

Part 1 General

1.1 DESCRIPTION

- .1 This specification shall cover the layout and rough grading of site features as indicated on the Drawings.

1.2 RELATED SECTIONS

- .1 Section 03 30 01 - Concrete Walks, Curbs, and Gutters
- .2 Section 32 10 00 - Clearing and Grubbing
- .3 CW 3110 – R19 – Sub-grade, Sub-base and Base Course Construction
- .4 Section 32 91 19 - Topsoil Placement and Finish Grading
- .5 Section 32 92 19 - Mechanical Seeding
- .6 Section 32 92 21 - Sodding

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D698-91(1998), Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m;).
- .2 City of Winnipeg Standard Construction Specifications, current edition:
 - .1 CW 3170 – Earthwork and Grading
 - .2 CW 2030 – Excavation Bedding and Backfill

1.4 EXISTING CONDITIONS

- .1 Known underground and surface utility lines and buried objects as indicated on the drawings. The Contractor shall be responsible for confirming all utilities with utility providers prior to commencing grading operations.
- .2 Report discrepancies to Contract Administrator if they impact proposed work.
- .3 Any damage to utilities during construction is the responsibility of the Contractor and shall be repaired at no cost to The City.

1.5 PROTECTION

- .1 Protect all existing features, benchmarks, pavement, curbs, trees and above / below ground utility lines. If damaged, Contractor to restore to original condition at no cost to The City.
- .2 Maintain access roads and to prevent accumulation of construction related debris on roads.

1.6 TESTING

- .1 The inspection and testing of fill / subgrade compaction will be carried out by a testing laboratory appointed by the Contractor and approved by the Contract Administrator. Testing laboratory to be certified in accordance with CSA A283. The Contractor shall coordinate the timing of this testing in an efficient way.
- .2 The inspection and testing of fill material will be paid for by the Contractor
- .3 Test fill / subgrade at five (5) locations as directed by the Contract Administrator.
- .4 Areas that fail minimum compaction requirements shall be re-compacted and tested by the Contractor at no cost to The City.

Part 2 **Products**

2.1 **MATERIALS**

- .1 Fill Material:
 - .1 Common fill: to City of Winnipeg Specification CW 3170 – Earthwork and Grading, subject to approval by Contract Administrator.
 - .2 Fill under landscaped areas: Class 4 backfill to City of Winnipeg Specification CW 2030.
 - .3 Fill to be:
 - .1 375mm below finished grade for shrub beds (300 topsoil 75 mulch).
 - .2 100mm below finished grade for sod.
 - .3 50mm below finished grade for mixed grassland and mixed fescue lawn.
 - .4 Fill under asphalt, cast in place concrete and crushed granular paving: Class 2 backfill to City of Winnipeg Specification - CW 2030.
 - .5 Fill material to be unfrozen and free from rocks larger than 75mm, cinders, ashes, sod, refuse or other deleterious materials.

Part 3 **Execution**

3.1 **EXAMINATION**

- .1 Verify existing conditions before starting work.

3.2 **LAYOUT**

- .1 Engage professional surveyor to layout all major site features as indicated on the drawings.
- .2 Stake out key corners, endpoints and centre lines complete with rough grade and finish grade markers.
- .3 Report any discrepancies encountered during layout to the Contract Administrator immediately.
- .4 Obtain approval of site development layout from Contract Administrator prior to proceeding with rough grading operations.

3.3 **ROUGH GRADING AND SHAPING**

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated on the Drawings using unfrozen fill materials identified in Part 2 item 2.1.
- .2 Compact sub-grade to density requirements noted on the Drawings.
- .3 Inspect sub-grade exposed by topsoil stripping with Contract Administrator and identify any problem areas that will require remediation. Cut out these 'soft areas' of sub-grade not capable of compaction and fill with Class 2 backfill to CW 2030.
- .4 Remove any areas found to be contaminated with fossil fuels or chemicals.
- .5 Systematically place fill material to allow maximum time for natural settlement. Do not place fill over porous, wet, frozen or spongy sub-grade surfaces.
- .6 Place and compact fill material in equal continuous layers in accordance with specification CW 2030. Layers not to exceed 150mm depth.
- .7 Employ a placement method that does not disturb or damage other work. Where areas are too small to be compacted with large machinery use vibratory compaction equipment or hand rollers to achieve required compaction. Obtain Contract Administrator's approval of alternate equipment prior to use.
- .8 Compact existing subgrade and fill areas to the density requirements noted on the Drawings. Maintain optimum moisture content of fill materials to attain required compaction density.

3.4 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping off site.

3.5 ACCEPTANCE

- .1 Obtain final approval of rough grading via site inspection with Contract Administrator.
- .2 Produce final compaction test results for deficient areas prior to proceeding with hard and soft landscape site development operations.

3.6 CLEANING

- .1 Upon completion of installation, remove construction and accumulated environmental dirt, surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 – Cleaning and Waste Processing.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Excavating and backfilling for building structure

1.2 RELATED REQUIREMENTS

- .1 Section 01 57 13 - Temporary Erosion and Sediment Control
- .2 Section 01 74 20 - Construction Waste Management, for construction waste management plan requirements
- .3 Section 07 26 00 - Vapour Retarders, for underslab vapour retarder in crawlspace
- .4 Section 31 22 13 - Rough Grading, for topsoil stripping
- .5 Section 31 37 50 - Culverts and Subgrade Drainage, for subsurface drainage

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600kN-m/m³)
- .2 City of Winnipeg
 - .1 Standard Construction Specifications, CW 2030 Excavation, Bedding and Backfill

1.4 PROJECT CONDITIONS

- .1 A geotechnical report has been prepared for this Project, and is available for information only. The opinions expressed in the report are those of the report's author and represent interpretations of subsoil conditions, tests, and results of analyses conducted by the report's author. Contract Administrator will not be responsible for interpretations or conclusions drawn from the data.
- .2 A subsurface investigation report has been prepared for this Project, and is available for information only. The opinions expressed in the report are those of the report's author and represent interpretations of subsoil conditions, tests, and results of analyses conducted by the report's author. Contract Administrator will not be responsible for interpretations or conclusions drawn from the data.
 - .1 Fill material on site is "impacted", and consists of road salt that remains from salt stockpiles that were once on the property. Road salt does not impose danger to health or require PPE while handling.
- .3 Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during excavation and backfilling operations.
 - .1 Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Contract Administrator and authorities having jurisdiction.
 - .2 Provide alternate routes around closed or obstructed traffic ways if required by Contract Administrator or authorities having jurisdiction.
- .4 Do not start excavation and backfilling operations until temporary erosion- and sedimentation-control measures, specified in 01 57 13 - Temporary Erosion and Sediment Control are in place.

Part 2 **Products**

2.1 **MATERIALS**

- .1 General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- .2 Frost-stable fill comprised of granular materials with less than 5% material passing a 0.075 mm sieve.
- .3 Clean Draining Fill: Type 3 fill in accordance with City of Winnipeg Standard Specification CW2030.
- .4 Clay Cap: Clayey gravel and sand mixture capable of compacting to a dense state.
- .5 Sand: in accordance with City of Winnipeg Standard Specification CW2030.

Part 3 **Execution**

3.1 **EXAMINATION**

- .1 Verification of Conditions:
 - .1 Examine geotechnical report.
 - .2 Before starting work verify and establish locations of buried services on and adjacent to site.
- .2 Evaluation and Assessment:
 - .1 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.
 - .2 Testing of materials and compaction of backfill will be carried out by testing laboratory approved by Contract Administrator.
 - .3 Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill and fill materials proposed for use.
 - .4 Not later than 48 hours before backfilling or filling with approved material, notify Contract Administrator so that compaction tests can be carried out by testing agency.
 - .5 Before starting work, conduct, with Contract Administrator, condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, and paving, survey bench marks and monuments that may be affected by the Work.

3.2 **PREPARATION**

- .1 Refer to Section 01 35 26 - Environmental Protection, and Section 01 57 13 - Temporary Erosion and Sediment Control.
 - .1 Use temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with sediment and erosion control plan.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls upon completion. Restore and stabilize areas disturbed during removal.
- .2 Before starting excavation:
 - .1 Contact affected utility companies regarding exact location and current status of utilities, voltage of underground and overhead power lines and pressure of natural gas lines.

- .2 Notify Contract Administrator if utility lines have been omitted from or incorrectly indicated on Drawings.
- .3 Identify known underground utilities. Stake and flag locations. Identify and flag surface and aerial utilities.
- .4 Notify utility companies to remove and relocate utility lines as required.
- .3 Expose building connections, service connections, utilities to be crossed to confirm horizontal and vertical alignment of existing utilities.
- .4 Expose existing utility lines by hand excavation to confirm location before machine digging within 600 mm of lines.
- .5 Maintain and protect existing above and below grade utilities which pass through work area. Protect active utility lines exposed by excavation, from damage. Hand excavate to final elevations and dimensions.
- .6 Where existing pipes, ducts or other underground services intersect a trench, support trench in a manner approved by authority having jurisdiction.
- .7 Where existing overhead line poles are adjacent to excavations, temporarily support poles in a manner approved by authority having jurisdiction.

3.3 PROTECTION

- .1 Protection of in-place conditions:
 - .1 Protect excavations from freezing.
 - .2 Keep excavations clean, free of standing water, and loose soil.
 - .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Contract Administrator's approval.
 - .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
 - .5 Protect buried services that are to remain undisturbed.

3.4 SHORING AND BRACING

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations.

3.5 DEWATERING

- .1 Maintain excavations free of water. Provide pumps, piping, temporary drains, trenches, sumps, and related equipment to remove water.
- .2 Do not use sanitary sewers or private property for discharge of water.

3.6 EXCAVATION

- .1 Impacted Soil: Do not remove impacted soil from the City-owned parcel of land on the north side of Transcona Boulevard.

- .2 Handle all site soils in the same way as follows:
 - .1 Fill material is considered impacted to a depth of approximately 0.7 metres.
 - .2 Relocate material excavated to a depth of 0.7 metres during construction to an area adjacent to the library site as directed by the Contract Administrator.
 - .3 Stockpiles:
 - .1 Height: maximum 2m high to limit erosion;
 - .2 Location: Do not locate near ditches or natural drainage.
- .3 Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock; soil materials, including impacted soil materials; and obstructions. No changes in the Contract Price or schedule will be authorized for rock excavation, impacted soil excavation, or removal of obstructions.
 - .1 If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - .2 Excavate to lines and grades indicated to permit installation of permanent construction.
 - .3 Excavate to elevations and dimensions indicated on Drawings within a tolerance of plus or minus 50 mm, and extending a sufficient distance from footings and foundation walls to permit placing and removal of concrete formwork, installation of services, other required construction, and for review.
 - .4 Excavations for foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
- .4 Do not excavate under wet conditions or when such conditions are anticipated.
- .5 Notify Contract Administrator if unsuitable bearing materials are encountered at indicated elevations. Carry excavation deeper and replace excavated material with suitable materials if and as directed by Contract Administrator.
- .6 Where bedrock is encountered at elevations above design subgrade, remove bedrock to 300 mm below bottom of concrete slab, and replace with compacted granular fill.
- .7 Protect bottom of excavations and soil around and beneath footings from frost.

3.7 SUBGRADE INSPECTION

- .1 Notify Contract Administrator when excavations have reached required subgrade.
- .2 If Contract Administrator determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

3.8 UNAUTHORIZED EXCAVATION

- .1 Fill unauthorized excavation under foundations by extending bottom elevation of concrete foundation to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 17.2 MPa, may be used when approved by Contract Administrator.
 - .1 Fill unauthorized excavations under other construction as directed by Contract Administrator.

3.9 STORAGE OF SOIL MATERIALS

- .1 Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - .1 Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILLING

- .1 Place and compact backfill in excavations promptly, but not before:
 - .1 Completing construction below finish grade including, where applicable, subdrainage, dampproofing, and perimeter insulation.
 - .2 Surveying locations of underground utilities for Record Documents.
 - .3 Testing and inspecting underground utilities.
 - .4 Removing concrete formwork.
 - .5 Removing snow, ice, trash and debris.
 - .6 Removing temporary shoring and bracing, and sheeting.
 - .7 Installing permanent or temporary horizontal bracing on horizontally supported walls.
- .2 Place backfill on subgrades free of mud, frost, snow, or ice.
- .3 Take care to prevent damage to or displacement of insulation, weeping tile installation, pipe, conduit and other work.
- .4 Compact subgrade to 95% SPMDD.
- .5 Placing:
 - .1 Backfill systematically, as early as possible, to allow maximum time for natural settlement.
 - .2 Place backfill material in 150 mm lifts unless indicated otherwise. Maintain optimum moisture content of materials being compacted, as required to attain specified compaction density.
 - .3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
 - .1 Permit concrete to cure minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure, and as approved by Contract Administrator.
 - .2 If approved by Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.
- .6 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
 - .1 Exterior side of grade beams: Use free-draining granular backfill placed and compacted in 200 mm lifts to 200 mm below hardscape level. Compact to 92% SPMDD. Provide clay cap over granular backfill at soft landscaping.
 - .2 Crawlspace: sand fill on top of vapour retarder.

3.11 GRADING

- .1 General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - .1 Provide smooth transition between adjacent existing grades and new grades.
 - .2 Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- .2 Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations.

3.12 FIELD QUALITY CONTROL

- .1 Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- .2 Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- .3 When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.13 PROTECTION

- .1 Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- .2 Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - .1 Scarify or remove and replace soil material to depth as directed by Contract Administrator; reshape and recompact.
- .3 Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - .1 Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- .1 Remove surplus satisfactory soil and waste materials, including trash, and debris, and legally dispose of them off-site.

END OF SECTION

PART 1 - General

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-In-Place Concrete.
- .2 Section 31 22 13 - Rough Grading.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM).
 - .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - .2 ASTM C131-06, Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .4 ASTM D1248-05, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.
 - .5 ASTM E11-09e1, Standard Specification for Wire Cloth and Sieves for Testing Purposes.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB 8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 American Association of State Highway and Transportation Officials (AASHTO).
 - .1 AASHTO M92-05, Standard Specification for Wire-Cloth Sieves for Testing Purposes.

1.3 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver all material to site in manufacturer's original unopened packaging with labels clearly identifying product name and manufacturer.
- .2 Store materials in a dry, enclosed area protected from exposure to moisture, construction activity, and direct sunlight in strict accordance with manufacturer's recommendations.
- .3 Handle all products with appropriate precautions and care as stated manufacturer's instructions.

1.4 SITE CONDITIONS

- .1 Locate all irrigation system lines and any other underground utilities that may interfere with the works. Ensure the location of all irrigation lines, sprinkler heads and other utilities are staked prior to the start of construction.

1.5 PROTECTION

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, existing cart paths, surface or underground utilities which are to remain. Make good any damage.
- .2 The Contract Administrator or designated representative will designate the area or areas in which the Contractor's activities may take place. The Contractor shall make good any damage caused by their activities within the construction area or areas. The Contract Administrator or designated representative will designate access routes to the designated work areas. The Contractor shall make good any damage caused by their activities along the access routes.

1.6 SUPERVISION AND INSPECTION

- .1 The Contractor shall provide preliminary staking for all drainage works for approval by the Contract Administrator. The Contractor will stake all modifications approved by the Contract Administrator as works are in progress.
- .2 The Contract Administrator or designated representative will provide periodic review of subgrade drainage installation as they are being undertaken and will provide direction to the Contractor.

PART 2 - Products

2.1 MATERIALS

- .1 HDPE corrugated pipe and fittings: to ASTM D1248, Big "0", Prinsco (or approved equal in accordance with B6) Internal Snap Coupling System pipe perforated all around complete with polyester geotextile fabric 'sock' filter, nominal inside diameter 4" (100mm), non-perforated couplings (insert type), sleeves, reducers, connectors, T's, Wye's, elbows and end caps (insert type). Refer to Drawings for applicable pipe size and location.
- .2 Clean river wash stone, $\pm 1.5"$ (38mm)
- .3 Filter fabric: permeable, commercial grade, woven landscape fabric approved by Contract Administrator, to required widths x full lengths.

PART 3 - Execution

3.1 INSPECTION

- .1 Ensure graded subgrade conforms with required drainage pattern before placing drainage material.
- .2 Ensure improper slopes, unstable areas, areas requiring additional compaction of other unsatisfactory conditions are corrected to approval of Contract Administrator. Do not begin installation of foundation drainage until deficiencies have been corrected.
- .3 Ensure that foundation repairs have been completed and approved by the Contract Administrator before commencing with drainage installation.

3.2 INSTALLATION

- .1 Pipe trench and bedding:
 - .1 Drainlines: Cut trenches in subgrade, compact trench bottom. Excavation must not interfere with the normal 45° bearing splay of foundations.
 - .2 Remove boulders, old construction rubble, and other obstructions encountered in course of excavation.
 - .3 Shape trench and bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .4 Smooth to grade as indicated on grading plans, providing continuous grade without low or high spots.
 - .5 Pipe bedding not required.
- .2 Pipe laying:
 - .1 Ensure pipe interior and coupling surfaces are clean before laying.
 - .2 Lay pipe to minimum slope, as indicated on drawings, to discharge site.
 - .3 Do not use shims to establish pipe slope.
 - .4 Use manufacturer's recommended fittings.
 - .5 Protect pipe ends and risers from damage and ingress of foreign material.

- .6 Connect pipe to catchbasins, sump pit or outlets by appropriate adapters manufactured for this purpose.
- .7 Secure all joints and fittings with woven, commercial grade duct tape prior to backfilling.
- .3 Drainage Trench Backfill:
 - .1 Protect catch basin and other inlet structures from contamination of backfill and other material by placing a piece of filter fabric of rim and place lid in to secure fabric. Remove fabric after construction is complete.
 - .2 Place backfill material after pipe installation is approved by the Contract Administrator.
 - .3 Perforated Drainlines: Place clean river wash stone backfill by hand to finish grade. Place layers uniformly and simultaneously on each side of pipe. Consolidate by hand, tamping lightly to design grade. Use appropriate devices or methods to ensure and prevent displacement of pipe during backfilling.
 - .4 Place backfill material above pipe surround in uniform lifts not to exceed 150mm compacted thickness up to grades as indicated.
 - .5 The Contractor is responsible to make good any settlement that may occur in pipe trenches.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 61 14 – Precast Concrete Piles.
- .2 Section 31 61 23 – Bored Concrete Piles.

1.2 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Contract Administrator and await further instructions.
- .4 Submit schedule of planned sequence of driving to for review, not less than 2 weeks prior to commencement of pile driving.
- .5 Equipment:
 - .1 Submit prior to pile installation for review by Contract Administrator, list and details of equipment for use in installation of piles.
 - .2 Impact hammers: submit manufacturer's written data as specified.
 - .3 Non-impact methods; submit characteristics to evaluate performance.
- .6 Quality assurance submittals:
 - .1 Test reports: submit 2 copies of certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's instructions.
- .2 Protect piles from damage due to excessive bending stresses, impact, abrasion or other causes during delivery, storage and handling.
- .3 Replace damaged piles to satisfaction of Contract Administrator.

1.5 EXISTING CONDITIONS

- .1 Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.
- .2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Contract Administrator. Do not proceed with pile locations / sizes / extensions, etc. where not on drawings without written approval from the Contract Administrator.

1.6 SCHEDULING

- .1 Provide schedule of planned sequence of driving to Contract Administrator for review, not less than two weeks prior to commencement of pile driving.

Part 2 Products

2.1 MATERIALS

- .1 Material requirements for piles are specified in Section 31 61 14 – Precast Concrete Piles.
- .2 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.
- .3 Splice piles only with written approval of Contract Administrator.
 - .1 When permitted, provide details for Contract Administrator review.
 - .2 Design details of splice to bear dated signature stamp of professional engineer registered or licensed in Province of Manitoba, Canada.

2.2 EQUIPMENT

- .1 Impact hammers: provide manufacturer's name, type, rated energy per blow at normal working rate, mass of striking parts of hammer, mass of driving cap and type and elastic properties of hammer and pile cushions.
- .2 Non-impact methods of installation such as augering, jacking, vibratory hammers or other means: provide full details of characteristics necessary to evaluate performance.
- .3 Hammer:
 - .1 Drop hammers will not be permitted.
 - .2 Hammers to be capable of developing a blow at operating speed with an energy of not less than 40,000 joules per blow. Hammer is to be capable of being adjusted to deliver reduced impact. When required bearing capacity is not obtained by use of hammers complying with minimum requirements, use larger hammer only as approved by Contract Administrator. For diesel hammers, provide independent calibrated pressure gauges on hammer side of all valves. Provide calibration certificate dated within 6 months of calibration.
- .4 Leads:

- .1 Construct pile driver leads to provide free movement of hammer. Hold leads in position at top and bottom, with guys, stiff braces, or other means to ensure support to pile while being driven. Inclined heads to be used for battered piles.
- .2 Length: provide length of leads so that use of a follower is unnecessary.
- .3 Swing leads:
 - .1 Not permitted.
- .5 Followers:
 - .1 Obtain written approval from Contract Administrator prior to using followers. When permitted, provide followers of such size, shape, length and mass to permit driving pile in desired location to required depth and resistance. Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.
 - .2 Drive applicable load test piles using similar follower.

Part 3 Execution

3.1 PREPARATION

- .1 Protection:
 - .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
 - .2 Arrange sequencing of pile driving operations and methods to avoid damages to adjacent existing structures.
 - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation.
 - .1 Make provision for access and support of piling equipment during performance of Work.
- .3 Prebore piles to 4 metres depth, or as required by geotechnical Contract Administrator.
- .4 Drive piles within embankments only when embankment has been placed and compacted to at least bottom elevation of pile cap.
- .5 Do not drive piles until excavation has been completed.
- .6 In areas requiring fill, either place and compact fill after piles are installed or drive piles after fill has been placed and compacted to at least bottom elevation of pile cap.

3.2 DESIGN LOAD CAPACITY

- .1 Allowable design load capacity of pile at working load is as indicated on drawings.
- .2 Installation of each pile will be subject to review of Contract Administrator. Contract Administrator will be sole judge of acceptability of each pile with respect to final driving

resistance, depth of penetration or other criteria used to determine bearing capacity. Pile driving rig shall not be removed from site prior to Contract Administrator's review of final driving of all piles.

- .3 Drive each pile to final set as directed by Contract Administrator, and in accordance with Geotechnical Report.
- .4 Determine required final driving resistance using formula approved by Contract Administrator.
- .5 Drive each pile to practical refusal in glacial till.

3.3 APPLICATION / DRIVING

- .1 Drive precast piles only when concrete has attained strength of 35 MPa.
- .2 Use driving caps and cushions to protect piles.
 - .1 Reinforce pile heads if necessary. Piles with damaged heads will be rejected by Contract Administrator.
- .3 Hold piles securely and accurately in position while driving.
- .4 Deliver hammer blows along axis of pile. Ensure pile is not overstressed.
- .5 Do not drive piles within 8 m of masonry or concrete which has been in place less than 7 days.
- .6 Ensure no contact between pile and structure takes place when driving batter piles adjacent to existing structures.
- .7 Do not drive batter piles until vertical piles within radius of 8m have been fully driven.
- .8 Restrike already driven piles lifted during driving of adjacent piles to confirm set.
- .9 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.
- .10 Cut off piles neatly and squarely at elevations to tolerance of plus or minus 25 mm.
 - .1 Provide sufficient length above cut-off elevation so that part damaged during driving is cut off.
 - .2 Do not cut tendons or other reinforcement, which will be used to tie pile caps to pile.
- .11 Remove cut-off lengths from site on completion of work.

3.4 DRIVING TOLERANCES

- .1 Pile heads to be within 50 mm of locations as indicated.
- .2 Piles not to be more than 2% of length out of vertical alignment.

3.5 OBSTRUCTIONS

- .1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, remove obstruction.

3.6 DAMAGED OR DEFECTIVE PILES

- .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
- .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

3.7 PROTECTION

- .1 Protect adjacent structures, services and work of other sections from hazards due to pile driving operations.
- .2 Arrange sequencing of pile driving operations and methods such that no damage occurs to adjacent existing structures. If damaged, remedy damaged items to restore to original or better condition at own expense.

3.8 FIELD QUALITY CONTROL

- .1 Independent review of piling operations shall be done by an independent inspection and testing agency under a cash allowance and retained by The City.
- .2 Maintain accurate records of driving for each pile, including:
 - .1 Type and make of hammer, stroke or related energy.
 - .2 Other driving equipment including water jet, driving cap, cushion.
 - .3 Pile size and length, location of pile in pile group, location or designation of pile group.
 - .4 Sequence of driving piles in group.
 - .5 Number of blows per metre for entire length of pile and number of blows per 25mm for final sets, over the last 75 mm.
 - .6 Final tip and cut-off elevations.
 - .7 Other pertinent information such as interruption of continuous driving, pile damage.
 - .8 Record elevation taken on adjacent piles before and after driving of each pile.
- .2 Provide Contract Administrator with three copies of records.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 61 13 – Pile Foundations, General Requirements.

1.2 MEASUREMENT PROCEDURES

- .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A82/A82M-05a, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - .2 ASTM A416/A416M-05, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 - .3 ASTM A421/A421M-05, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .3 CAN/CSA-G30.18-M92(R1998), Billet-Steel Bars for Concrete Reinforcement.
 - .4 CAN/CSA-A23.4/A251, Qualification Code for Architectural and Structural Precast Concrete Products.
- .3 Precast/Prestressed Concrete Institute (PCI)
 - .1 PCI MNL-116-[1999], Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition.

1.4 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports for piles from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

1.5 DESIGN REQUIREMENTS

- .1 Design loads as indicated on Structural Drawings.
- .2 Do not splice piles without Contract Administrator's permission. When permitted, provide details for Contract Administrator review. Design details of splice to bear signature and stamp of professional engineer registered or licensed in Province of Manitoba.

1.6 TEST REPORTS

- .1 Upon request, submit certified copies of quality control tests related to this project as specified in CSA A251.

1.7 QUALITY ASSURANCE

- .1 Manufacturer of precast concrete components: certified by CSA as meeting requirements of CSA A251.
- .2 A Contractor experienced in the related type or work and having at their disposal all necessary equipment shall perform all work.
- .3 Allowable tolerances:
 - .1 Lateral tolerances: all units shall be located so as to have a maximum lateral deviation at the top of the unit of 50 mm.
 - .2 Vertical tolerance: all piles shall be driven without varying more than 2% from the vertical.
 - .3 Pile cutoffs at elevations indicated +/- 25 mm.
 - .4 Piles not meeting these requirements will be rejected.
- .4 Drive all units to develop loads indicated on drawings to the criteria in the Geotechnical Report.
- .5 Comply with all local and provincial safety codes and regulations.

1.8 SITE CONDITIONS

- .1 Visit the site to ascertain any special conditions that may affect the work.
- .2 A subsurface Geotechnical investigation report of the site has been prepared and has been included as part of this specification.
- .3 Review the Geotechnical Report to identify subsurface conditions that may be encountered.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Ensure handling and installation stresses are within safe limits.
- .4 Avoid damage to piles during handling, placing pile in leads, and during pile driving operations.
- .5 Support piles laterally during driving, but allow rotation in leads.
- .6 Where pile or projecting reinforcement orientation is essential take precautionary measures to maintain orientation during driving.
- .7 Support battered piles to prevent excessive bending stresses in pile.
- .8 Square top of pile to longitudinal axis of pile.
 - .1 Maintain axial alignment of pile hammer with that of pile.
- .9 Provide identification for points of lifting by painted stripes or lift hooks set in.
- .10 Provide identification for points of support for storage. Store all units at site in such a way as to avoid undue stresses before driving.
- .11 During delivery and storage support long piles continuously along their lengths.
- .12 All foundation units delivered to site that do not conform to terms of this specification may be rejected by Contract Administrator.

1.10 PROTECTION

- .1 Protect public and construction personnel, adjacent structures and work of other sections from hazards attributable to pile driving operations.
- .2 Protect pile surfaces from damage and spalling.

Part 2 Products

2.1 MATERIALS

- .1 All piles standard hexagonal, precast, prestressed, to sizes indicated on drawings by an approved supplier.
- .2 Cement: Type HS or HSb, sulphate resistant.
- .3 Concrete strength: minimum 35 MPa at the time of driving. Concrete strength at transfer of prestress: as required by manufacturer.
- .4 Prestressing steel: to ASTM A416, uncoated seven-wire stress-relieved strand, grade 270.
 - .1 Prestressing steel: free of grease, oil, wax, paint, soil, dirt, and loose rust.
 - .2 Do not use prestressing strands or wire having kinks, bends, or other defects.
- .5 Welded wire mesh: to ASTM A-185.
- .6 Spiral reinforcement: to ASTM A82, cold drawn steel wire.
- .7 Cementitious materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .8 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing 400 MPa yield.

2.2 FABRICATION

- .1 Fabricate precast concrete piles to lengths, cross sectional areas, reinforcement as required to meet capacities indicated.
- .2 Fabricate piles to following finish tolerances:
 - .1 Length: ± 3 mm per metre of length.
 - .2 Cross section: solid section -6 to +12 mm.
 - .3 Deviation from straight line: not more than 3 mm per metre of length, nor 12 mm in full length.
 - .4 Pile head: ± 10 mm per metre from true right angle plane. Surface irregularities ± 3 mm.
 - .5 Location of reinforcing steel: Main reinforcing cover: -3mm to +6 mm. Spacing of spiral ± 12 mm.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Provide approved type of protection cap with cushion block to top of pile when driving. Cushion block material softwood such as green hemlock. Plywood not acceptable.
- .2 Do not typically splice piles. If splicing of piles should be required, only pre-manufactured cast-in splice shoes approved by the Contract Administrator will be considered.
- .3 On completion of driving, cut off pile at required elevation. Make circumferential cut with concrete saw to prevent spalling of pile below cut-off elevation. Make pile cut off absolutely horizontal.
- .4 Drive piles at locations indicated and to depth sufficient to develop required loading.
- .5 Minimum prebored depth for piles from excavation 4.0 metres.
- .6 Prebored holes to have 50 mm larger diameter than piles to be placed unless indicated otherwise on the drawings.
- .7 Remove boulders encountered in prebored holes using a core barrel or other approved method.

- .8 Remove, relocate, redrive and provide additional piles where directed when boulders or other obstructions prevent driving piles to an adequate bearing strata or within allowable tolerances in locations indicated on the drawings. Perform such work at no additional cost to the Contract.
- .9 Perform pile driving with a diesel hammer capable of delivering a rated energy of at least 40,000 joules.
- .10 Refusal criteria for driving piles shall be established by inspection at time of driving, and in accordance with the criteria in the Geotechnical Report.
- .11 Replace piles that are excessively damaged through driving or which are believed to be broken with new piles at a suitable location at no additional cost to Contract.
- .12 Piles shall be of sufficient length to allow 450 mm of strand to extend into the structure above.
- .13 If a pile or piles should be driven below required elevation to accommodate exposed strand requirements, cut off such piles 450 mm below the top of pile (except at single pile caps) and install an extension to details as supplied by the Contract Administrator at no extra cost to the Contract.
- .14 Drive all piles to required final set in competent hard glacial till deposit.
- .15 Drive piles continuously, without intermission until driven to required final set, at depth adequate to support the loads indicated on the drawings.
- .16 Observe and check pile upheaval. Redrive pile to refusal and final set any piles showing uplift after driving adjacent piles.

3.3

CLEAN-UP

- .1 After installation of foundation units, remove all excess concrete and other debris and leave site in clean condition.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 31 61 13 – Pile Foundations, General Requirements.
- .2 Section 31 61 14 – Precast Concrete Piles.

1.2 MEASUREMENT PROCEDURES

- .1 Friction Piles:
 - .1 Provide Lump sum price for the foundation work in accordance with the structural drawings.

1.3 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A36/A36M-05, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A53/A53M-05, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .2 American Welding Society (AWS)
 - .1 AWS D1.4/D1.4M-05, Structural Welding Code - Reinforcing Steel.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-04(July 2005), Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN/CSA-G30.18-M92(2002), Billet Steel Bars for Concrete Reinforcement.
 - .3 CSA-G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .4 CAN/CSA-S16-01(R2007), Limit States Design of Steel Structures.
 - .5 CSA W48-01(R2006), Filler Metals and Allied Materials for Metal Arc Welding.

1.4 EXISTING CONDITIONS

- .1 Sub-surface investigation report has been included as part of this specification. Contractor is to review the report and become familiar with the subsurface conditions.
- .2 Notify Contract Administrator in writing if subsurface conditions at site differ from those indicated and await further instructions from Geotechnical Contract Administrator.

1.5 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Indicate: size of pile, reinforcing steel and ties.

Part 2 Products

2.1 MATERIALS

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 Steel casing: As required and designed by installer.
- .4 Grout: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.2 SOURCE QUALITY CONTROL

- .1 Mill report to CAN/CSA-S16.
- .2 Concrete tests: to CSA-A23.1/A23.2.

Part 3 Execution

3.1 INSTALLATION

- .1 Friction Piles:
 - .1 Bore holes to diameters and lengths as indicated. The tips of the piles should not penetrate the glacial till.
 - .2 Install within 50mm of exact centres set out, 2% of vertical plumb and 25mm of required elevation. Correction of deviations beyond those defined to be at the discretion of the Contract Administrator, costs for correction are to be borne by the Contractor.
 - .3 Remove loose material, foreign matter and water as directed by geotechnical Contract Administrator.
 - .4 Vibrate top 4500mm of each pile.
- .2 Protective steel casing:
 - .1 Install casing as required. Cost of casing shall be included in lump sum for foundation work.
- .3 Remove stones up to 300mm in dimension, boulders over 300mm and rock in whole or in part before boring tool is deflected. If required, lower boring tool and clean hole to ensure that machine auger has reached the required depth.
- .4 Dispose of excavated materials off site.
- .5 Install steel reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing and as indicated.
- .6 Fill pile excavations with concrete to elevations as indicated.
 - .1 Place concrete in one continuous pour in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .7 Steel protective casing may be removed at option of Contractor.
- .8 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.
 - .1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing below level of concrete.
- .9 Where steel protective casing is left in place, fill void space between casing and shaft excavation with concrete.
- .10 Use tremie pipe or concrete pumping as required. Costs of tremied concrete shall be included in the lump sum for the foundation work.

3.2 PROTECTION

- .1 If superimposed work is to be placed later, protect top of each unit with at least 150mm of damp sand.

3.3 DEFECTIVE PILES

- .1 Cased concrete shaft piles rejected where:
 - .1 Soil has entered casing.
 - .2 Water has entered casing.
 - .3 Casing is damaged, out of tolerance or alignment.

- .2 Defective Friction Piles:
 - .1 Leave rejected pile in place, place adjacent pile and modify pile cap as directed in writing by Contract Administrator.
 - .2 No extra compensation will be made for additional piles and other costs due to installation of damaged or defective piles.

3.4 SAFETY

- .1 Conform to the latest regulations of the Provincial Building Protection Act and Provincial Building Code and provide all necessary safety equipment required.

3.5 FIELD QUALITY CONTROL

- .1 Independent review of friction piling operations shall be done by an independent inspection and testing agency under a cash allowance and retained by The City.
- .2 Maintain accurate records for each friction pile installation, including:
 - .1 Pile size and length of pile.
 - .2 Location.
 - .3 Top of Pile Elevation.
 - .4 Presence of Water.
 - .5 Other pertinent information.
- .3 Provide Contract Administrator with three copies of records.

3.6 CLEANING

- .1 Proceed in accordance with Section 01 74 00 – Project Clean-Up.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION