CIVIL WORKS QUALITY CONTROL

1. GENERAL

1.1 Summary

.1 This Section specifies quality control of all civil works.

.2 Design Builder shall complete all quality control testing including laboratory services and bacteriological testing for watermains.

.3 All testing to be completed by an accredited laboratory recognized within Manitoba.

.4 Design Builder to complete all repeat testing for unsuccessful tests.

.5 Design Builder's testing agency to be authorized and informed by Design Builder to copy the City directly with results of all testing completed.

1.2 Standards and Guidelines

.1 The City of Winnipeg, Winnipeg Sewage Treatment Plan Civil Design Guideline.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C136/D422 - Standard Test Method for Particle-Size Analysis of Soils.

.2 ASTM D75 - Standard Practice for Sampling Aggregates.

.3 ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

.4 ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

.5 ASTM D2216 - Standard Test Method for Laboratory Determination of Moisture Content of Soil and Rock.

.6 ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

.7 ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.8 ASTM D2216/D4718 - Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.

1.3 Definitions

.1 Field Density:

.1 Density of placed and compacted aggregate as measured by a nuclear densometer or other accepted industry standard and expressed as a ratio, in percent, of field density to reference density.

.2 Apply corrections for oversize material to either as-compacted field dry density or maximum dry density in accordance with ASTM D4718, as determined by the Design Builder.

.2 Lift: Loose (uncompacted) layer of material.

.3 Field Moisture Content: Level of moisture in soil expressed in percent as determined by nuclear densometer.

Reference Density: Laboratory test, per ASTM D698/07 or D1557/07, as applicable, used for comparison with field density values for compliance.

.4 Reference Moisture Content: Determined in accordance with ASTM D698 or D1557/07, as applicable, used for comparison with field moisture content values for compliance.

1.4 Submittals

.1 Provide submittals in accordance with Sections 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Test results including: one sieve analysis Atterberg limits, LA abrasion and maximum dry density (Standard Proctor) for each sub-base and base course material prior to commencement of construction. If one test fails to meet the requirements of the Specifications the material shall be re-tested. If the material fails a second test a new source of that material will be provided.

.3 During asphalt paving, Marshall Analysis test results for one sample for every 300 T of material required.

.4 One concrete test shall consist of three (3) lab cured cylinders (one at 7 days and two at 28 days of age) including slump and air content tests.

.5 Complete field density test reports on daily basis for the fill and backfill areas compaction testing.

1.5 Quality Assurance

.1 If there are questions as to whether any product or system is in conformance with applicable standards, the City reserves the right to have such products or systems tested to prove or disprove conformance. The cost for such testing will be borne by the City in the event of conformance with Schedule 18 Technical Requirements or by Design Builder in the event of non-conformance.

.2 Where specified standards are not dated, conform to latest issue of specified standards as amended and revised to the tender closing date.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in Schedule 18 Technical Requirements.

3.2 Compaction Deficiencies

.1 Design Builder shall review and certify all field density test results.

.2 Fills, embankments, backfills, trench backfills, or base courses that do not meet the specified requirements shall be removed or re-worked and re-compacted until the requirements are satisfied. Conduct additional testing to evaluate the lateral extent of areas that do not meet the Technical Specifications and re-testing after re-compaction.

.3 Project site grading: One field density test and field moisture content test per 100 m^2 per lift, but not less than one of each test per day of fill placement.

.4 Trench backfill: One field density test and field moisture content test per 10 lineal metres per 300 mm lift, but not less than one of each test per pipe segment.

.5 Granular subbase and base for roads: one field density test and field moisture content test per 50 lineal metres of roadway per 300 mm lift, or required lift thickness, minimum of three (3) tests per material per site visit.

.6 Asphaltic concrete paving for roads: one field density test every 50 m per lane, minimum three (3) tests per site visit when expected material requirement is less than 500 T per day.

.7 Asphaltic concrete paving for roads: one field density test every 100 m per lane, when expected material requirement is greater than 500 T per day.

.8 A minimum of three (3) core samples for thickness and density, when asphalt material requirement is less than 500 T per day.

.9 One core sample for thickness and density every 400 m per lane with a minimum of three (3) cores per day, when asphalt material requirement is greater than 500 T per day.

.10 Portland cement concrete paving for roads: One concrete test on the first truck delivered, then every 30 m^3 thereafter per day when total volume is less than 100 m^3.

.11 Portland cement concrete paving for roads: One concrete test on the first truck delivered, then every 100 m^3 thereafter per day when total volume is greater than 100 m^3.

.12 Concrete walks, curbs and gutters: One concrete test on the first truck delivered, then every 30 m^3 thereafter per day when total volume is greater less 100 m^3.

.13 Concrete walks, curbs and gutters: One concrete test on the first truck delivered, then every 100 m^3 thereafter per day when total volume is greater than 100 m^3.

.14 Nuclear methods are to be used for determining field density and field moisture content. The nuclear densometer shall be field calibrated before each site visit to conduct density testing.

END OF SECTION

SITEWORK DEMOLITION AND REMOVAL

1. GENERAL

1.1 Summary

.1 This Section specifies procedures for saw-cutting, demolishing, recycling removing and disposing of existing structures, facilities, utilities, and pavements designated to be removed in whole or in part, and for backfilling resulting trenches and excavations.

1.2 Submittals

.1 Provide submittals in accordance with Section 01300.

.2 Provide submittal outlining plan for demolition material removal, fill material, restoration blasting and hauling.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 Preparation

.1 Locate and protect utilities. Preserve active utilities traversing the Lands in operating condition.

3.2 Demolition

.1 Demolish and partially demolish structures as required for the Final Design.

.2 Remove existing equipment services and obstacles where required for re-finishing or making good of existing surfaces and replace as work progresses.

.3 Dust generation shall be minimized. To control dust, keep materials wetted.

.4 Do not sell or burn materials on the Lands.

.5 Cut off anchor bolts, reinforcement and structural steel 25 mm below final concrete surface and make good on completion to match existing finishes.

.6 Use all necessary barriers and other protective measures to protect equipment and structures beyond Work limits from falling or flying debris.

3.3 Removal Operations

.1 Suppress dust generated by the demolition and removal process.

.2 Equipment and methods of removal and hauling shall not tear, gouge, break or otherwise damage or disturb adjacent pavement or underlying granular material.

.3 Demolish the structures and facilities in their entirety including sub-grade structures, piping, concrete or steel structures as required by the Final Design.

.4 Removal of pavements, curbs and gutters:

.1 Suppress dust generated.

.2 Square-up adjacent surfaces to remain in place by saw cutting.

.3 Protect adjacent joints and load-transfer devices.

.4 Protect underlying and adjacent granular material.

.5 When removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving, prevent contamination with base coarse aggregates.

.6 When removing pipes under existing or future pavement area, excavate at least 300 mm below pipe invert.

.7 Stockpile material only at the designated areas prior to removal from the Lands. Excess material shall be removed from the Lands during or at the completion of the Work.

.8 Seal pipe ends and walls of manholes or catch basins. Securely plug to form watertight seal.

3.4 Restoration

.1 Restore areas and existing works outside areas of demolition to match conditions of adjacent undisturbed areas.

.2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

3.5 Blasting

.1 Blasting operations shall be prohibited on the Lands.

END OF SECTION

ALTERATIONS TO EXISTING STRUCTURES AND RELOCATION OF UTILITIES

1. GENERAL

1.1 Summary

.1 This Section specifies the requirements for modifying and altering existing structures for the installation of new piping and appurtenances, or partial demolition to complete the Work or removal of existing equipment piping and appurtenances for the Work.

.2 Construct the new utility pipes or utility corridors at a new location that are to replace the existing utilities or utility corridors. The existing utility or utility corridor between the relocation sections shall be removed and disposed offsite. For clarity, the interceptor sewers and discharge conduit that are abandoned are not required to be removed and disposed offsite. The interceptor sewers and discharge conduit shall be abandoned in place in accordance with Schedule 18 Technical Requirements.

.3 Coordinate with the City before starting any alteration of existing facilities or structures and relocation of utilities and relocation of infrastructure owned by authorities having jurisdiction, including following the City's coordination protocol.

1.2 Standards and Guidelines

.1 The City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guideline.

1.3 Definitions

.1 Alterations to existing structures: Fundamental change in the configuration or framework of an existing facility.

1.4 Submittals

.1 Provide submittals in accordance with Section 01300.

.2 Submit written request in advance of any cutting or alteration which may affect:

.1 Structural integrity or process capacity of any element.

.2 Integrity of weather-exposed or moisture-resistant elements.

.3 Efficiency, maintenance, or safety of any operational element.

.4 Aesthetics of visible elements.

.5 Include submittals for the City's coordination protocol.

.3 Include in submittal:

.1 Location and description of affected Work.

.2 Alternatives to cutting and patching.

.3 Date and time of start and completion of Work.

.4 All Drawings, diagrams and details showing sequence of disassembly and any supporting structures and underpinning.

.4 Submittals containing any information related to structures' design to bear the seal of a Professional Engineer registered in the Province of Manitoba.

2. PRODUCT (NOT USED)

3. EXECUTION

3.1 General

.1 Post warning signs on vulnerable electrical lines and equipment which must remain energized for the duration of the Work.

.2 Disconnect and cap services and utilities as required prior to relocation works.

.3 Execute work by methods which avoid damage to other work, and which provide proper surfaces to receive patching and finishing.

.4 Use materials to match existing.

.5 At penetration of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-resistant material with same fire rating, full thickness of the construction element.

.6 Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

.7 At penetration roofs or non-fire-rated floors completely seal voids with waterproof deck surfacing. Refer to Division 7.

END OF SECTION

DUST CONTROL

1. GENERAL

1.1 Summary

.1 This Section specifies products and placement of materials for control of dust on roadways.

1.2 Standards

.1 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-15.1 - Calcium Chloride.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300.

2. PRODUCTS

2.1 Materials

.1 Calcium Chloride, Type I: to CAN/CGSB-15.1, 35 percent aqueous solution.

.2 Clean water, free of hazardous or toxic contaminants.

3. EXECUTION

3.1 General

.1 Supply road watering and calcium chloride in enough quantities to mitigate dust.

.2 Apply water aqueous calcium chloride with distributors equipped with means of shut-off and with spray system capable of uniform application.

END OF SECTION

DEWATERING

1. GENERAL

1.1 Summary

.1 This Section specifies the requirements for supply and install of wells, pumps and piping and related works required for the groundwater depressurization system.

1.2 Standards

.1 All codes and standards to be latest edition unless noted otherwise.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM F480-90 - Specification for Thermoplastic Water Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), Sch 40 and Sch 80.

.3 American National Standards Institute (ANSI):

.1 ANSI/AWWA A100-90 - Water Wells.

.4 Canadian Standards Association (CSA):

.1 CAN/CSA A5-M93 - Portland Cement.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300.

.2 Provide the City Representative with a Groundwater Management Plan for the Works at least 30 Business Days prior to the scheduled commencement of groundwater depressurization works.

.3 The Plan shall be prepared and submitted in a format that clearly identifies how Design Builder will undertake the Works, specifically to address the requirements for bedrock groundwater depressurization and dewatering, including:

.1 The supply, installation and testing of pumping wells.

.2 The supply, installation, testing and commissioning of a bedrock groundwater depressurization pumping system.

.3 Measures to protect uncontaminated groundwater and surface water.

.4 Measures to remediate contaminated groundwater and surface water.

.5 Measures that will be undertaken during construction to prevent the ingress of groundwater (including contaminated groundwater) onto the lands from off site and the egress of groundwater (including contaminated groundwater) from the lands to off site, together with supporting documentation including data from field investigations, reports,

calculations, modelling and other activities consistent with good industry practice to demonstrate such measures will be effective.

.6 Bedrock groundwater depressurization system operation.

.7 Bedrock groundwater depressurization system decommissioning.

.8 Well decommissioning.

.4 The Groundwater Management Plan shall include provisions for drawing down the bedrock pressures sufficient to lower the pressure to a minimum of 1 m below the base of the excavation for the various facilities/works. This will require the use of wells. The Groundwater Management Plan for Pumping Station shall be further updated or altered as dictated by site conditions. The Groundwater Management Plan shall remain in effect until all construction and backfill activities are completed. Note the following regarding the Plan:

.1 Subject to the approval of the City Representative, water with up to 30 mg/L of suspended solids may be pumped into the land drainage sewer system.

.2 For water containing suspended solids, provide alternative means to remove the water from the Lands or treat the water prior to discharge.

.3 Formal approval for pumping water into the land drainage sewer system must be obtained from the City Representative in writing five (5) Business Days prior to commencement of pumping.

.5 The Groundwater Management Plan shall include a detailed description of the Work methodology. The methodology shall include a description of the equipment to be provided and the method of operation to ensure that groundwater levels are continuously maintained at the desired level, including contingency plans in the event of a pump or power failure.

1.4 Quality Assurance

.1 The Groundwater Management Plan is to be prepared by a qualified hydrogeologist.

.2 The Work described in this Section to be performed by a qualified well drilling and development contractor. Minimum qualifications to be:

.1 Contractor shall have been engaged in the business of test pumping, construction of test holes and wells of diameter, depth, and equivalent production equivalent to the proposed pumping wells for a period of at least 10 years. Well driller on site to have at least 10 years' experience.

.2 Be thoroughly familiar with governing regulations having jurisdiction on this project. The driller shall be a licensed Water Well Driller by the Province of Manitoba.

.3 Use qualified workers who are fully familiar with this work and perform all work under the direct supervision of an experienced well driller with a minimum of 10 years' experience.

2. PRODUCTS (NOT USED)

3. EXECUTION

3.1 General

.1 Design Builder shall notify the City Representative at least five (5) Business Days before the start of any operation of the groundwater depressurization system.

.2 Design Builder shall perform monitoring of the groundwater levels throughout the duration of the Work.

.3 Operate the full groundwater depressurization system continuously for at least 48 hours before initiation of excavation in the affected areas. Increase this duration as required based on monitoring of field groundwater conditions.

.4 Design Builder is advised that the City Representative will observe the installation, operation, monitoring, and decommissioning of the groundwater depressurization system and all associated works.

.5 Maintain all pumping and monitoring wells within the construction area for the duration of the Work. Repair or replace any well damaged during the Work.

.6 Be responsible for damage to any groundwater depressurization or monitoring system components during construction activities. Repair or replace damaged components to the satisfaction of the City Representative.

.7 Make arrangements to obtain fresh clean water for well drilling and transport to site.

3.2 Guidelines, Codes, and Regulations

.1 The work described herein shall be conducted in such a manner so as to comply with all applicable by-laws, ordinances, codes, and regulations, including all those pertaining to environmental and safety matters.

.2 Design Builder is to obtain a Letter of Authorization to operate the Groundwater Depressurization System from Manitoba Water Stewardship as well as any environmental approvals from Manitoba Sustainable Development.

.3 Design Builder will obtain the permit(s) required for groundwater withdrawal and discharge. Comply with the terms and conditions associated with these permits.

3.3 Reports

.1 On completion of the Work, submit to the City Representative reports containing:

.1 A description of the stratigraphy encountered in each borehole, including the depths of changes in stratigraphy;

.2 The size and length of each casing section installed, including the total depth of installation and the length of stick-up;

.3 Grouting details;

.4 Records of all static and pumping water level measurements, times at which they were taken and the corresponding pumping rate; and

.5 Well development data.

3.4 System Operation

.1 Notify the City Representative as least 48 hours prior to any dewatering activities.

.2 Operate and maintain the groundwater depressurization system on a 24 hour per day basis for the duration of construction activity that requires lowered groundwater levels. This will include the provision of a full-time operator 24 hours per day who will be capable of repairing the system or otherwise taking actions to ensure that lowered groundwater levels are maintained at all times. Damages to the construction site or the equipment and materials at the site due to the failure of the system will be the responsibility of Design Builder.

.3 The required discharge rate will depend on groundwater elevations at the time of construction and the elevation at the base of the excavation and will be specified by Design Builder's hydrologist at the start of construction and revised periodically during construction based on the monitoring results provided and on the final depth of excavation required.

.4 Monitor and record the flow rate at each pumping well once every hour. Measure and record ground water levels in the pumping wells once every 24 hours. Provide copies of the field data sheets to the City Representative daily.

.5 Monitor and record groundwater levels in all of the monitoring wells at the site once every 24 hours. Provide copies of the field data sheets to the City Representative daily.

.6 Monitoring the depressurization system throughout the duration of the Work.

.7 Non-Operating Periods: The wells shall be equipped with well seals to prevent infiltration of surface water into the underlying bedrock aquifer or the discharge of groundwater from the wells. Ensure that these components are in place and maintained during non-operating periods. Remove and reinstall equipment if necessary, during non-operating periods.

.8 Do not make changes to the set up or operation of the groundwater depressurization system without prior written acceptance by the City Representative. Where emergency changes are required to maintain the system in a fully functioning manner, take the appropriate action and then immediately advise the City Representative of the actions taken and the reasons, therefore. If requested by the City Representative, provide a written report of the source of the problem, the actions taken to rectify the issue and the steps taken to ensure the problem does not occur.

3.5 Groundwater Depressurization System Decommissioning

.1 Remove all pumps, back-up pumps, drop piping, connections, control valves, flow metres, discharge hose, energy dissipation mats and other appurtenances.

3.6 Well Decommissioning

.1 Decommissioning all pumping and observation wells at the end of construction.

.2 For open bedrock holes, backfill the lower portion of the wells that extend into the carbonate bedrock aquifer with clean sand. Tremie backfill the remaining casing with bentonite /cement grout to ground surface. Cut the casing off a minimum of 1 m below grade.

.3 For screened monitoring wells, tremie back the entire length with bentonite / cement grout up to ground surface. Cut the casing off a minimum of 1 m below grade.

3.7 Construction Sequence

.1 To minimize any potential impacts of pumping on nearby domestic wells, the construction sequence shall be such that the excavations for which depressurization is required are completed either simultaneously or within the shortest possible overall time frame. Coordinate and schedule the Work in a manner that minimizes the duration that groundwater depressurization is required.

END OF SECTION

SHAFT EXCAVATION AND INITIAL SUPPORT

1. GENERAL

1.1 Summary

.1 The work specified in this Section includes excavation and initial support of shafts, including launch shafts and receiving shafts on tunnel alignments, and shafts for manhole and other hydraulic structure excavations.

1.2 Standards

.1 All codes and standards to be latest edition unless noted otherwise.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM C31 - Practice for Making and Curing Concrete Test Specimens in the Field.

.2 ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

.3 ASTM C94 - Specifications for Ready Mixed Concrete.

.4 ASTM C150 - Standard Specification for Portland Cement.

.3 City of Winnipeg Specification CW 2030 Excavation, Bedding and Backfill.

.4 Canadian Standards Association (CSA):

.1 CSA A3000 - Cementitious Materials Compendium.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.2 As part of the excavation, shoring, and dewatering plan, describe shaft excavations, including the following information:

.1 Limits of shaft work sites.

.2 Location and dimensions of shaft excavations.

.3 Methods of excavation.

.4 Means of maintaining soil stability at the bottom of the shaft.

.5 Provisions for ventilating the excavation to prevent accumulations of hazardous gas.

.6 Measures employed at tunnel entry and exit points to stabilize the ground and to control groundwater.

.7 Site and shaft security arrangements.

.3 As part of the excavation, shoring, and dewatering plan, describe shaft supports, including any design Drawings and computations prepared by Design Builder, describing initial ground support systems. Design Drawings shall be signed and sealed by a Professional Engineer registered in the Province of Manitoba. Submittal shall include:

.1 Dimensioned layout of support system including location of members (such as caissons, beams, columns, piles, walers, struts, sheeting and other supports).

.2 Member sizes and thickness and bending tolerances of structural steel.

.3 Quality of materials to be used (by reference to recognized standards such as ASTM), including but not limited to timber structural members, sheeting, and blocking; steel structural members, sheeting, plates, and bars; concrete; and grout.

.4 Connection details.

.5 Maximum allowable spacing between bracing points on compression members to maintain stability and alignment.

.6 Requirements or limits on pre-loading braces.

.7 Sequence of erection and removal.

.8 Design loading conditions.

.9 Codes and reference standards used as a basis for design.

.10 Location, dimensions, and means of ensuring stability at openings.

.11 For initial support members installed in advance of excavation, describe methods of installation, of quality control, and of correcting support system defects exposed by subsequent excavation.

2. PRODUCTS

2.1 Performance Criteria

.1 Select methods of shaft excavation and initial ground support that are compatible with conditions, and with requirements for placement of permanent structures, control of water, safety of personnel, and protection of adjacent property and structures. Construction methods include secant piles, slurry wall, precast concrete caisson, cast in place caisson, sheet piling, soldier pile and lagging or other methods approved by Design Builder.

.2 Specific methods of initial ground support and groundwater control required in this Section or shown on the Drawings are to be considered minimum requirements. Design Builder is solely responsible for any additional construction measures necessary to achieve the requirements of this Section and is solely responsible for any damages resulting from failure to meet the requirements of this Section.

.3 Establish the size and configuration of shaft excavation to accommodate means and methods of construction.

.4 Design Builder shall be solely responsible for design of initial ground support systems, and for any revision of designs shown. The design shall be prepared and sealed by a Professional Engineer registered in the Province of Manitoba, having at least five (5) years of experience designing similar support systems in similar ground conditions.

.5 Initial ground support systems greater than 6 m deep shall be designed to the minimum ground loads and surcharge loads provided in the document. Design Builder shall verify that ground loads and surcharge load for design are adequate for the expected ground conditions, and are appropriate for the type of support system proposed. Design Builder shall add construction loads appropriate to the means and methods of construction.

.6 Design of the initial ground support system shall consider:

.1 Ground conditions described in the Geotechnical and Hydrogeological Report.

.2 Methods for control of water.

.3 Maintenance of soil stability at the bottom of the excavation.

.4 Deformation of the support system under load.

.5 The proximity of existing underground and above-ground structures, including buried water lines and the potential effect of their rupture on the support system.

.6 Effects of vibration on adjacent structures, from driving and pulling sheeting and piling.

.7 All loading conditions, including loading due to delay in adding support members, removal of support members, and dynamic loading.

.8 Tunnel break-in and break-out procedures.

.9 Placement of permanent lining and structures.

.10 Site and environmental conditions.

2.2 Cementitious Backfill Grout

.1 Cementitious backfill grout for shaft support systems shall consist of a mixture of water and portland cement, with flyash, ground blast furnace slag (GBFS), sand fillers, and admixtures as necessary to achieve a low-shrink, flowable grout.

.2 Cementitious backfill grout for shafts in soil shall have a minimum compressive strength of 1.4 MPa psi at 24 hours and 3.5 MPa at 28 days, when tested in conformance with ASTM C 109.

.3 Cementitious backfill grout for sections of shafts in rock shall have a minimum compressive strength of 4.8 MPa at 24 hours and 20 MPa at 28 days, when tested in conformance with ASTM C109.

2.3 Foundation Stabilization Material

.1 Foundation stabilization material shall conform to City of Winnipeg CW 2030 Type 2 or 3 material.

2.4 Skin Coat

.1 Concrete for skincoats shall conform to the requirements of City of Winnipeg CW 2160 Type B mix.

2.5 Backfill

.1 Shaft backfill shall conform to the requirements of Controlled Low Strength Material (CLSM) under existing and future paved roadways and within 0.6 m of pavement edge, in paved parking areas, and in any area where settlement must be held to a minimum. CLSM shall conform to City of Winnipeg Specification CW 2160 Type C Cement Stabilized Fill.

.2 In off-road areas, parks, and undeveloped lands where minor settlement will not adversely affect the function, appearance, or value of the excavated area, or where CLSM backfill or granular backfill are not specified or shown on the Drawings, earth backfill may be used conforming to City of Winnipeg CW 2030 Class 4 Standards.

.3 Backfill beneath utilities and structures exposed by shaft excavation shall conform to the requirements of City of Winnipeg Specification CW 2160 Type C Cement Stabilized Fill and shall be placed to conform to existing backfill under undisturbed portions of the utility.

.4 Backfill adjacent to permanent structures, manholes shall be completed to City of Winnipeg Specification CW 2160 Class 2 Standards.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer’s recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in Schedule 18 Technical Requirements.

3.2 Initial Ground Support Systems

.1 Construct initial ground support systems to line, grade, dimensions, and tolerances that allow permanent structures and pipes to be placed as shown on the Drawings and in accordance with specified tolerances.

.2 As the excavation progresses, perform periodic verification of shaft vertical alignment.

.3 Develop and maintain firm and uniform bearing of the support system against the ground by advancing the support system in advance of excavation, or by timely placement of internal supporting members, or by expanding the support system tightly against the ground, or by timely backfill grouting between a non-expanding support system and the ground.

.4 As the excavation progresses, perform periodic inspections for indications of loosening or instable ground; loss of ground through the support system; cracking and subsidence of ground near the excavation; or excessive deformation, overstress, or weakening of the initial support system.

.5 Maintain the initial ground support system in fully functional condition for the duration of its use. Promptly reset, repair, or replace support system elements that settle, become misaligned, were improperly installed, or become damaged.

.6 Utilize excavation methods which prevent basal heave or soil piping leading to instability of the shaft base. Adopt adequate embedment depths to prevent basal heave or soil piping leading to instability of the shaft base and adopt tremie concreting methods for construction of the shaft base where appropriate.

.7 Where precast or cast in place sinking systems are used, utilize bentonite or other supporting mud to assist shaft sinking and minimize the movement of the ground surrounding the shaft.

.8 Coordinate the installation of initial support systems with excavation to prevent heaving or raveling of exposed soils.

3.3 Backfill Grouting of Shoring Linings

.1 Where required to prevent subsidence or provide friction against heaving, settlement or floatation, provide backfill contact grout between the shaft support and ground.

.2 Locate grout ports in the lining to limit grout travel distances to less than 3 m from each port.

.3 On completion of shoring, grout behind the lining to displace annular bentonite, minimize ground movement into the annular space, and migration of fluids through the annular space.

.4 Inject grout in continuous progression of grout holes along the perimeter of the shaft, commencing from the bottom of the shaft and working upwards.

.5 Pump grout until material discharging from next hole in sequence is similar in consistency to that at the point of injection. Exercise care to completely fill voids around any obstruction to the natural flow of grout.

.6 Grouting pressure shall be established by Design Builder but shall not exceed safe limits established by the Design Builder in advance. Control grouting pressure to avoid distorting the lining.

.7 Equip the grout plant with reliable pressure gauges at the point of injection and at the pump, to provide accurate pressure readings on a continuous basis.

.8 After completing the grouting of a hole, hold the grout by means of the stop valve until the grout has set to the extent that it will be retained in the hole.

3.4 Removal of Initial Ground Support Systems

.1 Sheeting shall be removed where permitted, as the excavation is backfilled, and in a manner to maintain stability and strength of soils, and to avoid disturbing adjacent utilities and structures. Voids left on removal of sheeting shall be backfilled to prevent subsidence.

.2 Support systems that extend below the bottom of the excavation, such as sheeting, shall not be removed without prior approval by the engineer of record.

.3 Support systems that cannot be removed without causing damage to existing structures, utilities, or the Work.

.4 Remove wall support systems to at least 2 m below ground surface unless the wall support systems become part of the infrastructure.

.5 Design Builder to provide as-built of locations of shoring remaining in place.

.6 Repair any settlement or damage to the Work or adjacent property resulting from removal of initial ground support systems.

3.5 Soil Excavation

.1 Adopt a shaft support system that maintain continuous ground support during excavation.

.2 Excavate in a manner to minimize loss of soil into the excavation, to minimize soil movement outside the excavation, to maintain stability of the excavation, and to preserve the existing strength of soils surrounding the excavation.

.3 Methods of ground stabilization and groundwater control employed at shaft entry and exit points, such as ground freezing or jet grouting, shall be compatible with methods of tunnel excavation.

3.6 Shaft Bottom Stabilization

.1 Design and install a concrete base connecting to the wall support system, to prevent ground heave, loss of fines and water ingress.

.2 Use of foundation stabilization material.

.3 Where ground and hydrostatic conditions require, utilize tremie concreting techniques for placement of shaft bases.

3.7 Foundation Stabilization of Structures Not in Shaft

.1 Where the existing material in the bottom of the excavation is unsuitable for supporting the structure, over-excavate and remove the unsuitable material, as shown on the Drawings or as approved by the Professional of Record.

.2 Where unsuitable material extends below the depth of over excavation, place geotextile for stabilization over unsuitable material exposed in the excavation or as approved by the Professional of Record.

.3 Backfill the excavation with foundation stabilization material over the full width of the excavation, to the required excavation bottom necessary for foundation preparation.

.4 Spread foundation stabilization material in uniform, loose lifts not to exceed 300 mm. Compact to CW 2030 Class 2 Standards. Vibrate using a boom-mounted vibratory plate compactor or tamp using the excavator bucket.

3.8 Control of Water

.1 Control water within excavations to prevent flowing conditions in silty and sandy soils, piping of fine soils, and softening and deterioration of shale bedrock.

.2 Prevent piping and loss of fines through the lining.

.3 Design Builder to utilize appropriate measures such as advance ground treatment and/or adequate wall toe-in depths to prevent the possibility of base heave or soil piping.

.4 Take appropriate measures to prevent flooding of the shaft during periods of rainfall or overland flood.

.5 Prevent ice formation on shaft walls by groundwater cut-off, frequent scaling, heating of ventilation air, or other measures as necessary to eliminate the hazard of falling ice.

3.9 Control of Vibrations

.1 Control of vibrations to prevent damage to the work or to adjacent property caused by vibrations from driving piles.

3.10 Backfill of Shafts

.1 Remove all form materials and trash from the excavation before placing any backfill. Remove loose, sloughing, or caving soil from bottoms and sidewalls of excavation.

.2 Backfill around cast-in-place concrete only after concrete has attained 2/3 of the specified 28-day compressive strength.

.3 Raise backfill uniformly to prevent unbalanced lateral loading that could push the shaft structure out of vertical alignment.

.4 Limit lift heights to prevent hydrostatic loading that would overstress the shaft structure.

3.11 Shaft Security

.1 Provide a continuous shaft security system, anchored to the top of the shaft, around the full perimeter of the shaft or extend shaft lining around the full perimeter of shaft to a minimum height of 1 m above grade. The extended shaft lining shall provide a level of security equivalent to one full ring of liner plate backed by one steel support rib at mid-plate height.

.2 Secure shaft excavations deeper than 3 m during all periods when shaft site is unoccupied by Design Builder or security personnel, including routine absences such as lunch breaks, overnight, and weekends.

.3 Security measures shall be designed to deter vandalism, and to prevent unauthorized or accidental entry of persons, animals, or objects into the shaft. Minimum security measures shall consist of the following:

.1 Chain link security fence installed on the shaft work site perimeter; closed and locked whenever the site is unattended by Design Builder's personnel;

.2 Any other requirements by a Governmental Authority; and

.3 Any other requirements indicated in Design Builder's Health, Safety and Security Management Plan.

.4 Excavations which are exposed to public vehicular traffic, including run-off-the-road traffic, shall be barricaded along the exposed side with portable concrete "Jersey barriers" designed and positioned to deflect errant vehicles.

END OF SECTION

CONTACT GROUT FOR TRENCHLESS INSTALLATIONS

1. GENERAL

1.1 Summary

.1 This Section describes the minimum requirements for providing the contact grouting to be used.

1.2 Standards

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C31 - Practice for Making and Curing Concrete Test Specimens in the Field.

.2 ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

.3 ASTM C94 - Specifications for Ready Mixed Concrete.

.4 ASTM C150 - Standard Specification for Portland Cement.

.2 Canadian Standards Association (CSA):

.1 CSA A3000 - Cementitious Materials Compendium.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Grouting equipment to include layout of equipment during grouting operations.

.2 Calibration certificates for gauges, flow meters, and regulators.

.3 Applied pressure and estimated volume of grout per pipe or casing segment.

.4 Procedure to fill the annular space to help limit settlement and reduce long term embedment loads on the pipe. Provide procedure, schematic, equipment, layout, injection pressures, and design calculations.

.5 Provide estimated injection volumes and pressures, supported by calculations, for the anticipated soil conditions as well as control measures to prevent damage to the pipe or casing.

.1 MSDS for grout mix additives.

.2 Grout mix.

.3 Grout pressures.

1.4 Quality Assurance

.1 During grouting operations, provide access to and record the pressure gauge.

.2 Grout designer shall be a licensed Professional Engineer registered in the Province of Manitoba having at least five (5) years of demonstrable experience in the design of grout mixes. Experience and education shall be documented in a resume with a detailed description of the work performed on each reference project.

2. PRODUCTS

2.1 Design Criteria

.1 Grout mix shall be designed by Design Builder.

.2 Calculate grout pressures and determine effects of fluid pressure on pipe using a minimum factor of safety of 2.0.

.3 Stiffness, strength, injection pressure, and volume of the contact grout mix shall be compatible with the ground and groundwater conditions as determined by Design Builder's Geotechnical and Hydrogeological Report as well as the pipe that is being grouted.

2.2 Materials

.1 Use NSF/ANSI Standard 60 Certified or equal approved materials only.

.2 Cement shall conform to ASTM C150 and CSA A3000.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in Schedule 18 Technical Requirements.

.3 Contact Grouting Equipment:

.1 Provide equipment for mixing and injecting grout to satisfactorily mix and agitate the grout and force it into the grout holes, in a continuous flow at the desired pressure. Provide pumps capable of continuously developing a sustained pressure of 350 kPa at the grout port connections.

.2 Provide two pressure gauges, one at the grout pump and one at the collar of each hole being grouted. Provide gauge savers for all gauges, to prevent the entry of grout into the gauge housing. Check the accuracy of the gauges periodically with an accurately calibrated pressure gauge. Make available a minimum of two spare pressure gauges onsite.

.3 Provide the grouting equipment with a meter to determine the volume of grout injected. Calibrate the meter in cubic metre to the nearest one-tenth of a cubic metre.

.4 Maintain the grouting equipment in satisfactory operating condition throughout the course of the Work to ensure continuous and efficient performance during grouting operations.

.5 Provide suitable stop valves at the collar of each hole for use in maintaining pressure as required until the grout has set.

.4 Mixing and Injection of Contact Grout:

.1 Provide materials free of lumps when put into the mixer. Constantly agitate the grout mix. Install grout that flows unimpeded and completely fill voids. Dispose of grout not injected after 90 minutes of mixing.

.2 Operate and control the grouting process so that the grout will be delivered uniformly and steadily. Drilling grout holes through pipe will not be permitted.

.3 Recirculate grout mixes when any new mix is batched or after adding water, fluidifier, or sand to mix. Recirculate mix for at least 2 minutes prior to pumping grout into grout hole.

.4 Grouting will be considered completed when less than 0.25 cubic metre of grout of the accepted mix and consistency can be pumped in 5 minutes under the specified maximum pressure. After the grouting is finished, close the valve before the grout header is removed and leave closed until grout has set.

.5 Contact Grouting of Jacking Pipe:

.1 Commence contact grouting outside of the jacking pipe within 24 hours following the completion of each tunnelled drive. Conduct grouting operations continuously until completed.

.2 Install contact grout ports in the jacking pipe as shown on the drawings. Drilling grout holes through installed jacking pipe will not be permitted. Provide grout ports threaded to accept valve fittings and plugs.

.3 Inject grout through the tunnelled pipe grout connections in such a manner as to completely fill voids outside the pipe resulting from, or encountered during, tunnelling operations. Control grout pressure to avoid damaging the pipe, and to avoid movement of the surrounding ground or improvements.

.4 Grouting to generally progress sequentially in a constant up gradient direction from one grout port to the next grout port in the sequence indicated in the approved submittals.

.5 During the grouting operations, clean and make ready for grouting the sufficient contact grout ports ahead of the port to be grouted. Attach valves or other suitable devices and place in the fully open position on ungrouted ports within the maximum grout communication distance.

.6 For any hole ahead of the grouting operation, with a valve attached, and the valve in the open position, such hole shall be considered grouted if grout issues forth of the same consistency and color, and at the same rate as that being pumped. Replace grout plugs in pipe at the completion of grouting.

END OF SECTION

ASPHALTIC CONCRETE PAVING

1. GENERAL

1.1 Summary

.1 This Section specifies mixing and placing hot mix asphaltic concrete paving.

1.2 Standards and Guidelines

.1 City of Winnipeg Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

.2 The City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guideline.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300.

.2 Submit asphaltic concrete mix designs and samples of material in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

2. PRODUCTS

2.1 Materials

.1 All Asphaltic cement concrete supplied shall be Type 1A and shall be supplied in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

2.2 Mix Design

.1 Submit mix design in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer’s recommendations and as required by the Final Design.

.2 Plant and Mixing requirements shall be accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

.3 Pavers: Mechanical grade controlled self-powered pavers in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

.4 Rollers: Sufficient number of rollers of type and weight to obtain specified density of compacted mix in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

.5 Professional of Record to approve the base, existing surface, and tack coat prior to placing asphalt.

.6 Place asphalt concrete to thicknesses, grades and lines as set out in the Final Design and in in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

.7 Compaction shall be in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement.

.8 Finished asphalt surface tolerance shall be in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

.9 Correct irregularities in accordance with Standard Construction Specification CW-3410 Asphaltic Concrete Pavement Works.

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

END OF SECTION

PORTLAND CEMENT CONCRETE PAVING

1. GENERAL

1.1 Summary

.1 This Section specifies the construction of the new Portland cement concrete pavement for new roadways and parking lots.

1.2 Standards and Guidelines

.1 City of Winnipeg Standard Construction Specification - CW-3310 Portland Cement Concrete Pavement Works.

.2 City of Winnipeg Standard Construction Specification - CW-3230 Full-Depth Patching of Existing Slabs and Joints.

.3 City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guidelines.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300.

.2 Submit Portland cement concrete mix specifications in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works.

2. PRODUCTS

2.1 Materials

.1 All Portland Cement concrete supplied shall be in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works.

.2 All reinforcing steel supplied shall be in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works.

.3 Drilled dowels and tie bars supplied shall be in accordance with Standard Construction Specification CW 3230-R6.

.4 All dowels and dowel assemblies supplied shall be in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer’s recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in Schedule 18 Technical Requirements.

3.2 Plant and Mixing Requirements

.1 Plant and Mixing requirements shall be in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works.

3.3 Equipment

.1 Pavers and screeds: Mechanical grade controlled self-powered pavers and screeds shall be in accordance with Standard Construction Specification CW 3310 Portland Cement Concrete Pavement Works.

3.4 Placing

.1 Professional of Record to approve the base, existing surface, and tack coat prior to placing asphalt.

.2 Placement of Portland cement concrete pavement shall be accordance with Standard Construction Specification CW 3310 Portland Cement Concrete Pavement Works.

3.5 Pavement joints

.1 Pavement joints shall be in accordance with Standard Construction Specification CW 3310 Portland Cement Concrete Pavement Works.

3.6 Catch Basin and Manhole Isolations

.1 Catch basin and manhole isolations shall be in accordance with Standard Construction Specification CW 3310 Portland Cement Concrete Pavement Works.

3.7 Finished Tolerances

.1 Finished asphalt surface tolerance shall be in accordance with Standard Construction Specification CW 3310 Portland Cement Concrete Pavement Works.

3.8 Defective Work

.1 Correct defective work in accordance with Standard Construction Specification CW 3310 Portland Cement Concrete Pavement Works.

3.9 Cleanup

.1 Remove lids or covers from all castings and clean any Portland cement concrete residue from frames, lids, and covers of all castings.

END OF SECTION

CONCRETE WALKS, CURBS AND GUTTERS

1. GENERAL

1.1 Summary

.1 This Section specifies the construction of concrete sidewalks, curbs, and curb and gutter.

1.2 Standards and Guidelines

.1 City of Winnipeg Standard Construction Specification - CW-3310 Portland Cement Concrete Pavement Works.

.2 City of Winnipeg Standard Construction Specification - CW-3325 Portland Cement Concrete Sidewalk.

.3 City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guideline.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300.

.2 Submit concrete mix specifications in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works and Standard Construction Specification CW-3325 Portland Cement Concrete Sidewalk.

1.4 Quality Assurance

.1 Perform the following quality control tests:

.1 Concrete cylinder tests:

.1 At least one set of three (3) cylinders shall be made for each day's concreting or for each 40 m^3 of concrete placed, for each type of concrete mix.

.2 Concrete samples are to be taken at the point of deposit of the concrete.

.3 For each test, slump and air content are to be taken and three (3) standard cylinders are to be prepared and cured under laboratory conditions.

.4 One (1) cylinder from each test is to be tested at seven days and the remaining cylinders at 28 days.

.5 When temperatures are below 5°C additional field-cured cylinders shall be prepared to verify that adequate strength is attained.

.2 Test results shall be delivered directly from the test laboratory.

2. PRODUCTS

2.1 Materials

.1 Portland cement concrete shall be supplied in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works for Curb and Curb and Gutter.

.2 Portland cement concrete shall be supplied in accordance with Standard Construction Specification CW-3325 Portland Cement Concrete Sidewalk for sidewalk.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in Schedule 18 Technical Requirements.

3.2 Concrete Curb and Curb and Gutter

.1 Construct concrete curb and curb and gutter in accordance with Standard Construction Specification CW-3310 Portland Cement Concrete Pavement Works.

3.3 Concrete Sidewalk

.1 Construct concrete sidewalk in accordance with Standard Construction Specification CW-3325 Portland Cement Concrete Sidewalk.

END OF SECTION

CHAIN LINK FENCE

1. GENERAL

1.1 Summary

.1 This Section covers the supply and installation works of new chain link fencing, access gate, and related hardware.

1.2 Standards and Guidelines

.1 The City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guideline.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A5 - Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated Welded and Seamless.

.2 ASTM A90 - Test Method for Weight of Coating on Zinc-coated (Galvanized) Iron or Steel Articles.

.3 Canadian Standards Association (CSA):

.1 CAN/CSA-G164 - Hot Dip Galvanizing of Irregularly Shaped Articles.

.4 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-138.1 - Fabric for Chain Link Fence.

.2 CAN/CGSB-138.2 - Framework for Chain Link Fence.

.3 CAN/CGSB-138.3 - Installation for Chain Link Fence.

.4 CAN/CGSB-138.4 - Gates for Chain Link Fence.

.5 CGSB 1-GP-181M - Coating, Zinc-rich, Organic, Ready Mixed.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300.

2. PRODUCTS

2.1 Materials

.1 Galvanizing to DIN 50976 – Hot-Dip Batch Galvanizing.

2.2 Configurations, Components and Features

.1 Fencing:

.1 Fence heights and style matches the existing peripheral fence.

.2 Provide framework, fabric and accessories in accordance with ASTM F567.

2.3 Portland Cement Concrete

.1 Portland Cement Concrete shall be supplied in accordance with Section 03300.

2.4 Chain Link Fence Fabric

.1 Chain link fence fabric to CAN/CGSB-138.1.

.2 Fabric shall be No. 9 gauge steel wire woven into a 50 mm mesh or as specified. The top and bottom selvage shall be knuckled.

.3 Fabric shall be zinc-coated before weaving by the hot-dip process to an average mass per unit are of not less than 490 g/m^2.

.4 Excessive roughness, blisters, sal ammoniac spots, bruises, and flaking, if present to any considerable extent, shall provide a basis for rejection.

.5 Chain link fabric shall have a minimum tensile strength of 415 MPa.

.6 Height of fabric: match existing height or a minimum of 1.9 m whichever is greater.

2.5 Posts, Braces, and Rails

.1 Posts, braces and rails to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.

.2 Terminal posts comprising of end, gate, corner, and straining posts shall be a standard seamless, continuous weld, Schedule 40 steel pipe, hot-dip galvanized steel pipe weighing 11.28 kg per linear metre and not less than 88.9 mm outside diameter and 1800 m longer that the height of fabric to be used.

.3 Each terminal post shall be equipped with spiked ornamental fitting. Tubing, conduit, or open seam material will not be accepted.

.4 Under no circumstances shall a corner post also be a gate post.

.5 Line posts shall be standard seamless, continuous weld, Schedule 40 steel pipe, hot-dip galvanized weighing 5.43 kg per lineal metre, not less than 60.3 mm outside diameter and shall be 1370 m longer than the height of fabric to be used. Tubing, conduit, or open seam material will not be accepted for line posts.

.6 Line posts shall be supplied with eyetops to accommodate continuous top rail.

.7 Top rail shall be Schedule 40, hot-dip galvanized steel pipe, in 6.7 m length, not less than 43 mm outside diameter.

.8 Top rail sleeve couplings shall be Schedule 40, hot-dip galvanized steel pipe, 171 mm long and 45 mm inside diameter to accommodate a 43 mm outside diameter top rail and manufactured specifically as a top rail sleeve coupling for chain link fencing.

.9 Braces shall be Schedule 40, hot-dip galvanized steel pipe, not less than 43 mm outside diameter.

.10 Bottom tensions wire, tie wire fasteners.

.1 Bottom tension wire shall be no. 6 gauge galvanized wire.

.2 Tie wire fasteners to be aluminum alloy wire to CAN/CGSB-138.1, No. 9 gauge.

.11 Gates:

.1 Unless otherwise noted on the plans, the gates shall be double swing, 6.0 m opening gates, each leaf to be 3.0 m.

.2 The frames of the gates shall be made up, utilizing the same material as used in the top rail.

.3 The units shall be welded at all joints, complete with diagonal bracing and hot-dipped galvanized after welding. Gate braces where required shall be made of same material to match gate frame.

.4 Gates shall come equipped with galvanized malleable iron hinges, latches and latch catches.

.5 Each gate shall have a centre rest with a drop bolt for the closed position and a chain "hold open”.

.6 Gate latches shall be suitable for padlocks which can be attached and operated from either side of the gate. The hinges shall permit each gate to swing back against the fence 180 degrees if required.

.7 Provide a lock for each gate. Include one master keyed Master Lock 6121 Series lock for each gate where a lock is required.

.12 Projection Arms:

.1 Galvanized steel to accommodate three strands of barbed wire, sloped 45 degrees, top strand 300 mm from fence fabric.

.13 Barbed Wire:

.1 2.5 mm wire, 3 strands, 4 points at 150 mm o.c., zinc steel to ASTM A121.

.14 Pipe caps to be cast steel, hot dipped galvanized, sized to post diameter complete with through bolt retainer.

2.6 Fittings

.1 Tension bars shall be 5 mm by 19 mm galvanized flat steel.

.2 Tension bands and bolts shall be of adequate strength, at a maximum spacing of 380 mm on terminal posts.

.3 Brace bands and bolts shall be of adequate strength to fasten top rail receptacles to terminal posts.

.4 Fabric clips shall be No. 9 gauge aluminum alloy wire.

.5 Post tops, receptacles, and fittings shall be of adequate strength and may be of aluminum alloy, malleable steel, or pressed steel. All ferrous metals shall be hot dip galvanized.

2.7 Spare Parts

.1 Provide spare parts that are identical to and interchangeable with similar parts installed and in accordance with Schedule 18 Technical Requirements.

3. EXECUTION

3.1 General

.1 Install in accordance with Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in Schedule 18 Technical Requirements.

.3 Check location of underground work to make sure fence footings clear utilities and drainage work.

.4 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts. Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.

.5 Erect fence along lines as indicated and in accordance with CAN/CGSB-138.3.

.6 Excavate post holes to minimum depth of 2000 mm.

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

END OF SECTION

PLANTING OF TREES, SHRUBS AND GROUND COVERS

1. GENERAL

1.1 Summary

.1 This Section specifies the planting of shrubs and ground covers.

1.2 Submittals

.1 Provide submittals in accordance with Section 01300.

1.3 Quality Assurance

.1 Nursery shall have minimum five (5) years documented experience specializing in growing and cultivating plants.

.2 Installer must specialize in installation, planting, pruning and maintenance with a minimum of five years documented experience. Consider all equipment required for planting including access, fueling procedures, frequency, and emergency spill plans.

.3 Submit inspection certificates for each shipment of plant material and fertilizers.

2. PRODUCTS

2.1 Design Criteria

.1 City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guideline.

.2 Planting design shall complement the overall design concept with an emphasis on native species.

.1 Select plant materials based on their tolerance to the local climate and microclimate.

.2 Follow the principles of crime prevention through environmental design in accordance with good industry practice.

3. EXECUTION

3.1 General

.1 Topsoil, subgrade conditions, growing medium, and plant materials shall be approved by a landscape architect.

.2 Plant only during the season or seasons normal for such work determined by weather conditions and or as approved by a qualified professional. Plants planted before or after any stipulated dates may be considered a Non-Conformance.

END OF SECTION

POLYETHYLENE PRESSURE PIPE

1. GENERAL

1.1 Summary

.1 This Section specifies the requirements for constructing:

.1 Polyethylene wastewater forcemain and appurtenances.

.2 Dual containment polyethene forcemain.

1.2 Standards

.1 Unless otherwise specified, references to documents shall mean the latest published edition of the referenced document.

.2 City of Winnipeg Standard Construction Specifications.

.3 City of Winnipeg, Winnipeg Sewage Treatment Program Civil Design Guidelines:

.1 American National Standards Institute (ANSI)/American Water Works Association (AWWA):

.2 ANSI/AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76mm) for Water Service.

.3 ANSI/AWWA C906 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 63 In. (1,600 mm), for Water Distribution and Transmission.

.4 AWWA M55 Manual of Water Supply Practices, PE Pipe–Design and Installation.

.4 American Society for Testing and Materials (ASTM):

.1 ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

.2 ASTM D2774 Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

.3 ASTM 2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

.4 ASTM F2880 Standard Specification for Lap-Joint Type Flange Adapters for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3⁄4 in. to 65 in.

.5 ASTM D3035 Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

.6 ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

.7 ASTM D3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.8 ASTM F714 Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.9 ASTM F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

.10 ASTM F1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings.

.11 ASTM F2164 Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.

.12 ASTM F2206 Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock.

.13 ASTM F2620 Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

.14 ASTM F3124 Standard Practice for Data Recording the Procedure Used to Produce Heat Butt Fusion Joints.

.15 ASTM F3183 Standard Practice for Guided Side Bend Evaluation of Polyethylene Pipe Butt Fusion Joint.

.16 ASTM F3190 Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polyamide (PA) Pipe and Fittings.

1.3 Submittals

.1 Provide submittals in accordance with Section 01300 and the following:

.1 Manufacturer's descriptive literature for materials.

.2 Field Weld and Fusing Reports:

.1 Submit data on all fusion welds performed. Data shall include:

.1 Location of weld.

.2 Ambient temperature.

.3 Fusion Temperature.

.4 Interface pressure.

.5 Heating time.

.6 Cooling time.

.2 Submit data on all electrofusion welds performed.

.3 Hydrostatic leakage test report.

.4 Trenchless installation method.

.1 The Design Builder shall be responsible to verify and submit the calculations to confirm that the wall thickness of the pipe is adequate to withstand pressures exerted by directional drilling equipment. (The Safe Pull Strength calculations).

.5 Record Drawings:

.1 Provide data necessary to produce record Drawings showing locations of all mains and appurtenances, including directions for operating valves, list of equipment required valves, details of pipe material, and location of air and vacuum release valves.

1.4 Quality Assurance

.1 At least two (2) weeks prior to commencing Work, submit Manufacture's test data and certification that pipe materials meet requirements of this Section. Include Manufacturer's Drawings, information and Shop Drawings where pertinent.

.2 Provide written confirmation from Manufacturer certifying that the Contractor's personnel who will perform the jointing, is qualified and that the jointing equipment has been inspected and is suitable for the pipe supplied.

2. PRODUCTS

2.1 Design Criteria

.1 HDPE Open-cut Installation method. Use DR 17 for all piping unless otherwise approved.

.2 HDPE Trenchless Installation method. Use DR 11 for all piping unless otherwise approved.

.3 HDPE Dual Containment Pipe for corrosive chemical conveyance.

2.2 HDPE Forcemain Pipe and Fitting

.1 Use HDPE DR 11 or DR 17 for all piping unless otherwise stated.

.2 To be iron pipe sized, certified for potable water use, made in accordance with AWWA C906, CSA/Warnock Hersey/or NSF International certified.

.3 Pipe to be made from polyethylene resin compound with a minimum cell classification of PE 346564C for PE 4710 materials in accordance with ASTM D3350. Material to have a Long Term Hydrostatic Strength of 11 MPa when tested and analyzed by ASTM D2837. Resin to have a minimum hydrostatic design stress of 800 psi @140 F (i.e., 1600 PSI @ 73F).

.4 Minimum carbon black shall not be less than 2% when determined in accordance with ASTM D1603 as per CSA B137.1, 4.2 and 5.2.

.5 Shall contain no recycled material except that generated in the Manufacturer's own plant from the resin of the same specification and same raw material supplier.

.6 Compounds used shall meet the requirements of Clause 7.2 of CSA B137.0 for toxicity for potable water service.

.7 Manufacture pipe to ASTM F714.

.8 Markings: continuously or at 1.5 m intervals indent print the following: pipe Manufacturer, nominal pipe size, dimension ratio, PE grade per ASTM D3350, followed by the Hydrostatic Design basis in 100's of psi, CSA/Warnock Hersey/or NSF International certification complete with certification trademark logo, Manufacturing reference standard ASTM F714, and date of manufacture.

.9 Maximum pipe ovality for polyethylene pipe prior to joining shall be not exceed 4%.

.10 Polyethylene Fittings: To be iron pipe sized, certified for potable water use, made in same manner and materials as pipe. Fittings to have same certification as piping. Polyethylene to polyethylene joints to be as per the following:

.1 Joints to be thermal butt fusion welded.

.2 Electrofusion fittings as per AWWA C207.

.11 HDPE Pipe Flange Connections:

.1 Backup rings and connections to fittings shall utilize ASTM A351 CF8M (316) stainless steel backing rings.

.2 Bolts, washers and nuts shall be 304 or better stainless steel on all couplers or materials which are to be buried or submerged. Provide written confirmation to Contact Administrator that the materials used for bolts, nuts and washer meet this specification.

.12 Gate Valves and Valve Boxes:

.1 To AWWA C509, standard iron body, resilient seated wedge gate valve with non-rising stem, suitable for 1 MPa with joints to match pipe selected. End to be flanged when utilizing in conjunction with polyethylene piping.

.2 Valve body to be epoxy coated in accordance with AWWA C550.

.3 Valves to open counter clockwise with operating nut.

.4 Valve boxes to ASTM A 48 cast iron, bituminous coated, two-piece sliding type adjustable over a minimum of 450 mm complete with valve operating extension rod, of such length that when set on valve operating nut top of rod will be between 150 mm and 450 mm below cover. Top of box to be marked "S".

.13 Air and Vacuum Release Valves:

.1 Air and vacuum release valves: Use Apco Model 400 series (401, 402, or 403) or approved equal, sizing as approved. Valves to be fabricated of cast iron body and cover, with bronze trim, stainless steel floats with shock-proof synthetic seat suitable for 2 MPa working pressure. Valves shall permit venting of air at high rate during filling and venting at low rate during operation and permit unrestricted entry of air under vacuum conditions. Valves to be heavy duty combination air release valves employing direct acting kinetic

principle. Valve to be complete with surge check unit. Ends to be flanged to AWWA C110-82. Provide inlet and blow off valves, quick disconnect couplings and minimum 3 m of hose for flushing. Unit to be rated for operating range of 0 to 1000 kPa. Equip valve and hose with quick disconnect couplings. If required, utilize electrofusion saddle for connection to the forcemain. Shut off valves to be brass or approved equal. Couplings to be compression type.

.14 Polyethylene Pipe Couplings:

.1 Polyethylene Couplings: Couplings to have same certification as piping. Coupling locations to be approved by the Contract Administrator. Utilize electrofusion fittings to AWWA C207 and couplings unless otherwise approved by the Contract Administrator. The following alternative joint types suitable for use on polyethylene piping require approval prior to use:

.1 ASTM A351 CF8M (316) Stainless steel mechanical couplers complete with metal insert stiffeners in accordance with Manufacturer's recommendations. Submit written Manufacturer's recommendations for coupler to be used for review of the Contract Administrator. Mechanical coupling will not be permitted for joints submerged in water.

.2 Back-up Rings: Back-up rings shall be stainless steel 316.

2.3 HDPE Forcemain Dual Containment Pipe and Fittings

.1 Dual containment HDPE plain end pipe consisting of DR 11 containment pipe and DR 17 carrier pipe when the carrier pipe diameter is between 100 mm to 1575 mm.

.2 Pipe to be made from polyethylene resin compound with a minimum cell classification of 445474C for PE 4710 materials in accordance with ASTM D3350.

.3 Material to have a long-term hydrostatic strength of 1600 psi when tested and analyzed by ASTM D2837.

.4 The raw material shall contain a minimum of 2%, well dispersed, carbon black. Additives which can be conclusively proven not to be detrimental to the pipe may also be used, provided the pipe produced meets the requirements of the standard.

.5 Dual Containment Manufacture pipe:

.1 13 mm to 75 mm (1/2” to 3”) shall be manufactured to ASTM D3035 and meet AWWA C901.

.2 100 mm to 1575 mm (4” to 63”) shall be manufactured to ASTM F714 and meet AWWA C906.

.6 The following markings shall be continuously printed on the pipe spaced at 1.5 m intervals:

.1 Name and/or trademark of the pipe Manufacturer.

.2 Nominal pipe size (OD).

.3 Dimension Ratio.

.4 The letters PE followed by the polyethylene grade per ASTM D3350, followed by the Hydrostatic Design basis in 100's of psi.

.5 Manufacturing reference standard ASTM F714.

.6 Production code from which the date and place of manufacture can be determined.

.7 Dual containment pipe configuration to be as follows:

.1 Containment pipe – DR 11 unless otherwise approved.

.2 Carrier pipe – DR 17 unless otherwise approved.

.3 Finish pipe ends for joining using the butt fusion method.

.4 Notwithstanding the above, the annulus between the carrier pipe and the containment pipe shall not be obstructed by the butt fusion bead on the carrier pipe to such an extent that would preclude the monitoring of pressure in the annulus area with a single pressure sensor as noted herein.

.8 Dual Containment HDPE Fittings:

.1 General – Fittings shall be made of HDPE material with a minimum material designation code of PE4710 and with a minimum Cell Classification as noted in 2.2.3. The pressure rating of carrier fittings shall have a minimum pressure rating equal to or greater than the pipe to which they are joined unless otherwise specified on the plans or accepted by City/Contract Administrator. Where required, all fittings shall meet the requirements of AWWA C901 or C906.

.2 End Terminations – End termination fittings shall be used to seal the system at both ends. The fitting shall be simultaneously butt fused to the carrier and containment pipe to seal the annular space. Terminations that are not butt fused in the system will not be allowed. This fitting will also provide the transition to single wall piping using the following components and guidelines:

.1 Flange Adapters shall meet the dimensional and material requirements of ASTM F2880.

.2 Stainless Steel back-up rings shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (or B or E), ASME/ANSI B 16.5 Class 150, ASME/ANSI B 16.1 Class 125, or ASME/ANSI B16.47 Series A.

.3 Flange assemblies shall be assembled and torqued according to AWWA C906.

.3 Centralizers – Centralizers used for pipe ends will be either molded from HDPE Pipe Grade resins or machined from HDPE Pipe Grade sheet. Manual or hand cut centralizers are not permitted since they have a low degree of dimensional accuracy. Centralizers should have at least two openings that will permit the flow of liquid between the carrier pipe and the containment pipe. The OD of the centralizer shall match the ID of the containment piping as closely as possible. Centralizer spacing for prefabricated pipe will have a spacing of 1.2 m unless otherwise approved.

3. EXECUTION

3.1 General

.1 Install in accordance with the Manufacturer's recommendations and as required by the Final Design.

.2 Undertake commissioning phases as specified in the Schedule 18 Technical Requirements.

3.2 Preparation

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

3.3 Trenching, Bedding, and Backfill

.1 Do excavation, bedding, backfill and compaction work to be in accordance with Section 02223 – Excavation, Bedding, and Backfill and City of Winnipeg Standard Construction Specifications CW2030.

.2 Trenching and trenchless installation methods to be in accordance with City of Winnipeg Standard Construction Specifications CW2110.

3.4 Installation of HDPE Pipe in Open Trench

.1 Lay and join pipes in accordance with applicable AWWA specification for type of pipe selected and latest Manufacturer's standard instructions and specifications.

.2 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends. Do not drag pipe in a manner which may scratch or otherwise damage the pipe.

.3 Prior to installation clean the interior of all pipes and appurtenances of dirt and foreign material and wipe dry.

.4 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever Work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.5 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time and entry of foreign material.

.6 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows undue settlement after installation.

.7 Do not exceed permissible deflection at joints as recommended by pipe Manufacturer.

.8 Cut pipes as required for specials, fittings or closure pieces, in a neat manner as recommended by pipe Manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe. Minimum length of cut pipe to be 1.0 m.

.9 Position and join pipes with approved equipment utilizing hand slings or crane during lowering as required.

.10 High density polyethylene pipe joints:

.1 Thermal butt fusing to be in accordance with ASTM F-2620.

.2 Use qualified personnel for all welding operations (butt-fusion jointing of polyethylene pipe), submit qualifications of personnel to Contract Administrator for review. Welding personnel to be trained specifically for the fusing machine being utilized by qualified technician from the pipe Manufacturer. Jointing machine to be approved by pipe Manufacturer. Provide a written verification from Manufacturer certifying that the Contractor's personnel who will perform the jointing, is qualified and that the jointing equipment has been inspected and is suitable for the pipe supplied.

.3 Prior to commencement of the works provide Manufacturer's written bulletins on required heat and pressures. Use procedures to allow pressure readings during fusion to be accurately measured.

.4 Ensure pipe ends are clean and dry prior to commencing fusing and do not allow ends of pipe to become wet during fusion operation.

.5 Do not weld pipe in long sections which become unmanageable for maneuvering and placement.

.6 During cold or inclement weather, provide adequate shelter over the pipe joining equipment while fusing for protection from the elements (i.e. cold, rain, or wind, etc.)

3.5 Installation of HDPE Pipe Using Trenchless (Horizontal Directional Drilling)

.1 Install HDPE pipe using the horizontal directional drilling method in accordance with ASTM Standard Guide F 1962 for “Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings”.

.2 Employ experienced personnel to operate the directional drilling and tracking equipment.

.1 Personnel to have previously performed horizontal directional drilling for comparable pipe length and diameter within the past three (3) years.

.2 Contractor to provide references of past work including client contact name, address, and telephone number.

.3 Pipe radius shall conform to the Manufacturer’s specifications during construction and after installation.

.4 Depth of clay cover above top of pipe shall be 3.0 m or greater beneath the low flow channel.

.5 Submit an HDD Construction Method Statement as per Shop Drawings prior to construction. Include the following information:

.1 Equipment specifications, functionality and capacity.

.2 Size of pilot hole.

.3 Number and size of pre-reams.

.4 Calculations showing determination of the appropriate back-ream rate for each pre-ream and product pullback.

.5 Method of suspending, supporting and directing pipe during pullback.

.6 Type and capabilities of tracking system.

.7 Drilling fluid and cuttings management plan including type of drilling fluid, drilling fluid pressure, fluid containment storage recycling, and transport and disposal.

.8 Management plan for frac-outs as specified herein.

.9 Sketch of Work Site including equipment layout, slurry containment pits and entry and exit locations.

.6 Maintain alignment of directional drilling as close as possible to the proposed plan and profile shown on the drawings taking into account the capabilities of drilling equipment and the allowable stresses of HDPE pipe and drilling rods. Advise the Contract Administrator of deviations to line and grade as they occur for discussion and approval.

.7 Continuously monitor and track the drill bore in the pilot hole. Record the depth to the nearest 0.10 m from ground surface at major changes in surface elevation, at maximum 10 m intervals along flat surfaces and at horizontal and vertical changes in alignment. Indicate the location that the depth was recorded by spray paint, marker buoy, or other method to allow the Contract Administrator to obtain the coordinates of the location.

.8 Begin reaming operations to enlarge pilot hole after acceptance of the pilot bore. The number and size of reaming heads is at the discretion of the Contractor.

.9 Continuously monitor and track the following during boring operation:

.1 Thrust and pullback pressure.

.2 Rotational torque.

.3 Times when drilling fluid circulation was lost.

.4 Drilling fluid composition.

.5 Ground conditions encountered.

.10 Operate and maintain a closed loop drilling fluid system if possible.

.11 Ensure drilling fluids and cuttings are contained and stored at entrance and exit hole locations in accordance with the management plan. Drilling fluid shall at no time be directed to the low flow channel, watercourses, sewers, manholes, or catch basins. Drilling fluid and cuttings shall be loaded, hauled from the Site and disposed of off site.

.12 The pipe grip shall consist of a fused polyethylene adapter, internal/external clamp, or bolting device. Basket type or internal only grips are not allowed.

.13 Install a swivel between the reamer or compactor head and the pipe to reduce torsional loads transmitted to the pipe during pipe pullback. Rating of the swivel shall be somewhat larger than the lower of either the pull force capability of the drill rig or strength of the pipe.

.14 Cap end of pipe before pulling into bore hole to prevent matter and fluids from entering the pipe.

.15 Provide pipe rollers, side booms or other devices to support and protect pipe while pulling into bore hole.

.16 If required, fill carrier pipe with water when pulling into bore hole to help prevent flotation. Notify Contract Administrator prior to pipe filling and pull in.

.17 Install a breakaway link between the swivel and pipe grip to ensure the pull back force on the pipe does not exceed the maximum tensile force allowed by the pipe Manufacturer.

.18 Pull the pipe beneath the low flow channel and to the staging area where the dual containment pipe will terminate allowing for rebound of the pipe.

.19 Allow HDPE forcemain pipe a minimum 24 hours to recover and rebound after pull-in before making connections to ends of dual containment pipe. Measure location of both pipe ends to ensure pipe recovery is complete.

3.6 Thrust Blocks

.1 Thrusts blocks to be in accordance with the City of Winnipeg Standard Construction Specification Standard detail SD-004 and SD-005.

3.7 Gate Valves and Valve Boxes

.1 Install in accordance with the City of Winnipeg Standard Construction Specification Section CW 2110. Ensure valve box adjustable range is suitable for pipe burial depth.

.2 Install valve box lids that are marked "S" for sewer.

3.8 Valve Markers

.1 Install valve marker perpendicular with air release valve chambers and adjacent valve. Along GWWD rail line post to be set 0.5 m from edge of ballast for rail line.

.2 Posts to be hydraulically driven to a depth of 1.0 m. Set posts straight and plumb.

.3 Install signs (supplied by Owner) at 2.3 m height above ground.

3.9 Hydrostatic Leakage Testing

.1 The hydrostatic leakage testing shall conform to ASTM F2164.

.2 After the system has been installed and backfilled to the satisfaction of the Contract Administrator, pressure test the system. Test piping in sections not exceeding 700 m in length or between successive valves unless otherwise authorized by the Contract Administrator.

.3 Provide labour, equipment and materials required to perform hydrostatic leakage tests hereinafter described. Ensure system will pass test prior to requesting Contract Administrator to witness test.

.4 Notify Contract Administrator at least two (2) working days in advance of all proposed tests. Perform tests in presence of Contract Administrator.

.5 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete or two (2) days if high early strength concrete is used.

.6 Open mainline valves.

.7 Expel air from main by slowly filling main with potable water and complete flushing by running water to waste. Install temporary or use existing mainline access points as required for flushing and testing. Obtain Contract Administrator's approval for location of mainline access points. Do not damage Environment with chlorinated water. Dechlorinate water at the point of disposal discharge to thoroughly neutralize the chlorine residual to non detectable levels.

.8 In preparation for the pressure test, after pressurizing the mainline to the test pressure, bleed off the quantity of water equivalent to allowable leakage or 20 L, whichever is less. Bleed location to be remote from the gauge location. Verify that the pressure indicated on the gauge drops the corresponding amount to provide an indication that all air has been bled from the system.

.9 Polyethylene piping - To accommodate the initial expansion of the pipe under test, sufficient make-up water shall be added to the system for four (4) hours to return to the test pressure.

.10 After completion of the initial expansion phase of the pipe, reduce the pressure by 70 kPa (10 psi) for a test period of one (1) hour. The pressure shall not drop by more than 5% of the reduced pressure.

.11 Apply a leakage test pressure as per design, based on the elevation of highest point in main and corrected to elevation of gauge, for a period of one (1) hour. Do not exceed the test pressure within 72 hours prior to completing the pressure testing.

.12 No leakage shall be permitted in polyethylene piping.

.13 Locate and repair defects if leakage is greater than amount specified. Report leaks to Contract Administrator prior to excavating to allow Contract Administrator to be on Site if so desired. Provide written summary of all repair works completed.

.14 Record tests whether acceptable or not on leakage test form City of Winnipeg Standard Construction Specification CW2125.1. Sign and submit leakage test form to the Contract Administrator.

.15 Repeat test in the presence of the Contract Administrator until leakage is within specified allowance.

.16 Remove all temporary access points after satisfactorily completion of test and seal holes with brass plugs or as otherwise directed by the Contract Administrator.

.17 For dual containment piping the carrier pipe shall be tested independently of the carrier pipe. Carrier pipe to be tested at mainline pressure specified above. Containment shall be tested at 500 kPa.

3.10 Dual Containment

.1 Pre-fabrication of Dual Containment Pipe Sections:

.1 Pre-fabricate dual containment pipe sections in a factory prior to delivery to Site, consisting of HDPE carrier pipe, containment pipe, centralizers, and fittings. Each containment pipe section shall have the carrier pipe and centralizers in place.

.2 Pipe Manufacturer shall provide documentation that the fabricator/welders have a minimum of two (2) years experience fabricating dual containment systems.

.3 Field fabrication of the dual contained pipe sections shall not be acceptable.

.4 Factory fabricated dual containment pipe sections shall be joined into one continuous length on site following the guidelines of ASTM Standard Practice F 2620 for “Heat Fusion Joining of Polyethylene Pipe and Fittings”.

.5 A continuous annular space between the carrier pipe exterior and containment pipe interior shall be maintained for the full length of the pipe section. The ends of each pipe section shall maintain a continuous annular space between the carrier and containment pipe when the pipe sections are butt fused during the full pipe length assembly.

.6 Provide centralizers between the containment and carrier pipe sections as follows.

.1 Centralizers shall support the carrier pipe within the containment pipe.

.2 Weld centralizers to carrier pipe 1.20 m apart between pipe ends.

.3 Weld end centralizers to carrier pipe and containment pipe.

.4 Install end centralizer a sufficient distance from pipe section end to allow for facing of the pipe end and fusing such that the bead created when fusing two pipe sections does not seal the ports in the centralizer.

.5 Install centralizers hydraulically using a minimum pressure of 0.83 MPa (120 psi) pressure on fusion machine.

.7 Pipe sections needing field splicing for fit up purposes shall use press fit centralizers recommended and provided by the Manufacturer.

.8 Two termination end fittings at both ends. The termination fitting shall be simultaneously butt fused to the carrier and containment pipe to seal the annular space. No other closure termination will be allowed. This fitting will also provide transition to single wall piping, if required.

.9 Termination fittings shall be manufactured with a 300 mm (one ft) long section of carrier pipe on one end and simultaneously butt fused dual containment pipe on the other end.

.10 The Manufacturer of the dual containment system shall have demonstrated successful installations for a period no less than ten (10) years.

.11 Installation instructions must be provided to the Contract Administrator prior to installation. These instructions are to be used on every fusion joint with no exceptions.

.2 Handling of Dual Containment HDPE Pipe:

.1 Handle pipe in a manner that will not damage or excessively deform the pipe.

.2 Replace at own expense pipe that has been kinked or has scratches, cuts or gouges deeper than 10% of the total wall thickness or has other defects present that will compromise integrity of dual contained system.

.3 Lift pipe sections using at least two slings spread far enough apart to balance the load. Use pads under chains or cables if used to lift pipe. Do not position slings on butt fused joints.

.4 Ensure ground where pipe is placed is level, clean, dry, and free of sharp objects that may damage the pipe. Limit stacking of pipe to a maximum height as recommended by the Manufacturer to prevent excessive deformation of pipes on the bottom.

.5 Take precautions to ensure joined sections of pipe are not damaged or over-stressed when dragging into position to install in bore hole. Do not drag pipe over sharp and cutting objects. Do not insert chains, cables and ropes into pipe ends to drag pipe.

.6 Temporarily plug ends of pipe with suitable plugs or stoppers until pipe is joined and installed.

.3 Joining of Dual Containment HDPE Pipe Sections:

.1 Join dual containment HDPE pipe sections together by means of thermal butt-fusion in accordance with the Manufacturer’s instructions and ASTM Standard Practice F 2620 for “Heat Fusion Joining of Polyethylene Pipe and Fittings”.

.2 Check the temperature and uniformity of temperature over the heating surface of the heating tool with a pyrometer on the first joint of the day and periodically during the day in accordance with Section 6.3 of ASTM Standard Practice F 2620 for “Heat Fusion Joining of Polyethylene Pipe and Fittings”. Select multiple checkpoints to ensure uniform surface temperature.

.3 Use a datalogging device with the hydraulic joining equipment to record fusion parameters of pressure, temperature, and time for each joint.

.4 If required, join single wall pipe at end of dual containment pipe to non dual wall containment pipe by electrofusion in accordance with the Manufacturer’s instructions within the pressure monitoring manhole.

.5 Fusion shall produce a joint weld with strength equal to or greater than the tensile strength of the pipe itself.

.6 Sections of dual containment that are to be installed by Horizontal Directional Drilling (HDD) methods shall be joined together on-Site and temporarily stored to facilitate hydrostatic testing prior to installation.

.4 Pressure Testing of Dual Containment Forcemain before Installation:

.1 The hydrostatic leakage testing shall conform to ASTM F2164.

.2 Dual containment pipe that is to be installed by HDD methods shall be subject to a Pressure Test both pre- and post-installation.

.3 Hydrostatic Pressure Testing of Carrier Pipe:

.1 Perform hydrostatic and visual testing of the entire length of dual containment forcemain after fusion joining and before installation in directionally drilled bore hole.

.2 Hydrostatic test procedure shall consist of an initial expansion phase followed by a test phase.

.3 Test pressure shall be 0.70 MPa at the lowest elevation under test.

.4 Testing shall be witnessed by the Contract Administrator. Contract Administrator shall be notified at least three (3) days in advance of hydrostatic, pressure, and visual testing. Final test report shall be delivered within thirty (30) days.

.5 Fill entire carrier pipe with clean water. Bleed any trapped air from the pipe.

.6 The following procedure shall be followed for the initial expansion phase.

.1 The initial expansion phase shall last 4 hours.

.2 Pressurize the pipe to the test pressure of 0.70 MPa.

.3 Add make-up water to the pipe to restore pressure to 0.70 MPa test pressure.

.7 The following procedure shall be followed for the test phase.

.1 The test phase shall commence 4 hours after initial pressurization and after the initial expansion phase.

.2 Reduce the test pressure by 70 kPa (10 psi).

.3 The test phase shall last for 1 hour. If there is no visible leakage and the test phase remains steady (within 5% of the test phase pressure) for the 1-hour phase, a passing test is indicated.

.4 Irrespective of volume of make-up water required, repair any known leaks.

.8 If the hydrostatic pressure test is not completed after the pipe has been initially pressurized, the pipe shall be allowed to relax for at least 8 hours before pressurizing the pipe for the next test.

.4 Pneumatic Pressure Testing of Containment Pipe:

.1 Perform pressure and visual test on the containment pipe with an air test to 0.035 MPa and not exceeding 0.070 MPa.

.2 Compressed air shall be used for the test medium. The test medium shall be non-flammable and non-toxic.

.3 Build and release pressure slowly.

.4 Hold pressure for 10 to 60 minutes but not longer than 60 minutes.

.5 Ambient temperature shall be above 0°C for air test. Test procedure to be in accordance with CW 2125.

.6 Detect leaks with mild soap solution (avoid strong detergents) or other non-deleterious leak detecting fluids applied to the joint. Bubbles indicate leakage. Rinse soap solution from pipe surface with clean water after leak testing.

.5 Determine cause of any leaks, repair and re-conduct test until successful pressure test carried out.

.5 Installation of HDPE Pipe Using Horizontal Directional Drilling (HDD):

.1 Install Dual Containment pipe under the low flow channel by HDD methods.

.2 Install Dual Containment Pipe either trenchless methods (including HDD if desired) or open cut methods. If installed by open cut methods, install as per Clause 3.10.6.

.3 Install HDPE pipe using the horizontal directional drilling method in accordance with ASTM Standard Guide F 1962 for “Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings”.

.4 Employ experienced personnel to operate the directional drilling and tracking equipment.

.1 Personnel to have previously performed horizontal directional drilling for comparable pipe length and diameter within the past three (3) years.

.2 Contractor to provide references of past work including client contact name, address, and telephone number.

.5 Containment pipe radius shall conform to the manufactures specifications during construction and after installation.

.6 Depth of clay cover above top of pipe shall be 3.0 m or greater beneath the low flow channel. Depth of cover for the open cut sections for the remainder of the dual containment pipe shall be 2.5 m.

.7 Submit an HDD Construction Method Statement as per Shop Drawings prior to construction. Include the following information:

.1 Equipment specifications, functionality and capacity.

.2 Size of pilot hole.

.3 Number and size of pre-reams.

.4 Calculations showing determination of the appropriate back-ream rate for each pre-ream and product pullback.

.5 Method of suspending, supporting and directing pipe during pullback.

.6 Type and capabilities of tracking system.

.7 Drilling fluid and cuttings management plan including type of drilling fluid, drilling fluid pressure, fluid containment storage recycling, and transport and disposal.

.8 Management plan for frac-outs as specified herein.

.9 Sketch of Work Site including equipment layout, slurry containment pits and entry and exit locations.

.8 Maintain alignment of directional drilling as close as possible to the proposed plan and profile shown on the drawings taking into account the capabilities of drilling equipment and the allowable stresses of HDPE pipe and drilling rods. Advise the Contract Administrator of deviations to line and grade as they occur for discussion and approval.

.9 Continuously monitor and track the drill bore in the pilot hole. Record the depth to the nearest 0.10 m from ground surface at major changes in surface elevation, at maximum 10 m intervals along flat surfaces and at horizontal and vertical changes in alignment. Indicate the location that the depth was recorded by spray paint, marker buoy, or other method to allow the Contract Administrator to obtain the coordinates of the location.

.10 Begin reaming operations to enlarge pilot hole after acceptance of the pilot bore. The number and size of reaming heads is at the discretion of the Contractor.

.11 Continuously monitor and track the following during boring operation:

.1 Thrust and pullback pressure.

.2 Rotational torque.

.3 Times when drilling fluid circulation was lost.

.4 Drilling fluid composition.

.5 Ground conditions encountered.

.12 Operate and maintain a closed loop drilling fluid system if possible.

.13 Ensure drilling fluids and cuttings are contained and stored at entrance and exit hole locations in accordance with the management plan. Drilling fluid shall at no time be directed to the low flow channel, watercourses, sewers, manholes, or catch basins. Drilling fluid and cuttings shall be loaded, hauled from the Site and disposed of off site.

.14 The pipe grip shall consist of a fused polyethylene adapter, internal/external clamp, or bolting device. Basket type or internal only grips are not allowed.

.15 Install a swivel between the reamer or compactor head and the pipe to reduce torsional loads transmitted to the pipe during pipe pullback. Rating of the swivel shall be somewhat larger than the lower of either the pull force capability of the drill rig or strength of the pipe.

.16 Cap end of pipe before pulling into bore hole to prevent matter and fluids from entering the pipe.

.17 Provide pipe rollers, side booms or other devices to support and protect pipe while pulling into bore hole.

.18 If required, fill carrier pipe with water when pulling into bore hole to help prevent flotation. Notify Contract Administrator prior to pipe filling and pull in.

.19 Install a breakaway link between the swivel and pipe grip to ensure the pull back force on the pipe does not exceed the maximum tensile force allowed by the pipe Manufacturer.

.20 Pull the pipe beneath the low flow channel and to the staging area where the dual containment pipe will terminate allowing for rebound of the pipe.

.21 Allow HDPE forcemain pipe a minimum 24 hours to recover and rebound after pull-in before making connections to ends of dual containment pipe. Measure location of both pipe ends to ensure pipe recovery is complete.

.6 Installation of HDPE Pipe in Open Trenches:

.1 If installation is to be by open cut methods, installation by open cut is to be completed after pipe has been pulled under the low flow channel.

.2 Excavations shall be a minimum 10 m from the edge of the low flow channel.

.3 Bed pipe using Type 3 granular bedding in accordance with specification CW 2030 and SD-001.

.4 Backfill excavations using Class 4 backfill in accordance with CW 2030 and SD-002.

.7 Hydrostatic Testing of Forcemain Dual Containment After Installation:

.1 Hydrostatic Pressure Testing of Carrier Pipe:

.1 Perform hydrostatic testing of the entire length of dual containment forcemain after installation.

.2 Hydrostatic test procedure shall conform to Clause 3.10.4.

.2 Pneumatic Pressure Testing of Containment Pipe:

.1 Perform pressure test on the containment pipe with an air test to 0.035 MPa and not exceeding 0.070 MPa.

.2 Perform pressure test as per Clause 3.10.4 with the proviso that acceptance criteria shall be limited to pressure drop only as visual classification methods will not be feasible.

END OF SECTION