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Consultants:

David Nairne + Associates Ltd.

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Fisheries and Oceans Canada Kitimat Hatchery Domestic Water System

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Drawings:

Refer to drawing package under separate cover.

Mechanical Room Photographs



1 EXISTING PAD FOR THE PROPOSED
WATER TREATMENT EQUIPMENT AND STORAGE TANK
(EXISTING EQUIPMENT ON THE PAD TO BE RELOCATED OR
REMOVED BY CONTRACTOR)



2 EXISTING BOOSTER PUMPS AND PRESSURE TANKS (BLUE)



3 EXISTING PAD FOR THE PROPOSED WATER
TREATMENT EQUIPMENT AND STORAGE TANK

**4**

- on the left: EXISTING PAD FOR THE PROPOSED WATER TREATMENT EQUIPMENT AND STORAGE TANK
- Blue Tank: EXISTING PRESSURE TANK TO BE RETAINED BUT RELOCATED TO FACILITATE INSTATLLATION OF NEW EQUIPMENT
- Yellow pipe: INCOMING SUPPLY TO BE CONNECTED TO PROPOSED STORAGE TANK AND TREATMENT PROCESS



5 EXISTING PAD FOR THE PROPOSED WATER TREATMENT EQUIPMENT
AND STORAGE TANK TO THE RIGHT OF PICTURE

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

- .1 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.
- .2 Submit to the Departmental Representative, for review, shop drawings, product data and samples specified.
- .3 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.

**1.6 Samples and
Mock-ups**

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

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

1.2 Construction Safety Measures

- .1 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Provincial Government, Workmen's Compensation Board, Workplace Hazardous Materials Information System Requirements, including training of all workers on the job site, and municipal status and authorities.
- .2 In event of conflict between any provisions of above authorities the most stringent provision will apply.

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 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 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.
- 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 suspended materials or harmful 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 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.
- .2 Use new material and equipment unless otherwise specified.
- .3 Provide material and equipment of specified design and quality, performing to published ratings and for which replacement parts are readily available.
- .4 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 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.
- 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 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.

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

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
.2 Hot mix asphalt concrete paving Section 02512
- 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 specified material, 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

**EXCAVATION, TRENCHING
AND BACKFILLING**

**Departmental Representatives:
David Nairne + Associates Ltd.**

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 manufacturers 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

- | | | |
|-------------------------------------|----|--|
| 1.0 General | .1 | Section 02512 refers to those portions of the work that are unique to the supply and placement of hot-mix asphalt concrete paving. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein. |
| 1.1 Related Work | .1 | Traffic Regulation Section 01570 |
| 1.2 References | .1 | The abbreviated standard specifications for testing, materials, fabrication and supply, referred to herein, are fully described in References – Section 02000. |
| 1.3 Material Certification | .1 | Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this section. |
| 1.4 Submission of Mix Design | .1 | Submit asphalt concrete mix design and trial mix test results to Departmental Representative for review at least one week prior to commencing work. |
| 1.5 Measurement and Payment | .1 | Payment for asphaltic concrete paving includes all construction joint preparation, supply and placing of the asphaltic concrete, compaction, adjusting and cleaning frames, covers and lids of all castings affected and taped temporary pavement marking. |
| | .2 | For measurement and payment purpose, Departmental Representative may order cores to be taken from finished paving to determine finished paving thickness. Three cores will be taken from paving areas up to 1,500m ² each. Cores for each area will be averaged to determine overall thickness for that area. If average thickness of cores indicates that pavement thickness varies from the thickness specified, Departmental Representative may do one of following: <ul style="list-style-type: none">.1 if thickness is less than that specified, Departmental Representative may require an overlay to be placed in deficient areas with no additional payment for the overlay and any other work necessary to place such overlay..2 if thickness is greater than specified, Departmental Representative may accept the work, if the excess thickness is acceptable; and calculate the amount of excess paving |

and, for payment purpose, reduce the quantity of asphaltic concrete paving placed accordingly.

- .3 Payment for asphaltic concrete sidewalks, driveways, in-fill strips and specified permanent patching paving includes all construction joint preparation, supply and placing of the asphaltic concrete, compaction and adjusting and cleaning frames, covers and lids of all castings affected. Measurement for asphaltic concrete sidewalks, driveways, in-fill strips and specified permanent patching will be made separately for each of specified thicknesses which may be checked by Departmental Representative as given in paragraph 1.5.2. in this Section.
 - .1 if thickness is less than that specified, Departmental Representative may require an overlay to be placed in deficient areas with no additional payment for the overlay and any other work necessary to place such overlay.
 - .2 if thickness is less than specified, Departmental Representative may calculate amount of asphaltic concrete deficiency and, for payment purpose, reduce the item amount in pro-rata accordingly.
 - .3 if thickness is greater than specified, Departmental Representative may accept the work, if the excess thickness is acceptable; or may require the work to be removed and replaced with appropriate thickness, all without additional payment.
- .4 Payment for extruded asphalt concrete curb will be made separately for each type of curb specified and will include the asphaltic concrete, all preparatory work and placing by extrusion.
- .5 No additional payment will be made for work described in this Section for surface restoration if payment is already included under work described in other Sections.
- .6 Payment for all the above-described asphaltic concrete work placed by hand will only be made for such work specifically ordered by Departmental Representative.
- .7 Payment for saw cutting asphaltic concrete or Portland cement concrete pavement will only be made for permanent reinstatement and other specific work shown on Contract Drawings or as directed by Departmental Representative and will not include saw cutting prior to trench excavation for pipe laying work.

- .8 Payment for permanent reinstatement of pavement includes all work under Section 02223 – 3.6.7 but not saw cutting edges of pavements.

1.6 Inspection and Testing .1 Refer to General Conditions, Clause 4.12, Inspections.

2.0 PRODUCTS

- 2.1 Materials**
- .1 Asphalt cement: to CGSB-16.3-M90, Grade 80 – 100.
- .2 Reclaimed asphalt pavement: Crush and screen so that 100% of reclaimed asphalt pavement (RAP) material passes 37.5 mm screen before mixing.
- .3 Aggregates: to Section 02226 – Aggregates and Granular Materials and following requirements:
- .1 Crushed stone or gravel consisting of hard, durable, angular 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 and ASTM C117.

Sieve		Percent Passing				
		*Lower Course #1	*Lower Course #2	*Upper Course #1	*Upper Course #2	*Fine Mix
25.0	mm	100	--	--	--	--
19.0	mm	--	100	100	--	--
12.5	mm	70 – 85	84 – 99	84 – 99	100	--
9.5	mm	--	73 – 88	73 – 88	--	100
4.75	mm	40 – 65	50 – 68	50 – 68	55 – 75	80 – 100
2.36	mm	32 – 53	35 – 55	35 – 55	38 – 58	64 – 89
1.18	mm	26 – 44	27 – 46	27 – 46	28 – 47	48 – 76
0.600	mm	18 – 36	18 – 36	18 – 36	20 – 36	32 – 60
0.300	mm	10 – 26	10 – 26	10 – 26	10 – 26	16 – 42
0.150	mm	4 – 17	4 – 17	4 – 17	4 – 17	6 – 23
0.075	mm	3 – 8	3 – 8	3 – 8	3 – 8	4 – 10

Footnote to asphalt mix-type selection:

Lower Course #1: Arterial and collector, lower course only.

Lower Course #2: Local, lower course only.

Upper Course #1: Arterial and collector, upper course only.

Upper Course #2: Local, surface course only.

Fine Mix: Skim patch on existing asphalt surface.

- .3 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.
- .4 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.
- .5 Do not use aggregates having known polishing characteristics in mixes for upper courses.
- .6 Sand equivalent: to ASTM D2419.....Min: 40
- .7 Magnesium Sulphate soundness: to ASTM C88.
Max % loss by mass after five cycles:
 - .1 Coarse aggregate:15
 - .2 Fine aggregate18
- .8 Los Angeles abrasion: Grading B, to ASTM C131.
Max % loss by mass:
 - .1 Coarse aggregate, upper course:25
 - .2 Coarse aggregate, lower course:35
- .9 Absorption: to ASTM C127.
Max % by mass:
 - .1 Coarse aggregate, upper course1.75
 - .2 Coarse aggregate, lower course.....2.00
- .10 Loss by washing: to ASTM C117.
Max % passing 0.075 mm sieve:
 - .1 Coarse aggregate, upper course1.5
 - .2 Coarse aggregate, lower course:2.0
- .11 Flat and elongated particles: (with length to thickness ratio greater than 3):
Max % by mass:
 - .1 Coarse aggregate, upper course.....10
 - .2 Coarse aggregate, lower course10
- .12 Crushed fragments: at least 60% of particles by mass within each of following sieve designation ranges, to have at least 2 freshly fractured faces. Material to be tested according to ASTM C136 and ASTM C117.

Determination of amount of fractured material will be in accordance with Ministry of Transportation and Highways'

Specification 1-11, Fracture Count for Coarse Aggregate,
Method "B", which determines fractured faces by mass.

Passing		Retained On
25mm	to	12.5mm
12.5mm	to	4.75mm

- .13 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.
- 4. Mineral filler:
 - .1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.
 - .2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.
 - .3 Mineral filler to be dry and free flowing when added to aggregate.

2.2 Mix Design

- .1 Submit job mix formula to Departmental Representative for review and approval.
- .2 Mix may contain up to a maximum 20% by mass of RAP without a special mix design. Departmental Representative may approve higher proportion of RAP if Contractor demonstrates ability to produce mix meeting requirements of specification.
- .3 Design of mix: by Marshall method to requirements below.
 - .1 Compaction blows on each face of test specimens: 75.
 - .2 Mix physical requirements:

Property		Pavement Course	
Marshall Stability at 60°C	kN min.	6.4	lower course
		5.5	upper course
		5.5	fine
Flow Value	mm	2 – 4	

Air Voids in Mixture	%	3 – 6	lower course
		3 – 5	upper course
		3 – 5	fine
Voids in Mineral Aggregate	% min.	13	lower course 1
		14	lower course 2
		14	upper course 1
		15	upper course 2
		15	fine
Index of Retained Stability	% min.	75	
.3 Measure physical requirements as follows:			
.1 Marshall load and flow value: to ASTM D1559.			
.2 Air voids: to ASTM D3203.			
.3 Index of Retained Stability: measure in accordance with Marshall Immersion Test (ASTM D1559).			
.4 Do not change job-mix without prior approval of Departmental Representative. Should change in material source be proposed, new job-mix formula to be submitted to Departmental Representative for review and approval.			

3.0 EXECUTION

3.1 Planting and Mixing Requirements

- .1 Batch and continuous mixing plants:
 - .1 To ASTM D995.
 - .2 Heat asphalt cement and aggregate to mixing temperature. Do not heat asphalt cement above 160°C.
 - .3 Before mixing, dry aggregates to a moisture content not greater than 0.5% by mass or to a lesser moisture content if required to meet mix design requirements.
 - .4 Departmental Representative will monitor temperature of completed mix at plant and at paver after considering hauling and placing conditions.
 - .5 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders.
 - .6 Feed cold aggregates to plant in proportions that will ensure continuous operations.
 - .7 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job-mix requirements.
 - .8 Store hot screened aggregates in a manner to minimize segregation and temperature loss.
 - .9 Where RAP is to be incorporated into mix:
 - .1 Feed from separate cold feed bin specially designed to minimize consolidation of material. Provide 37.5 mm

- scalping screen on cold feed to remove oversized pieces of RAP.
- .2 Ensure positive and accurate control of RAP cold feed by use of hydraulic motor or electric clutch and equip with anti-rollback device to prevent material from sliding backward on feed belt.
- .3 Combine RAP and new aggregates in proportions as specified. Dry mix thoroughly, until uniform temperature within plus or minus 5°C of mix temperature is achieved prior to adding new asphalt cement. Do not add new asphalt cement where temperature of dry mix material is above 160°C.
- .10 Maintain temperature of materials within plus or minus 5°C of specified mix temperature during mixing.
- .11 Mixing time:
 - .1 In batch plants, dry mix for not less than 10 s. Continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 75 s.
 - .2 In continuous mixing plants, mixing time as required but not less than 45 s.
- .2 Dryer drum mixing plant:
 - .1 Where RAP to be incorporated into mix, dryer drum mixer to be designed to prevent direct contact of RAP with burner flame or with exhaust gases hotter than 180°C.
 - .2 Feed aggregates to burner end of dryer drum by means of a multi-bin cold feed unit and blend to meet job-mix requirements by adjustments of variable speed feed belts and gates on each bin.
 - .3 Feed RAP from separate cold feed bin designed to minimize reconsolidation of material.
 - .4 Meter total flow of aggregate and RAP by electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and RAP and asphalt entering mixer remain constant.
 - .5 Provide for easy calibration of weighing systems for aggregates and RAP without having material enter mixer.
 - .6 Make provision for conveniently sampling full flow of materials from the cold feed.
 - .7 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate and RAP from cold feed prior to entering drum.
 - .8 Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.

- .9 Accomplish heating and mixing of asphalt mix in a drum dryer-mixer. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by plant operator. Submit printed record of mix temperatures at end of each week, if required.
- .10 Mixing period and temperature to produce a uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 0.5%.
- .3 Temporary storage of hot mix:
 - .1 Provide mix storage of sufficient capacity to permit continuous operation, maintained at specified temperatures and designed to prevent segregation.
 - .2 Do not store asphalt mix in storage bins in excess of 12 h.
- .4 Mixing tolerances:
 - .1 Permissible variation in aggregate gradation from job mix (percent of total mass):

.1 4.75 mm sieve and larger	5.5
.2 2.36 mm sieve	4.5
.3 0.600 mm sieve	3.5
.4 0.150 mm sieve	2.5
.5 0.075 mm sieve	1.5
 - .2 Permissible variation of asphalt cement from job mix, 0.3%.
 - .3 Permissible variation of mix temperature at discharge from plant, 5°C.

3.2 Equipment

- 1 Pavers: mechanical grade-controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown as shown on Contract Drawings.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers:
 - .1 Minimum drum diameter: 1200 mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .4 Haul trucks: of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .4 Trucks which cannot be weighed in a single operation on scales supplied will not be accepted.
- .5 Hand tools:
 - .1 Lutes or rakes with covered teeth for spreading and finishing operations.
 - .2 Tamping irons having mass not less than 12 kg and a bearing area not exceeding 310cm² for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.
 - .3 Straight edges, 3.0 m in length, to test finished surface.

3.3 Preparation

- .1 Reshape granular roadbed in accordance with Section 02231 – Reshaping Granular Roadbed, Section 02520 – Roller Compacted Concrete Paving and Section 02575 - Full Depth Reclamation, if required.
- .2 When paving over existing asphalt surface, clean pavement surface in accordance with Section 02581 – Pavement Surface Cleaning and Removal of Pavement Markings. When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .3 Adjust existing castings to new elevations and protect from asphaltic mix.
- .4 When matching new pavement with existing pavement make vertical cut between existing pavement and new pavement as shown on Contract Drawings.
- .5 Apply prime coat and/or tack coat in accordance with Section 02546 – Asphalt Prime and/or Section 02547 – Asphalt Tack Coat prior to paving.
- .6 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 Transportation of Mix

- .1 Transport mix to job site in vehicles cleaned of foreign material.
- .2 Paint or spray truck beds with light oil, limewater, soap or detergent solution, at least once a day or as required. Elevate

truck bed and thoroughly drain. No excess solution will be permitted.

- .3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves artificial light.
- .4 Deliver material to paver at a uniform rate and in an amount within capacity of paving and compacting equipment.
- .5 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within specified range. Temperature of mix upon placement shall not be less than 125°C.

3.5 Placing

- .1 Obtain Departmental Representative's approval of base, existing surface, tack coat, or prime coat prior to placing asphalt.
- .2 Place asphalt concrete to thicknesses, grades and lines as shown on Contract Drawings.
- .3 Placing conditions:
 - .1 Place asphalt mixtures only when air temperature is above 5°C. Place overlay pavement only when air temperature is above 10°C.
 - .2 When temperature of surface on which material is to be placed falls below 10°C, provide extra rollers as necessary to obtain required compaction before cooling.
 - .3 Do not place hot-mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.
- .4 Place asphalt concrete in compacted lifts of thickness as shown on Contract Drawings:
 - .1 Levelling course(s) to thicknesses required but not exceeding 100 mm each.
 - .2 Lower course in layers not to exceed 100 mm each.
 - .3 Surface course in layers of maximum 60 mm each.
- .5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.
- .6 Spread and strike off mixture with self propelled mechanical finisher.
 - .1 Construct longitudinal joints and edges true to line markings. Position and operate paver to follow established line closely.
 - .2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by

first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.

- .3 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.
- .4 Correct irregularities in alignment left by paver by trimming directly behind machine.
- .5 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.
- .6 Do not throw surplus material on freshly screeded surface.
- .7 When hand spreading is used:
 - .1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.
 - .2 Distribute material uniformly. Do not broadcast material.
 - .3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.
 - .4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.
 - .5 Provide heating equipment to keep hand tools free from asphalt. Avoid high temperatures which may burn material. Do not use tools at a higher temperature than temperature of mix being placed.

3.6 Compaction

- .1 Roll asphalt continuously to average density not less than 97% of 75 blow Marshall density in accordance with ASTM D1559 with no individual test less than 95%.
- .2 General:
 - .1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one roller to be pneumatic tired type.
 - .2 Start rolling operations as soon as placed mix can bear weight of roller without undue displacement of material or cracking of surface.
 - .3 Operate roller slowly initially to avoid displacement of material. For subsequent rolling do not exceed 5 km/h for static steel-wheeled rollers and 8 km/h for pneumatic-tired rollers.
 - .4 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 20

impacts per metre of travel. For lifts less than 50 mm thick, impact spacing should not exceed compacted lift thickness.

- .5 Overlap successive passes of roller by at least one half width of roller and vary pass lengths.
 - .6 Keep wheels of roller slightly moistened with water to prevent pick-up of material but do not over-water.
 - .7 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.
 - .8 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.
 - .9 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side.
 - .10 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.
 - .11 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.
- .3 Breakdown rolling:
- .1 Commence breakdown rolling immediately following rolling of transverse and longitudinal joint and edges.
 - .2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.
 - .3 Operate breakdown roller with drive roll or wheel nearest finishing machine. Exceptions may be made when working on steep slopes or super-elevated sections.
 - .4 Use only experienced roller operators for this work.
- .4 Second rolling:
- .1 Use pneumatic-tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.
 - .2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.
- .5 Finish rolling:
- .1 Accomplish finish rolling with steel wheel rollers while material is still warm enough for removal of roller marks.
 - .2 Conduct rolling operations in close sequence.
- 3.7 Joints**
- .1 General:
- .1 Remove surplus material from surface of previously laid strip. Do not dispose on surface of freshly laid strip.

- .2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as specified.
- .3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .2 Transverse joints:
 - .1 Offset transverse joint in succeeding lifts by at least 600 mm.
 - .2 Cut back to full depth vertical face and tack face with thin coat of asphalt prior to continuing paving.
 - .3 Compact transverse joints to provide a smooth riding surface.
- .3 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100°C prior to paving of adjacent lane. If cold joint can not be avoided, tack face of adjacent lane with thin coat of asphalt prior to continuing paving.
 - .3 Overlap previously laid strip with spreader by 100 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static roller, shift roller over onto previously placed lane in order that 100 to 150 mm of drum width rides on newly laid lane, then operate roller to pinch and press fines gradually across joint. Continue rolling until thoroughly compacted neat joint is obtained.
 - .7 When rolling with vibratory roller, have most of drum width ride on newly placed lane with remaining 100 to 150 mm extending onto previously placed and compacted lane.
- .4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade. Location of feather joint as specified.
- .5 Construct butt joints at locations and to details as shown on Contract Drawings.
- .6 Wherever practical, locate joints under future traffic markings (paint lines).

- 3.8 Pavement Patching**
- .1 Ensure temporary and permanent pavement patching done by handwork conforms to all standards specified for machine placed asphaltic concrete.
 - .2 Subbase and base preparation as specified in Section 02234 and 02233, respectively, unless shown otherwise on Contract Drawings.
- 3.9 Sidewalks, Driveways and Curbs**
- .1 Hot-mix asphalt concrete sidewalks, driveways and curbs as shown on Contract Drawings.
 - .2 Machine place where practical.
 - .3 Ensure placement by handwork conforms to all standards specified for machine placed asphaltic concrete.
 - .4 Other than requirements relating specifically to Portland cement concrete, ensure hot-mix asphalt concrete sidewalks and curbs comply with all requirements of Section 02523 – Concrete Walks, Curbs and Gutters.
 - .5 Ensure hot-mix asphalt concrete driveways comply with all requirements of Section 02512 – Hot-Mix Asphalt Concrete Paving.
- 3.10 Finished Tolerances**
- .1 Ensure finished asphalt surface within 6 mm of design elevation but not uniformly high or low.
 - .2 Ensure finished asphalt surface does not have irregularities exceeding 6 mm when checked with a 3 m straight edge placed in any direction.
 - .3 Water ponding not permitted.
 - .4 Against concrete gutter, finished asphalt surface to be higher than the gutter by not more than 6 mm.
- 3.11 Defective Work**
- .1 Correct irregularities which develop before completion of rolling by loosening upper mix and removing or adding material as required.
 - .2 If irregularities or defects remain after final compaction, remove upper course promptly and lay new material to form a true and even surface and compact immediately to specified density.

3.12 Clean-Up

- .1 Remove lids or covers from all castings and clean any prime, tack coat or hot-mix asphaltic concrete from frames, lids and covers of all castings.

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 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.

1.7 Measurement and Payment

- .1 See the Tender Form - Schedule 3, Unit Measurement and Payment.

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, for taps 38 mm diameter and larger in asbestos-cement pipe, with galvanized malleable iron bodies with neoprene gasket cemented to box, and cadmium plated or stainless steel mounting hardware.
- .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, AWWA C603 (latest edition) for asbestos-cement 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 asbestos-cement pipe must use double strap. 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 filled with water, pipe bedding, concreting of all valves and fittings and backfilling to be completed as required in 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 pressure 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, repair 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

PART 1 - GENERAL

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|------------|---|----|--|
| 1.1 | General | .1 | The "General Conditions" and "Supplementary General Conditions" shall form part of this section. |
| 1.2 | Description | .1 | This section specifies requirements for all plain and reinforced cast-in-place concrete as described herein and as shown on the Drawings, or reasonably implied to provide a complete structure. |
| 1.3 | Reference Standards | .1 | Do cast-in-place concrete work in accordance with the latest issues of: <ul style="list-style-type: none"> .1 CSA CAN3-A23.1-M - Concrete Materials and Methods of Concrete Construction. .2 CSA CAN3-A23.2-M - Methods of Test for Concrete. .3 CSA CAN3-A23.3-M - Code for the Design of Concrete Structures for Buildings. |
| | | .2 | Keep a copy of the above CSA Standards on site for the duration of the work. "Standard" referred to later in this Specification means these CSA Standards. |
| 1.4 | Related Work Specified Elsewhere | .1 | Not Applicable |
| 1.5 | Mix Design | .1 | Submit certified copy of mix design showing concrete mix design conforming to specified requirements. |
| 1.6 | Measurement and Payment | .1 | See the Tender Form - Schedule 3, Unit Measurement and Payment. |

PART 2 - PRODUCTS

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|------------|------------------|----|--|
| 2.1 | Materials | .1 | Cement: to CSA CAN3-A5-M, normal Type 10 unless otherwise specified. |
| | | .2 | Water, fine aggregates, normal weight coarse aggregates: to CSA CAN3-A23.1-M, Group 1, unless otherwise specified. |
| | | .3 | Form work lumber: plywood and wood form work materials to CSA CAN3-A23.1-M. |
| | | .4 | Form ties: removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface. |

- .5 Reinforcing bars: billet steel, grade 400 deformed bars to CSA G30.12-M unless indicated otherwise. Provide with identifying marks.
- .6 Welded steel wire fabric: to CSA G30.5; provide in flat sheets only.
- .7 Air-entraining admixtures: to CSA CAN3-A266.1-M.
- .8 Non-shrink grout: premixed compound consisting of metallic aggregate, cement, water reducing and plasticizing agents, of pouring consistency, capable of developing compressive strength of 50 MPa at 28 days.
- .9 Dry pack: premixed or non-premixed composition of non-metallic aggregate, cement and sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.

2.2 Concrete Mix

- .1 Except where indicated or specified otherwise, use concrete designed to meet all of the following:
 - .1 Compressive cylinder strength at 28 days of 28 MPa.
 - .2 Maximum coarse aggregate size of 20 mm.
 - .3 Water/cement ratio maximum of .55.
 - .4 Slump between 50 mm and 80 mm at time and point of deposit.
 - .5 Air content of 5%, plus or minus 1%, except in slabs requiring hard trowelling where it is not to exceed 3%.
- .2 Admixtures: obtain written approval of Departmental Representative before using admixtures other than air entraining agents or water reducing agents. When permitted, use only in accordance with Standard.
- .3 Mass density: supply only concrete with air dry unit mass between 2,150 and 2,500 kg/m³ unless otherwise specified.
- .4 Prior to execution of the work, provide a statement certifying that the materials, including admixtures, are in accordance with this Specification and evidence that the mix proportions selected will produce concrete of the specified quality and strength.

PART 3 - EXECUTION

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|---|---|
| 3.1 Workmanship | <p>.1 Notify Departmental Representative 24 hours prior to the anticipated time of any concrete pour.</p> <p>.2 Obtain the inspection and approval by the Departmental Representative of the preparation for all pours before placing concrete.</p> <p>.3 Ensure pipework are not disturbed during concrete placement.</p> |
| 3.2 Waterpipe | <p>.1 Correctly position all pipes, sleeves, bolts, hangers and other inserts in the concrete as required by other trades or as shown on the Drawings.</p> <p>.2 Obtain approval by the Departmental Representative of all sleeves, ducts, pipes or other openings (except openings less than 100 x 100 mm in floors and walls) which are not shown on the Structural Drawings before placing concrete.</p> |
| 3.3 Inspection and Testing | <p>.1 Where required, the Owner will employ an independent testing firm to make the required field and laboratory tests in accordance with the Standard for field control of concrete quality during construction. Make available materials, space and equipment as are necessary for the tests.</p> |
| 3.4 Curing | <p>.1 Cure concrete in accordance with the Standard. Obtain approval of the Departmental Representative for each method used.</p> |
| 3.5 Ready-Mix Concrete | <p>.1 Obtain approval by the Departmental Representative of the ready-mix manufacturers before ordering.</p> |
| 3.6 Failure to Meet Requirements | <p>.1 When any concrete is not in accordance with these Specifications or the Standard, obtain Departmental Representative's ruling on whether to remove and replace it or apply the remedies provided in the Standard to the Departmental Representative's approval.</p> |

END OF SECTION

PART 1 - GENERAL

1.1 General

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

PART 2 - PRODUCTS

- .1 Refer to Construction Drawings
- .2 Equipments and products listed in the drawings and the specifications to be considered as a "minimum required" by Contractor who may have to supply and install additional products or equipments to ensure proper installation and functioning.

PART 3 - EXECUTION

3.1 General

- .1 Install all pipe work, fittings, equipment and fixtures to the satisfaction and approval of the Departmental Representative.
- .2 Run exposed pipe work parallel to walls and ceiling neatly grouped in parallel lines.
- .3 Temporarily plug ends of pipe work to keep foreign matter out before final connections are made.
- .4 The Contractor must assure that the completed work will be adequately supported, correctly oriented, and braced and be dimensionally correct.
- .5 Should the Contractor wish to make changes to the piping system shown, a request for change must be made in writing and approval given by the Departmental Representative.
- .6 Install all products as per details shown in the contract documents and manufacturers specifications

3.2 Tolerances

- .1 All horizontal drain leaders above ground shall be graded to one percent slope, unless otherwise shown on the drawings.
- .2 All drain lines and horizontal lines of soil and waste piping shall be graded two percent minimum unless otherwise shown on the drawings.
- .3 Horizontal branches of all pipe work shall be graded downwards so that they may be completely drained through

risers, fixtures or drain cocks. Minimum slope one-half of one percent.

3.3 Installation of Pipe work

- .1 Solvent welding of PVC pipe shall be done in accordance with the manufacturer's recommendations.
- .2 Welding of steel pipe shall be done in accordance with AWWA C-206-62.
- .3 Co-ordinate installation of valves, flow meters and other devices supplied by other suppliers or Sub-contractors.
- .4 Do no cutting that may impair the strength of the building. Drill no holes, except for expansion bolts and small screws in the structure without obtaining prior approval from the Departmental Representative.
- .5 Pipes passing through roofs, floors or other areas requiring waterproofing shall be flashed by the Contractor. Seal pipe passing through walls and floors inside the building with flexible caulking applied into space between pipe and sleeve or as detailed.
- .6 Run all piping parallel to building lines. Fasten supports to inserts in concrete. Do not use perforated band iron for hangers. All hanger rods are to have machine threads capable of vertical adjustment after pipe is erected.
- .7 Piping, ducts and equipment shall be thoroughly cleaned of dirt, cuttings and other foreign substances. Should any pipe, duct or other part of systems be obstructed by any foreign matter, disconnect, clean and re-connect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in the course of removing obstructions.
- .8 Provide temporary bracing and supports to adequately support the pipe during installation.
- .9 Take care to prevent damage to the pipe, pipe coatings and the adjacent structure during erection. Make good all damage. Completely repaint all ferrous pipe work and fittings after installation is completed.
- .10 Where the required piping is not shown on the drawings or shown only diagrammatically, install pipes in such a way as

to conserve head room and interfere as little as possible with free use of the space through which they pass.

- .11 Install all valves so as to facilitate servicing or re-packing.
- .12 Erect and support all piping in a manner that will not put undue strain on pumps, tanks, equipment or adjacent piping.
- .13 Where pipe sizes differ from connections to equipment, install reducing fittings close to equipment.
- .14 Use non-corrosive lubricant or teflon tape applied to male threads.
- .15 Install flanges or unions to permit removal of equipment without disturbing piping systems.

3.4 Installing Steel Pipe

- .1 The drawings show the piping system spooled sections and these sections are to be made up in the shop lined before shipping to the site.
- .2 The Contractor must assure that the completed work will be adequately supported, correctly oriented, and braced and be dimensionally correct.
- .3 It is intended that there be no field cutting, fitting or welding. If any should be required, approval is first required and internal lining is to be repaired with care in a manner approved by the Departmental Representative.
- .4 The welding operators and supervisors employed and the welding procedure shall be qualified in accordance with the current CSA Standard W-47 Welding Specification Code. Each operator's certificate of qualification and experience record shall be on file at the site, and shall be made available to the Departmental Representative on request. Each operator shall be currently qualified for the P number covering the material on which he will be engaged as prescribed in the Welding Qualification Code, latest revision.

3.5 Hydrostatic and Leakage Testing

- .1 Hydrostatic and leakage testing is an acceptance test to be performed prior to commissioning piping within the plant.
- .2 Test all installed lines and fittings.

- .3 Notify the Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of the Departmental Representative.
- .4 Testing of water pressure pipelines shall be in accordance with 02555 Watermains specification.
- .5 Testing of sewers/drains shall be in accordance with 02517 Gravity Sewers specifications.
- .6 Locate leaks, repair and re-test until the line tests satisfactorily and is accepted by the Departmental Representative.

3.6 Disinfection

- .1 Disinfect all watermains according to AWWA C651.
- .2 Follow procedure presented in Section 02555, 3.10.

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 Scope** .1 This section includes general requirements for mechanical work.
- 1.3 Shop Drawings** .1 The Contract Drawings show the locations of major components and the piping configuration in schematic form with only major components identified.
- .2 Prior to fabrication, submit four complete sets of Shop Drawings and data sheets covering all details of equipment, materials and fabrication intended for installation under this Contract, and in accordance with the Contract Documents.
- .3 All Shop Drawings submitted for approval shall be certified by the manufacturer and carefully checked by the Contractor, noting all changes required and shall bear the Contractor's approval stamp and signature prior to submitting to the Departmental Representative for approval; drawings will not be considered if not previously checked by the Contractor.
- 1.4 Equipment Requirements and Installation** .1 Permit equipment maintenance and disassembly by use of unions or flanges to minimize disturbance to connecting piping and duct systems and without interference from the building structure or equipment.
- .2 Provide accessible means for lubricating equipment including permanent lubricated "lifetime" bearings.
- .3 Base mounted equipment to be mounted on chamfered edge housekeeping pads a minimum of 50 mm high and 50 mm larger than equipment dimensions all around.
- .4 Pipe drain lines to drains. Provide piped drains from pump packing glands to building drain.
- .5 Equipment, floor plates and ceiling plates shall line up with building walls wherever possible.
- .6 Provide all structural work required for foundation and support of the units, foundation bolts, sleeves, washers, nuts, shims, and templates to locate position of bolts.

- .7 Install pumps, motors and other equipment as shown on the drawings, in accordance with the manufacturer's instructions and as directed by the Departmental Representative.
- .8 Motors shall be aligned, shimmed, and coupled to fit driven shaft to satisfy the tolerance given by the equipment manufacturer.
- .9 For anchorage, embed anchor bolts sufficiently to prevent pull-out. Provide minimum of 25 mm of grout between bedplate and foundation; fill void; finish to approval; do not remove wedges before grout is set.
- .10 Align piping to avoid excessive forces on fixed equipment when piping connections are tightened.
- .11 Pipes shall not be bolted to equipment until grouting and alignment are completed. Bolting shall be done so that no stresses are set up in the flanges.

1.5 Pipe Hangers and Supports

- .1 Fabricate hangers, supports and sway braces in accordance with ANST B31.1 and requirements of ULC C203.
- .2 Suspend hangers from steel channels or angles. Submit anchorage system for review. Acceptable products Grinnell Fig. 202, 194, 213, 195.
- .3 Use split adjustable steel ring hanger on piping less than 38 mm diameter. Use clevis type for 38 mm diameter and above. Acceptable products Grinnell Fig. 104, 160, 65.
- .4 For copper pipe, use copper finish tubing hangers Grinnell Fig. CT-109, CT-65 tube strap.
- .5 For pipes supported from floor, use adjustable pipe support saddle welded to pipe support and fabricated base to suit, bolted to floor. Grinnell Fig. 264.
- .6 Pipe 38 mm diameter and smaller may rest on cast wall bracket and held by U-bolt, Grinnell Fig. 213, 137; or may be strapped to wall using Fig. 126, 231, 262.
- .7 Use rod diameters and spacing for pipe supports as shown in table with the following exceptions.
 - .1 Support plumbing piping in accordance with more stringent requirements of authorities having jurisdiction.

- .2 Support plastic piping in accordance with manufacturer's recommendations.

Pipe Size	Rod Diameter	Maximum Steel	Spacing Copper
NPS 1/2	-	-	1.5m
NPS 1, 3/4	10 mm	2.1m	1.8m
NPS 1 1/2	10 mm	2.7m	2.4m
NPS 2	10 mm	3.0m	2.7m
NPS 2 1/2-3	10 mm	3.6m	3.0m
NPS 4	16 mm	4.2m	3.6m

- .8 Submit arrangement and type of hangers and wall hooks for review.
- .1 Place support within 300 mm of each horizontal elbow.
- .2 Hangers shall be three piece minimum standard, consisting of hanger, rod and pipe attachment.
- .3 Med steel wall hooks may be used to support non-expanding piping.
- .4 Isolate copper piping from ferrous hanger.

1.6 Escutcheons and Plates

- .1 Provide on pipes passing through finished walls, partitions, floors and ceilings.
- .2 Use chrome or nickel plated brass with set screws for ceiling or wall mounting.
- .3 Inside diameter shall fit around finished pipe. Outside diameter shall cover opening or sleeve.

1.7 Tests

- .1 Give 24 hours notice of date when tests will be made.
- .2 Conduct tests in presence of Departmental Representative.
- .3 Leave work exposed until tested and approved.
- .4 Bear costs including re-testing and making good.
- .5 Hydraulically test water supply systems at 860 kPa and maintain test pressure without loss for 4 hours.
- .6 Test fuel oil systems to CSA B139.
- .7 Test drainage, waste and vent piping to code.

1.8 Dielectric Couplings

- .1 Provide wherever pipes of dissimilar metals are joined.

- .2 Provide insulating unions for pipe sizes NPS 2 and under and flanges for pipe sizes over NPS 2.
- .3 Provide felt or rubber gaskets to prevent dissimilar metals contact.

**1.9 Instruction of
Operating Staff**

- .1 Provide nameplates for all valves and pieces of equipment, supplied by either the Contractor or others, as directed by the Departmental Representative.
- .2 Nameplates to be laminated plastic with black face and white centre of minimum size 90 x 40 x 2.5 mm nominal thickness, engraved with 6 mm high lettering. Use 25 mm lettering for major equipment, as directed by Departmental Representative.
- .3 Fasten nameplates securely in conspicuous place. Where nameplates cannot be mounted on a cool surface, provide standoffs or hang from chain.
- .4 Identify equipment type and number of service zone, as applicable. eg. shut-off valve, pressure relief valve, etc.
- .5 Submit list of equipment nameplates for review prior to engraving.

**1.10 Identification
of Piping**

- .1 Identify all piping with markers showing identification of pipe and directional flow arrows.
- .2 Use block capital letters 50 mm high for pipes of 75 mm nominal and larger diameter, and not less than 20 mm high for smaller diameters.
- .3 Use direction arrows 150 mm long by 50 mm wide for piping of 75 mm nominal or larger diameter and 100 mm long by 20 mm wide for smaller diameters.
- .4 Use waterproof plastic marker tapes for pipes and tubing of 19 mm and smaller diameter.
- .5 Acceptable Product: WH Brady identification tapes and bands and Seton Name Plate Corporation Setmark pipe markers.
- .6 Locate identification as follows:

- .1 Identify piping runs at least once in each room.
- .2 Do not exceed 5 m between identifications in open areas.
- .3 Identify both sides where piping passes through walls, partitions and floors.
- .4 Where piping is concealed in pipe chase or other confined space, identify at point of entry and leaving, and at each access opening.
- .5 Identify piping at starting and ending points of runs and at each piece of equipment.
- .6 Identify piping at major manual and automatic valves immediately upstream of valves. Where this is not possible, place identification as close to valve as possible.
- .7 Identify branch, equipment or building served after such valve.

**1.11 Temporary and
Trial Usage**

- .1 Temporary or trial usage by the Owner of any mechanical machinery, apparatus, equipment, or any other work or materials supplied under the contract before final written acceptance by the Departmental Representative, is not to be construed as an evidence of the acceptance of same by the Owner. The Owner shall have the privilege of such temporary and trial usage as soon as the Contractor shall claim that said work is completed. Any damage caused by defective material or workmanship through temporary or trial usage by the Owner shall be the responsibility of the Contractor.

END OF SECTION

PART 1 - GENERAL

- 1.1 General** .1 The "General Conditions" and "Supplementary General Conditions" shall form part of this section.
- 1.1 Scope** .1 The work and materials covered by this section include the furnishing and installation of the pump station mechanical equipment.
- 1.3 Related Work Specified Elsewhere**
- | | | |
|----|-------------------------------|---------------|
| .1 | Miscellaneous Metals | Section 05500 |
| .2 | Mechanical General Provisions | Section 15010 |
- 1.4 Standard**
- .1 Cast Iron Pipe: AWWA C151
Cast Iron Flanges: ASA B16.1
Galvanized Iron Pipe: ASTM A120
Malleable Iron Pipe Fittings: ASTM A107
- .2 Install piping in accordance with the requirements of the latest edition of the British Columbia Plumbing Code.
- 1.5 Certificates** .1 Provide written certificate that components are compatible, and where applicable, certified for intended use by nationally recognized testing agency.

PART 2 - PRODUCTS

- .1 Refer to Construction Drawings

PART 3 - EXECUTION

- 3.1 General**
- .1 Install all pipework, fittings, equipment and fixtures to the satisfaction and approval of the Departmental Representative.
- .2 Run exposed pipework parallel to walls and ceilings neatly grouped in parallel lines.
- .3 Temporarily plug ends of pipework to keep foreign matter out before final connections are made.
- 3.2 Tolerances**
- .1 All horizontal drain leaders above ground shall be graded to one percent slope, unless otherwise shown on the Drawings.
- .2 All drain lines and horizontal lines of soil and waste piping shall be graded two percent minimum unless otherwise shown on the Drawings.

**3.3 Installation
of Pipework**

- .3 Horizontal branches of all pipework shall be graded downwards so that they may be completely drained through risers, fixtures or drain cocks. Minimum slope one-half of one percent.
- .1 Do no cutting that may impair the strength of the building. Drill no holes, except for expansion bolts and small screws in the structure without obtaining prior approval from the Departmental Representativeing.
- .2 Pipes passing through roofs, floors or other areas requiring waterproofing shall be flashed by the Contractor. Seal pipe passing through walls and floors inside the building with flexible caulking applied into space between pipe and sleeve or as detailed.
- .3 Run all piping parallel to building lines. Fasten supports to inserts in concrete. Do not use perforated band iron for hangers. All hanger rods are to have machine threads capable of vertical adjustment after pipe is erected.
- .4 Piping, ducts, and equipment shall be thoroughly cleaned of dirt, cuttings and other foreign substances. Should any pipe, duct or other part of systems be obstructed by any foreign matter, disconnect, clean and re-connect whenever necessary for purpose of locating and removing obstructions. Repair work damaged in the course of removing obstructions.
- .5 Provide temporary bracing and supports to adequately support the pipe during installation.
- .6 Take care to prevent damage to the pipe, pipe coatings and the adjacent structure during erection. Make good all damage. Completely repaint all ferrous pipework and fittings after installation is completed.
- .7 Where the required piping is not shown on the plans or shown only diagrammatically, install pipes in such a way as to conserve head room and interfere as little as possible with free use of the space through which they pass.
- .8 Install all valves so as to facilitate servicing or re-packing.
- .9 Erect and support all piping in a manner that will not put undue strain on pumps, tanks, equipment or adjacent piping.

- .10 Install eccentric reducers in horizontal piping to permit drainage and eliminate air pockets.
- .11 Where pipe sizes differ from connections to equipment, install reducing fittings close to equipment. Reducing bushings are not permitted.
- .12 Use non-corrosive lubricant or teflon tape applied to male threads.
- .13 Install flanges or unions to permit removal of equipment without disturbing piping systems.

3.4 Welding of Steel Pipe

- .1 Do pipe welding in accordance with the current AWWA Specification C-206-62. The welding operators and supervisors employed and the welding procedure shall be qualified in accordance with the current CSA Standard W-47 Welding Specification Code. Each operator's certificate of qualification and experience record shall be on file at the site, and shall be made available to the Departmental Representative on request. Each operator shall be currently qualified for the P number covering the material on which he will be engaged as prescribed in the Welding Qualification Code, latest revision.
- .2 The Departmental Representative reserves the right to specifically test, at no cost to the Owner, the qualification of individual welders employed by the Contractor. Any welder who does not perform satisfactorily in the Departmental Representative's test shall be removed from the job at no cost to the Owner.
- .3 All welding shall be shielded metal-arc welding process. Welded pipe joints shall be single-V butt joints, using a root gap of 1.6 mm. Welds shall be full penetrating welds. Care shall be exercised to keep the interior pipe lining free from damage during welding. Longitudinal weld seams shall be on opposite sides of the pipe at the joint. Welding shall not be carried on when weather conditions, in the opinion of the Departmental Representative, are unsatisfactory and would impair the quality of the welds.
- .4 The minimum distance between the edges to adjacent circumferential welds shall be 50 mm. If this requirement cannot be satisfied, stress-relieving of the welds must be undertaken.

3.5 Valve, Equipment

and Appurtenance

- .1 Install all valves, equipment and appurtenances to manufacturer's instructions and these Specifications.

**3.6 Final Inspection
and Start-up**

- .1 Subject to systems and equipment to operational test.
- .2 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.
- .3 Provide pump, temporary connections and labour required for tests.
- .4 Carry out the following before final inspection:
 - .1 complete construction and site restoration
 - .2 complete all painting and finishing
 - .3 align and adjust all equipment
 - .4 where applicable, mail equipment warranty form to manufacturer. Provide the Owner with a copy of the original warranty for any equipment which has a warranty period longer than one year.
- .5 Notify Departmental Representative at least 48 hours prior to start-up.

END OF SECTION

PART 1 - GENERAL

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|---|----|---|---------------|
| 1.1 General | .1 | The "General Conditions" and "Supplementary General Conditions" shall form part of this section. | |
| 1.1 Scope | .1 | The work and materials covered by this section include the furnishing and installation of the pump station mechanical equipment. | |
| 1.3 Related Work Specified Elsewhere | .1 | Mechanical General Provisions | Section 15010 |
| | .2 | Mechanical | Section 15350 |
| 1.4 Standard | .1 | American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME) | |
| | | ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250. | |
| | | ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings | |
| | | ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings. | |
| | | ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500. | |
| | .2 | American National Standards Institute/National Sanitation Foundation (ANSI/NSF). | |
| | | ANSI/NSF 61, Drinking Water System Components. | |
| | .3 | Install piping in accordance with the requirements of the latest edition of the British Columbia Plumbing Code. | |
| 1.5 Certificates | .1 | Provide written certificate that components are compatible, and where applicable, certified for intended use by nationally recognized testing agency. | |

PART 2 – PRODUCTS

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| 2.1 Pipe | .1 | See drawings for pipe type and details |
|-----------------|----|--|

2.2 Fittings

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS2 and larger: roll grooved to CSA B242. Cast bronze to ANSI/ASME B16.18 or wrought copper ANSI/ASME B16.22.
- .6 Fittings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
- .7 NPS 1 ½ and under: Cast copper, ANSI/ASME B16.18 or wrought copper, ANSI/ASME B16.22; with 301 stainless steel internal components, EPDM seal, and push-to-connect or press fit joints, for hard drawn copper tube type L or K, rated for 1300 kPa at ASTM B88.

2.2 Joints

- .1 Rubber gaskets, latex-free, 1.6 mm thick: to ANSI/AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 tin copper alloy lead free.
- .4 Push-to-connect: EPDM gasket, UL classified in accordance with ANSI/NSF 61 for potable water service.
- .5 Teflon tape: for threaded joints.
- .6 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket. Gasket to be classified in accordance with ANSI/NSF 61 for potable water service. Couplings to be manufactured to copper-tube dimensions. Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.
- .7 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

2.3 Gate Valve

- .1 NPS2 and under, soldered:

Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.

- .1 NPS2 and under, screwed
Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 – Valves - Bronze.
- .3 NPS2-1/2 and over, in mechanical rooms, flanged:
Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 – Valves – Cast Iron.
- .4 NPS2-1/2 and over, other than mechanical rooms, flanged:
Non-rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, bronze trim, bolted bonnet specified Section 23 05 23.02 – Valves – Cast Iron.

PART 3 - EXECUTION

3.1 General

- .1 Install all pipework, fittings, equipment and fixtures to the satisfaction and approval of the Departmental Representative.
- .2 Run exposed pipework parallel to walls and ceilings neatly grouped in parallel lines.
- .3 Temporarily plug ends of pipework to keep foreign matter out before final connections are made.

3.2 Installation of Pipework

- .1 Install in accordance with Canadian Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 – Installation of Pipework and by certified journeyman supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Grooved joint couplings and fittings to be installed in accordance with the manufacturer's written installation instructions. Grooved ends to be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets to be verified as suitable for the intended service prior to installation.

Gaskets to be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative to provide on-site training for Contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative to periodically visit the jobsite and review installation. Contractor to remove and replace any joints deemed improperly installed.

- .5 Push-to Connect Piping: Prepare copper tube and install in strict accordance with installation instructions. Pipe ends to be cleaned, free from indentations, projections, burrs, and foreign matter. Use a tube preparation tool to clean and make installation mark. Push copper tube into fittings to installation depth mark, per installation instructions. Keep fittings free of dirt and oil.
- .6 Install CWS piping below and away from HWS and HWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .7 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

3.5 Valve, Equipment and Appurtenance

- .1 Install all valves, equipment and appurtenances to manufacturer's instructions and these Specifications.

3.6 Final Inspection and Start-up

- .1 Subject to systems and equipment to operational test.
- .2 During tests, stop any leaks and remove and repair any defective part. Perform test over again until satisfactory results are obtained.
- .3 Provide pump, temporary connections and labour required for tests.
- .4 Carry out the following before final inspection:
 - .1 complete construction and site restoration
 - .2 complete all painting and finishing
 - .3 align and adjust all equipment
 - .4 where applicable, mail equipment warranty form to manufacturer. Provide the Owner with a copy of the original warranty for any equipment which has a warranty period longer than one year.

- .5 Notify Departmental Representative at least 48 hours prior to start-up.

END OF SECTION

PART 1 - GENERAL

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| 1.1 General | .1 The "General Conditions" and "Supplementary General Conditions" shall form part of this section. |
| 1.2 Scope | <p>.1 This section includes general clauses applicable to the supply and installation of all electrical systems.</p> <p>.2 The Contractor shall provide all labour, materials, tools and equipment required for the work except such materials and/or equipment that is specified as supplied by Owner.</p> <p>.3 It is the intent of the Drawings and Specifications to provide a complete and workable installation. Any work, fitting and/or necessary material not specifically mentioned or shown on the Plans, but obviously necessary to complete the installation shall be furnished by the Contractor as if specifically mentioned herein and detailed.</p> |
| 1.3 CSA Approval | .1 All electrical equipment shall be new CSA approved, and of the highest quality in its class. |
| 1.4 Drawings and Specifications | <p>.1 The Drawings and Specifications are complementary each to the other and what is called for by one shall be binding as if called for by both.</p> <p>.2 Should any discrepancy appear between the Drawings and Specifications, which leaves the Contractor in doubt as to the true intent and meaning of the Plans and Specifications, a ruling shall be obtained from the Departmental Representative before submitting his tender. If this is not done, it will be assumed that the most expensive alternative has been allowed for.</p> |
| 1.5 Setting Out the Work | <p>.1 The Contractor shall be responsible for prompt installation of his work in advance of concrete pouring or similar work.</p> <p>.2 Where any equipment supplied by the Contractor must be built in with the work of other Contractors, this Contractor shall be responsible for the supplying of the equipment to be built in or measurements to allow necessary openings to be left so as not to hold up the work.</p> <p>.3 The Contractor shall be responsible for any damage caused the Owner or any of the other Contractors by improper location or carrying out of his work.</p> |

**1.6 Codes, Permits
and Inspections**

- .1 The installation shall comply with the requirements of the Canadian Electrical Code C22.1-1982 and all applicable local codes and bylaws.
- .2 The Contractor shall obtain all permits required and after completion of the work, shall furnish to the Departmental Representative a Certificate of Final Inspection and Approval from the Inspection Department. The Contractor shall obtain and pay for all permits at the beginning of work.
- .3 The Contractor shall submit a set of Electrical Drawings to the Electrical Inspection Department under whose jurisdiction this comes, within two (2) weeks from date contract is awarded.
- .4 In the event that this is not done and the Inspection Department requires some changes, the changes will be made at the expense of the Contractor.

**1.7 Compliance of Equipment
with Specifications**

- .1 The Contractor shall be completely responsible for ascertaining that every item of equipment he includes in his tender complies in all respects with the Specifications and Drawings in each case.
- .2 After the tender has been awarded, any item or equipment found by the Departmental Representative not to comply with the Specifications and Drawings shall be replaced at no additional cost to the Owner, with a unit of the Departmental Representative's choice.
- .3 Substitutions to specified materials and equipment may be submitted as alternatives only, provided complete technical data and price differences are submitted with the Tender.

**1.8 Finishes of
Equipment**

- .1 All supports, hanger rods, pull boxes, channel frames, conduit racks, outlet boxes, brackets, clamps, etc. shall have galvanized or approved painted finish.

**1.9 Excavation
and Backfilling**

- .1 All excavation and backfilling for the Electrical work, both within the building and outside the building, is included in the work of Section 16.

- .2 Sand bedding, planking or other means required to protect electrical systems during backfilling operations are included in the work of Section 16.
- 1.10 Painting**
- .1 All on-site painting for the Electrical work is included in "Painting" section of these Specifications.
- .2 Although painting for electrical work is not included in this Section, identification of equipment and materials to be painted, as well as cooperation in scheduling painting, shall be considered part of the work of this Section 16.
- 1.11 Electrical Service**
- .1 Where a new electrical service will be required, the Contractor shall make all necessary arrangements with local power company to ensure connection of the service when it is required.
- 1.12 As-Built Drawings**
- .1 The Contractor shall record on a set of drawings, all changes, additions, and deletions to the original contract to show the 'as-built' installation.
- .2 This set of drawings shall be returned to the Departmental Representative at the completion of the Contract.
- 1.13 Warranty**
- .1 The Contractor shall guarantee all equipment and materials, except those supplied by others, against faulty manufacture and/or installation for a period of one year from the date of acceptance of the complete installation.
- 1.14 Shop Drawings**
- .1 The Contractor shall submit a minimum of six (6) copies of shop drawings and all supporting material sufficiently in advance of requirements to allow time for review.
- .2 Approval of shop drawings by the Departmental Representative is general and shall not relieve the Contractor of responsibility of checking for errors and/or omissions.
- 1.15 Identification**
- .1 All equipment plus metering CT's and meter cabinets, if supplied, shall be identified by engraved lamacoid nameplates, white letters on black. Wording and size of nameplates shall be submitted for approval. All control wiring shall be identified at each end, spare wires as such. Panel branch circuit index card shall be typewritten.
- 1.16 Control Panel**
- .1 The control panel shall be as supplied by Allied Controls Ltd., or an approved equal.

- .2 If the Contractor wishes to use an alternate supplier, the Departmental Representative must receive shop drawings for his review and approval, before panel fabrication begins.
- .3 The panel shall be EEMAC 12 Ind. rust proof lockable enclosure and the Owner shall be provided with two (2) keys. All indication lights, meters, gauges, switches, etc. on the panel shall be identified by a lamacoid label.
- .4 All panel mounted electrical equipment to be installed fully wired and interconnected and shop tested prior to shipment. All terminals and devices to be labeled, using numbers shown on schematic drawings. Labels shall be affixed to the panel and not wire ways. All wire connections to terminals, relays, etc. to be marked using Electrovert Type Z wire markers or hot stamped markings on heat shrinkable tubing. Wire numbers shall be as shown on the schematics.

2.0 Existing Conditions

- .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.
- .2 Permit no interruptions to the electric power, fire alarm, or other similar systems in the existing buildings during normal working hours. Advise Clients Representative in writing of any intended interruptions, including the time and duration of outage. Obtain permission from Clients Representative at least 24 hours before partially or completely disabling any of the systems. Clients Representative may cancel such permission in emergencies at the last minute without penalty or extra cost. Minimize duration of outage.
- .3 Assume full responsibility for any disruption to existing services and systems caused by the Contractor. Provide all necessary material and equipment and provide all labour at no extra cost for any temporary connections required to maintain services during work in the existing buildings.

2.1 Coordination

- .1 Locate distribution systems, equipment and materials to provide minimum interference and maximum usable space.
- .2 Where interference occurs, Clients Representative must approve relocation of equipment and materials regardless of installation order.

- .3 Proposed distribution systems, equipment and material to be able to work without effecting current Hatchery operations and electrical supply.

END OF SECTION