EXCAVATION AND BACKFILLING FOR STRUCTURES

1. GENERAL

1.1 Work Included

.1 Work under this Section includes, but is not necessarily limited to, the following items:

.1 Excavation to required elevations for the foundation, base slabs, and grade beams.

.2 Supply and placement of granular levelling material below void form.

.3 Supply, placement, and compaction of backfill and fill materials to attain indicated grades and profiles.

.4 Disposal of surplus excavated material.

.5 Dewatering of excavations.

1.2 Reference Standards

.1 Conform to requirements of the NBC 1995 with Manitoba Amendments and the Canadian Construction Safety Code.

.2 Comply with excavation and trenching regulations of Provincial authorities.

1.3 Submittals

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 If shoring, bracing, or sheet piling are used, submit design documentation signed and sealed by a qualified Professional Engineer registered in the Province of Manitoba.

1.4 Samples

.1 For granular materials, submit a 25 kg sample for coarse, gravelly soil or 75 kg sample for coarse, crushed stone of each type, clearly labelled for type and source of the materials, for analysis by testing laboratory. Ship samples prepaid or deliver in tightly closed containers to testing laboratory designated by Contract Administrator.

.2 There shall be no charge for any materials taken by the Contract Administrator for testing purposes.

.3 All materials shall be reviewed and accepted by the Contract Administrator at least ten (10) days before any construction is undertaken.

.4 Costs for analysis will be paid by the City.

1.5 Compaction Testing

.1 Testing of compacted fill materials will be performed by an independent inspection and testing firm appointed and paid by the City. Testing will be performed so as to least encumber the performance of the Work.

.2 The City will pay for the first series of tests only, on the area being evaluated. Pay costs for additional testing, if required, due to improper performance of Work.

.3 Tests will be performed in accordance with ASTM D698 for Standard Proctor Density on representative samples to control compaction requirements. The Contract Administrator will decide the frequency and number of tests required.

.4 The field density of the compacted layers shall be verified by field density tests in accordance with ASTM D2922, using nuclear methods performed by the inspection and testing firm. The frequency and number of tests required will be decided by the Contract Administrator.

.5 Notify the Contract Administrator when Work of this Section or portions of Work are completed to own satisfaction. Do not proceed with additional portions of Work until test results have been verified and accepted.

.6 If tests indicate that compacted materials do not meet specified required materials, remove defective Work, replace, and re-test at own expense as directed by the Contract Administrator.

.7 Ensure compacted fills are tested and accepted before proceeding with placement of surface materials.

1.6 Geotechnical Information

.1 Refer to Specification E2 for a list of test hole logs and reports available associated with the Site.

2. PRODUCTS

2.1 General

.1 All materials to be subject to Contract Administrator's acceptance.

.2 Granular materials to be composed of sound, hard, uncoated particles, free from injurious quantities of clay, flaky particles, soft shale, friable materials, roots, vegetable matter, and frozen lumps.

.3 Grading of granular materials to show no marked fluctuations between opposite ends of extreme limits.

.1 Type 1: pit run granular backfill shall consist of a clean, well-graded, and free-draining pit run material with a maximum size of 75 mm, and less than 5% by weight finer than 0.075 mm.

.2 Type 2: crushed gravel graded within following limits:

Canadian Metric Sieve Size	Percent Passing	
	Crushed Granular	Crushed Limestone
25,000	100	-
20,000	80 - 100	100
5,000	40 - 70	40 - 70
2,500	25 - 55	25 - 60
315	13 - 30	8 - 25
80	5 - 15	6 - 17

At least 60% of material retained on 5 mm sieve to have at least one (1) freshly fractured face.

.4 Type 3: pit run sand for levelling with maximum stone size 40 mm.

.5 Type 4: common clay backfill shall be free from organic material and rocks larger than 150 mm in size and building debris. Fill under landscaped areas to be free from alkali, salt, petroleum products and other materials detrimental to plant growth. Common backfill shall be obtained from the Disposal Site just west of the Deacon Booster Pumping Station, subject to review by Contract Administrator.

.6 Drain material (for utility vault): granular drain material shall consist of natural or crushed stone having clean, hard, strong, durable, uncoated particles free from injurious amounts of soft, friable, thin, elongated, or laminated pieces, alkali, organic, or other deleterious matter, and ranging in size from 5 to 20 mm. Limestone material will not be accepted for drain material.

.7 Drainage Filter Fabric (for utility vault): drainage fabric shall conform to CW 3120.

3. EXECUTION

3.1 Finish Elevations and Lines

.1 For setting and establishing finish elevations and lines, secure the services of a registered surveyor or experienced instrumentman acceptable to the Contract Administrator.

.2 Carefully preserve all data and all monuments set by the registered surveyor. If displaced or lost, immediately replace to the acceptance of the Contract Administrator, at no additional cost to the City.

3.2 Excavation

.1 Perform excavation in strict compliance to Work Place Safety and Health and authorities have jurisdiction.

.2 Excavate to noted limits and as required for walls and foundations. Stockpile material to be used for backfilling on Site as directed by the Contract Administrator. Excess material is to be disposed of immediately as per Item 3.6, Disposal.

.3 When complete, request Contract Administrator to review excavations.

.4 Local pockets of material which, in the opinion of the Contract Administrator are unsuitable, shall be removed to such depths as required by the Contract Administrator.

.5 The completed excavation shall provide clean, level, solid, and water-free surfaces at the required elevations, ready to receive construction.

.6 Excavations are not to encroach on existing slopes and as indicated in the geotechnical information.

.7 Backfill and compact all over-excavated areas under structure surfaces with Type 1 fill and compact to 90% Standard Proctor Density and at no additional cost to the City.

.8 Make good all damage occurring as a result of inadequate, unauthorized, or defective methods of protection.

.9 Areas used for temporary stockpiling shall be restored to existing condition or better.

3.3 Shoring, Bracing, and Sheet Piling

.1 Supply and install all shoring, bracing, and sheet piling required to prevent injury to personnel and damage to existing structures and excavations, and where necessary for safe work within the excavated areas.

.2 Comply with all applicable rules and regulations of governmental authorities.

.3 Erect shoring, bracing, and sheet piling independent of utilities and structures.

.4 Prefabricated cages or shields may be used to supplement or replace conventional shoring, provided they comply with all applicable safety regulations and permit placing and compacting of backfilling material around new construction.

.5 Maintain shoring, bracing, and sheet piling during backfilling and remove in stages as backfilling progresses.

.6 Remove all shoring, bracing, and sheet piling unless otherwise permitted by the Contract Administrator.

.7 If shoring, bracing, and sheet piling are allowed to remain, cut off to an elevation at least 1,000 mm below finish grade and structures.

.8 Assume full responsibility for any failure, collapse, or movement of existing structures, rail lines, shoring, bracing, sheet piling, earth banks, trenches, and other excavations.

3.4 Dewatering

.1 Provide Site drainage and dewatering around the structures in accordance with Specification E7.

3.5 Backfilling, Fill, and Compaction

.1 Preparation

.1 Ensure areas to be backfilled are free from debris, snow, ice, and water and that ground surfaces are not in a frozen condition.

.2 Backfilling and Filling

.1 Backfill and fill to grades, contours, levels, and elevations indicated on Drawings.

.2 Do not backfill against foundation walls until the perimeter drainage system has been installed and accepted by the Contract Administrator.

.3 Maintain optimum moisture content of materials to permit compaction to specified densities.

.4 Compact each soil layer to at least the specified minimum degree; repeat compaction process until plan grade is attained. Compaction densities indicated herein are based on ASTM D698 for Standard Proctor Density.

.3 Bedding over Sub-Grade

.1 Type 1 pit run gravel fill for over excavation shall be placed in uniform lifts not greater than 200 mm in thickness and shall be compacted to a density of at least 95% Standard Proctor Density.

.2 Type 3 pit run sand for the levelling layer shall be spread on the subgrade in varying thickness as required (nominal 50 mm) to attain smooth surfaces and required elevations indicated on the Drawings for the placement of the voidform under the footings and base slabs.

.4 Backfill around Structure Walls

.1 Type 1 pit run gravel fill and Type 4 common clay backfill shall be placed in lifts not greater than 200 mm in thickness to the extents shown on the Drawings and shall be compacted to a density of at least 95% Standard Proctor Density to allow equipment

tractability and limit settlement, but not result in a significant decrease in permeability of the Type 1 pit run gravel.

.2 Successive lift placement of Type 1 and Type 4 shall be coordinated so that the maximum difference in the elevations of the respective working surfaces shall not exceed 200 mm.

.3 The top three layers of Type 4 common clay fill shall be placed in lifts not great than 150 mm in thickness and each compacted lift shall be scarified a minimum of 50 mm prior to placement of successive lifts to ensure adequate bonding between each lift. A homogeneous, continuous, low permeability zone of impervious clay shall be achieved, free from any clay lumps, cracks, rutting, or deleterious material, to the satisfaction of the Contract Administrator.

.4 Type 2 crushed gravel under concrete slabs on grade shall be placed in uniform lifts not greater than 150 mm in thickness and shall be compacted to a density of at least 100% Standard Proctor.

.5 Care shall be taken when placing fill materials immediately adjacent to the structure to ensure no damage occurs to the wall and any covering materials. Any damage shall be repaired by the Contractor at his expense.

3.6 Disposal

.1 Surplus material not required for backfill and fill purposes shall be disposed of on Site to a location designated by the Contract Administrator at no extra cost to the City.

3.7 Clean-Up

.1 As excavation proceeds, keep roads, streets, and sidewalks clean of dirt and excavated material.

.2 Clean-up and wash down to remove all dirt and excavated materials caused by Work of this Section.

.3 Clean at the end of each working day.

END OF SECTION

RAILROAD WORK

1. GENERAL

1.1 Description

.1 Work includes, but is not necessarily limited to the following items:

.1 Reconstruction of the GWWD rail siding from station 1+00 to station 6+10.247, for a total distance of approximately 511 m. This Work includes the removal of the existing 60 lb per yard rail, ties, and other track material; excavating and disposing to the reach the top of the proposed subgrade; compacting subgrade, supplying and installing woven geotextile fabric, Supplying and Installing new sub-ballast and ballast material; and finally installing and supplying 100 lb rail PW, new ties, and other track material (specified below). The Work shall include supplying and installing new 85/100 lb compromise bars at station 1+00 and station 6+10.247. No work will be required on the existing Number 9 Turnouts, at both the westerly and easterly ends of the siding.

.2 The Supply and Installation of one Number 9 100 lb per yard Crossover (two Number 9 Turnouts and tangent) between the mainline and siding. The distance between mainline and siding (track centre) equals 4.297 m (14'-$1^{1/8}$"). It is located at station 2+51.620 (west point of switch of turnout) to station 3+08.367 (east point of switch of turnout) for a total distance of approximately 57 m of track. This Work includes re-building a portion of the mainline track, in the vicinity of the westerly switch, from 85 lb per yard to 10 lb per yard. 85/100 compromise bars shall be installed east and west of the westerly point of switch in order to transition from 100 lb per yard back to the existing 85 lb per yard.

.3 Supply and installation of track, ties, ballast, sub-ballast and other track material within the Railcar Shelter structure in accordance with 1.1.1.1 above.

.4 Supply and installation of a 150 mm sub-drain system between the mainline rail and the building along the north wall of the Railcar Shelter structure. This runs from approximately station 3+98.2 to 4+52.8 for a total distance of approximately 54.6 m. An additional section of sub-drain system shall be supplied and installed along the south side of the new rail siding, at the south edge of sub-ballast layer, keyed into the clay layer. This section will tie into the manhole located at the northwest corner of the Railcar Shelter. This length is approximately 91 m.

1.2 Job Conditions

.1 Railway Safety and Coordination:

.1 Portions of the Work will be performed in the vicinity of tracks operated by the GWWD Railway. The Contractor shall perform the Work so not to interfere with railway operations.

.2 The Contractor, when constructing trackage and turnouts on or near operating trackage, shall ensure safe and clear passage of all train traffic.

.3 The Contractor shall not undercut mainline track.

.4 The Contract Administrator, after consulting with the GWWD Railway will, when required, endeavour to allow the Contractor to block the affected track or tracks for the number of consecutive hours required to perform the work indicated on the Drawings.

.5 During this track block time, no rail traffic shall pass through the construction area except in case of emergency.

.6 The Contract Administrator shall notify the Contractor, at least seven hours in advance, of the approximate hours of commencement and of the extent of the track block. The hour of commencement shall be confirmed to the Contractor 60 minutes prior to actual commencement as shall be the hour when the tracks must be open and ready to receive rail traffic.

.7 The Contractor shall provide the Contract Administrator a minimum of forty eight (48) hours advance written notice of the day on which work requiring a track block is to be carried out and shall not commence any work requiring such a track block until the Contractor has received confirmation from the Contract Administrator that the block is in effect. Any delays to the Contractors operations due to the prohibition of these track blocks shall not be the basis for a claim.

1.3 Reference Standards

.1 AREMA Manual for Railway Engineering, Part 4 Track Construction and Trackwork Plans.

.2 CP Rail System Plan No. T-14-66-4 – Standard No. 9 Turnout with 16'-6" Switch Points 100 lb CP-RE Rail.

.3 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate, ASTM Designation C88.

.4 Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing, ASTM Designation C117.

.5 Standard Test Method for Lightweight Particles in Aggregate, ASTM Designation C123.

.6 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate, ASTM Designation C127.

.7 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine, ASTM Designation C131.

.8 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates, ASTM Designation C136.

.9 Determination of particle shape - Flakiness index, British Standard BS EN 933-3:1997.

1.4 Field Samples

.1 Material Samples

.1 At a minimum of two weeks prior to the start of the work, the Contractor shall submit 75 kg sample of sub-ballast and ballast material specified for testing.

.2 Samples are to be shipped pre-paid or deliver in tightly closed containers to testing laboratory designated by the Contract Administrator.

.3 Costs for analyses will be paid by the City.

2. PRODUCTS

2.1 Steel

.1 Rail:

.1 All rail shall be partly worn (PW) 100 lb RE.

.2 Vertical head wear shall not exceed 8mm for 100 LB RE head free (HF) and 11 mm for 100 lb RE.

.3 Rail used shall be without known defects (and may only contain bends that can be straightened easily).

.4 Joint batter is not to be in excess of 3 mm.

.5 Rails of different manufacturer should not be mixed in any stretch.

.6 The position of brand marks should be uniform in the same line of rail.

.2 Number 9 Crossover:

.1 The Crossover shall consist of two No. 9 Turnouts, 16 ft 6 inch Points, Rigid Bolted Frog, 100 lb RE Rail. Layout and materials shall be in accordance with CP Rail System drawing no. T-14-66-4 for a Standard No. 9 turnout unless noted otherwise in this Specification.

.2 Switch point guard shall be a Western-Cullen-Hayes Model FM Switch Point Guard or approved equal.

.3 Switch Stands:

.1 Switch stand shall be new Racor 36-E Trihandle or approved equal.

.4 Splice Bars:

.1 Partly-worn toeless 4-hole splice bars.

.2 New track bolts and washers: bolt diameter 25.4 mm.

.5 Tie Plates:

.1 14 inch tie plates on turnouts.

.2 11 inch tie plates on 100 lb tracks.

.6 Rail Anchors:

.1 Rail anchors shall be new improved Fair anchors and will be applied to all trackage and through all turnouts.

.7 Spikes:

.1 Spike shall be new 150 mm spikes and will be applied to both 14 inch tie plates and 11 inch tie plates. Two per plate required.

2.2 Wood

.1 Track Ties:

.1 Track ties shall be new No. 2 softwood treated ties.

.2 Switch Ties:

.1 Switch ties shall be new hardwood switch ties.

2.3 Crush Rock Ballast

.1 The Contractor, shall supply, haul and distribute all track ballast required for the Works.

.2 Railway ballast shall be composed of hard, strong and durable particles, clean and free from injurious amounts of deleterious substances and conforming to the following requirements of this Specification:

Material	Maximum percent by mass
Soft and friable places	5.0
Material finer than 75 sieve	2.0
Clay lumps	0.5

.3 The percentage of wear shall be less than 32%, as determined by the LA Abrasion Test, ASTM Designation C131.

.4 The soundness loss shall be less than 13.0%, as determined by the magnesium sulphate soundness test for coarse aggregate, ASTM Designation C88.

.5 The railway ballast shall contain less then 5% by mass of flat pieces. In case of dispute, the test method “Determination of particle shape - Flakiness index”, British Standard BS EN 933-3:1997, shall be used.

.6 The minimum bulk specific gravity shall be 2.80, ASTM Designation C127.

.7 At least 60% of the railway ballast shall have 2 or more fractured faces.

.8 Railway ballast shall conform to the following gradation in accordance with ASTM Designation C136 and C117:

Canadian Metric Sieve Size	Percent Passing
50,000	100
38,000	90 - 100
25,000	20 - 55
19,000	0 - 15
9,500	0 - 5
75	0 - 2

2.4 Sub-ballast

.1 The granular material supplied shall be crushed or screened pit run gravel conforming to the following gradation:

Canadian Metric Sieve Size	Percent Passing
75,000	100
25,000	60 - 90
4,750	35 - 60
75	0 - 5

.2 The granular material shall not contain more than 3% organics by mass as determined by ASTM C-123.

3. EXECUTION

3.1 Protection of the Cell 1 Outlet Pipe (located at station 1+88)

.1 As indicated on the Drawing there is an area in which special construction methods apply to work over the Cell 1 Outlet Pipe. This is a very fragile pipe that can not tolerate the weight or impact of construction equipment. Excavation within 5 m of the centerline of Cell 1 Outlet Pipe shall be completed by backhoe and restrictions outlined within Section E10. Compaction within 5 m of the centerline of the Cell 1 Outlet Pipe shall be restricted to vibratory compaction equipment with a maximum weight of 1000 kg or static rolling. Heavy equipment shall cross the Cell 1 Outlet Pipe at designated road crossings. Crossings will be permitted on the rail grade once sub-ballast is in place.

.2 The use of specialized equipment or hand methods will be considered incidental to the Work.

3.2 Steel

.1 Rail:

.1 The Contractor shall lay rail as specified.

.2 Gauge of track must be laid to be 1435.1 mm with maximum tolerance + 3mm. Gauge of track after laying must be uniform.

.3 Rails will be laid with staggered joints; the stagger between joints in opposite rails will not be less than 3658 mm except when otherwise authorized by the Contract Administrator.

.4 Cutting and drilling of rail shall be performed using rail saws and rail drilling equipment. Under no conditions shall welding equipment be used to cut rail or cut holes in rail.

.5 On completion of the rail laying, the track must be surfaced and lined if necessary, as soon as possible, to avoid damage to the rail.

.6 The Contractor will line all trackage conforming to the line established by the Contract Administrator with a tolerance of ±13 mm.

.2 Number 9 Turnout:

.1 The turnout must be installed in accordance with accepted Standard Practice and the standard plan contained in the AREMA Portfolio of Track Plans.

.2 Supply and installation of a switch point guard is required.

.3 Turnout stockrail must be horizontally bent as shown on the standard plan by an approved type of rail bender.

.4 Switch points must fit snugly against the stock rails for the entire length of the planning.

.5 Switches, frogs and guard rails must be fully bolted. All bolts must be provided with a spring washer or cotter pin, and must be kept tight.

.6 The distance between the gauge side of a frog and the bearing side of the guardrail must be maintained at 1387 mm. If the gauge of track is increased the flangeway at the guard rail must be increased by the same amount.

.7 Frog guard rails must be fully spiked inside and outside.

.8 The top surface of the switch points shall be installed 6 mm higher than the stock rail. Switch points must be installed with the proper thimble at the heel casting.

.9 Switch point and guard rail faces should be lubricated.

.10 Line, surface and gauge through turnouts must be accurately maintained. The Contractor will line all turnouts with a tolerance of ±13 mm.

.11 A detailed inspection of all turnouts shall be made and deficiencies rectified.

.3 Switch Stands:

.1 Switch rod bolts, and connecting rod bolts, except the bolt under the switch stand, must be installed with the nut on the upper side to permit ready inspection of the cotter pin. The connecting rod bolt under the switch stand must be installed with the head on the upper side. All connecting and switch rod bolts must be installed with cotter pins. Switch stands must be fully spiked, bolted, or lagged down.

.2 Switch stands, switch plates, connecting rod bolts and spring frogs must be properly lubricated after assembly.

.3 Targets and locks installed.

.4 Splice Bars:

.1 Partly worn splice bars may be used. Splice bars shall be toeless and must be applied before the rail is spiked.

.2 Rail joints must be fully bolted and the bolts tightened to the proper torque. When installed, the fishing surfaces of rail joints must be lubricated with grease and the threads of bolts lubricated with oil. All joints, except insulated joints, must have their fishing surfaces lubricated with grease.

.3 New track bolts and washers are to be supplied. Install bolts with alternate nuts on the inside of the track. Strike both bars with a sledgehammer during the tightening process to help seat the bars properly. Do a final re-tightening of the two middle bolts.

.4 Bolts in the rail joints shall be tightened in the following sequence:

.1 The two bolts at the centre of the bar

.2 The second bolt from the end of each rail

.3 The third bolt from the end of each rail

.5 Bolts must be torqued to the following specification:

Bolt Diameter	Torque (N-m)
25	750

.6 An approved lubricant will be applied at the joints.

.7 Fibre or hardwood shims must be used to obtain proper expansion space. Expansion shims must not be removed until the rail is properly spiked, bolts tightened and rail anchors applied. The required expansion space will be determined by the Contract Administrator at the time of construction.

.5 Tie Plates:

.1 All tracks and turnouts shall be tie plated with partly worn double shouldered tie plates.

.2 Tie plates that are bent, broken, or badly corroded must not be used.

.3 Use two plates per tie on tracks and follow standard plan layouts for turnout tie plates.

.4 Tie plates must be installed so that:

.1 The cant of the rail is inward

.2 The tie plates are centred on the tie

.3 The outside shoulder of the tie plate has a full bearing against the base of the rail

.4 No portion of the shoulder at the tie plate will be under the base of the rail

.5 The plates provide a flat, uniform bearing on the tie

.5 Tie plates must be installed in continuous stretches.

.6 Tie plates having different slopes on the rail seat must not be mixed together in the same stretch of track. Tie plates must have a cant of 1:20.

.6 Rail Anchors:

.1 Anchors applied to any one tie should be of the same type.

.2 To avoid tie skewing, rail anchors must be installed in the same direction against the same tie on the opposite rail.

.3 Rail anchors must not be applied where they are inaccessible for visual inspection.

.4 Sufficient rail anchors shall be applied through both tracks of turnouts, and on each side of turnouts to prevent rails from moving sufficiently to disturb location of switch points or frogs. The number and distribution of anchors to be applied will be as follows:

Application	Requirement
Track	4 boxed anchors every second tie
Turnouts	8 anchors every second switch tie or as shown on the standard plans or as directed by the Contract Administrator, including the switch point area using anchors which will not interfere with the points

.5 When installing rail anchors ensure the base of the rail is reasonably clean or it will not accept the anchor.

.6 Anchors must be applied so as to have full bearing against the tie or tie plate. Before applying anchors which bear against the tie plate, the tie plate should be properly placed and spiked.

.7 Anchors should be applied on the gauge side of the rail.

.8 Care must be taken when applying rail anchors to ensue that they are not over driven. They must be applied and removed with the proper tools. When they are applied by machine, the machine must be properly adjusted.

.7 Spikes

.1 Before spikes are driven, ties should be properly spaced and square to the rail.

.2 Tie plates must be centred on the tie and provide a full bearing with the tie.

.3 Uniform track gauge must be maintained when spiking, and must be checked by use of a standard track gauge.

.4 The number of spikes to be used shall be as follows:

Application	Requirement
Tangent and curved track	2 spikes per rail, 4 per tie
Special trackwork frogs, switches, frog guard rails, etc	fully spiked in all plate holes provided except where twin tie plates are used where one spike per plate end shall be used

.5 When 2 spikes per rail, 4 per tie are used, they must, where possible, be staggered so that the field side spikes are on the same side of the same tie and the gauge side spikes are on the other side of the same tie.

.6 When laying rail, spikes must not be driven until splice bars have been bolted in place.

.7 When spiking, care must be taken not to strike the rail, fastenings, or signal appliances with the spiking tool.

.8 Spikes must not be driven against the end of splice bars and must not be driven in the slots of slotted splice bars.

.9 Spikes may be driven by use of a Standard Spike Maul or by machine but in either case:

.1 Spikes must be driven with the head pointing to the rail.

.2 Spikes must be started and driven vertically and square to provide a full bearing against the edge of the base of rail.

.3 Spikes must not be driven to contact the top of the base of the rail. They should be so driven as to allow not more than 4.76 mm clearance between the underside of the head of the spike and the top of the base of rail. Properly adjusted stops must be used on power operated spiking machines.

.4 Spikes must be driven into sound wood.

3.3 Wood

.1 Track Ties:

.1 The Contractor must install new No. 2 softwood treated ties at right angles to the rail. Ties shall be spaced at 2980/mile or at 21 1/4" centre to centre for the siding.

.2 On each side of each grade beam for each entrance to the Railcar Shelter the tie configuration shall be as follows, starting at the grade beam and working away:

.1 Two 14’ ties, two 12’ ties, two 10’ ties, and finally transitioning back to 8’ ties

.3 Treated ties must not be handled with a pick, shovel or other tool that may cause damage to the tie. Ties must not be allowed to become centre bound. Track ties must be laid with the heart side facing down.

.4 The end of the track ties should be lined true on the south side of the entire length of the track.

.5 When ties are respiked, the spike holes must be plugged. Where rail is re-laid and ties not replaced, ties must be adzed a minimum amount to give uniform bearing for the tie plates. All adzed surfaces of ties must be coated with an approved preservative.

.6 All ties installed on existing track must be thoroughly tamped and spiked before the close of the day.

.2 Switch Ties:

.1 The requirements of Clause 3.2.1 Track Ties shall apply to switch ties, except gauge, spacing, and the layout must be in accordance with standard plans.

.2 Turnout ties must be firmly tamped for 400 mm on either side of the Mainline and Turnout rails. Head block ties must be firmly tamped as above with the voids filled on the remainder of the tie. Ties must be installed using spacing straps and lag screws.

3.4 Crush Rock Ballast

.1 The Contractor will place the ballast on top of the skeleton track and lift the track to top of ballast.

.2 The Contractor shall place and distribute the ballast in sufficient quantities on trackage and turnouts to achieve the required lift, as determined by the grade of the stakes, and to conform to the ballast sections as shown on the drawings.

.3 The Contractor is cautioned that damage caused by his equipment to track and turnouts during the distribution of ballast will be repaired by the Contractor at his expense.

.4 The Contractor will raise all trackage and turnouts with the ballast to provide a minimum depth of 350 mm from the top of the tie on all trackage and turnouts to top of sub ballast or to such depth as shall be directed by the Contract Administrator. Ballast shall be laid in lifts, not exceeding 150 mm in thickness.

.5 Ballast shall be well packed or tamped with tamping machines or other approved mechanical tamping equipment as directed from a point 400mm inside each rail for 2440 mm ties, on both sides of the ties to the end of the ties. Tamping will not be permitted at the centre of the tie between the above stated limits. The centre shall be tamped simultaneously and tamping inside and outside of the rail shall be done at the same time. Turnout ties are to be firmly tamped for 400 mm on either side of the mainline and turnout rails. The areas under the frog, guard rails and heel castings must be hand tamped with bars or mechanical hand tampers. Hand tamping will be permitted only for minor tamping work.

.6 The Contractor shall trim the ballast to allow for 300 mm of shoulder and two (2) horizontal to one (1) vertical side slopes. The Contractor will dispose of any surplus ballast after trimming the ballast section as directed by and to the satisfaction of the Contract Administrator.

3.5 Sub-ballast

.1 The Contractor shall spread and blade the sub-ballast material to form layers conforming to the required cross section and grade as shown on the drawings. The sub-ballast shall be placed in 150 mm layers. Each layer shall be compacted to its full width by rolling with a vibratory roller to a minimum of 95% of the maximum dry density as determined by the Standard Proctor Compaction Test (ASTM D698, latest edition). The vibratory roller shall meet the following minimum requirements:

.1 Vibratory force: 4500 lbs per cycle per foot width (65.8 kN per m width)

.2 Vibratory frequency: 1600 cycles per minute.

.2 Rolling shall continue until a satisfactory compacted grade is obtained. In general, a minimum of four complete passes by the roller shall be given. The Contractor shall maintain the sub-ballast layer in a clean condition, free-draining and unfouled by the addition of other material until final acceptance of the work. Any portion of the sub-ballast layer which becomes fouled shall be replaced by the Contractor at his expense.

3.6 Excavation and Track Disposal

.1 The material excavated from the existing roadbed shall be removed and hauled to an existing disposal site, located just west of the DBPS.

.2 The 60 lb and 85 lb rail and other track material shall be piled neatly adjacent to the railway siding, at a location designated by the Contract Administrator. This material will then be picked up by GWWD railway personnel. All ties from retired track are to be disposed of by the Contractor offsite in an approved and environmentally responsible manner.

3.7 Subgrade

.1 Subgrade shall be constructed in accordance with City of Winnipeg Standard Construction Specification CW3170. The subgrade in which the new spur line will be installed shall be compacted in accordance with CW 3170.

.2 Measurement and payment clauses of CW3170-R3 shall not apply.

.3 All topsoil and organic growth within the limits of embankment construction shall be excavated and disposed of as directed by the Contract Administrator.

.4 Embankments shall be constructed from suitable clay materials from the building excavation. This clay is located on the west side of DBPS.

.5 A woven geotextile that meets the approved products list as specified in CW3130 shall be utilized as shown on the drawings.

END OF SECTION

PILE FOUNDATIONS, GENERAL

1. GENERAL

1.1 Work Included

.1 Supply, pick-up, delivery, and installation of precast concrete piles.

1.2 Storage, Handling, and Installation

.1 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes from point of pick-up and during storage and handling. Install piles to stated driving tolerances.

.2 The Contract Administrator shall be the sole judge of the acceptability of supplied piles.

.3 Replace rejected piles to satisfaction of Contract Administrator. Causes for pile rejection are as follows:

.1 Out of fabrication tolerances at time of installation.

.2 Cracked, spalled, or broken piles.

.3 Out of stated driving tolerances.

1.3 Geotechnical Information

.1 Refer to Specification E2 for a list of test hole logs and reports available associated with the Site.

.2 Notify Contract Administrator in writing if subsurface conditions at Site differ materially from those indicated and await further instructions from Contract Administrator.

2. PRODUCTS

2.1 Materials

.1 Piles shall be fabricated and supplied as specified in Section 02468 – Precast Concrete Piles.

.2 Piles shall be fabricated full length piles without cutting and splicing requirements. Contractor shall provide equipment to handle full length piles.

.3 If pile extensions are required and allowed by the Contract Administrator, the pile extensions shall be constructed in accordance with the details shown on the Drawings.

3. EXECUTION

3.1 Delivery, Storage, and Handling

.1 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during delivery, storage, and handling.

3.2 Equipment

.1 Prior to the commencement of pile installation, submit details of equipment for installation of piles to Contract Administrator for review.

.2 Hammer:

.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 Hammers with proven performance in local conditions for piles of the same size specified in the Contract Documents will be accepted for use on this Work. For other hammers the driveability analysis as outlined in the following paragraphs shall be submitted to the Contract Administrator for review prior to driving piles.

.3 Hammers to be selected on the basis of driveability analysis using wave equation theory, performed to show that piles can be driven to levels indicated.

.4 The driveability analysis shall include, but not be limited to, the following: hammer, cushion, and capblock details; static soil parameters; quake and damping factors, total soil resistance, blow count, pile stresses, and energy throughput at representative penetrations.

.5 Driveability analysis shall be submitted to the Contract Administrator for review of the hammer or hammers.

.6 When required criteria cannot be achieved with the proposed hammer, use larger hammer and take other measures as required.

.7 Drop hammers are not permitted.

.3 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.

.2 Length: provide length of leads so that use of a follower is unnecessary.

.3 Swing leads: firmly guy top and bottom to hold pile in position during driving operation.

.4 Followers:

.1 When permitted, provide followers of such size, shape, length, and mass to permit driving pile in desired location to required depth and resistance.

.2 Provide followers with socket or hood carefully fitted to top of pile to minimize loss of energy and prevent damage to pile.

3.3 Preparation

.1 Ensure that ground conditions at pile locations are adequate to support pile driving operation and load testing operation. Make provision for access and support of piling equipment during performance of work.

.2 Pre-bore with a 400 mm diameter auger to a depth of 224.600 unless authorized otherwise by the Contract Administrator in writing.

3.4 Field Measurement

.1 Contractor shall cooperate with the Contract Administrator and shall allow access during the pile installation operations so that all the field measurements can be performed expeditiously.

.2 Contractor shall comply with all Manitoba Workplace Safety and Health Regulations. Including all necessary protection for the Contract Administer and the designate pile Inspector to ensure protection of these personnel during pile installation.

3.5 Driving

.1 Drive precast piles only when concrete has attained strength of 35 MPa as determined by related concrete compression testing in accordance with CAN/CSA A23.2-00. Use driving caps and cushions to protect piles. Reinforce pile heads as required by Contract Administrator. Piles with damaged heads as determined by Contract Administrator will be rejected.

.2 Hold piles securely and accurately in position while driving.

.3 Deliver hammer blows along axis of pile.

.4 Drive piles to practical refusal, as outlined in the geotechnical information. Blow count requirements shall be determined by the Contract Administrator. If followers are used, established criteria for refusal will be increased by 50%.

.5 When driving piles, adjust hammer as required to deliver reduced impact, so that reflected tensile stress in pile does not exceed allowable.

.6 Do not drive piles within 10 m of masonry or concrete that has been in place less than seven (7) Calendar Days. Do not drive piles within 30 m of masonry or concrete that has been in place less than one (1) Calendar Day.

.7 Re-strike already driven piles lifted from original set during driving of adjacent piles to confirm and assure set. Maximum allowable uplift of piles from original set is 3 mm. The Contractor should expect the influence of uplift from driving adjacent piles to be up to 16 m and that it may be necessary to re-strike piles more than once until minimum acceptable uplift of 3 mm is achieved.

.8 Remove loose and displaced material from around piles after completion of driving, and leave clean, solid surfaces to receive foundation concrete.

.9 Cut off piles neatly and squarely at elevation ranges as indicated on the Drawings. Final cut off elevations will be confirmed during construction. Provide sufficient length above cut off elevation so that the part damaged during driving is cut off. Do not cut tendons or other reinforcement which will be used to tie supported structure above to pile. A minimum of 450 mm of strands shall remain for this purpose. The cut off surface of the piles shall be mechanically chipped to expose sound concrete.

.10 Remove cut off lengths from site on completion of work.

3.6 Design Load Capacity

.1 Allowable design load capacity of piles at specified loads is:

.1 400 mm diameter hex - 800 kN

.2 Installation of each pile will be subject to the review of the Contract Administrator. Contract Administrator will be the sole judge of acceptability of each pile with respect to final driving resistance, depth of penetration, or other criteria used to determine load capacity. Contractor shall allow Contract Administrator to review final driving of all piles prior to removal of pile driving rig from Site.

3.7 Driving Tolerances

.1 Pile heads shall be within ± 50 mm of locations as indicated.

.2 Piles shall not to be more than 2% of length out of vertical alignment.

3.8 Obstructions

.1 Where obstruction is encountered that causes sudden unexpected change in penetration resistance or deviation from specified tolerances, proceed as directed by the Contract Administrator.

3.9 Repair/Restoration

.1 The Contract Administrator may require one (1) or more of the following remedial measures:

.1 Remove rejected pile and replace with a new, and if necessary, a longer pile

.2 Remove rejected piles, fill holes, and replace with new piles

.3 Leave rejected piles in place and cut off as directed by Contract Administrator

.4 Leave rejected pile in place, place adjacent pile(s), and modify pile cap as directed by Contract Administrator

.2 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

3.10 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 Undertake review of all adjacent infrastructure with the Contract Administrator complete with a photographic record sufficient to establish pre-driving conditions of the existing adjacent infrastructure.

.4 Protection for pile strand ends:

.1 Highly visible protection safety caps shall be installed for all pile reinforcing strand ends immediately following strand exposure operations. One (1) protection cap may be used for each pile by grouping and securely tying the strands.

.2 The protection caps shall be highly visible and shall be made secure so that accidental contact will not easily dislodge the caps. Dislodged caps shall be re-installed immediately.

.3 Pile reinforcing strands shall be protected from severe bending. Kinked or broken strands shall be repaired to the satisfaction of the Contract Administrator.

END OF SECTION

PRECAST CONCRETE PILES

1. GENERAL

1.1 Work Included

.1 Fabrication, storage, and loading of 400 mm diameter precast concrete piles.

1.2 References

.1 CSA:

.1 CAN/CSA-A23.1-00/A23.2-00, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.2 CSA A23.4, Precast Concrete – Materials and Construction.

.3 CAN/CSA-A3000, Cementitious Materials Compendium (consists of A3001, A3002, A3003, A3004, and A3005).

.2 ASTM:

.1 ASTM A416/A416M, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

.2 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.

1.3 Shop Drawings

.1 Submit Shop Drawings in accordance with Section 01300 – Submittals.

.2 Each drawing submitted shall bear the signature and stamp of a qualified Professional Engineer registered in the Province of Manitoba.

.3 Indicate the following items:

.1 Lifting point details and locations

.2 Storage support point locations

.3 Mechanical pile splice details complete with calculations

.4 Rock points

.5 Concrete strength

.6 Reinforcing details

.7 Type and grade of steel

1.4 Certificates

.1 Piles delivered to the Site to be certified by Manufacturer that each batch of piles to have strength of 35 MPa at 28 Days.

1.5 Review and Monitoring

.1 Provide free access to all portions of Work and cooperate with testing and inspection firm retained and paid by the City.

2. PRODUCTS

2.1 Materials

.1 Concrete mixes and materials: to CSA-A23.1-00 and CSA-A23.4.

.2 Reinforcing steel: to CAN/CSA-G30.18.

.3 Cold-drawn steel wire for concrete reinforcement: to ASTM A416/A416M.

.4 Spiral reinforcing: 6 mm diameter hot-rolled rod conforming to Chemical Composition Specification C1008, minimum yield strength 250 MPa.

.5 Supply or fabricate full length piles as indicated and provide equipment to handle full length piles without cutting and splicing.

2.2 Concrete Mixes

.1 Proportion normal density concrete in accordance with CSA-A23.1-00 to give following properties:

.1 Class of exposure: S-1

.2 Cement: Type 50 (Type HS) Portland Cement in accordance with CAN/CSA-A3000

.3 Minimum compressive strength at 28 days: 35 MPa

.4 Maximum water to cementitious material ratio: 0.34

.5 Nominal size of coarse aggregate: 19 mm maximum

.6 Air content: 3 to 6%, to ASTM C260

.7 Chemical admixtures: in accordance with CAN/CSA-A3000

.8 Pozzolanic mineral admixtures: in accordance with CAN/CSA-A3000

3. EXECUTION

3.1 Fabrication

.1 Fabricate precast concrete piles to lengths as specified.

.2 Fabricate precast concrete piles with solid cross section.

.3 Fabricate piles to following tolerances:

.1 Length: ± 3 mm/m of length

.2 Cross section: - 5 to + 10 mm

.3 Deviation from straight line: not more than 3 mm/m of length and not more than 10 mm in full length

.4 Deviation of reinforcing cage from true position: 10 mm

.5 Location of reinforcing steel main reinforcing cover: - 3 to + 5 mm; spiral: 10 mm

.6 Pile head: 10 mm/m from true right angle plane; surface irregularities 3 mm

.7 Strand projection: strands shall be cut off flush or slightly below pile head surface for driving

.4 Prestress piles under the direction of an experienced and competent supervisor. All personnel operating the stressing equipment shall have been trained in its use.

.5 De-tension in a manner to keep eccentricity to a minimum.

3.2 Handling, Storage, and Delivery

.1 Inspection of the fabricated product upon shipment and certification that the product is free from any damage or defects.

.2 Replace damaged piles to satisfaction of Contract Administrator.

.3 Protect piles from damage due to excessive bending stresses, impact, abrasion, or other causes during storage and handling.

END OF SECTION

CONCRETE ENCASED DUCT BANKS AND UTILITY VAULTS

1. GENERAL

1.1 Work Included

.1 Supply installation of concrete encased duct banks and precast concrete utility vaults for site electrical services.

1.2 References

.1 ASTM D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber

.2 ASTM A185, Welded Steel Wire Fabric for Concrete Reinforcement

.3 CAN/CSA-A3000, Cementitious Materials Compendium

.4 CAN/CSA-A23.1-00/A23.2-00, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete

.5 CSA G30.18, Billet Steel Bars for Concrete Reinforcement

.6 CSA C22.2 No. 211-1, Rigid Types EB1 and DB2/ES2 PVC Conduit

.7 American Standards for Testing and Materials: ASTM A48 - Grey Iron Castings

.8 CAN/CSA A82.1 - Burned Clay Brick (Solid Masonry Units made from Clay or Shale)

.9 CAN/CSA C83 - Communication and Power Line Hardware

.10 CAN3-C22.3 #7 - Underground Systems

1.3 Shop Drawings

.1 Submit Shop Drawings for precast concrete vaults, reinforcing for duct banks, floor drain, back-water valve, trap, and cable racks in accordance with Section 01300 – Submittals.

2. PRODUCTS

2.1 PVC Ducts

.1 PVC ducts, type DB2, encased in reinforced concrete, size as indicated on Drawings.

2.2 PVC Duct Fittings.

.1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors, spacers as required to ensure complete installation.

.2 Expansion joints.

.3 Rigid PVC 5 degree angle couplings.

.4 Rigid PVC 1.5 m radius bend fittings.

2.3 Precast Concrete Utility Vaults

.1 Pre-cast concrete manholes and auxiliary sections fabricated in steel forms

.2 Aggregates: to CAN/CSA-A23.1-00/A23.2-00

.3 Portland cement: to CAN/CSA-A3000

.4 Steel welded wire fabric mesh reinforcing: to ASTM A185

.5 Steel reinforcing bars: to CAN/CSA-G30.18

.6 Neoprene gasket seals between manhole sections: to ASTM D1056

.7 Nominal inside dimensions: as indicated in schedule

.8 Barrel/neck: 1200 mm inside diameter, height as required

.9 Sump pit: 300 x 300 x 125 mm

.10 Slab top complete with cast iron manhole frame and cover

.11 Cover size: 900 mm inside diameter minimum

.12 Uplift drain holes: 2-75 mm diameter holes each side 150 mm from top of floor located at third points.

.13 Hole in floor for installation of ground rod.

.14 Acceptable product: Vault Con-Force Type 108

2.4 Grounding

.1 In accordance with Section 16160 – Primary Grounding for Duct Bank, Manhole, and Cable Rack Grounding.

2.5 Cable Racks

.1 Cable racks and supports manufactured from ASTM A-36 steel and hot dipped galvanized per ASTM A-123 and A-153.

.2 12 x 100 mm galvanized steel inserts for rack mounting.

2.6 Cable Pulling Equipment

.1 Pulling iron: galvanized steel rods, size and shape as indicated, integrally cast in concrete.

.2 Pull rope: 6 mm stranded nylon, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.7 Miscellaneous Materials

.1 Cast-in-place concrete shall conform to CSA-A23.1-00 and Section 03300 – Cast-In-Place Concrete, exposure Class S1.

.2 Reinforcing steel for cast-in-place concrete shall conform to Section 03200 – Reinforcing Steel.

.3 Drain pipe shall be PVC SDR 35 conforming to City of Winnipeg Standard Construction specifications.

.4 75 mm floor drain fittings consisting of floor drain, back water valve, and trap.

.5 Manhole frames and covers: cast ferrous alloy frames and covers shall conform to ASTM A48, Class No. 30 C. Acceptable product: Titan Foundry TF-114-F9 frame with TF-114-CH lid.

.6 Waterproofing material shall be emulsified asphalt, anionic slow-setting type.

.7 Granular material for bedding and backfill in accordance with Section 02223 – Excavation and Backfill for Structures.

.8 Concrete cable markers: 100 x 600 x 100 mm, with words: “cable”, “joint” or “conduit” impressed in the top surface, with arrows to indicate change in direction of duct runs.

3. EXECUTION

3.1 Installation General

.1 Install underground duct banks including formwork and utility vaults.

.2 Install duct banks and utility vault on undisturbed soil or on well-compacted granular fill not less than 100 mm thick, compacted to 95% Standard Proctor dry density.

.3 Open trench completely between utility vaults to be connected before duct banks are placed and ensure that no obstructions will necessitate change in grade of duct banks.

.4 Install duct banks at elevations and with slope as indicated and minimum slope of 1 to 400. Duct runs shall be graded to drain towards one or both terminal points of each duct run and graded away from building or structure entrances.

.5 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.

.6 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts as indicated. Stagger joints in adjacent layers at least 150 mm and make joints watertight.

.7 Install 4/0 ground conductors as indicated on Drawings.

.8 Make transpositions, offsets, and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.

.9 Use bell ends at duct terminations in vaults, buildings, or structures.

.10 Conduit penetrations into buildings shall be sealed with Roxtek RS seals complete with acid proof stainless steel rings, unless indicated to be the draining ends.

.11 Cut, ream, and taper end of ducts in field in accordance with Manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.12 Allow concrete to attain 75% of its specified strength before backfilling.

.13 Use anchors, ties, and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

.14 Clean ducts before placing. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.15 Immediately after placing of concrete, pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth, and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling in cables.

.16 Place concrete thoroughly filling space under and around ducts, vibrate or rod as required to fill all voids.

.17 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 Inspection

.1 Construction review of duct will be carried out by Contract Administrator prior to placing. Placement of concrete and duct cleanout to be done with Contract Administrator present.

3.3 Installation of Utility Vaults

.1 Earth Excavation

.1 Earth shall be excavated to accommodate a minimum 150 mm thick granular base in accordance with Section 02223 – Excavation and Backfilling for Structures, using Type 2 fill compacted to 95% Standard Proctor density.

.2 Earth shall be excavated for drain pipes as indicated on the Drawings.

.2 Installation of Utility Vaults:

.1 Utility Vaults shall be oriented such that ducts or duct bank entries will have an angle of 90 degrees between maintenance hole wall and the axis of the ducts or duct bank. If this is not possible, the angle shall not be less than 45 degrees.

.2 All sharp projections and edges of concrete shall be ground smooth prior to installation of wiring baffles or mechanical supports for cables.

.3 Install precast concrete vault so as to bring cover 40 mm above grade in unpaved areas, using riser rings as required.

.4 Seal and waterproof precast sections in accordance with Manufacturer's instructions.

.5 All liquid and debris shall be cleaned from the units upon completion and prior to the acceptance of work by the Contract Administrator.

.6 The precast unit shall be installed plumb, true to alignment and grade, and firmly bedded on the granular base.

.7 During installation, the duct entry holes shall be oriented in the required direction. The enlarging of duct entry holes is prohibited.

.8 Install drain fittings and piping. Extend drain piping to 3 m beyond vault, direction of drain will be provided by Contract Administrator.

.9 Make vault to duct connections as indicated on Drawings.

.10 Install 19 x 3000 mm copper clad ground rod through hole in vault floor.

.11 Install 4/0 bare copper conductor around interior perimeter floor.

.12 Bond each cable rack with two (2) 4/0 bare copper conductors.

.13 Connect ground rod, perimeter conductor, duct bank ground conductors and cable rack ground together using cadweld connections.

.14 Install ladder rungs, anchor bolts, pulling irons, and cable racks as indicated.

.15 Install manhole riser and cover.

.3 Grounding:

.1 Vault frames or covers shall be connected to the system ground wire. Where frames are not present, 1.5 m of #6 AWG ground wire shall be connected between the system ground wire and the metallic cover and at least 1.5 m of wire shall be left loose for cover removal.

.4 Frames and Covers:

.1 Cast iron frames for vault access covers shall be adjusted to the required elevation and crossfall. Mortar mix shall be used to smooth out any edges protruding above the concrete envelope.

.2 Cast iron covers for vault access shall be secured as indicated on the Drawings.

.3 Covers for precast concrete units shall be firmly seated conforming to the Manufacturer's instructions.

.5 Backfill:

.1 Backfill for units installed within roadbeds or in sidewalks shall be carried out with clean granular material compacted to minimum 95% Standard Proctor density.

.2 Backfill for units installed in grassed areas shall be native backfill placed and compacted to minimum 95% Standard Proctor density.

.3 Install granular drainage material in accordance with Section 02223 – Excavation and Backfilling for Structures, around the vault perimeter with a cross section 300 mm above the uplift drain holes to the underside of vault floor and 600 mm wide. Wrap drainage material in filter cloth in accordance with Section 02223.

END OF SECTION

PIPE CULVERTS

1. GENERAL

.1 Culvert Installation shall for the GWWD Railway embankment shall be in accordance with Specification CW 3610, "Installation of Culverts" except where noted, revised, or supplemented in this Specification.

2. PRODUCTS

2.1 General

.1 The Contractor shall supply railway ballast in accordance with the requirements hereinafter specified.

.2 Railway ballast shall be composed of hard, strong and durable particles, clean and free from injurious amounts of deleterious substances and conforming to the following requirements of this Specification

.1 The limits for deleterious substances are as follows:

.1	Soft and friable pieces	5.0%
.2	Material finer than No. 200 Sieve	2.0%
.3	Clay lumps	0.5%

.3 The percentage of wear shall be less than 32%, as determined by the LA Abrasion Test, ASTM Designation C131.

.4 The soundness loss shall be less than 13.0%, as determined by the magnesium sulphate soundness test for coarse aggregate, ASTM Designation C88.

.5 The railway ballast shall contain less than 25% by mass of flat pieces. In case of dispute, the test method "Determination of Flakiness Index", British Standard B12, shall be used.

.6 The minimum bulk specific gravity shall be 2.60, ASTM Designation C127.

.7 At least 60% of the railway ballast shall have two or more fractured faces.

.8 Railway ballast shall conform to the following gradation in accordance with ASTM Designation C136 and C117:

Sieve Opening Size	Permissible Range (% by Weight Passing)
2 inch	100
1½ inch	90 – 100
1 inch	20 – 55
¾ inch	0 – 15
¾ inch	0 – 5
No. 200	0 - 2

3. EXECUTION

3.1 General

.1 The City of Winnipeg will be responsible for removing and re-installing the ties and rail. At least two (2) days notice shall be given to the GWWD (City of Winnipeg). The Contractor shall notify the Contractor Administrator.

.2 The Contractor shall complete the excavating, culvert installation, and backfilling within a twenty four (24) hour period following removal of the ties and rail.

.3 The Contractor shall excavate to the lines and grades as specified in the Contract Documents and install the culvert according to CW3610.

.4 After proper placement and backfill of the culvert the Contractor shall rebuild the subgrade and sub-ballast structure to match the existing.

.5 The sub-ballast layer shall be a minimum of 300 mm in thickness. The Contractor shall utilize a 50 mm down crushed limestone material meeting CW3110. It shall be placed and compacted according to CW3110.

.6 The ballast material layer shall be a minimum of 300 mm in thickness. The Contractor shall supply this material and place in a stockpile location as approved by the Contract Administrator. The material will then be utilized by the GWWD when the ties and rails are re-installed.

END OF SECTION