 Backfill around and over culverts as shown on Contract Drawings.

.2 Place specified granular backfill material in layers to full width, alternately on each side of culvert, so as not to displace it.

.3 Compact each layer to minimum 95% Modified Proctor density taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross during construction of project. Width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

3.9 Fluming

.1 Assemble and install fluming as indicated.

.2 Set top edges of fluming flush with side slope.

3.10 Endwalls

.1 Construct endwalls as shown on Standard Detail Drawings or as shown otherwise on Contract Drawings.

**** END OF SECTION ****

1.0 GENERAL

.1 Section 02831 refers to those portions of the work that are unique to the supply and installation of chain link fences and gates. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

.2 Industry standards to apply where details and procedures not specified.

1.1 Related Work

.1 Cast-in-Place Concrete Section 03300

1.2 References

.1 The abbreviated standard specifications for testing, materials, fabrication and supply, referred to herein, are fully described in Section 02000 – Reference Specifications - Site and Infrastructure.

1.3 Shop Drawings

.1 Shop drawings are not required.

1.4 Samples

.1 Samples are not required.

1.5 Inspection and Testing

.1 Refer to General Conditions, Clause 4.12, Inspections.

2.0 PRODUCTS

2.1 Materials

.1 Fencing: as shown on Contract Drawings.

.2 Concrete mixes and materials: Section 03300 - Cast-in-Place Concrete.

.1 Nominal coarse aggregate size: 19 mm.

.2 Compressive strength: 20 MPa minimum at 28 days.

.3 Chain-link fence fabric: 9 gauge (3.55 mm diameter) 50 mm mesh, galvanized, plastic coated or electro galvanized as specified in Contract Documents.

.4 Posts and rails: to CAN/CGSB-138.2, Schedule 40 galvanized steel pipe.

.1 Top and brace rails: 42 rrm nominal outside diameter, wall thickness 3.55 mm.

.2 End and corner posts: 75 mm nominal outside diameter, wall thickness 5.15 mm.

.3 Line posts: 60 mm nominal outside diameter 3.90 mm wall thickness.

.4 Gate Posts: 89 mm minimum nominal outside diameter or as otherwise specified.

.5 Bottom tension wire: single strand, aluminum, galvanized, or vinyl coated steel wire, 6 gauge, (4.50 mm diameter).

.6 Tie wire fasteners: single strand, vinyl coated or aluminum wire 9 gauge, (3.55 mm diameter).

.7 Tension bar: 4.76 x 19 mm minimum galvanized steel.

.8 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.9 Gate frames: to ASTM A53, Schedule 40 galvanized steel pipe, 42 mm nominal outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing; or as otherwise shown on Contract Drawings.

.1 Fabricate gates with electrically welded joints, and hot-dip galvanize or paint with zinc pigmented paint after welding.

.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.

.10 Fittings and hardware: cast aluminum alloy, galvanized steel or malleable or ductile cast iron. Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail. Overhang tops to provide waterproof fit, to hold top rails and an outward or inward projection, as shown on Contract Drawings, to hold barbed wire overhang. Provide projection with clips or recesses to hold 3 strands of barbed wire spaced 100 mm apart. Projection of approximately 300 mm long to project from fence at 45° above horizontal. Turnbuckles to be drop forged.

.11 Organic zinc rich coating: to CGSB 1-GP-181M.

.12 Barbed wire: 2 mm diameter galvanized steel wire to ASTM A121 or aluminum coated steel wire to ASTM A585, 4 point barbs 125 mm spacing.

2.2 Finishes

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1

.2 For pipe: 550 g/m^2 minimum to ASTM A90.

.3 For barbed wire: to ASTM A121, Class 2.

.4 For other fittings: to CSA G164.

.2 Aluminum coating: For barbed wire: to ASTM A585, Class 2.

.3 Vinyl coating: 0.045 mm dry film thickness minimum.

3.0 EXECUTION

3.1 Grading

.1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface neither less than 30 mm nor more than 50 mm.

3.2 Installation of Fence

.1 Install fence along lines as shown on Contract Drawings and in accordance with CAN/CGSB-138.3.

.2 Excavate post holes to dimensions shown on Standard Detail Drawing C13.

.3 Space line posts maximum 3 m apart, measured parallel to ground surface.

.4 Space straining posts at equal intervals not exceeding 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.

.5 Install additional straining posts at sharp changes in grade where shown on Contract Drawings.

.6 Install corner post where change in alignment exceeds 10°.

.7 Install end posts at end of fence and at buildings. Install gate posts on both sides of gate openings.

.8 Place concrete in post holes then embed posts into concrete to depths shown on Standard Detail Drawing C13. Extend concrete 40 mm above ground level and slope to drain away from posts... Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.

.9 Do not install fence fabric until concrete has cured a minimum of 5 days.

.10 Install brace between end and gate posts and nearest line post, placed in centre of panel and parallel to ground surface. Install braces on both sides of corner and straining posts in similar manner.

.11 Install overhang tops and caps.

.12 Install top rail between posts and fasten securely to terminal posts and secure waterproof caps and overhang tops. Connect rails with slip-on sleeves: use expansion springs at 40 m spacing.

.13 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.14 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 375 mm intervals. Knuckled selvage at top and bottom.

.15 Secure fabric to top rails, line posts and bottom tension wire as detailed on Standard Detail Drawing C13. Give tie wires minimum two twists.

.16 Where specified, install barbed wire strands and clip securely to lugs of each bracket.

**** END OF SECTION ****

PART 1 - GENERAL

1.1 General

.1 Not used

1.2 Description

.1 This section describes the supply and installation of on-line measuring instruments.

PART 2 – PRODUCTS

.1 Refer to Construction Drawings

PART 3 - EXECUTION

3.1 Installation

.1 Install instruments at the locations shown on the drawings and according to the manufacturer's instructions.

.2 All instruments are to be hard wired to the power distribution.

.3 All instruments are to be control wired

.4 Provide all miscellaneous tubing, connections and mounting pieces necessary for a complete and operating system.

END OF SECTION

PART 1 - GENERAL

1.1 General .1 Not used

1.2 Description

.1 This section specifies requirements for supplying, producing and placing the Fish Culture Tank(s) including fish exclusion screens, sumps, side boxes, and bottom drain standpipe for water level control, and all appurtenances and components necessary to provide a complete and fully functional Fish Culture Tank system.

1.3 Related Work Specified Elsewhere .N/A

1.3 REFERENCES

.1 Commercial Standards
.1 ASTM American Society for Testing and Materials
.2 AWS American Welding Society
.3 ANSI/ASME Performance Test Code
.4 AWWA American Water Works Association
.5 MSS Manufacturers Standardization Society of the Valve and Fitting Industry

1.4 SUBMITTALS

.1 Product Data and Shop Drawings: Submit complete assembly and installation drawings and product data for the Fish Culture Tank equipment as a complete system, in accordance with SECTION 01 33 00 - SUBMITTAL PROCEDURES. The following are to be included in the submittal:
.2 Product data and shop drawings for approval as per SECTION 01 33 00 – SUBMITTAL PROCEDURES. Drawings are to show locations and connections of water inlet and outlet.
.3 Equipment name and applicable specification number
.4 Product data including:

- .1 Dimensions and capacity
- .2 Components including resin and reinforcement
- .3 Tank construction materials,
- .4 Exact pipe connection sizes, types and locations
- .5 Schematic flow diagrams showing piping and equipment
- .6 Floor and wall slopes,
- .7 Tank interior and exterior color
- .8 Finishes including UV absorbers, pigments and gelcoats
- .9 Weights and thicknesses
- .10 Specifications for accessory items.

.11 Assembly and Installation Drawings: Complete assembly and installation drawings and instructions including piping, equipment assemblies, required, clearances, method of field assembly, location and size of each field assembly, mounting, and anchoring.

1.5 QUALITY ASSURANCE

.1 Manufacturer Qualifications: A firm experienced in FRP vessel manufacture similar to that indicated for this project and with a record of successful in-service performance in similar applications.

.2 Installer Qualifications: Engage personnel experienced in FRP vessel installations similar to that required by this project who are acceptable to the FRP vessel manufacturers.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading: Manufacturer shall provide shipping of all items specified to the project location. The Contractor shall make the Manufacturer fully responsible to adequately crate and protect all fibreglass items from damage during shipping. Damaged units may be rejected by Departmental Representative and returned to the manufacturer for replacement or repair.

.2 Storage and Protection: Stored units shall be kept fully crated and protected from damage at all times prior to installation.

1.7 WARRANTY

.1 Warranties for materials and workmanship for all equipment and accessories as specified in this section are to be valid for a period of not less than one (1) year, starting from final acceptance by the Departmental Representative.

Part 2 PRODUCTS

2.1 MATERIALS

.1 The contractor shall not install any material containing cadmium, brass, bronze, copper, zinc, or their alloys, which could come in contact with fish rearing water. These heavy metal materials have been shown to be toxic to fish.

.2 Resin

. 1 The resin shall be US FDA-approved for use with foods and potable water. The resin, unless otherwise specified shall be as produced by Reichhold, Dow, or Ashland or approved equivalent. The same resin shall be used throughout the laminate unless otherwise specified.

.2 An isophthalic polyester resin, rated for use in fresh water applications at temperatures up to 65.6°C (150°F), shall be used for all FRP vessels, except where contact with ozone could occur when an ozone-resistant epoxy vinyl ester resin such as Derakane 411 by Ashland shall be used.

.3 The resin used shall not contain fillers, unless specified. When specified up to 2% by weight thixotropic agent, Cab-O-Sil, may be used for viscosity control in the paraffinated top coat on vertical surfaces, provided it will not interfere with visual inspection.

.4 Unless otherwise agreed upon by the Manufacturer and the Departmental Representative, the cure system used for the resin shall be in accordance with the resin manufacturer's current recommendations. Proper curing of the resin is the FRP vessel Manufacturer's responsibility. All products fabricated to this specification shall be cured to at least 90% of the minimum Barcol Hardness specified by the resin manufacturer. This requirement applies to both interior and exterior surfaces. (Note: The use of paraffin in the resin or the use of synthetic veil may lower the Barcols below the resin manufacturer's specifications, this is acceptable.)

.5 No chemical-resistant surface, interior or exterior, shall be acetone sensitive.

.3 Reinforcement

.1 Woven roving shall be Type E (electrical borosilicate) glass, nominal 24 oz./sq. yd., 4 by 5 weave, with a silane-type finish and a binder compatible with the lay-up resin.

.2 Chopped strand mat shall be Type E glass, 1-1/2 oz. per sq. ft., with a silane finish and a styrene-soluble reactive binder.

.3 Continuous roving used in chopper gun for spray-up shall be Type E.

.4 Laminate Construction

.1 The vessel shall be constructed using a multi-layered system consisting of, at minimum, the following layers:

.1 Polyester gel coat

.2 Chop strand fibreglass

.3 Woven roving

.4 Chop strand fibreglass

.5 Polyester gel coat

.2 The minimum thickness shall be 3/16 inches (4.763 mm).

.3 The inner surface of each tank shall be smooth from a molded surface and consist of a polyester gel coat 15 to 18 mil thick and medium brown in color. The exterior of each tank shall be finished with a polyester gel coat a minimum of 10 mil thick and medium brown in color.

.4 All factory perforations must be sealed with resin and gel coat. Field cut perforations may be sealed with epoxy or polyester resin and gel coat or with marine grade sealant.

.5 A visual inspection of the laminate shall be made by the manufacturer. ASTM D2563 shall be used for quality control of construction. Laminate defects and the permissible limits shall be in accordance with the following table:

Defect	Process Surface	None Process Surface
Blisters	None	Max ¼ inch diameter, 0.0625 inch high
Burned Areas	None	None
Chips	None	Max ¼ inch with max thickness 20% of wall
Cracks	None	None
Crazing	None	Slight
Dry Spots	None	Max 2 sq. in./sq. ft.
Entrapped Air	None at surface	0.125 inch diameter max;no more than 3% laminate, 0.0625 inch diameter of area, max 10/sq. in.
Exposed Glass	None	None
Exposed Cut Edges	None	None
Foreign Mater	None	None if it effects the properties of the laminate
Pits	Max 0.125 inch by 0.03125 inch deep, max 10/sq. ft.	Max 0.125 inch diameter by 0.0625 inch deep
Scratches	None (Coated)	None (Coated)
Surface Porosity	None	None
Wrinkles	Max deviation 20% of wall thickness	Max deviation 20% of wall thickness
Sharp Discontinuity	None	None

2.1 COMPONENTS

.1 Tank numbers and dimensional information will be required as noted below:

Number Required	Diameter (ft)	Depth (ft)	Features required
8	20	4	Bottom center drain sump, sidebox, exterior standpipe, Fishpump connection ports

.1 Fish exclusion screen may be manufactured out of semi-rigid aluminum or stainless steel. Opening slots shall be staggered with a maximum opening of 1/8" by ½".

.2 Tank bottom center drain sump may be constructed of FRP or PVC. It must include a fish escapement screen with total open area not less than 240.0 sq. inches. The screen must be removable and securely fit into a recess around the interior of the Center Sump. The outlet sump shall be equipped with a side exit fitting as shown on the drawings.

.3 Sidewall drain box may be constructed of FRP and incorporate a fish exclusion screen. The side box may be bolted in position by the contractor during assembly. Side boxes shall be manufacturer's standard width and extend down the entire height of the tank to allow for rapid draining. Side boxes are to be equipped with the number of outlet drains as shown on the drawings. The screen assembly shall be firmly secured to the tank or sidewall drain box all around the edges. It should be able to be removed and replaced with another screen. The escapement screen shall be the same area as the tank side box.

.4 Removable level control standpipes as shown on drawings shall be provided on both sidewall box flows and bottom drain flows.

.5 Use 316 stainless steel fasteners where required to assemble component pieces unless noted otherwise.

.6 Provide mounting brackets for belt feeders for each tank.

.7 Provide covers over all tanks. The covers shall provide 70% shading. Cover for the existing 10' diameter tanks can be reused.

.8 Tanks that are 12' in diameter and larger shall have dual screens for the center and side box drains. The small screens shall be 1/16" and the large screens shall be 1/8". The screens shall be designed such that when the small screens are removed the large screens

Part 3 EXECUTION

3.1 General

.1 All fish culture tanks shall be properly designed and built for stresses that may occur during fabrication, shipping, installation, and intermittent or continuous operation. Workmanship shall be of high industrial standards in all respects.

.2 Surface Preparation: Clean and disinfect the fish culture tanks. Remove dirt and debris as work progresses.

3.2 INSTALLATION / CONSTRUCTION

.1 The fish culture tanks shall be installed according to the tank manufacturer's recommendations.

.2 The Fish Culture tank installation shall be coordinated with the process piping and other aquaculture equipment. Elevation of equipment should conform to the requirements of the DFO representative responsible for system hydraulics.

.3 The Center Sump, if not integral with the tank, shall be secured to the fish culture tank in the field using marine grade urethane sealant and stainless steel anchor bolts, as appropriate to ensure a sturdy and water tight seal.

3.3 ADJUSTING

.1 Upon completion of the installation, the fish culture tanks shall be tested for satisfactory operation. All equipment shall be adjusted and checked for alignment, levelness, clearances, supports, and adherence to safety standards, until found satisfactory. This work will be performed by the Contractor

.2 The tank water level and flow in pipe systems is the responsibility of the DFO representative responsible for system hydraulics. Adjust standpipe lengths as specified by the DFO representative responsible for hydraulics to achieve target water level and flow rates.

3.4 DEMONSTRATION

.1 Test for leaks and defects in the fish culture tanks and parts of existing piping that have been altered, extended or repaired. Perform hydrostatic testing in accordance with manufacturer's instructions and test to design flow conditions. Repair leaks and defects with new materials and retest until satisfactory results are obtained.

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 The work includes furnishing all labour, materials and equipment required to provide and install all process water piping designated as shown on the Drawings and as specified herein. The work covered in this specification also includes piping appurtenances, fittings and valves for installation of the above and below grade piping systems.

1.2 RELATED SECTIONS

.1 Not Used.

1.3 REFERENCES

.1 ASTM International Inc.

.1 ASTM D638, Standard Test Method for Tensile Properties of Plastics

.2 ASTM D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load.

.3 ASTM D695, Standard Test Method for Compressive Properties of Rigid Plastics.

.4 ASTM D1784, Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.

.5 ASTM D 2467, Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80.

.6 ASTM D 2564, Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

.7 ASTM D 2672, Specification for Solvent Cement Joint Sockets on Belled PVC Pressure Pipe.

.8 ASTM D 2321-89, Underground Installation of Flexible Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

.9 ASTM D2240, Standard Test Method for Rubber Property-Durometer Hardness.

.10 ASTM D 3034,Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings

.11 ASTM D 3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

.12 ASTM D 3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

.13 ASTM F 437, Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.14 ASTM F 439, Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

.15 ASTM F 441, Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

.16 ASTM F 477-76, Specification for Elastomeric Seals (Gaskets) for joining Plastic Pipe.

.17 ASTM F 493, Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

.18 ASTM F 667, Specifications for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

.2 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)

.1 ANSI B1.20.1, Pipe Threads, General Purpose.

.2 ANSI B16.34, Valves-Flanged, Threaded and Welding End.

.3 AWWA C500, Gate Valves for Water and Sewerage Systems.

.4 AWWA C504, Rubber-Seated Butterfly Valves

.5 AWWA C507, Ball Valves, 6 IN through 48 IN (150 MM through 1200 MM)

.6 AWWA C509, Resilient-Seated Gate Valves 3 through 12 NPS, for Water and Sewage Systems.

.7 AWWA C606, Grooved and Shouldered Joints

.8 AWWA C 900, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in.

.3 Canada Green Building Council (CaGBC)

.1 LEED Canada-NC Version 1.0-[2004], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.

.2 Rating System Addenda for New Construction and Major Renovations LEED Canada-NC Version 1.0-[Addendum 2007].

.3 LEED Canada-CI Version 1.0-[2007], LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.

.4 Canadian Standards Association (CSA International)

.1 CSA B242-[05], Groove and Shoulder Type Mechanical Pipe Couplings.

.5 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).

.6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.7 National Research Council (NRC)/Institute for Research in Construction

.1 NRCC 38728, National Plumbing Code of Canada (NPC) - [1995].

.8 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992, c. 34 (TDGA).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop drawings: The Contractor shall provide shop drawings and product, showing laying diagram fabrication, joint details, and each special fitting to be furnished. These details and drawings shall be submitted to the DEPARTMENTAL REPRESENTATIVE for review and acceptance prior to ordering and fabrication

.3 Manufacturer's certification that products meet specification requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 The pipe shall not be dropped or subjected to any unnecessary jar, impact or other treatment that might damage the pipe. Any unit of pipe that in the opinion of the Departmental Representative is damaged beyond repair shall be replaced by another unit. Any pipe that is damaged and repairable shall, at the discretion of the Departmental Representative, either be disallowed for use on this project or repaired in the field to the Departmental Representative’s satisfaction.

Part 2 Products

2.1 PIPING MATERIALS

.1 Piping materials and classifications shall be as indicated on the Drawings. Specifications for the piping materials and classifications shall be as specified herein except as noted below:

2.2 REARING TUB SUPPLY WATER: RTS

.1 SCHEDULE 40 AND SCHEDULE 80 PVC PIPE AND FITTINGS:

.1 PVC pipe shall be manufactured by CertainTeed, Diamond Plastics, J-M Manufacturing, or Scepter or approved equivalent.

.2 Pipe and fittings shall be made from Class 12454-A or 12454-B virgin compounds in accordance with ASTM D 1784. Pressure pipe shall have the NSF seal of approval and shall be installed with solvent weld joints and fittings. Joints shall meet ASTM D 2672. Solvent cement shall meet ASTM D 2564. Socket type fittings shall meet ASTM D 2467.

2.3 REARING TUB DRAIN PIPING: RTD, RTO, TCD, AND TSD

.1 PVC SEWER PIPE:

.1 PVC sewer pipe and fittings shall conform to ASTM D 3034 and F 679, SDR-35. Joints shall comply with ASTM D 3212 for bell and spigot joints using flexible elastomeric seals.

.2 Change in direction of drain piping shall be made with 45° bends, 1/8 bends, long sweep 1/4 bends, combination wye and 1/8 bend. No sanitary tees or double hubs shall be used in horizontal drains.

.3 Pipe joints, meeting ASTM D 3139, shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type

joint. Rubber ring gaskets shall meet ASTM F 477. Furnish adequate gasket lubricant for connections and joints.

.2 DR SCHEDULE PVC PIPE:

.1 Pipe 12" and smaller shall be in accordance with AWWA C 900 and have the DR rating as indicated on the Drawings.

.2 All DR schedule PVC pipe shall be constructed of cell class 12454B PVC compound in accordance with ASTM D 1784.

.3 Joints shall be bell and spigot type with thickened internal bells conforming to ASTM D 3139 and measured in accordance with ASTM D 2122. Gaskets shall meet the requirements of ASTM F 477.

2.4 PIPE APPURTENACES

.1 Flanges and Unions:

.1 Unless otherwise noted, all flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI/ASME B16.1, class as required to meet the pressure rating of the connecting pipe. All pipe threads shall conform in dimension and limits of size to ANSI/ASME B1.20.1, Taper Pipe Thread.

.2 Unions for PVC pipe shall be rated for Schedule 80 PVC materials and fittings and comply with ASTM D 1784 for PVC Type 1, Grade 1. Threaded fittings shall conform to ASTM D 2464.

.3 Adapter Flange. Adapter flanges shall be ductile iron complying with ASTM A 536. The flange shall meet ANSI B16.1 with cast iron flanges (ANSI B16.1), forged steel flanges (ANSI B16.5), and steel plate flanges (C207). Class of flange shall be as required to meet the requirements of the connecting pipe.

.1 PVC: Uni-Flange Corp. Series 900, EBAA Iron Series 8500, or approved equal.

.2 Ductile Iron: Uni-Flange Corp. Series 400, EBAA Iron Series 1000 "EZ", or approved equal.

.3 Set screws shall comply with AISI 4140 steel tensile, 190,000 psi minimum heat treated and zinc plated.

.4 Blind Flanges. All blind flanges shall be manufactured of ductile iron in compliance with AWWA C 110 (ANSI A21.10), drilled and faced in accordance with ANSI B16.1, class as required to meet the pressure rating of the connecting pipe.

.5 Flange Hardware

.1 Flange gaskets shall comply with ANSI A21.10 and AWWA requirements. The 1/8 inches thick gaskets shall be of SBR or neoprene rubber complying with ANSI requirements.

.2 Flange bolts and nuts of high carbon, heat treated steel shall comply with ANSI B18.2.1 standard and be zinc chromate plated.

.6 PVC Fittings. Unless otherwise noted on drawings or in the specifications, fittings for PVC pipe excluding schedule pipe shall be PVC and manufactured by Head Manufacturing Co., Preston, ID, or approved equal and certified for the pressure rating of the associated pipe. Elbow fittings shall be standard angles, a combination of standard angles, or angles fabricated to the nearest one degree for PIP, IPS, and sewer pipes.

.2 Floor Sleeves

.1 All pipe sleeves installed in the floors shall be Schedule 40 steel and hot-dipped galvanized. Sleeves shall extend 4 inch above finished floors, or as otherwise shown on the Drawings.

.2 Pipe sleeves where a mechanical seal is called out or shown on the Drawings and a water-tight seal is necessary shall be provided and shall be one of the following:

.3 Mechanical Seals

.1 Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.

.2 Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall opening.

.3 The seal shall be constructed so as to provide electrical insulation between the pipe and wall, thus reducing chances of cathodic reaction between these two members.

.4 Where mechanical seals are installed into concrete walls or floors, the seal manufacturer shall provide a sleeve designed for use with the seal to be cast into the concrete.

.5 Mechanical seal shall be manufactured by "Link Seal" from Thunderline Corp or approved equivalent.

.4 Flexible Couplings

.1 The pipe couplings shall be of a gasketed, sleeve-type with diameter to properly fit the pipe.

.2 Each coupling shall consist of one (1) steel middle ring, of thickness and length specified, two (2) steel followers, two (2) rubber-compounded wedge section gaskets and sufficient trackhead steel bolts to properly compress the gaskets.

.3 Flexible couplings shall be rated or above the pressure rating of the pipe.

.4 Flexible couplings to be straight type flexible couplings for joining plain end pipe of same size diameter or transition-type flexible couplings for joining plan end pipe of different outside diameter.

2.5 BALL VALVES

.1 BALL VALVES – PLASTIC BODY

.1 Ball valves shall be lever handled true union rated at 150 psi, non-shock. Valves shall be thermoplastic PVC materials with self lubricating Teflon seats, EPDM O-rings, full-port design. Valves shall be "safe blocked" such that downstream end can be disassembled while upstream remains pressurized.

.2 Termination ball valves may be single union.

2.6 BUTTERFLY VALVES

.1 Butterfly Valves - Plastic Body

.1 Plastic butterfly valves shall have polyvinyl chloride (Type 1, Grade 1) body with polypropylene (Type 1) disc. Seat shall be neoprene and provide bubble tight shut-off. Stems shall be stainless steel.

.2 Valve shall be rated for 150 psi or greater.

.2 Butterfly Valves - Iron Body

.1 Valves shall be tight closing by means of a corrosion resistant metal disc against a resilient seat of Buna-N, Hycar or EPDM material.

.2 Valve shafts shall be stainless steel with self-lubricating bronze or brass bushing and permanently packed seals.

.3 Discs shall be ductile or cast iron secured to shafts in such a way as to transmit normally occurring operating torques.

.4 Valves shall be rated for 150 psi or greater and have a wafer style body or be provided with grooved connections for use with grooved piping.

.3 Exposed butterfly valves shall be lug type and have mechanical gear operators. Valve operators shall be designed to hold disc in any intermediate position between full open and fully closed without creeping or fluttering.

.4 Buried Butterfly Valves

.1 All buried valves shall be iron body construction and furnished with mechanical gear operators. Valve operators shall be designed to hold disc in any intermediate position between full open and fully closed without creeping or fluttering. They shall be totally enclosed, lifetime lubricated, fully gasketed and designed to withstand submersion in water.

.2 Valve operator shall be traveling nut type designed to withstand 450 foot-pounds of input torque at full open and closed positions without damage to the valve or operator. Valves shall open with a counter-clockwise rotation. The maximum force needed to operate the valve shall be no more than 80 pounds.

.1 Where indicated on the Drawings, buried valves shall have buried actuators at the valve with extension shafts terminating at ground or floor level in a valve box with a 2 inch square AWWA nut. Extension shafts shall be 1-1/4" square and have a centering device for installation in a 5-1/4" valve box.

.2 Buried valves shall have flanged ends or grooved joint ends or as indicated on the Drawings. Discs shall be stainless steel or factory coated iron.

2.7 BURIED VALVE BOXES AND WRENCHES

.1 Valve boxes for buried valves shall be cast iron two piece adjustable units of standard 5 1/4" shaft diameter. Boxes shall be screw type for height adjustment. A cast iron cover shall be furnished with each box.

.2 All valve wrenches (T-handle valve key) shall fit 2 inch square operating nuts and be compatible with the valves and boxes furnished.

2.8 CURB STOPS

.1 Curb stops shall be bronze body, Mueller Oriseal III. Provide extension rods for all curb stops.

.2 Valve boxes shall be cast iron, extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 3/16 inch. The word "WATER" shall be cast in the cover. The boxes shall be of such length as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location. Mueller Type H-10365 with a H-10361 Lid or equal shall be supplied for all valves.

.3 Provide four valve wrenches for entire project to operate box covers and curb stops.

2.9 VALVE ACTUATORS

.1 Valve Actuators - General:

.1 Provide actuators as shown on Drawings or specified.

.2 Counter clockwise opening as viewed from the top.

.3 Direction of opening and the word OPEN to be cast in hand wheel or valve bonnet.

.4 Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on hand wheel or chain wheel or 300 foot-pounds torque on the operating nut.

.5 Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.

.6 Extension Stem:

.1 Install where shown or specified.

.2 Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.

.3 Pin all stem connections.

.4 Center in valve box or grating opening band with guide bushing.

.2 Buried Valve Actuators:

.1 Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover.

.2 Box base to enclose buried valve gear box or bonnet.

.3 Provide 2 IN standard actuator nuts complying with Section 3.16 of AWWA C500.

.4 Provide at least two teehandle keys for actuator nuts, with 5 FT extension between key and handle.

.5 Extension Stem:

.1 Provide for buried valves greater than 4 FT below finish grade.

.2 Extend to within 6 IN of finish grade.

.3 Exposed Valve Manual Actuators:

.1 Provide for all exposed valves including those having electric actuators.

.2 Provide hand wheels for gate and globe valves.

.1 Size hand wheels for valves in accordance with AWWA C500.

.3 Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller except if shown otherwise on the drawings.

.1 Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.

.2 Provide at least two levers for each type and size of valve furnished.

.4 Gear actuators required for plug valves, butterfly valves, and ball valves 4 IN DIA and larger except if shown otherwise on the drawings.

.5 Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.

.6 Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Install in accordance with Plumbing Code and local authority having jurisdiction.

.2 Assemble piping using fittings manufactured to ANSI standards.

.3 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.4 Exposed and interior piping shall be run parallel and square with the lines of the structures unless otherwise indicated. Pipes shall be accurately cut to allow assembly without springing or forcing.

.5 All exposed and interior piping, valves, and fittings shall be securely fastened to the structure with hangers, supports, guides, anchors or sway braces to maintain pipe alignment, prevent sagging and straining due to uncontrolled movement. All supports shall support the weight of pipe, fittings, valves and contents without exceeding the maximum recommended load for the pipe support.

.6 Pipe supports shall be installed to support pipes at all pump connections and changes in direction.

.7 Contractor shall provide additional supports which may be determined as necessary by the DEPARTMENTAL REPRESENTATIVE for the proper suspension, bracing, or support for the pipe.

.8 Contractor shall provide special supports under the pipe where fixtures such as valves, etc., are to be supported by the pipe. No attempt is made to show all of these supports or bracings and they shall be installed in a manner which would be considered as good practice in the trade and in compliance with the requirements of the DEPARTMENTAL REPRESENTATIVE.

.9 All pipe supports, hangers, racks and anchors shall be hot-dip galvanized after fabrication. All hangers, racks, saddles and supports shall be of standard manufacture for that purpose. No straps or hangers of plumber's tape shall be acceptable.

.10 Flanged joints shall be made up true and square so that there is no strain on pipe or valve. Bolts shall be tightened uniformly around the joint.

.11 Threaded joints shall be neatly cut with sharp tools, and the jointing procedure shall conform with the best trade practice. Before jointing, all scale shall be removed from pipe by some suitable means such as standing on end and rapping sharply. After cutting, all pipe shall be reamed. All pipe shall be screwed together with an application of approved pipe compound applied to all threads, and once a joint has been screwed tight, it shall not be backed off unless the threads are re-cleaned and new compound applied. This application shall be neatly made and all compound and dirt shall be thoroughly wiped off the outside of every joint.

.12 Unions shall be installed in all threaded joint piping to facilitate the removal of sections for maintenance and repair in accordance with the best trade practice. All such unions shall be included in the bid price whether shown on the drawings or not. Connections between pipes of dissimilar metals shall be made with insulating unions (dielectric). This shall include cast-iron valve connections to adapters for copper pipe, etc.

.13 Special joints such as plastic fittings, copper tubing joints, etc., shall be made in accordance with the manufacturer's specifications. All low points in piping shall have valved drains.

3.3 VALVES

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

.2 Setting Buried Valves:

.1 Locate valves installed in pipe trenches where buried pipe indicated on Drawings.

.2 Set valves and valve boxes plumb.

.3 Place valve boxes directly over valves with top of box being brought to surface of finished grade.

.4 Install in closed position.

.5 Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.

.6 After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.

.3 Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping..

.4 Install valves accessible for operation, inspection, and maintenance.

3.4 PRESSURE TESTS

.1 Tests shall be conducted at any time during the course of construction as deemed necessary by the DEPARTMENTAL REPRESENTATIVE. The type of test conducted shall be at the DEPARTMENTAL REPRESENTATIVE's option. Whenever the rate of infiltration, exfiltration or deflection is found to exceed the allowable amounts, the Contractor shall stop construction. The Contractor may then be required to provide at his own expense, televised or photographic visual inspection of the interior of the pipe to help determine the reason for failing the testing. The Contractor shall make appropriate repairs by methods approved by the DEPARTMENTAL REPRESENTATIVE, and shall retest the pipeline until it is satisfactory. No compensation shall be paid to the Contractor for testing, televising, photographing, repairing, delays or reconstruction to comply with the allowable leakage amounts.

.2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa for pressure lines and 350 kPa for drain lines.

.3 Work accomplished under this subsection will not be measured, nor will it be paid for directly. This work will be considered as incidental to the subject pipe installation and all costs in connection therewith shall be included in the unit price for the pipe.

.4 Pressurized water lines shall be hydrostatic tested.

.5 The Contractor shall provide all test equipment including test pumps, gauges, pipe connections, instruments, other apparatus required, and personnel necessary to conduct the test. Pressure gauges used shall be graduated in increments not greater than 35 kPa and shall have a range of approximately twice the test pressure. Only recently calibrated gauges and instruments may be utilized for testing procedures.

.6 Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system.

.7 Prior to testing, remove from systems all equipment which would be damaged by test pressure. Provide and install plugs as required for testing. Replace removed equipment after testing.

.8 Test time will be accrued only while full test pressure is on system. Prepare and brace the pipeline in accordance with equipment manufacturer's instructions.

.9 Fill each section of the pipe slowly with water and expel air by means of taps at high points. Apply the specified test pressure by means of pump connected to the pipe in an approved manner. The pressure shall be slowly built up to the maximum design working pressure. Pressurization should take a minimum of ten (10) minutes for pipes four 100mm and smaller in a test section of 1,000 feet and proportionally longer for increased diameters and lengths. Maintain the test pressure by additional pumping if necessary for the specified time during which the system and exposed pipe, valves and fittings, shall be carefully examined for leakage. Repair or remove and replace all defective elements and repeat the test until all visible leakage has been stopped and no leakage is detected. Monitor pressure drops

and inspect the pipeline in its entirety while the test pressure is maintained. Test pressure shall be normal operating pressure plus 350 kPa as determined by the DEPARTMENTAL REPRESENTATIVE.

.10 The duration of each leakage test shall be two hours, unless otherwise specified, and during the test the main shall be subjected to the quantity of water that must be supplied into the newly laid pipe, or any specified leakage test pressure after the pipe has been filled with water and the air in the pipeline has been expelled. No installation will be accepted if leakage is detected.

.11 Using methods reviewed and accepted by the DEPARTMENTAL REPRESENTATIVE, correct leaks by remaking joints with new material after the leaks have been corrected the system shall be retested using the same method.

END OF SECTION