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APPENDICES

SCHEDULE 15-2
DESIGN AND CONSTRUCTION REQUIREMENTS

PART 2
CIVIL AND GUIDEWAY

ARTICLE 1 INTRODUCTION

1.1 General

(a) The Existing Confederation Line is a dual Track system from Tunney's Pasture Station to Blair Station.

(b) The Confederation Line shall be extended west from Tunney's Pasture Station to Lincoln Fields Station. From Lincoln Fields Station, separate branches will extend to Moodie Station and to Baseline Station. New Stations will be located at Westboro Station, Dominion Station, Cleary Station, New Orchard Station, Lincoln Fields Station, Queensview Station, Pinecrest Station, Bayshore Station, Iris Station and Baseline Station.

(c) The Confederation Line shall be extended east from Blair Station to a new Trim Station with Stations also located at Montreal Road Station, Jeanne d'Arc Station, Place d'Orléans Station, and Orléans Boulevard Station.

1.2 General Description of the Guideway and Guideway Requirements

(a) DB Co shall design the Guideway with two Tracks for operation extending:

(i) west from the Existing Confederation Line terminus at Tunney's Pasture to Moodie and Baseline Stations for a total length of approximately 15.3km;

(ii) DB Co shall provide the Systems in accordance with the requirements set out in this Project Agreement and any deviations or variances to the application of the selected standards shall be subject to approval by the City; and,

(iii) east from the Existing Confederation Line terminus at Blair Station to Trim Station for a length of approximately 12.8km.

(b) The Guideway alignment characteristics shall be as follows:

(i) At grade section, within the existing Transitway trench, from Tunney's Pasture Station to Dominion Station with an approximate length of 2.45 km;

(ii) Tunnel section from west of Dominion Station to west of Richmond Road with an approximate length of 3.0 km;

A. The Tunnel section that is constructed within NCC property shall be no more than 10.5m wide (for tangent Track, increased on curves for

superelevation and carbody overhang) from exterior face of permanent Tunnel Structure to exterior face of permanent Tunnel Structure and located within the permanent Lands such that there is at least a 3m permanent buffer on each side of the permanent Tunnel Structure to the permanent Lands property parcel limits.

(iii) At grade section from the West Portal south of Richmond Road through Lincoln Fields Station, where it splits to Baseline Station and to Moodie Station of approximate lengths of 2.7km and 6.1km respectively; includes a 370m tunnel under Connaught Avenue between Lincoln Fields Station and Queensview Station;

(iv) Lincoln Fields Station shall include a 3rd Track as a Pocket Track between the two Mainline Tracks;

(v) The Guideway to Moodie Station shall cross over the Guideway to Baseline Station on a continuous elevated structure crossing over the SB Guideway to Baseline Station, over Pinecrest Creek and over a MUP;

(vi) Baseline Station is a Terminal Station located below ground in the existing Structure and shall include:

A. Two storage Tracks located in front of the Station Platform of sufficient length to accommodate two Trains of maximum length plus a safety buffer distance on each end in each Track, coordinated with the CBTC system designer.

i. At least one side of each Vehicle parked in the storage Track shall be accessible from a paved surface of adequate width. Space shall be provided for a short Operator platform, to allow the Operator to transfer from one car to the other car, with a safety fence separating the Operator from the mainline.

(vii) At grade section from Blair Station to the elevated section (Flyover Structure) located just east of the existing Transitway overpass over OR174 of an approximate length of 0.8 km including;

A. A Pocket Track of sufficient length to accommodate one Train of maximum length plus a safety buffer distance on each end to allow for uninterrupted movement of a Train into the storage Track (Train shall be able to enter in ATO mode without manual intervention) coordinated with the CBTC system designer. The maximum length Train to be accommodated shall include the future additional 10m long body section in one Vehicle of the trainset.

i. Space shall be provided for a short (10m long minimum) Operator platform with a safety fence separating the Operator from the mainline.

(viii) Elevated Section (Flyover Structure) crossing over the OR174 WB lanes to the OR174 center median of an approximate length of 0.25km; and,

(ix) At grade section located in the OR174 center median from the Flyover Structure to Trim Station for an approximate length of 11.6 km including;

A. Two Tail Tracks beyond Trim Station as follows:

i. The northern Track shall be an approximate length of 130m with OCS terminating 90m beyond the end of the Platform.

ii. The southern Track shall extend at least 50m beyond the Train stop location on the Platform and shall meet the requirements of Clause 2.6(d) of Schedule 15-2, Part 1 – General Requirements.

iii. Measures to prevent Vehicles from travelling beyond the Tail Track and into the at-grade intersection shall be installed.

iv. A secure gated vehicle access to the Tail Track area with a drivable route along one side of the northern Tail Track.

(c) The Guideway shall include components for safe and efficient operation of the system, including but not limited to:

(i) Traction Power;

(ii) OCS;

(iii) Communications and low voltage power duct banks;

(iv) Signal and control Systems;

(v) Drainage systems and SWM;

(vi) Other appurtenances as required by DB Co's design for the safe and efficient operation of the system;

(vii) Track Switch Control.

(d) Lighting shall be provided to the required safety walkway area as per the requirements of NFPA 130.

1.3 Access of Emergency Services Vehicles to the Guideway

(a) All sections of the Guideway shall be designed and constructed with a means of Emergency egress in compliance with the requirements of NFPA 130 via an unobstructed clear width.

(b) DB Co shall provide Emergency egress points along the Guideway that will allow ESP access as per the requirements of NFPA 130. These locations shall be in addition to end of Platform egress points. These points shall be provided with a gated entry through the security fencing of the Guideway where they are located between Stations. A unique identification system shall be developed for the gates in consultation with the City and signage shall be fixed to both sides of each gate for identification purposes.

(c) Emergency vehicles shall be able to travel by a paved route to within 15m of the gated entry point. The route may be by existing Transitway roadway, nearby public roadway allowance, nearby commercial parking lot or public MUP. If the route is more than 90m in length then a turnaround for the Emergency vehicle shall be provided at the gated entry point. A minimum of one turnaround shall be provided at the end of the route if multiple entry points are being accessed from one route. The turnaround shall be designed for a minimum centreline radius of 12m. The turnaround shall be either a circular cul-de-sac or a hammerhead with minimum dimensions of 14m x 14m.

(d) DB Co shall provide an identification scheme for the gates on OR174 that includes a reference to the OR174 mileage marker number.

(e) Access gate locations shall be located to provide Emergency access from both directions of travel on OR174 in alternating fashion along the Guideway.

(f) The use of the existing Queensway Transitway Station Platforms shall be permitted as an emergency access point on south side only. DB Co shall confirm during the design that such an approach is in conformance with NFPA 130.

(g) The guideway shall be fenced or otherwise enclosed for security.

ARTICLE 2 GEOMETRIC DESIGN CRITERIA FOR TRACK ALIGNMENT

2.1 Reference Documents

(a) The design and construction of the alignment work shall comply with the criteria contained within this Article and the Applicable Law, guidelines or practices applicable to the Project, including the following Reference Documents. In the event of a conflict between the criteria, commitments or requirements contained within one document when compared with another, the more stringent shall apply. The Order of Precedence for this portion of the Contract shall be as follows:

(i) The criteria in this Article;

(ii) Transit Cooperative Research Program TCRP Report 155 – Track Design Handbook for Light Rail Transit, 2nd Edition;

(iii) The American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering;

(iv) European (EN) Standards for Railway Applications

(v) OHSA R.S.O. 1990;

(vi) Standard Respecting Railway Clearance - Transport Canada - TC E-05 (1992)

2.2 Use of Minimum or Maximum Criterion

(a) Where specific numbers are given for limitations on alignment elements, such limitations are not targets to be achieved by DB Co, but limits to be avoided. DB Co shall meet or exceed the minimum requirements.

(i) Design for maximum Passenger comfort where no physical restrictions or significant construction cost differences are encountered.

(ii) Design shall meet the operating objectives, without compromising ride quality or taxing the mechanical limits of the Vehicle, and meet the operational performance requirements.

(iii) Minimum and maximum values are determined primarily by the Vehicle design limitations and/or safety considerations, with maximum operating speeds and Passenger comfort as secondary considerations. Minimum and maximum values have potential impacts in terms of maintenance costs, noise, wheel life and Track life. Minimum and maximum values shall only be used where physical restrictions prevent the use of Passenger comfort values. The use of minimum and maximum values shall be justified and documented in a design report, and shall require approval by the City.

2.3 General

(a) DB Co shall provide the Mainline Track, non-revenue Track, including Connecting Track, storage Track, and Yard Track, for maximum operating speed to satisfy the criteria identified in Schedule 15-2, Part 1, Article 3 – Operational Performance Requirements; as dictated by existing topography, permanent physical features, property, and alignment constraints.

(b) DB Co shall ensure that the design and construction for the Confederation Line East Extension and Confederation Line West Extension is integrated with the Existing Confederation Line.

2.4 Horizontal Alignment

(a) DB Co shall design the horizontal Track alignment in accordance with the requirements of Clause 2.2 of this Part 2, and shall be such that all of the SI is contained within the Lands as defined in Schedule 20 – Lands.

(b) DB Co shall design the Mainline Track for an operating speed of 100km/h unless Physical Constraints do not allow, in which case DB Co shall design the Mainline Track so as to maximize the operating speed.

(c) DB Co shall design the LMSF Connecting Track for a speed of no less than 30 km/hr and shall also consider the safety of the geometrics.

(d) DB Co shall provide a tangent horizontal alignment through Station Platform limits for a distance of 25m beyond the end of Platforms. Where a Physical Constraint exists this may be reduced to a minimum of 15m subject to approval from the City, and only if sufficient running clearance between the Revenue Vehicle or Non-Revenue Vehicles, and Platform is achieved. The distance from the end of the Platform to spiral transition curve may be further reduced if site conditions do not provide sufficient length, provided the requirements of Clause 2.7 (a), of this Part 2, at a pass through speed of 30 km/h and clearance requirements for Maintenance Vehicles are considered.

(e) All non-Track related Construction layout shall be related to or dimensioned from the centreline of the EB Track, unless otherwise noted.

2.5 Track Centres

(a) Minimum Tunnel Track centre spacing with a center wall shall be 5.3m on tangent Track, increased on curves for superelevation and carbody overhang.

(b) Ballasted Track centre spacing shall be 4.0m or greater.

(c) Where Physical Constraints are present, Track centre spacing of less than 4.0m on tangent Track, and increased on curves for superelevation and carbody overhang, may be constructed, subject to approval by the City.

2.6 Horizontal Curves

(a) DB Co shall define circular curves by the arc definition of curvature and specified by their radius in metres to three decimal places.

(b) Mainline Track curves shall be designed to maintain the maximum operating speed as dictated by existing topography, permanent physical features, property, and the alignment constraints per Clause 2.7 of this Part 2. The minimum radius used shall be 95m.

(c) DB Co shall provide the LMSF Track with curves of the following radii:

(i) LMSF Connecting Track radii shall be designed to operate with maximum design speed of 30km/h. The minimum radius of curve shall be 55m.

(ii) LMSF Yard Track shall be designed to operate with maximum speed of 15km/h. The minimum radius of curve shall be 55m.

(d) DB Co shall provide a tangent distance between horizontal curves, including reverse curves, for the Mainline Track, Connecting Track and Yard Track as per the following formula where V is speed in km/h and L_T is the length of the tangent:

(i) $L_T=0.57V$;

(ii) the minimum tangent length between curves for Mainline Track and Connecting Track shall be 25 m; and,

(iii) The minimum tangent length between curves for Yard Track shall be 15m.

(e) Compound Curves

(i) Compound curves shall be permitted on the Mainline Track design.

(ii) Circular curves shall be joined by a spiral curve where two or more circular curves will be connected into a compound curve. The superelevation of each circular curve shall be adjusted to ensure that the maximum permissible speeds for all parts of the compound curve are identical, except as indicated below:

A. For Confederation Line East Extension, a compound curve shall be provided approximately 1km east of Blair Station on the flyover

2.7 Spirals

(a) Spiral transition curves shall be used on all mainline and LMSF connection Tracks to connect circular curves to tangents, with the exception that spirals are not required where both actual superelevation is zero and unbalanced superelevation is less than 50mm.

(b) DB Co shall determine the minimum length of a spiral transition curve (Ls) by selecting the following greatest value, based upon the actual superelevation (Ea, mm), unbalanced superelevation (Eu, mm), and design speed (V, km/h):

(i) Ls = Ea V/108;and

(ii) Ls = Eu V/180

Where Ea = actual superelevation in mm

Eu = unbalanced superelevation in mm

V = design speed in km/h

Ls = length of spiral in meters

(iii) The absolute minimum length of spiral shall be 10m.

2.8 Superelevation

(a) Superelevation shall be linearly attained throughout the full length of the spiral curve by raising the rail farthest from the curve centre, while maintaining the top of the inside rail at profile grade.

(b) Superelevation shall be determined by DB Co by applying the following equations:

(i) $Ee = 11.83\ V^2/R$

(ii) $Ea = (V^2/(12.96*R*9.81)-0.0499)*1505$

(iii) Eu=Ee-Ea

where Ee = equilibrium superelevation in mm

Ea = actual or applied superelevation in mm

Eu = unbalanced superelevation in mm

V = design speed in km/h

R = horizontal curve radius in meters

(iv) The Track superelevation shall be adjusted as needed to meet or exceed the following criteria for all Track types:

A. Absolute maximum unbalanced superelevation, Eu of 115mm

B. Desired maximum unbalanced superelevation, Eu of 75mm

C. Absolute maximum actual superelevation, Ea of 150mm

D. Desired maximum actual superelevation, Ea of 100mm

E. Actual superelevation shall be rounded to the nearest 5mm

F. Superelevation, Ea and Eu shall be applied equally or proportionally up to maximum Eu with no Eu until Ea = 13mm.

(c) For Special Trackwork, zero actual superelevation shall be used by DB Co, with a maximum unbalanced superelevation of 75mm at turnouts.

2.9 Vertical Alignment

(a) General

(i) All references to profile in the vertical alignment shall represent the top of the low rail for a given Track.

(ii) DB Co shall provide vertical curves separated by a minimum tangent length of:

A. the greater of either: Lt = 30m or Lt = 0.57V;

B. minimum: Lt = 12m; and,

C. where Lt = minimum vertical tangent length in metres

D. V = design speed in km/h.

(b) Grades

(i) DB Co shall not apply changes in grade or vertical curves within the limits of Station Platforms and future Platforms.

(ii) DB Co shall provide grades through Stations of a minimum grade of 0.5% and a maximum grade of 1.5%. A minimum grade of 0.0% shall be permitted when additional measures to accommodate positive drainage are provided.

(iii) DB Co shall provide the Mainline Track with a maximum tangent grade of 4.0%.

A. Grades between 4.0% and 5.0% shall only be permitted for a maximum distance of 250m, with the following exception:

i. Between the Connaught Tunnel and the Lincoln Fields flyover the maximum distance shall be 350m.

B. Grades between 5.0% and 6.0% shall only be permitted for a maximum distance of 250m and are subject to City approval.

C. Grades of 6% shall only be permitted subject to City approval where physical constraints prohibit lesser grades.

D. Grades of more than 6% shall not be permitted.

E. The maximum grades, stated above, are after compensating for any horizontal curvature.

i. compensation for horizontal curvature:

1 $Gc = G + 0.04\% \times (5729.6/R \times 3.28)$

Where

Gc = compensated gradient to account for horizontal curvature, in percent;

G = grade before adjustment in percent;

R = horizontal curve radius in metres

(iv) Where a continuously ascending or descending profile is composed of a series of vertical tangents of varying grades, DB Co shall provide the alignment such that the weighted average gradient does not exceed 4.0%, with the exception of the Lincoln Fields flyover where the maximum weighted average gradient shall not exceed 4.3%. Calculation of the weighted average gradient shall ignore vertical curves and consider gradients from PVI to PVI.

(v) DB Co shall provide the alignment such that the maximum grade for mainline turnouts is 2.0% with the following exceptions:

A. Lincoln Fields Split Structure: the maximum grade shall be no more than 3.75%; and,

B. Moodie Extension approach to LMSF grade shall be no more than 3%.

(vi) DB Co shall provide Mainline Storage Track and Tail Tracks with a maximum grade of 0.3% with Tail Tracks sloped away from the mainline, or provide means of mitigating potential Vehicle rollaway onto Mainline Track in case of brake failure with the following exception:

A. Blair Pocket Track shall be no more than 2%.

(vii) All Special Trackwork shall be located on constant grades with no vertical curves within the limits of Special Trackwork.

(c) Vertical Curves

(i) DB Co shall provide parabolic vertical curves for all grade changes.

(ii) DB Co shall provide a minimum distance of 15m between Platform limits and any point of vertical curvature.

(iii) Length of vertical curves shall be as long as practicable, but not less than shown below:

A. The minimum length of vertical curve (LVC, m) for mainline and connection tracks shall be determined by the following equations, where A = algebraic difference in grades and V = speed:

i. LVC = 60A; or where Physical Constraints do not allow

1 LVC = 0.005AV2, for crest curves; and,

2 LVC = 0.003AV2, for sag curves.

2.10 Special Trackwork

(a) Alignment

(i) DB Co shall provide the Special Trackwork on tangent Track and on a constant vertical grade.

(ii) DB Co shall provide the alignment such that the minimum horizontal tangent length beyond Special Trackwork located on Mainline Track and Connecting Track shall be 15m.

(iii) A minimum tangent length of 20m shall be inserted between the back to back switch points where the turnout arrangement may entail a reverse curve movement through turnouts.

(iv) Special Trackwork shall not be located within 15m from the end of the Station Platform and shall not be within a Station Platform.

(v) Special Trackwork shall not be located within 50m of the transition between ballasted and direct fixation Track as outlined in the TCRP Light Rail Handbook. DB Co shall provide for special accommodations to mitigate the effects of different Track modulus under various geometric conditions.

(vi) Crossover locations shall be integrated with signaling and OCS system designs.

(vii) The location of all mainline turnouts and crossovers shall be optimized to meet or exceed the operations performance requirements outlined in Schedule 15-2, Part 1, Article 3 – Operational Performance Requirements.

2.11 Other Alignment Requirements

(a) Combined horizontal and vertical curvature shall be avoided. Where this situation is unavoidable, DB Co shall provide justification in its Trackwork design report with reference to alignment safety at the design speed.

2.12 Clearances

(a) Vehicle Clearances

(i) Horizontal clearance dimensions shall always be measured perpendicular to the Track centreline accounting for any superelevation and curvature in the Track.

(ii) DB Co shall account for structure chord lengths, tilt from superelevation, Track type, and outswing and inswing of a Vehicle that occurs along horizontal curves in their horizontal clearance calculations.

(iii) DB Co shall define the Revenue Vehicle clearance envelope as the space occupied by the dynamic envelope, or maximum movement, of the Vehicle as it travels along the Track plus an additional running clearance of 150mm or any other dimension in excess of 150mm deemed pertinent by DB Co's own analysis.

(iv) DB Co shall provide the alignment based on the information of the Vehicle dynamic envelope which is defined in Figure 2-2.1 of this Part 2.

(v) Where a walkway is present:

A. On tangent Track a minimum side clearance of 2500mm from the Track centreline to a curb, railing, fence, wall, OCS Pole or other physical feature shall be maintained on at-grade, elevated, Tunnel and retained cut Guideway Track;

B. On curved Track the minimum side clearance from the Track centreline to a curb, railing, fence, wall, OCS Pole or other physical feature shall be the maximum internal or external dimension for each radius which is defined in Figure 2-2.1 of this Part 2, increased by 885mm.

(vi) Where no walkway is present:

A. On a tangent Track, a minimum side clearance of 1800mm from the Track centreline to a curb, railing, fence, wall, OCS Pole or other physical feature shall be maintained on at-grade, elevated, Tunnel and retained cut Guideway Track.

B. On curved Track, the minimum side clearance from the Track centreline to a curb, railing, fence, wall, OCS Pole or other physical feature shall be the maximum internal or external dimension for each radius which is defined in Figure 2-2.1 of this Part 2, increased by 226mm.

(vii) DB Co shall determine the horizontal clearance distance from the centreline of Track to the finished edge of Station Platform based on the criteria identified in Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria, Revenue Vehicle pass-through speed criteria, and compliance with applicable accessibility standards.

(viii) Vertical clearance dimensions shall always be measured in a vertical plane irrespective of any superelevation or profile grade. When superelevation is present, the top of low rail shall be used as the reference elevation when calculating vertical clearance.

(b) Other Clearance Requirements

(i) Signal and Trackwork equipment mounted on Track slab along the alignment shall be kept clear of the under car clearance envelope of the Vehicle.

(ii) Temporary clearance requirements for construction shall be assessed on an individual basis.

(iii) Vertical clearance to contact wire shall be as described in Figure 2-2.2 of this Part 2.

Figure 2-2.1 – Dynamic Gauge Envelope

[REDACTED]

Figure 2-2.2 –Pantograph Gauge

[REDACTED]

ARTICLE 3 TRACKWORK

3.1 Reference Documents

(a) DB Co shall provide Trackwork, in accordance with the criteria contained in this Article; and all standards, regulations, policies, Applicable Law, guidelines or practices applicable to the Project, including but not limited to each of the following Reference Documents:

(i) APTA Manual of Standards and Recommended Practices for Rail Transit Systems;

(ii) European (EN) Standards For Railway Applications

(iii) AREMA Manual for Railway Engineering;

(iv) International Union of Railways (UIC) ;

(v) ASTM Standards;

(vi) ISO 2631 Mechanical Vibration and Shock;

(vii) NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems;

(viii) TCRP Report 155 – Track Design Handbook for Light Rail Transit, Latest Edition;

(b) In the event of a conflict between the criteria, commitments, or requirements contained within one document when compared with another, the more stringent shall apply.

3.2 Scope of Work

(a) DB Co shall provide all Works related to the complete Construction of Special Trackwork, including the design, supply, installation and testing of Special Trackwork, including all turnouts, crossover components, adjoining Track, fastening components, Track materials, end-of-track devices, wheel/rail friction control devices, and all other Track materials.

(b) DB Co shall be responsible for control and any mitigation which may be a result of wheel-rail noise throughout the system in accordance with Schedule 17 - Environmental Obligations.

3.3 Track Classification

(a) DB Co shall classify Track as follows:

(i) Mainline Track: used for the operation of Revenue Vehicles carrying Passengers and railbound Maintenance Vehicles;

(ii) Tail Track: located at Terminal Stations to provide for potential Vehicle storage;

(iii) Mainline Storage Track/Pocket Track: used to store Revenue Vehicles adjacent to Mainline Track and for potential crossover functionality;

(iv) Yard Track: includes shop Tracks located in maintenance shops, storage Tracks, spur Tracks, and other Tracks required beyond Connecting Tracks within the LMSF;

(v) Connecting Track/Lead Track: links Yard Track to Mainline Track.

3.4 General Requirements

(a) DB Co shall provide Track that is durable for more than or equal to the Design Life identified in Schedule 15-2, Part 1, Article 4 – Design and Construction.

(b) DB Co shall provide Track that is safe, efficient and allows continuous operation under all operating conditions.

(c) DB Co shall provide Track that performs safely and efficiently under all local, site-specific climatic and environmental conditions.

(d) DB Co shall provide Track that allows for expandability and extendibility of the system without major reconstruction.

(e) DB Co shall provide for the coordination of Track with conduits, cabling, duct banks, raceways, wayside equipment, and Track-mounted equipment for associated TPSS, OCS, S&TCS, communications, electrical, and other systems.

(f) DB Co shall submit a Track Design and Construction Test Plan in accordance with Schedule 10 – Review procedure.

(g) Track Gauge and Rail Cant

(i) DB Co shall provide 1435mm Track gauge on tangent Track.

(ii) DB Co shall provide 1:40 cant Trackwork.

(h) DB Co shall set the criteria for total and differential post-construction settlements along the Track bed to satisfy the requirements of Clauses 3.10 through 3.12 of this Part 2.

(i) Track Loading

(i) DB Co shall provide Track to accommodate the vertical, horizontal and longitudinal loading from the Revenue Vehicles and Maintenance Vehicles,

without exceeding permissible stress limits of the elements comprising the Track system or Track subgrade.

(ii) DB Co shall incorporate loading arising from thermal stress within the rail, based on the rail temperature range for local climatic and environmental conditions, into the Track system design, including allowance for heating due to direct sunlight exposure and extreme cold.

(j) Corrosion Control

(i) DB Co shall protect all Track components from corrosion in accordance with the requirements outlined in Schedule 15-2, Part 3, Article 12 - Corrosion Control.

(ii) DB Co shall provide reinforcing steel compliant with structural grounding requirements identified in Schedule 15-2, Part 3, Article 12 - Corrosion Control, and compliant with ACI 318M and AREMA Chapter 8 requirements.

(iii) DB Co shall provide a Track system that is electrically isolated from ground.

(iv) Electrical Continuity of Track

A. DB Co shall ensure rail electrical continuity and rail bonding are in accordance with the requirements identified in Schedule 15 – Output Specifications.

B. DB Co shall ensure that the rails shall be electrically bonded at locations requiring bolted rail joints. All rail shall be CWR meeting AREMA requirements.

C. DB Co shall provide electrical continuity of the Traction Power negative return system at locations requiring insulated joints.

D. DB Co shall provide rail bonding compliant with the standards identified in AREMA Chapter 33 Part 7 and Chapter 4 Section 3.7.

E. DB Co shall employ means to lower the negative return resistance to the TPSS.

F. DB Co shall employ means of protecting rail bonds from ground for rail bonding of embedded Track.

3.5 Track Structure Types

(a) General

(i) DB Co shall provide Track to support and hold the rails in place to the correct alignment, profile, cross level, and Track gauge.

(ii) DB Co shall provide Track fasteners that have Design Life and maintenance requirements integrated with and similar to the Existing Confederation Line.

(iii) DB Co shall provide Track compliant with NFPA 130 requirements for trainways.

(iv) DB Co shall coordinate the placement of Track fastener assemblies and ties with the location of deck or slab steel reinforcement, rail joints, Track-mounted equipment, and wayside equipment.

(v) DB Co shall provide a direct fixation Track system with Track noise and vibration mitigation measures for Tunnel and underground locations where an invert slab exists, compliant with the noise and vibration criteria defined in Schedule 17 – Environmental Obligations.

(vi) DB Co shall provide any of the following permitted Track types for at-grade locations or elevated Guideways,:

A. direct fixation; or,

B. ballasted.

(b) Direct fixation Track

(i) DB Co shall provide direct fixation Track as an open Track form consisting of a resilient, elastic direct fixation Track fastener system anchored into a concrete foundation slab or elevated structure deck.

(ii) Direct fixation Track for Tunnel and underground locations where an invert slab exists:

A. DB Co shall provide Track directly fixed onto a concrete slab with Track noise and vibration mitigation measures.

B. The Track shall be integrated with the Tunnel by DB Co as stated in Schedule 15-2, Part 8, Article 6 - Systems Interface.

C. The Tunnel invert shall act as an interface between the Track and Tunnel structure to provide the following minimum functions:

i. vertically and laterally support the Track system;

ii. provide for Track drainage requirements; and,

iii. provide a safety walkway.

D. DB Co shall provide Track directly fixed onto the box Culvert under West Transitway (SN018231 and SN018232).

(c) Ballasted Track

(i) DB Co shall provide ballasted Track as an open Track form consisting of a resilient, elastic fastening system and precast concrete ties.

(ii) Ballasted Track shall be permitted for use for at-grade locations, provided that:

A. Vehicle clearance envelope for ballasted Track is applied;

B. Guideway fits within prescribed property limits; and,

C. NFPA 130 requirements are satisfied.

(iii) Material Requirements

A. Crushed stone or other material shall conform to AREMA ballast specifications, with evidence of previous approval on a similar or heavier electrified rail system within the last 5 years provided to the City.

B. The particle size requirements shall conform to AREMA requirements in relation to the crushed stone ballast, class number 4A.

C. DB Co shall provide ballast gradation that has sufficient voids to permit water to migrate freely and shall not contact the running rails for mitigation of stray current and loss of shunting or calibration with signal systems. Ballast shall be at least 25mm clear of the rail of any fixation so as to mitigate stray current leakage.

D. DB Co shall provide sub-ballast that is compliant with the requirements of AREMA Chapter 1 Part 2.

(d) Track Transition Area

(i) DB Co shall provide a gradual, uniform change in Track modulus, by means of a Track transition area of sufficient length, at the interface point where two Track structure types abut one another, in compliance with the principles found in AREMA Chapter 8 and Chapter 30 and TCRP Report 155. Track transition area shall extend from the end of the Structure abutment or the end of slab Track, a minimum of 6.0m into the ballasted Track section

3.6 Guard Rail Configurations

(a) Restraining Rail

(i) All Restraining Rail for Track shall be new and shall conform to the associated AREMA or UIC specifications.

(ii) Application:

A. DB Co shall install Restraining Rails along the gauge side of the low rail for all mainline horizontal curves with a radius of 145m or less.

B. Restraining Rail shall be electrically isolated from running rail.

C. Restraining Rail may use bolted joints to avoid differences in thermal stress levels between the restraining rail and adjacent CWR running rail.

(b) Emergency (Steel Inner) Guard Rail

(i) Emergency Guard Rail shall be provided at locations where it is important to prevent a derailed Train from leaving the Track section. Emergency Guard Rails shall be installed at retained embankments, on approaches to Tunnel portals, near overhead Structure abutments and at locations where a derailed Train would likely impact critical non-transit facilities such as high tension power line poles.

(ii) DB Co shall provide Emergency Guard Rail at the following direct fixation and ballasted Track locations where structural lateral restraints capable of containing a derailed Train within the Guideway are not present:

A. Adjacent (within Train car length) to pier or column

B. Track is on embankment near the top of retaining walls where the top of rail is a minimum of 600mm above the surrounding grade, or other value agreed upon by DB Co and the City.

C. Track is located on a Bridge or aerial structure;

D. At approaches to obstructions or other adjacent Structure.

(iii) DB Co shall provide Emergency Guard Rail that:

A. On Mainline Tracks shall extend 30m ahead of the beginning of the Bridge Structure or area being protected on the approach end, and 15m beyond the end of the protected Structure on the departure end.

(iv) Emergency Guard Rail shall not be required on Tracks where structural lateral restraints occur and such restraints have been designed to contain a derailed Vehicle.

3.7 Track Materials

(a) General

(i) Track materials provided by DB Co shall be new, with the exception of Emergency Guard Rail.

(b) Rail

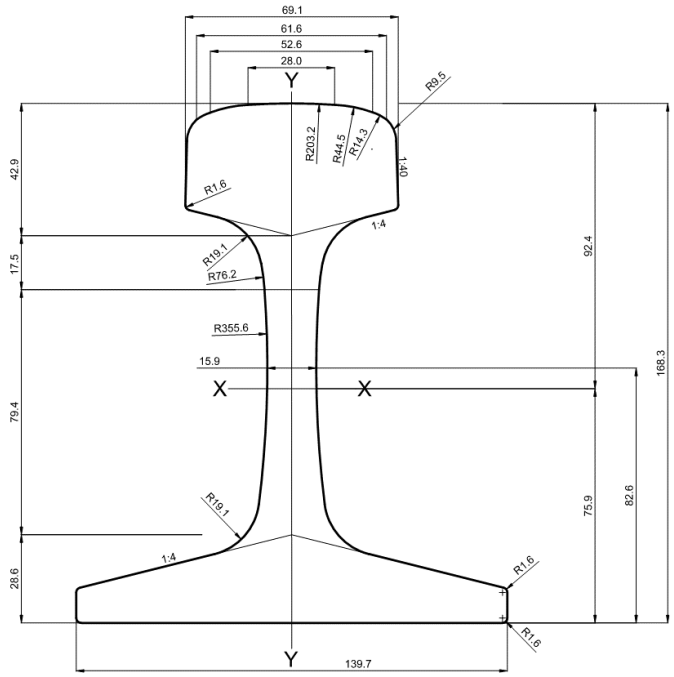
(i) General

A. DB Co shall provide new 115 RE running rail that meets:

i. AREMA Volume 1, Chapter 4, Part 2;

ii. ASTM A1; and,

iii. 115RE Rail Profile shown below.



RAIL 115RE
SCALE 1:1

B. DB Co shall provide Standard and Head-hardened rails that meet the following requirements:

i. Standard Rail—310 minimum BHN.

ii. High-strength rail—341 to 388 BHN (may be exceeded provided a fully pearlitic microstructure is maintained).

C. Head hardened (high strength) rail shall be used:

i. on all curves with radius 500m or lower

ii. on vertical gradients steeper than 4.0%

iii. On Special Trackwork sections

D. DB Co shall provide running rail as CWR in accordance with AREMA Chapter 4 Section 3.11, and Chapter 5 Part 4 and Part 5 standards.

(c) Track Fasteners

(i) General

A. All Track fasteners shall have Design Life as identified in Schedule 15-2, Part 1, Article 4 – Design and Construction.

B. DB Co shall provide Track fastening systems that:

i. provides vertical and lateral stability to the rail;

ii. Restrain the rail movement during rail break incidents limiting the rail break gap to 55mm;

iii. distributes loadings to the Track substructure;

iv. resists longitudinal CWR forces due to thermal, acceleration and braking forces;

v. prevents rail buckling under all climatic and environmental conditions;

vi. resists corrosion and electrically insulate the rail from ground;

vii. absorbs vibration energy in order to attenuate noise and vibration and reduce Track Substructure loading;

viii. are of a standardized elastic, resilient, self-tensioning type that applies a constant toe load to the rail under all service conditions;

ix. permits the removal and re-installation of the rail vertically without loss of fastener function;

x. are easily installed and removed by one person with standard hand tools;

xi. are capable of being removed and reinstalled without loss in toe load, stiffness, or other performance properties; and,

xii. are compatible with the Revenue Vehicle dynamic envelope and clearances.

(ii) Track DFF

A. DB Co shall provide the DFF:

i. to be compliant with AREMA Chapter 8 Section 27.7;

ii. to accommodate structural interface forces;

iii. to provide means of achieving a minimum of 12mm rail lateral adjustment in 3mm maximum increments utilizing a mechanical interlocking system;

iv. to provide means of achieving vertical rail adjustment;

v. to permit Track gauge adjustment without removal of elements below the rail; and,

vi. to provide a means of preventing not more than 2mm lateral movement of the rail base relative to the Track fastener in the event of failure or loosening of the anchorage devices, or other acceptable value agreed upon by DB Co and the City.

B. DB Co shall implement a DFF qualification test program as part of the Track Design and Construction Test Plan in accordance with Schedule 10 – Review Procedure.

(d) Concrete Ties

(i) Concrete ties shall be made from monoblock pre-stressed reinforced concrete, conforming to the requirements of Chapter 30, Part 4 of the AREMA Manual for Railway Engineering.

(ii) Concrete Ties shall be chosen based on having consistent design life and maintenance requirements to the Existing Confederation Line.

(iii) Concrete ties shall have a minimum Design Life as per Schedule 15-2, Part 1, Article 4 – Design and Construction.

(iv) Concrete ties may also be furnished with elastomeric pads attached to the underside of the tie to protect the tie from abrasion against the ballast.

(v) Concrete ties shall be constructed on a minimum 225mm ballast section measured beneath the underside of the tie.

(vi) Tie spacing shall be determined by DB Co on a system-wide basis, considering factors such as loading, allowable bearing pressure, Vehicle speed, cost, allowable Track deflection, lateral stability, ability to maintain gauge, etc. Tie spacing shall not result in over-stress on ballast, sub-ballast, and sub-grade. Centre-to-centre tie spacing shall never exceed 750mm for concrete crossties.

(e) Timber Ties

(i) Timber ties shall be made from hardwood and shall conform to the requirements of Chapter 30, Part 3 of the AREMA Manual for Railway Engineering.

(ii) Timber ties shall be treated with a wood preservative, and shall be furnished with anti-splitting devices. All wooden ties shall be predrilled to prevent splitting of the ties.

(iii) Hardwood ties shall have a minimum Design Life as per Schedule 15-2, Part 1, Article 4 – Design and Construction.

(iv) Wood ties within Special Trackwork layouts shall be provided in various lengths to suit the size and layout of the turnout. The Special Trackwork designer or supplier shall determine the appropriate tie layout for the appropriate fastening assembly.

(f) Rail Joints

(i) Insulated Joints

A. DB Co shall determine the need for and the positioning of insulated rail joints based on coordination with the S&TC requirements and in compliance with applicable AREMA standards and industry best practice.

B. DB Co shall provide factory bonded insulated joints compliant with the requirements of AREMA Chapter 4 Section 3.8 or equivalent where insulated rail joints are required.

C. DB Co shall provide field bonded insulated joints where the use of factory bonded insulated joints is not practical.

D. DB Co shall provide insulated rail joints to isolate Special Trackwork and to support the broken rail protection maintenance regime developed for the Existing Confederation Line with a maximum spacing of 3000m.

(ii) Welded Joints

A. General

i. DB Co shall provide no holes in the rail located within a minimum of 150mm of the weld location, including for temporary bolted locations.

B. Flash-Butt Welds

i. All CWR shall be welded by means of electric flash-butt method compliant with the requirements of AREMA Chapter 4 Section 3.10. Electric flash-butt welds shall be used for all running rail

connections consistent with CWR practice. Rail shall be welded into the longer strings practical during Construction.

C. Thermite Welds

i. DB Co shall perform the thermite welding method compliant with the requirements of AREMA Chapter 4 Section 3.13, where impossible to weld rail joints by means of flash-butt welding.

(iii) Bolted Joints

A. Standard bolted joints shall not be installed in Mainline Track. Bolted Joints shall be accepted as a temporary condition only.

B. DB Co shall provide bolted joints with standard diameter holes and standard hole-spacing for the rail type.

(iv) Rail Expansion Joints

A. DB Co shall determine the need for rail expansion joints at elevated Structures based on rail-to-structure interface analysis.

3.8 Special Trackwork

(a) General

(i) DB Co shall provide Special Trackwork that incorporates standard 115RE rail and complies with:

A. Union Internationale des Chemins de Fer (International Union of Railway – UIC) Standards.

B. European Norm Standards for railway applications.

C. AREMA Manual for Railway Engineering

(ii) DB Co shall provide Special Trackwork that is compatible with the Revenue Vehicle used on the existing system and shall be responsible for obtaining any additional information that may be required to ensure compatibility.

(iii) DB Co shall provide Special Trackwork designed for concrete slab or ballasted Track on concrete ties for mainline installations and Special Trackwork designed for ballasted Track on timber ties for LMSF installations.

(iv) All components and the final assembly of components shall be designed such that the specified tolerances can be maintained throughout the operating life of the Special Trackwork with minimal maintenance.

(v) DB Co shall provide drainage for switch machines and turnouts in accordance with the requirements of Article 5 – Drainage and Stormwater Management Design Criteria, of this Part 2 such that Revenue Service operations can safely continue.

(b) Design

(i) DB Co shall only use No. 12 and No. 8 tangential geometry turnouts and crossovers on Mainline Tracks and No. 6 and No. 4-equilateral turnouts for Yard Tracks and storage Tracks.

(ii) DB Co shall provide Special Trackwork with fabrication tolerances that conform with +2mm and -1mm track gauge tolerance and ±1mm horizontal, vertical and crosslevel tolerances measured in 2m chords.

(iii) The radius of the gauge corner in the wheel contact area for all Special Trackwork components shall be based on the Revenue Vehicle wheel profile. A maximum differential wear of 3mm between new and worn wheel profiles shall be considered in the design of Special Trackwork.

(iv) DB Co shall provide Special Trackwork that is electrically isolated from ground. The pads, insulators and other electrical insulation features shall be designed to ensure that there is not electrical continuity between the Special Trackwork and ground. There shall be a minimum air gap of 10mm and a surface electrical tracking distance of not less than 13mm between the Special Trackwork and ground.

(v) All rail joints shall be welded or insulated bonded joints.

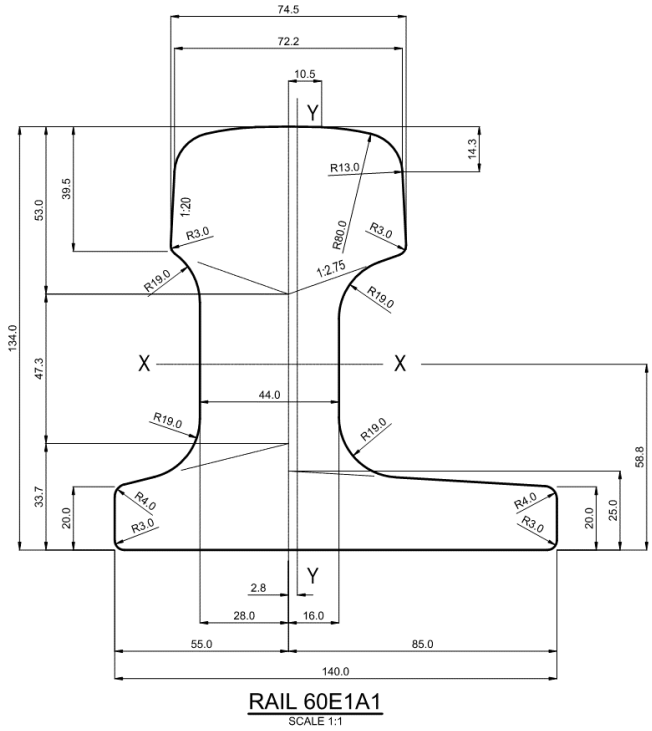
(vi) DB Co shall provide boltless monoblock frogs or moveable-point frogs in turnouts and crossovers.

(vii) Frog guard rails shall be adjustable to accommodate rail wear. Guard rail mounting plates shall be integral to running rail plates. Flangeways shall be designed to accommodate the Revenue Vehicle.

(viii) DB Co shall provide switch point rails machined from 60E1A1 Rail with a forged transition to 115RE rail. Plant welded rail joints shall not be placed within the limits of the switch point rails supported on slide chairs.

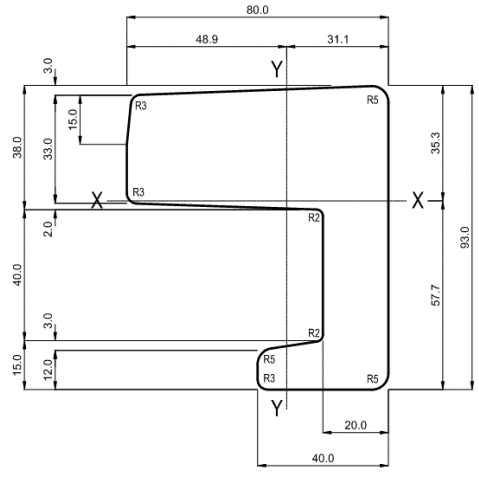
(ix) DB Co shall provide point rails of Grade R350HT in accordance with EN13674, or approved equal.

(x) DB Co shall provide asymmetric rail profiles for switch points that match the profile shown below:



RAIL 60E1A1
SCALE 1:1

(xi) DB Co shall provide guard rail sections that match the profile shown below:



GUARD RAIL 33C1
SCALE 1:1

3.9 Other Trackwork Appurtenances

(a) End-of-Track Protection Devices

(i) DB Co shall provide reusable end-of-Track protection devices at stub-end storage, Pocket Tracks and Tail Tracks and shall be suitable for permanent exterior exposure.

(ii) End-of-Track shock-absorbing devices shall meet the following criteria:

A. be capable of stopping an unoccupied Train travelling at 25 km/hr;

B. engage the Vehicle symmetrically about the coupler at bumper height; and,

C. have a cushioned face and not produce any damage to a Vehicle at Vehicle speeds less than 5km/hr. DB Co shall coordinate the design of the stopping device to ensure engagement to the car is adequate to prevent damage.

(b) Wheel/Rail Friction Control

(i) DB Co shall provide wheel/rail friction control measures in locations consistent with the practices identified in AREMA Chapter 5 Section 5.9 and Chapter 4 Section 4.11.

(ii) DB Co shall provide lubricant selection and application aimed at minimizing loss of traction and electrical conductivity of the Traction Power negative return rail.

(iii) DB Co shall provide lubricators capable of adjusting lubricant application based on site-specific conditions.

(iv) DB Co shall provide space within the Guideway for lubricator cabinets, tubing, ancillary equipment, and maintenance access. DB Co shall protect tubing from impact damage.

3.10 Track Commissioning Tests

(a) DB Co shall complete and submit the following minimum verification tests of Track installation to the City, in accordance with Schedule 10 – Review Procedure prior to Revenue Service:

(i) Track geometry measurement;

(ii) Track clearances measurement;

(iii) Revenue Vehicle clearance to Platform measurement;

(iv) rail measurement;

(v) rail defects assessment; and,

(vi) ride quality measurement.

3.11 Track Measurement and Assessment Standards

(a) DB Co shall implement the following Track measurement and assessment standards:

(i) Track parameters as follows:

A. Track gauge limits;

B. gauge-side rail wear and vertical rail wear;

C. cross level and superelevation;

D. horizontal lateral misalignment;

E. relative horizontal deviation;

F. relative vertical deviation;

(ii) Track clearances compliant with the criteria in this Part 2;

(iii) Revenue Vehicle clearance to Platforms compliant with the criteria defined in Schedule 15-2, Part 4, Article 2 - Architectural Design Criteria; and,

(iv) Other measurement and assessment criteria conforming to:

A. AREMA;

B. APTA Manual of Standards and Recommended Practices for Rail Transit Systems;

C. UIC and EN Standards for new Construction.

3.12 Track Measurement and Assessment Methodology

(a) DB Co shall complete verification of Track geometry by means of a self-propelled Track geometry measuring vehicle in accordance with EN or AREMA Chapter 2 Part 1 practices. The measuring vehicle shall provide measurements at the intervals and tolerances per EN or AREMA for alignment, gauge and superelevation.

(b) DB Co shall complete verification of Track clearances by means of a Track clearance measuring system in accordance with Good Industry Practice and AREMA Chapter 2 practices.

(c) DB Co shall complete verification of rail measurement by means of a rail measuring system in accordance with AREMA Chapter 2 Part 2 practices.

(d) DB Co shall complete verification of rail defect removals by means of an ultrasonic rail flaw detection system in accordance with practices identified in AREMA Chapter 4, Part 4 and Part 5.

(i) Requirements, applicable to visual Trackwork and CWR inspections; and,

(ii) For other Track measurement and assessment activities, the more stringent requirements identified in APTA Manual of Standards and Recommended Practices for Rail Transit Systems or Transport Canada Track Safety Rules.

(iii) Track Construction tolerances shall be as shown in "Trackwork Design Brief Issued for Construction" RES-22-0-0000-DBC-003_0, Section 5.0 Construction Tolerances and Appendix A Construction Tolerances.

ARTICLE 4 STRUCTURAL DESIGN CRITERIA AND REQUIREMENTS

4.1 Scope

(a) This Article governs the design, modification, rehabilitation and construction of Bridges, Elevated Guideways, at-grade Guideways, portal walls, retaining walls, Culverts, pole bases and other Structures not included elsewhere.

(b) The design and construction of Underground Structures shall be per the requirements of Schedule 15-2, Part 8 – Underground Structures and Stations and Ancillary Facilities shall be in accordance with Schedule 15-2, Part 4 – Stations.

4.2 Codes, Standards and Manuals

(a) The codes, standards, and references indicated in this clause shall be utilized for the design and construction of the Structures indicated in this Article, except as explicitly indicated in other articles. The structural design shall conform to the most current edition of the following codes and standards. If the criteria sources conflict, unless otherwise noted, the following shall apply in descending order of precedence:

(i) Applicable laws and regulations;

(ii) Specific obligations and Design Criteria identified in this Part 2 – Civil and Guideway;

(iii) CAN/CSA S6 Canadian Highway Bridge Design Code; and Exceptions to the Canadian Highway Bridge Design Code CAN/CSA S6 for Ontario;

(iv) City of Ottawa Standard Tender Documents for Unit Price Contracts;

(v) MTO Structural Manual;

(vi) OPSS;

(vii) OPSD;

(viii) CAN/CSA A23.3 Design of Concrete Structures;

(ix) CAN/CSA A23.1 Concrete Materials and Methods of Construction;

(x) AASHTO Guide Specifications for Design and Construction of Segmental Concrete Bridges;

(xi) CAN/CSA S16 Design of Steel Structures;

(xii) CAN/CSA G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel;

(xiii) AREMA Manual for Railway Engineering, hereinafter referred to as AREMA;

(xiv) MTO RSS Guidelines;

(xv) MTO Reports and Guidelines;

(xvi) MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads; and,

(xvii) TAC Geometric Design Guide for Canadian Roads.

4.3 General Requirements

(a) DB CO shall design all Structures by the Limit States Design method in accordance with CAN/CSA-S6. The design of all Structures shall also consider loads due to system-wide elements such as electrification, signalization and communication equipment.

(b) DB Co Shall design all Roadway and pedestrian Structures in accordance with the Load Factors and Load Combinations as indicated in CAN/CSA S6.

(c) DB Co Shall design all Guideway Structures subject to Vehicle loadings in accordance with the Load Factors and Load Combinations indicated in CAN/CSA S6, supplemented as indicated in Clause 4.5 of this Part 2, to recognize the listed permanent, transitory and exceptional loads.

(d) The loading criteria to which the Structures are designed shall appear on the Structural drawings. Concrete placing sequence shall be indicated on the drawings or in the supplementary conditions, when required by design conditions.

4.4 Design Requirements

(a) Minimum Clearance Requirements

(i) New Overhead Structures and existing Overpass/Underpass Structures being modified to Overhead Structures shall span the alignment and meet the minimum horizontal clearance requirements for the Vehicle, in accordance with Clause 2.12 of this Part 2.

(ii) New Guideway Structures and existing Structures being modified to Guideway Structures shall have a minimum structure width to allow for the passage of the alignment and meet the minimum horizontal clearance requirements for the Vehicle, in accordance with Clause 2.12 of this Part 2.

(iii) The minimum vertical clearance shall be as specified below unless stated otherwise in Appendix E of this Part 2.

A. New Overhead Bridge Structures shall be designed to ensure they achieve a minimum vertical clearance of 4.5m from the TOR to the underside of the Structure.

B. New Overpass/Underpass Bridge Structures shall be designed to ensure they achieve a minimum vertical clearance in accordance with the MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads.

C. Existing Overpass/Underpass Bridge Structures being modified to Overhead structures shall achieve a minimum vertical clearance of 4.5m from the TOR to the underside of the Structure.

(b) Seismic Design

(i) Importance Categories

A. DB Co shall design new Guideway Bridge Structures to meet major-route importance category.

B. Existing Bridge Structures being repurposed to Guideway Structures shall be seismically retrofitted as required and shall be classified as major-route Bridges.

C. DB Co shall design new Bridge Structures not subject to Vehicle loads to meet importance category "Other".

(ii) DB Co shall use the PBD approach for all Bridge Structures.

(iii) New Bridges shall be analyzed for design earthquake loads for all three return periods and damage states in accordance with CAN/CSA S6.

(iv) Existing Bridges shall be analyzed for design earthquake loads for two return periods (975 years and 2475 years) and performance levels as specified in Table 2-4.1. The ASL category shall be determined in accordance with the Report on Study of Return Period Selection for Seismic Evaluation and Retrofit of Bridges in City of Ottawa. The seismic evaluation of existing buried Structures is not required.

(v) Table 2-4.2 summarizes the design approach, return period and performance requirements.

(vi) Seismic design for buried Structures and retaining walls shall be as per CAN/CSA S6

Table 2-4.1: Return Period and Performance Requirements for Existing Bridges

Importance Category	Return Period (Years)	ASL 1 0-15 yrs		ASL 2 16-50 yrs		ASL 3 >50 yrs	
		Service	Damage	Service	Damage	Service	Damage
Major-Route	2475	-	-	Life Safety	Probable Replacement	Disruption	Extensive
	975	-	-	Disruption	Extensive	Limited	Repairable
Other	2475	-	-	Life Safety	Probable Replacement	Life Safety	Probable Replacement
	975	-	-	-*	-*	Disruption	Extensive

*No need for evaluation/retrofit design since performance objectives will automatically be satisfied after meeting the requirements of longer return periods

Table 2-4.2: Design Approach, Return Period and Performance Requirements

	New Bridges	Existing Bridges
Design Approaches	PBD	PBD
Seismic ground motion probability of exceedance in 50 years (return period)	2%, 5% and 10% (2475yrs, 975yrs, and 475yrs)	2% and 5% (2475yrs and 975yrs)
Performance Level and Criteria	As per CAN/CSA S6	As per Table 2-4.1

(c) Collision Protection

(i) Piers supporting new and existing Bridges over the alignment and with a clear distance of less than 6m from the centerline of a Track shall be of heavy construction or shall be protected by a reinforced concrete crash wall.

A. Crash walls shall have a minimum height of 1200mm above the top of rail. The crash wall shall be at least 600mm thick and at least 3.5m long. When two or more columns compose a pier, the crash wall shall connect the columns and extend at least 900mm beyond the outermost columns parallel to the Track. The crash wall shall be anchored to the footings and columns, if applicable, with adequate reinforcing steel and shall extend to at least 1200mm below the lowest surrounding grade.

B. Piers shall be considered of heavy construction if they have a cross-sectional area equal to or greater than that required for the crash wall and the larger of its dimensions is parallel to the Track.

(d) Vibration and Deflection Control

(i) Vibration and deflection control for pedestrian Structures shall be in accordance with CAN/CSA S6 and the MTO Structural Manual.

(ii) Vibration and deflection control for Guideway Structures shall be in accordance with the following:

A. All Structures supporting the Guideway including all elements of retaining walls, infill, retaining, and backfill material, and supporting Guideway fill shall have a proven performance record with respect to detrimental effects of vibration, and other long term factors such as loss of fines and aggregates, and corrosion for the duration of the Design Life.

B. Provision for vibration and deflection control shall be incorporated into the design of new Structures. Vibration and deflection shall be reviewed for existing Structures and mitigated to meet the applicable criteria. Proposed variances for vibration and deflection limits for existing structures shall be submitted for approval in accordance with Schedule 10 – Review Procedure. The design for vibration and deflection control shall be based on the characteristics of the vehicle.

C. Girders of simple or continuous spans shall be designed so that deflections due to live load plus dynamic load allowance shall not exceed 1/1000 of the span length. The deflection of cantilever arms due to live load plus dynamic load allowance shall not exceed 1/300 of the cantilever arm.

D. To limit vibration amplification due to the dynamic interaction between the superstructure and the rail Vehicle, the Guideway spans shall be designed so that the natural frequency of the first mode of vertical vibration is not less than 2.5 Hz.

(e) DB Co shall design or modify new or existing Guideway Bridges such that major rehabilitation work can be performed while maintaining a minimum of one Vehicle Track. DB Co shall design or modify new or existing Roadway Bridges such that major rehabilitation work can be performed while maintaining a minimum of one vehicle traffic lane in each direction, bicycle lanes and one sidewalk, as applicable.

(f) The structural capacity and condition of existing Structures being modified to carry Vehicle loading or subject to DB Co construction activities shall be assessed and confirmed in coordination with the applicable Governmental Authorities. DB Co shall perform any repairs or strengthening required to accommodate the Vehicle loading or DB Co construction activities.

(g) DB Co shall note all Design Criteria, including geotechnical and condition survey information to which the Structures are designed on submissions and/or structural drawings.

(h) Design of new Structures, which are interfacing with existing Structures, shall be coordinated with the City and shall comply with the design and construction requirements of the applicable Governmental Authorities. Environmental, hydrology and hydraulic studies shall be performed to address all immediate and long-term impacts and issues for

Culverts and all Bridges, including Elevated Guideways, over water in coordination with the applicable Governmental Authorities, and the design shall comply with the requirements of the applicable Governmental Authorities.

(i) New steel girder Structures over and adjacent to highways or exposed to salt spray shall be steel box girders.

(j) Access to steel girders for inspection purposes shall be incorporated into the design, including devices/system to enable inspectors to walk along all girders and tie-off safely.

(k) All new Bridges, Elevated Guideways and at-grade Guideways designed exclusively for Vehicle operation shall meet NFPA 130 requirements. Emergency walkways on Guideway Structures and under Overhead Structures shall be in accordance with NFPA 130.

(l) Noise and vibration measures and control shall comply with the requirements of Schedule 17 – Environmental Obligations.

(m) Aesthetic Design

(i) All new Structures shall meet the requirements of the MTO Aesthetic Guidelines for Bridges, supplemented by the additional requirements of this Article. All references in the MTO Aesthetics Guideline to Ministry Bridge Aesthetics Evaluation Group or MBAEG shall be replaced with the City. The aesthetic design review process and approval procedures as detailed in Chapter 11 of the MTO Aesthetic Guidelines for Bridges shall not be applicable to this Project. Chapter 11 of the MTO Aesthetic Guidelines for Bridges shall be considered deleted in its entirety.

(ii) The Bridge Aesthetic Level and Classification for new Structures is specified in Appendix E of this Part 2.

(iii) The aesthetic design of Level One Bridges (High Aesthetic Classification) is subject to City review and approval. DB Co shall prepare and submit an Aesthetic Design Report for all Level One Structures.

A. Be signed by the Design Architect.

B. Document the consideration of the following aesthetic design principals, as defined in the MTO Aesthetic Guidelines for Bridges, and how each of the aesthetic design principals were successfully addressed in the preliminary bridge design:

i. Functional clarity – The size and shape of each primary element shall be appropriate for its respective structural task and the form of the Structure shall truthfully and clearly express the loads that are being carried and transferred to the ground;

ii. Economy and simplicity – The number of materials, textures, colours and architectural features shall be kept at a minimum without becoming visually monotonous and shall be applied consistently to provide a continuity of appearance;

iii. Scale and proportion – The Structure shall be designed to minimize the overall dimensions of elements and shall appear in scale with its surroundings;

iv. Harmony and visual balance – The Structure exhibits visual balance amongst its component part as well as with its surroundings;

v. Contrast and complexity – The design of the Structure shall introduce complexity as a means of relieving visual monotony without the use of excessive eye-catching elements, colours or superfluous decoration;

vi. Enduring visual quality, with a focus on surface finishes – The Structure shall be designed and constructed to ensure the quality and durability of base materials in order to achieve a lasting positive visual effect; and,

vii. Integration with context – The Structure shall be designed to make a positive aesthetic contribution to its physical setting.

C. Include drawings of Bridge alternatives, details of specific aesthetic enhancements and 3D computer renderings of the proposed Structure viewed at perspective angles. Renderings shall be inclusive of the surrounding context.

(iv) Level Three Bridges (Low Aesthetic Classification) do not require aesthetic design approval by the City. Submission of Aesthetic Design Report is not required for Level Three Bridges (Low Aesthetic Classification).

(v) There are no Level Two Bridges (Medium Aesthetic Classification) on this project.

(vi) Chain link fencing shall not be used on pedestrian Structures.

(vii) DB Co shall detail and protect the structural steel-to-concrete interface in a way that no rust staining of the concrete occurs.

(n) Durability

(i) New Structures shall be designed to attain the indicated Design Life as detailed in Schedule 15-2, Part 1, Article 4 – Design and Construction. Time dependent

design calculations, including corrosion, creep and fatigue shall be based on indicated Design Life. Design Life calculations shall be per CAN/CSA-S6.

(ii) Time dependent design calculations for modified existing Structures, shall take into account the age and condition of the Structure.

(iii) Guideway Structures shall be designed to protect against salt spray or exposure.

(iv) Fatigue cycles for Guideway Structures shall be a minimum 15,000,000 cycles for peak period Trains of 120m to 150m length.

(v) The durability of concrete Structures shall be assured through design and detailing, application of high performance materials, protection of reinforcing steel, and application of concrete sealers.

(vi) Waterproofing shall be required for all Structure decks. The top of the existing and new concrete Structures shall be waterproofed as per applicable standards. Where direct fixation is utilized, a waterproofing technology compatible with direct fixation shall be applied. In-situ testing and warranties shall be required.

(vii) Corrosion protection for below grade elements shall be in accordance with AREMA and shall meet the requirements in Schedule 15-2, Part 3, Article 12 – Corrosion Control. Steel piles shall not be used in corrosive ground water. Precast concrete piles may be used under these conditions, if specified with sulphate resisting cement.

(viii) Where technically feasible, new Bridges shall be designed with integral or semi-integral abutments.

(o) Stray current corrosion control for all Structures shall be in accordance with Schedule 15-2, Part3, Article 12 – Corrosion Control.

(p) A depressed approach slab shall be provided at all transitions between Track slab or Bridge decks with DFF and tie and ballast Track. Approach slabs of Guideway structures shall be waterproofed.

(q) Approach slabs shall be designed and constructed for all new Structures supporting highway loads. Approach slabs of Roadway structures shall be waterproofed.

(r) Drainage

(i) All Structures shall include provisions for drainage in accordance with Article 5 – Drainage and Stormwater Management Design Criteria, of this Part 2.

(ii) Joints shall be detailed to allow longitudinal conveyance of runoff without leaking at the joints.

(iii) Drain pipes shall be external to the concrete.

(iv) Drainage from Structures within RVCA or SNC regulated floodplains shall be in accordance with Article 5 – Drainage and Stormwater Management Design Criteria, of this Part 2 and meet the requirements of applicable Governmental Authorities within whose jurisdiction the Structures are located.

(v) Drainage pipes shall not reduce the vertical clearance of Structures.

(vi) Catch basins shall not be located within the approach slab area.

(s) Ductbanks

(i) Ductbanks shall be provided as necessary for Systems and operation conduits, including pull boxes and access to connecting devices.

(ii) The design of ductbanks at Structures shall comply with the requirements of the applicable Governmental Authorities.

(iii) Services carried through or under Bridges shall be located as per the requirements of the MTO Structural Manual.

(t) The OCS foundation and structural design shall include, but not be limited to, consideration of wind, ice accretion, wire tensioning forces, upward force to the contact wire or contact rail, and the effect of wire break. The OCS foundation shall be designed in conjunction with the requirements in Schedule 15-2, Part 3, Clause 14.4.

(u) Design of "U" Approaches and other Retaining Structures

(i) A drainage layer shall be provided behind the wall to mitigate the build-up of hydrostatic pressure, where Structures are designed as drained. Both the water pressure and the lateral soil pressure shall be considered in the design. Water from the drainage layer shall be removed with a drainage system acceptable to the local Governmental Authority.

(ii) MSE walls and MSE true abutments shall not be utilized as the primary support paths for Bridge beams and girders.

(iii) Earth retaining Structures, whether temporary or permanent, greater than 3m in height shall be designed on the basis of specific soils information relating to the backfill material. Such walls shall be analyzed using a recognized numerical design method accounting for the rigidity or flexibility of the soil-structure interaction.

(iv) All Tunnel approach retaining walls with exposed faces below the water table shall be waterproofed in accordance with the requirements of Schedule 15-2, Part 8, Clause 3.4.

(v) Demolition and Restoration

(i) Demolition and restoration shall be as per Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal, in addition to the provision contained in this clause.

(ii) The condition of the existing Structures within the Project ZOI of the demolition shall be surveyed and recorded with the cooperation of the owners of the Structures affected and the Governmental Authorities. The condition of Structures to be demolished is not required to be surveyed and recorded.

(iii) The demolition, including protective measures, site maintenance and restoration shall comply with the requirements of the owners and the Governmental Authorities.

(w) DB Co shall provide a barrier, in accordance with CAN/CSA S6, at the exterior face of all new and existing Structures. The barrier type provided on each Structure shall be based on the following:

(i) A bicycle barrier shall be provided on all pedestrian/MUP Structures.

(ii) A combination (bicycle) barrier shall be provided on all roadway Structures accessible to pedestrians and/or cyclists. In site specific locations, where a traffic barrier is specified between the Roadway lanes and the pedestrians and/or cyclists, a bicycle barrier shall be provided at the exterior face of the Structure.

(iii) A traffic barrier shall be provided on all Roadway Structures, not accessible to pedestrians and/or cyclists, and Guideway Structures. The Test Level for barriers used on Guideway Structures shall be Test Level 4 (TL-4).

(x) Existing Structure foundations may be reused where DB Co has demonstrated them to be structurally adequate and capable of safely supporting the design load for the duration of the Design Life of the Structure.

(y) Any structural work or upgrades undertaken by DB Co shall not obstruct existing MUP, sidewalk, Roadway or waterway connections on or under the Structure.

4.5 Loads and Forces

(a) Guideway Structures shall use the following load combinations in addition to those given in CAN/CSA S6. It is imperative that Guideway Structures remain standing after experiencing one of these exceptional events.

ULS Combination 10a[1] = $\alpha_D D + \alpha_E E + \alpha_P P + 1.0LR + 1.1L + 1.0K + 1.3LE$

ULS Combination 10b = $\alpha_D D + \alpha_E E + \alpha_P P + 1.0LR + 1.1L + 1.0K + 1.3DR$

ULS Combination 10c = $\alpha_D D + \alpha_E E + \alpha_P P + 1.0LR + 1.0L + 1.3H$

ULS Combination 10d = $\alpha_D D + \alpha_E E + \alpha_P P + 1.0LR + 1.0L + 1.3BR$

ULS Combination 10e = $\alpha_D D + \alpha_E E + \alpha_P P + 1.0LR + 1.0L + 1.3A$

[1]For ULS Combination 10a, do not use LF in L.

Where:

LR Longitudinal Restraint
LE - Emergency braking (from LF)
DR - Derailment load (by LRV)
H - Collision with pier or column (by other LRV)
BR - Broken rail
A - Ice Accretion

(b) Permanent Loads

(i) Dead Load (D) shall be determined in accordance with CAN/CSA S6 for roadway and pedestrian Structures and in accordance with AREMA for Guideway Structures.

(ii) Loads due to horizontal earth pressure and hydrostatic pressure (E) shall be determined in accordance with CAN/CSA S6. For lateral earth pressure, a maximum load factor of 1.5 shall be used for proportioning wall sections of "U" approach and other earth retaining Structures.

(iii) Longitudinal Restraint (LR) for direct fixation Track, the structural design shall make provision for transverse and longitudinal forces due to temperature variations in the rail. These forces shall be applied in a horizontal plane at the top of the low rail. The magnitude of the forces shall be established based on the characteristics of the direct fixation system and the continuity of the Tracks. Longitudinal restraint shall have a load factor of 1.0 and shall be applied to all ULS load combinations.

(c) Transitory Loads

(i) Live Load (L)

A. Live Load for highway and pedestrian loading shall be determined in accordance with CAN/CSA S6.

B. Guideway Structures

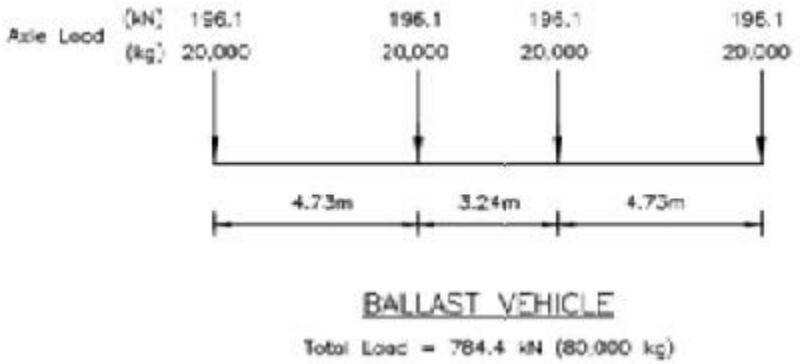
i. The **[REDACTED]** electrical vehicle shall be used as the Confederation Line Vehicle. The maximum axle load for this Vehicle is 14.9 tonnes (126kN), as shown in Figure 2-4.1.

Figure 2-4.1: [REDACTED]

[REDACTED]

ii. The ballast vehicle, as shown in Figure 2-4.2 shall be used as the Confederation Line maintenance vehicle. The maximum axle load is 20 tonnes (196.1kN).

Figure 2-4.2: Maintenance Vehicle Loading



iii. The Live Load (L) indicated in CAN/CSA S6 shall include the following effects:

1 L – Vehicle or Maintenance Vehicle live load
2 DLA – dynamic load allowance (impact)
3 LF_1 – Longitudinal traction/breaking force
4 LF_2 – Longitudinal acceleration/deceleration force
5 CF – Centrifugal force

iv. For Structures carrying more than one Track, any combination of Vehicle axle loading on one or more Tracks which produces the critical design loading shall be the vertical live load used for structural design. It should be noted therefore, that the vehicle live load shall include as many cars as can be accommodated on the span or span(s) under consideration.

v. Design situations such as Train evacuations, Train breakdown, and Train derailment shall be taken into account. This analysis shall consider the recovery of a disabled Vehicle, which could result in a crush loaded Train in combination with an empty Train.

vi. All Guideway Structures shall be designed to accommodate highway vehicular loading CL-625-ONT Loading (CL-625-ONT Truck or CL-625-ONT Lane Load), as specified in CAN/CSA S6, in addition to the rail Vehicle loading.

C. The DLA or impact is an equivalent static load expressed as a percentage of the vehicle vertical live load (L) which is considered to be equivalent to the dynamic and vibratory effects of the interaction of the moving vehicle

and the structure including the vehicle response to irregularity in the riding surface. The DLA or impact shall be determined in accordance with CAN/CSA S6 for highway loading and in accordance with AREMA for Vehicle loading, supplemented by the following:

i. For direct fixation decks, the DLA shall be 30% for Vehicle loading.

ii. Impact shall be applied to the superstructure and generally to those members of the Structure that extend down to the top of footings. The portion above the ground line of concrete or steel piles rigidly connected to the superstructure as in rigid frame or continuous design is included. Impact shall not be considered for abutments, retaining walls, wall-type piers, piles, footings and service walks, except for the portion of piles rigidly connected to the superstructure, underground Structures with 900mm or more of cover and base slabs supported by earth (either at-grade or in subways).

iii. The impact force shall be applied at the top of low rail, distributed the same as outlined for the axle loads.

iv. In addition to the vertical impact, a horizontal impact or hunting (nosing) force (HF) equal to 10% of the Vehicle load shall be applied. This force shall be equally distributed to the individual axles of the Vehicle and shall be assumed to act in either direction transverse to the Track at the top of the low rail. Hunting force shall be applied to one Track only of any tangent duel-Track Structure. On horizontal curves the more critical of hunting force or centrifugal force shall be applied.

v. Rolling (Rocking) Force (RF) is a force equal to 10% of the Vehicle loading per Track shall be applied downwards on one rail and upwards on the other, on one or all Tracks. The rolling or rocking force is an impact load in addition to other vertical impact loads and shall be considered when detrimental to the Structure.

D. Longitudinal Force (LF) shall be determined in accordance with CAN/CSA S6 for highway loading and as per the requirements below for Vehicle loading.

i. A longitudinal traction and braking force equal to 25% of the static vertical live load shall be applied on all loaded Tracks at the level of the uppermost rail. The force generated is offset by the resistive clamping force of the rail clip and the number of plinths on the Bridge. The clip clamping force (typically 13.35 kN) shall be

checked and confirmed by DB Co for each individual case prior to being used in the design.

ii. A longitudinal acceleration/deceleration force equal to 21% of the Vehicle design load, without impact, per Track, shall be applied at the center of gravity of the Vehicle above the top of the rail. Consideration shall be given to combinations of acceleration and deceleration forces where there is more than one Track on the Structure.

E. Centrifugal Force (CF) shall be determined in accordance with CAN/CSA S6 for highway loading and as per the requirements of AREMA for Vehicle loading.

(ii) The effects of strains (K) due to temperature (T), shrinkage (SH), creep (CR) shall be considered in accordance with CAN/CSA S6 unless noted otherwise below:

A. Provision shall be made for all movements and forces that can occur in the Structure as a result of shrinkage, creep and temperature variations as well as for the presence of thermal gradients through the depth of the superstructure. Load effects that may be induced by a restraint of these movements, including temporary restraints required during construction and restraints imposed by rail fasteners, shall be included in the analysis.

B. Thermal forces resulting from the temperature variations in the OCS shall be considered. Loads shall be determined in accordance with AREMA unless otherwise determined by DB Co using other established codes of practice.

(iii) Wind Load on Structure (W) shall be designed to withstand wind loads in accordance with the CAN/CSA S6. Wind loading on the OCS shall be considered in the design of both superstructure and substructure elements.

(iv) Wind Load on traffic (V) is wind load acting on the rail Vehicle and/or highway vehicular traffic and shall be in accordance with CAN/CSA S6.The entire length of the vehicle or any part or parts of that length producing critical response multiplied by the actual height of the vehicle above the side wall shall be considered as the frontal area.

(v) Differential Settlement (S) are loads induced on the Structure and shall be considered.

(d) Exceptional Loads

(i) Earthquake (EQ) load shall be in accordance with CAN/CSA S6 and as modified by Clause 4.4 of this Part 2.

(ii) Loads due to stream pressure and ice flows (F) shall be considered in accordance with CAN/CSA S6.

(iii) Ice Accretion (A) Load shall be in accordance with CAN/CSA S6 and as modified below:

A. During normal operations, ice accretion equivalent to an average thickness of 40mm shall be applied to the roof of the Vehicles. It shall be assumed that there will be no ice build-up on vertical surfaces of the Vehicle.

B. During normal operations, ice (9.8 kN/m^3) accretion on the Guideway deck slab to the top of the running rails shall be applied as well as an additional accumulation of compacted snow (4.7 kN/m^3) on catwalks to the top of the barrier wall.

C. Snow and ice load during suspended operations is less than that caused by normal operating vehicle live loads; and shall not be included as a design case under load combinations in this Article.

(iv) Collision Load (H) shall be in accordance with CAN/CSA S6 for roadway and pedestrian Structures and as modified below for Guideway Structures:

A. Piers or other Guideway Structure support elements that are situated less than 3m from the edge of an adjacent street or highway shall be designed to withstand a horizontal static force of 1000 kN, unless protected with suitable barriers. This force is to be applied on the support element at an angle of 10 degrees from the direction of the road traffic and at a height of 1200mm above ground level. This condition occurs with the dead load of the Structure but need not be applied concurrently with other loadings. The provisions of this clause shall apply to existing and proposed Guideway Structures.

(v) Potential Derailment Load (DR) effects shall be considered. In the absence of actual crash test data or the results of a detailed dynamic crash/impact analysis the load effect of a derailment event can be accounted for by applying concurrently vertical and horizontal (transverse) forces to the supporting Structure as follows:

A. The vertical derailment load of the Vehicle shall consist of the Vehicle's maximum weight multiplied by an impact factor. A vertical impact factor of 100% of the Vehicle weight shall be used to compute the equivalent static derailment load.

B. Horizontal (transverse) load effect – equal to 20% of the Vehicle load, distributed proportionately along the length of the Vehicle in accordance with the axle load distribution along the length of the Train, acting perpendicular (transverse) to the Track alignment at the top surface of the rail.

C. When checking any component of superstructure to substructure that supports two or more Tracks, only one Vehicle on one Track shall be considered to have derailed, with the other Track being loaded with a stationary work train, including work train, cranes, flats, etc., or another Vehicle, ready to receive Passengers from the derailed Train. The design load used shall be the greatest of these loadings.

D. For derailment events that would cause the Vehicle's wheels to bear directly on the Structure slab, the wheel load distribution on the slab shall be established using a rational method. Location of derailed wheel excursion limited by guard rails or curbs shall be that location that achieves maximum loading condition.

E. All elements of the Guideway Structure shall be checked assuming simultaneous application of all derailed wheel loads. The reduction of positive moment in continuous slabs due to derailed wheel loads in adjacent spans shall not be permitted.

(vi) Broken Rail (BR) forces are those which are transferred to the Structure in longitudinal shear by the fasteners when a pull-apart occurs. The rail will slip, on both sides of the pull-apart, until the tensile force in the rail before the break is counteracted by the reversed fastener restraint forces.

A. The unbalanced force from the broken rail is resisted by both the unbroken rails and the Guideway Structure support system, in proportion to their relative stiffness's. The distribution to the Structure shall be determined by analysis. The probability that more than one rail will break at the same time on a given dual-lane Structure or single-lane Structure is very small and shall not be considered.

B. The longitudinal restraint of the fastener shall be such that the calculated gap of a pull-apart will be less than 65mm at the minimum expected rail temperature. Computation of this gap shall include both rail slip in the fasteners and deflection of the Guideway Structure.

(e) Construction loads shall be determined in accordance with CAN/CSA S6.

4.6 Distribution of Loads

(a) Distribution of Wheel Loads to Slab for Tie and Ballast Track

(i) For tie and ballast Track, wheel loads are transmitted to the deck slab through the ballast. Wheel loads shall be uniformly distributed longitudinally over a length of 900mm, plus the depth of the Track Structure, plus twice the effective depth of slab, except as limited by wheel spacing. Wheel loads shall have uniform lateral distribution over a width equal to the length of the tie plus the depth of ballast

under the tie, except as limited by the proximity of adjacent Tracks or the extent of the Structure.

(b) Distribution of Wheel Loads to Slab for direct fixation Track

(i) For direct fixation Track, wheel loads are transmitted to the deck slab through the rail fastening system placed directly on the slab. Wheel loads shall be uniformly distributed over a length of 900mm along the rail. This load shall be distributed transversely (normal to the rail and centered on the rail) by the width of the rail fastener plus twice the depth of the deck and Track support Structure except as limited by the proximity of adjacent Tracks or the extent of the Structure.

4.7 Material

(a) Material used for the modification, repair and rehabilitation of existing Structures shall be compatible with the existing in-situ material.

(b) Material selection and/or coating of attached elements shall be used to minimize staining to concrete elements.

(c) All material for the Structures as identified in this Clause shall conform to OPSS.

(d) Earth Retaining Structures

(i) Permanent RSS systems located beyond the salt spray zone, shall meet, as a minimum, medium performance and low appearance requirements in accordance with MTO RSS Design Guidelines. RSS systems within 10m of a salt spray zone or associated with the Bridge Structure shall meet high performance and high appearance requirements in accordance with MTO RSS Design Guidelines.

(ii) Where accessible to Passengers within the Fare Paid Zone, including bus Platform areas and adjacent to public areas at Station entrances, gabion stones at the face of gabion walls shall be sized to prevent removal.

(e) Concrete

(i) Concrete shall conform to OPSS 1350 and City Special Provision F-9045 and F-9043.

(ii) All concrete mixes shall be in accordance with CAN/CSA A23.1

(iii) Concrete strength for Roadway and pedestrian Structures shall be as per MTO Structural Manual, except for Bridge decks and sidewalks which shall be 35 MPa.

(iv) Chloride Permeability - Rapid Chloride Permeability as determined by ASTM C1202 and measured at 91 days, shall not exceed 1000 coulombs for the superstructure mix.

(f) Reinforcing Steel

(i) Reinforcing Steel shall meet the material requirements as defined in OPSS 905 and OPSS 1440.

(ii) Minimum reinforcement designation shall be 15M.

(iii) Welded splices or joints in reinforcing steel shall not be permitted. Welding for purposes of bonding and grounding continuity is permitted.

(iv) Couplers shall not be permitted in plastic hinge zones.

(v) No splices shall be permitted in plastic hinge zones for substructure components.

(vi) Premium reinforcing for Roadway and pedestrian Structures shall be used where required in accordance with the MTO Structural Manual.

(vii) Premium reinforcing for Guideway Structures shall be used in:

A. Top and bottom of cantilevers;

B. Guideway plinths that may be subject to de-icing salts, such as adjacent to Platforms;

C. Substructure elements that are located within the splash zone of Roadways treated with de-icing salts;

D. Barrier and parapet walls; and,

E. Sidewalks.

(viii) Where electrical continuity is required for managing stray currents, weldable reinforcement and suitable welding shall be used.

(g) GFRP Reinforcing bars

(i) GFRP reinforcing bar shall only be permitted in barrier and parapet wall applications.

(ii) The GFRP reinforcing bars shall conform to the following standards:

A. CAN/CSA S806: Design & Construction of Building Structures with Fibre Reinforced Polymer

B. CSA S807: Fibre Reinforced Polymers

(iii) GFRP shall have a minimum modulus of elasticity of 40 GPa.

(iv) GFRP shall have a specified minimum tensile strength of 1000 MPa.

(v) GFRP shall be type 2 and type 3.

(h) Prestressing Tendons

(i) Internal unbonded post-tensioning tendons shall not be permitted.

(ii) External grouted post-tensioning tendons shall be permitted for segmental Construction and shall be corrosion protected.

(i) Structural Steel

(i) Structural steel for Roadway and pedestrian Structures shall conform to the material requirements in the MTO Structural Manual.

(ii) Structural steel for Guideway Structures

A. Superstructure primary members shall be grade 350AT Category 3 for primary plates, girders and rolled section members.

B. Primary members made from pipe sections shall meet the minimum Charpy impact energy specified in Table 9 of CSA G40.21 for the similar yield strength of steel tested at a Category 3 temperature.

C. Secondary steel members shall be grade 350W or 350A.

D. ASTM A 588 may be substituted for grade 350A or grade 350AT. ASTM A 588 shall only be substituted for grade 350AT steel when the Charpy impact energy requirements are verified by the submission of test documentation.

(iii) Steel fabrication companies shall be CWB certified.

(j) Deck joint assemblies shall comply with City of Ottawa Special Provision F-9201, including the 5 year warranty period for all NMI Structures.

(k) Bearings shall comply with City of Ottawa Special Provision F-9221, including the 5 year warranty period for all NMI Structures.

(l) Corrugated steel pipe, regardless of thickness or type, shall not be used for Bridge or Culvert construction.

4.8 Construction

(a) Concrete Construction shall be in accordance with OPSS 904 and City of Ottawa Special Provision F-9040.

(b) Precast Prestressed Concrete

(i) Construction shall be in accordance with OPSS 909.

(ii) Precast members shall not be erected until sample cylinders tested per OPSS 1350 achieve a design 28 day compressive strength.

(iii) Precast Segmental Concrete Bridges shall be constructed in accordance with the requirements of AASHTO's Guide Specifications for the Design and Construction of Segmental Concrete Bridges except where it conflicts with CAN/CSA S6.

(c) Structural Steel shall be Constructed in accordance with OPSS 906.

(d) Soffits shall be uncovered and without coatings.

(e) Bearings shall be uncovered.

(f) Bolted connections shall have a minimum diameter of 22mm and A325M designation of weathering steel.

(g) Welded connections – critical welds, such as over supports and midspan, shall be treated as tension splices subjected to more stringent tests (Non-Destructive Testing). Testing schemes shall be submitted by DB Co for review in accordance with Schedule 10 – Review Procedure.

4.9 Description of Project Structures

(a) Provisions contained in this Clause shall be read in conjunction with Appendix E of this Part 2.

(b) DB Co shall perform the following as part of the work for Confederation Line East Extension:

(i) Blair Road Bridge over Transitway (SN226780)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, abutment walls, wingwalls and retaining walls;

ii. Concrete patch repairs to all delaminated areas on the wingwalls; and,

iii. Replace longitudinal joint seal.

(ii) Blair Road E-N/S Ramp (SN226790)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, abutment walls, ballast walls, wingwalls and retaining walls;

ii. Concrete patch repairs to all delaminated areas on the soffit, abutment walls, bearing seat, wingwalls and piers; and,

iii. Replace the abutment bearings.

(iii) Transitway Bridge over OR174 (SN224880)

A. Remove existing Bridge in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal.

B. Remove culverts A224636 and A224635 in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal. These culverts located along the shoulder shall be removed and replaced with open ditch.

(iv) Montreal Road Flyover (SN224980)

A. Design and construct a new Elevated Guideway to carry the alignment over OR174 WB lanes. The new Structure shall accommodate:

i. The EB and WB alignment, including Emergency walkways on the Structure; and,

ii. The proposed OR174 WB roadway cross section in accordance with Clause 6.19 of this Part 2 under the Structure.

(v) Westbound OR174 Bridge over Montreal Road (SN224850)

A. Remove existing Bridge in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal.

B. Design and construct a new Overpass Bridge to carry OR174 WB lanes over Montreal Road. The new Structure shall accommodate:

i. The proposed OR174 WB roadway cross section in accordance with Clause 6.19 of this Part 2 on the Structure; and,

ii. The proposed Montreal Road cross section in accordance with Clause 6.19 of this Part 2 under the Structure.

iii. Scour/erosion protection treatments at the bridge including embankment slopes.

C. Bridge shall be an independent structure and designed in conjunction with the Montreal Road Station Bridge and the Eastbound OR174 Bridge over Montreal Road.

D. Retaining walls, abutments and Bridge superstructure shall be of concrete construction.

E. Bridge abutments shall be semi-integral and designed with deep foundations extending to bedrock.

F. Architectural concrete shall be used for all concrete elements exposed to the adjacent Station and/or within the Station limits. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements in Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

G. Construction of the new structure shall be staged in accordance with Schedule 15-2, Part 7, Article 2 – Existing Municipal Roadways.

(vi) Montreal Road Station Bridge (SN224855)

A. Design and construct a new Elevated Guideway to carry the alignment over Montreal Road. The new Structure shall accommodate:

i. The EB and WB alignment and the Montreal Road Station Train Platform on the Structure; and,

ii. The proposed Montreal Road cross section in accordance with Clause 6.19 of this Part 2 and the east and west Montreal Road Station entry plazas under the Structure.

B. Design of the Elevated Guideway shall be coordinated with the design of the Montreal Road Station. Refer to Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

C. The Elevated Guideway shall be an independent structure and designed in conjunction with the Westbound OR174 Bridge over Montreal Road and the Eastbound OR174 Bridge over Montreal Road Bridges.

D. Architectural concrete shall be used for all concrete elements exposed to the adjacent Station and/or within the Station limits. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements in Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

E. Retaining walls, abutments and superstructure shall be of concrete construction.

F. Bridge abutments shall be designed with deep foundations extending to bedrock.

G. Construction of the new Structure shall be staged in accordance with Schedule 15-2, Part 7, Article 2 – Existing Municipal Roadways.

H. Design of Station elements, on or below the Structure, shall meet the structural requirements of Schedule 15-2, Part 4, Article 4 – Structural Design Criteria and Requirements in addition to the requirements of this Article.

(vii) Eastbound OR174 Bridge over Montreal Road (SN224851)

A. Remove existing Overpass Bridge in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal.

B. Design and construct a new Overpass Bridge to carry OR174 EB lanes over Montreal Road. The new Bridge shall accommodate:

i. The proposed OR174 EB roadway cross section in accordance with Clause 6.19 of this Part 2 on the Structure; and,

ii. The proposed Montreal Road cross section in accordance with Clause 6.19 of this Part 2 under the Structure.

iii. Scour/erosion protection treatments at the bridge including embankment slopes.

C. Bridge shall be an independent structure and designed in conjunction with the Montreal Road Station Bridge and the Westbound OR174 Bridge over Montreal Road.

D. Retaining walls, abutments and Bridge superstructure shall be of concrete construction.

E. Bridge abutments shall be semi-integral and designed with deep foundations extending to bedrock.

F. Architectural concrete shall be used for all concrete elements exposed to the adjacent Station and/or within the Station limits. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements in Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

G. Construction of the new Structure shall be staged in accordance with Schedule 15-2, Part 7, Article 2 – Existing Municipal Roadways.

(viii) Green's Creek Culvert under OR174 (SN227110)

A. Design and construct a section of this culvert to facilitate the future replacement of the existing Green's Creek culvert without interruption to the rail service. Following the future removal of the existing culvert by the City, it is intended that the new Structure section will serve as part of the new Green's Creek Culvert. DB Co shall be responsible to provide a design of the complete Culvert to replace the existing Green's Creek Culverts to demonstrate feasibility.

B. Design and construct a new Culvert section over the two easterly cells of the existing Green's Creek Culvert and under the alignment in accordance with Clause 5.7 of this Part 2. The new Culvert shall accommodate:

i. The EB and WB alignment, including Emergency walkways; and,

ii. The two easterly cells of the existing Green's Creek Culvert.

C. Design and construct new retaining walls at the south sides of the existing Culvert with concrete traffic barrier to retain the road section.

D. Construction of the new Culvert section shall be staged in accordance with Schedule 15-2, Part 7, Article 2 – Existing Municipal Roadways.

E. The new Culvert section shall be designed and constructed to allow for future extension to accommodate the ultimate OR174 roadway cross section. Design and construction of the new Culvert section shall:

i. Ensure a future Culvert extension to both the north and south sides of the new Culvert section can be constructed without causing disruption to the Confederation Line;

ii. Not cause any damage to the existing Green's Creek Culvert;

iii. Ensure the future removal of the existing Green's Creek Culvert can be performed without causing disruption to the Confederation Line;

iv. The design of the complete Culvert replacement shall ensure to keep a minimum horizontal clearance of 5m from the existing watermain at north side from the proximate structural components of the future extension of the Culvert.

(ix) Green's Creek Pedestrian Bridge (SN221250)

A. Design and construct a pedestrian Bridge over Green's Creek located north of the Green's Creek Culvert in accordance with Clause 5.7 of this Part 2. The new Structure shall accommodate:

i. A MUP on the Structure; and,

ii. Green's Creek.

B. Bridge shall be an independent Structure and designed in conjunction with the Green's Creek Culvert under OR174.

C. Scour/erosion protection treatments shall be provided at the Bridge embankment slopes.

(x) Sir George-Etienne Cartier Parkway Bridge over OR174 (SN224860)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent inspection report and shall include the following, as a minimum:

i. All medium cracks on the soffit.

(xi) Jeanne d'Arc Boulevard Bridge over OR174 (SN224870)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Modify the existing Bridge to provide access to and accommodate the new Jeanne d'Arc Station and provide access to the Station from Jeanne d'Arc Boulevard. Modifications to the existing Bridge shall meet the

requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

i. DB Co shall ensure the existing Structure has adequate structural capacity to accommodate all required modifications. Any required repairs or strengthening shall be performed by DB Co.

ii. Modifications to the Bridge for the Station shall include the relocation of conflicting Utilities.

D. Undergo a structural rehabilitation of the existing Underpass Bridge to address all substructure and superstructure deficiencies. The scope of rehabilitation shall be based on the most recent conditions reports and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, abutment walls, wingwalls, median island, sidewalk and barrier/parapet walls;

ii. Concrete patch repairs to all delaminated and spalled areas on the soffit, abutment walls, piers, ballast walls, sidewalk and barrier/parapet walls;

iii. Provide concrete sealer on the inside face of barriers;

iv. Replace the abutment bearings;

v. Mill and pave the asphalt wearing surface on the Bridge and approach slabs;

vi. Replace concrete end dams and deck joint seals; and,

vii. Reconstruct adjacent areas affected by construction of the proposed Jeanne d'Arc Station.

(xii) Orléans Boulevard Bridge over OR174 (SN224240)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Modify the existing Bridge to provide access to and accommodate the new Orléans Boulevard Station. Modifications to the existing Bridge shall meet the requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

i. DB Co shall ensure the existing Structure has adequate structural capacity to accommodate all required modifications. Any required repairs or strengthening shall be performed by DB Co.

ii. Modifications to the Bridge for the Station shall include the relocation of conflicting Utilities.

(xiii) Bilberry Creek Culvert under OR174 (SN224510)

A. Ensure structural capacity of Culvert not be exceeded with passage of the alignment and/or the increase of fill over the Structure. Any required repairs or strengthening shall be performed by DB Co.

(xiv) Place d'Orléans Pedestrian Bridge over OR174 (SN228030)

A. Repurpose the existing Underpass pedestrian Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Modify the existing Bridge to provide access to and accommodate the new Place d'Orléans Station. Modifications to the existing Bridge shall meet the requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

i. DB Co shall ensure the existing Structure has adequate structural capacity to accommodate all required modifications. Any required repairs or strengthening shall be performed by DB Co.

ii. Modifications to the Bridge for the Station shall include the relocation of conflicting Utilities.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following as a minimum:

i. Crack repairs to all medium cracks on the soffit;

ii. Concrete patch repairs to all spalled areas of the piers; and,

iii. Concrete repairs to exposed pier foundations.

(xv) Place d'Orléans Station Pedestrian Bridge over EB OR174 (SN228025)

A. Design and construct a new pedestrian Bridge over OR174 EB lanes in accordance with the requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria. The new Structure shall accommodate:

i. A fare paid pedestrian connection between the Bus Station to the LRT Station on the Structure; and,

ii. The proposed OR174 EB roadway cross section in accordance with Clause 6.19 of this Part 2 under the Structure.

B. Architectural concrete shall be used for all concrete elements exposed to the adjacent Station and/or within the Station limits. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements in Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

C. The new Bridge shall be designed and constructed in conjunction with the Place d'Orléans Station. Refer to Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

(xvi) Champlain Street Bridge over OR174 (SN224890)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following as a minimum:

i. Crack repairs to all medium cracks on the abutment walls.

(xvii) Tenth Line Road Bridge over OR174 (SN894010)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the abutment walls, ballast walls, soffit, diaphragms and piers; and,

ii. Replace south transverse expansion joint seal.

(xviii) Box Culvert under OR174 (SN894040)

A. Complete a structural evaluation to ensure the structural capacity of the Structure is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the Structure. Any required repairs or strengthening shall be performed by DB Co.

(xix) Taylor Creek Culvert under OR174 (SN894050)

A. Complete a structural evaluation to ensure the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the structure. Any required repairs or strengthening shall be performed by DB Co.

(xx) DB Co shall design and construct retaining walls as dictated by grade and where site conditions do not allow for an embankment with a stable slope to be installed. Retaining wall locations include but shall not be limited to the following:

A. Directly adjacent to the wingwalls on the west side of the new Westbound OR174 Bridge (SN224850) over Montreal Road.

B. Directly adjacent to the wingwalls on the east side of the new Eastbound OR174 Bridge (SN224851) over Montreal Road.

C. Along Ramp S-E OR174 EB between the Montreal Road Interchange and Green's Creek Culvert.

D. Along Ramp E-N/S OR174 WB off-ramp to Montreal Road.

(c) DB Co shall perform the following work as part of the work for Confederation Line West Extension:

(i) Box Culvert under West Transitway (SN018231 and SN018232)

A. Complete a structural evaluation to ensure the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the Structure. Any required repairs or strengthening shall be performed by DB Co.

B. Replacement of Culvert joints includes the replacement of all joint accessories (i.e. dowels). Premium reinforcing shall be used for all reinforcing steel, including dowels, required as part of the replacement of the Culvert joints.

(ii) West Transitway South Rock Wall (SN019991)

A. DB Co shall complete an updated condition assessment including a detailed field survey to verify location and extent of wall defects and locations of increased deterioration on the existing rock wall and concrete retaining wall between SJAM Parkway and Piney Street. DB Co shall perform the updated condition assessment and categorize specific segments of the rock wall based on the following probability of failure:

i. Low Risk:

1 Rock is currently considered stable (i.e., clean rock face, thickly bedded rock layers with very little loose rock or rock which is slightly overhanging but is situated on a flat lying ledge or the rock is currently keyed into the rock mass) and it is unlikely that the rock will become unstable in the next 30 years.

ii. Medium Risk:

1 Rock is stable at present (i.e., rock is overhanging but supported on loose rock or rock that is susceptible to weathering and further deterioration) but could become unstable within the next 30 years if acted upon by external forces including ongoing weathering and groundwater.

iii. High Risk:

1 Rock is marginally stable at present (i.e., rock is overhanging and only partially supported on loose rock or rock that is susceptible to weathering or is situated on a potential sliding plane and could slide with increased groundwater pressure) and would very likely become unstable within the next 30 years.

iv. Very High Risk:

1 Rock is currently considered unstable and could fail at any time. The rock is situated on a steeply inclined sliding plane possible with an open tension crack at the back of the block or has a very significant overhang. There is also evidence of some past movement (offset across open joints or disturbance of the soil/vegetation).

B. DB Co shall implement rock face stabilization for all medium, high and very high risk zones. Acceptable stabilization strategies shall include, at a minimum:

i. Acceptable stabilization strategies shall include, at a minimum:;

1 Concrete re-facing with drainage system for the sections of the rock face that is comprised of siltstone and eroded limestone; and,

2 Installation of a drapery system on the remaining sections.

ii. Preparatory works for both strategies shall include removal of loose blocks & vegetation, filling weak shelly interbeds (>100mm into the rock) and filling underside of overhangs (>300mm) with shotcrete where bottom ledge exists. The required minimum Design Life shall be 10 years.

C. DB Co shall complete an updated post construction condition assessment including a detailed field survey to confirm that only low risk failure zones are present following rock wall stabilization.

(iii) West Transitway North Rock Wall (SN019992)

A. DB Co shall complete an updated condition assessment including a detailed field survey to verify location and extent of wall defects and locations of increased deterioration on the existing rock wall and concrete retaining wall between SJAM Parkway and Piney Street. DB Co shall perform the updated condition assessment and categorize specific segments of the rock wall based on the following probability of failure:

i. Low Risk:

1 Rock is currently considered stable (i.e., clean rock face, thickly bedded rock layers with very little loose rock or rock which is slightly overhanging but is situated on a flat lying ledge or the rock is currently keyed into the rock mass) and it is unlikely that the rock will become unstable in the next 30 years.

ii. Medium Risk:

1 Rock is stable at present (i.e., rock is overhanging but supported on loose rock or rock that is susceptible to weathering and further deterioration) but could become unstable within the next 30 years if acted upon by external forces including ongoing weathering and groundwater.

iii. High Risk:

1 Rock is marginally stable at present (i.e., rock is overhanging and only partially supported on loose rock or rock that is susceptible to weathering or is situated on a

potential sliding plane and could slide with increased groundwater pressure) and would very likely become unstable within the next 30 years.

iv. Very High Risk:

1 Rock is currently considered unstable and could fail at any time. The rock is situated on a steeply inclined sliding plane possible with an open tension crack at the back of the block or has a very significant overhang. There is also evidence of some past movement (offset across open joints or disturbance of the soil/vegetation).

B. DB Co shall implement rock face stabilization for all medium, high and very high risk zones.

i. Acceptable stabilization strategies shall include, at a minimum:

1 Concrete re-facing with drainage system for the sections of the rock face that is comprised of siltstone and eroded limestone; and,

2 Installation of a drapery system on the remaining sections.

ii. Preparatory works for both strategies shall include removal of loose blocks & vegetation, filling weak shelly interbeds (>100mm into the rock) and filling underside of overhangs (>300mm) with shortcrete where bottom ledge exists. The required minimum Design Life shall be 10 years.

C. DB Co shall complete an updated post construction condition assessment including a detailed field survey to confirm that only low risk failure zones are present following rock wall stabilization.

(iv) Goldenrod Bridge at Tunney's Pasture (SN016255)

A. Design and construct a new Bridge to carry Goldenrod Driveway over the alignment. The new Structure shall accommodate the following:

i. The proposed Goldenrod Driveway roadway cross section in accordance with Clause 6.19 of this Part 2 on the Structure; and,

ii. The EB and WB alignment, including Emergency walkways under the Structure.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Ensure no conflict between the Structure and the box Culvert under the West Transitway.

D. Track elevation under Structure to be optimized in order to allow for maximum vertical clearance and shall meet the vertical clearance indicated in Appendix E of this Part 2.

(v) Ross Avenue Bridge (SN016260)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2 Part 3, Article 14 – Overhead Contact System.

B. Ensure the existing Bridge Structure fencing meets the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria. DB Co shall perform any required fence upgrade, rehabilitation or replacement.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit;

ii. Concrete patch repairs to all delaminated areas on the soffit; and,

iii. Concrete patch repairs to all spalled areas on the retaining walls.

(vi) Northwestern Avenue Bridge (SN016270)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium cracks on the soffit;

ii. Concrete patch repairs to all delaminated areas on the abutment walls; and,

iii. Mitigate and repair undermining of wingwall.

(vii) Carleton Avenue Bridge (SN016330)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Ensure the existing Bridge Structure fencing meets the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria. DB Co shall perform any required upgrade, rehabilitation or replacement

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium cracks on the abutment walls and soffit;

ii. Concrete patch repairs to all spalled areas on the abutment walls and soffit; and,

iii. Concrete patch repairs to all delaminated areas on the soffit.

(viii) Island Park Drive Bridge (SN016280)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, wingwalls, and abutment walls; and,

ii. Concrete patch repairs to all delaminated areas on the abutment walls.

(ix) Lanark Avenue Bridge (SN016290)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit and abutment walls; and,

ii. Concrete patch repairs to all spalled areas on the abutment walls and slope protection.

(x) Hydro Utility Bridge (SN019890)

A. Repurpose the existing Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

(xi) Tweedsmuir Avenue Bridge (SN016300)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Modify the existing Bridge to provide access to the new Station in accordance with the requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

i. DB Co shall ensure the existing Structure has adequate structural capacity to accommodate all required modifications. Any required repairs or strengthening shall be performed by DB Co.

ii. Modifications to the Structure for the Station shall include the relocation of conflicting Utilities.

D. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit and abutment walls; and,

ii. Concrete patch repairs to all spalled areas on the abutment walls.

(xii) Westboro Station Pedestrian Bridge (SN018240)

A. If the Structure is not incorporated into DB Co design solution, DB Co shall decommission the superstructure in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal; or

B. If the Structure is incorporated into DB Co design solution, DB Co shall:

i. Repurpose the existing Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System;

ii. Modify the existing Bridge to accommodate DB Co design solution as required. Any required repairs or strengthening required by DB Co's design shall performed by DB Co; and,

iii. Perform structural rehabilitation to address all substructure, deck and soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

1 Crack repairs to all medium and wide cracks;

2 Concrete patch repairs to all spalled and delaminated areas; and,

3 Replacement of wearing surfaces.

(xiii) Athlone Avenue Bridge (SN016310)

A. Repurpose the existing Underpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Modify the existing Bridge to provide access to and accommodate the new Station to meet the requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

i. DB Co shall ensure the existing Structure has adequate structural capacity to accommodate all required modifications. Any required repairs or strengthening shall be performed by DB Co.

ii. Modifications to the Structure for the Station shall include the relocation of conflicting utilities.

D. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium cracks on the abutment walls and soffit; and,

ii. Concrete patch repairs to all spalled areas on the wingwalls.

(xiv) Churchill Avenue Bridge (SN016320)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Ensure the existing Bridge Structure fencing meets the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria. DB Co shall perform any required upgrade, rehabilitation or replacement.

(xv) Roosevelt Avenue Bridge (SN018220)

A. Remove existing Bridge in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal and replace with a temporary Structure as part of the Transitway detour along Scott Street in accordance with the requirements in Schedule 15-2, Part 7, Article 3 – Existing Transitway System.

B. Once the Transitway detour is no longer in service, DB Co shall design and construct a new pedestrian Bridge over the alignment. The new Structure shall be constructed in the location of the existing Bridge and shall accommodate the following:

i. A reinstated MUP connection at Roosevelt Avenue providing a minimum clear width of 4.2m on the Structure; and,

ii. The EB and WB alignment under the Structure.

C. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

D. DB Co shall install cyclist/pedestrian counters on the new Roosevelt Avenue Structure in accordance with Schedule 15-2, Part 7, Article 3 – Existing Transitway System.

(xvi) SJAM Parkway at Carleton Avenue Pedestrian Overpass (SN018620, SN018621)

A. DB Co shall ensure the structural capacity of EB and WB Structures is not exceeded with the passage of laden and unladen OC Transpo Buses. The design and installation of a temporary support system, if required, shall be performed by DB Co. Uninterrupted pedestrian passage under the Bridges shall be maintained at all times.

B. Undergo a structural rehabilitation to address all identified Structure deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks;

ii. Concrete patch repairs to all spalled and delaminated areas; and,

iii. Replace barrier with owner specified modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail. The installation shall include all associated transitions, terminal elements and end treatments as per the details in Appendix F, Drawings F-3 to F-5, of this Part 2 and in accordance with Clause 6.21 of this Part 2.

(xvii) SJAM Parkway at Lanark Avenue Pedestrian Overpass (SN018610, SN018611)

A. DB Co shall design and construct all necessary modifications to the existing WB pedestrian Overpass Structure as required in order to accommodate a widened MUP. Lane and MUP configuration shall be in accordance with Schedule 15-2, Part 2, Article 6 – Roadways, Bus Terminals and Lay-bys.

i. DB Co shall ensure the existing Structure has adequate structural capacity to accommodate all required modifications for the MUP and lane reconfiguration. Any required repairs or strengthening shall be performed by DB Co.

B. DB Co shall ensure that the structural capacity of the WB and EB Structures is not exceeded with the passage of laden and unladen OC Transpo Buses. The design and installation of a temporary support system, if required, shall be performed by DB Co. Uninterrupted pedestrian passage under the Bridges shall be maintained at all times.

C. Undergo a structural rehabilitation to address all identified Structure deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks;

ii. Concrete patch repairs to all spalled and delaminated areas; and,

iii. Replace barrier with owner specified modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail. The installation shall include all associated transitions, terminal elements and end treatments as per the details in Appendix F, Drawings F-3 to F-5, of this Part 2 and in accordance with Clause 6.21 of this Part 2.

(xviii) U Approach – Depressed Guideway Parkway East Portal (SN019212)

A. Design and construct and new tunnel portal at the east end of the Parkway tunnel. The new portal shall accommodate the EB and WB alignment, including Emergency walkways.

B. Design and construction of the portal shall be completed in conjunction with the design and construction of the Parkway Tunnel.

C. Architectural concrete shall be used for all exposed concrete elements. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements of Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

(xix) U Approach – Depressed Guideway Parkway West Portal (SN019213)

A. Design and construct and new tunnel portal at the west end of the Parkway tunnel. The new portal shall accommodate the EB and WB alignment, including Emergency walkways.

B. Design and construction of the portal shall be completed in conjunction with the design and construction of the Parkway Tunnel.

C. Architectural concrete shall be used for all exposed concrete elements. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements of Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

(xx) SJAM Parkway at Churchill Avenue Pedestrian Overpass (SN018920)

A. Design and construct new twin Bridge Structures to provide MUP connection between the north and south pathway systems along the SJAM Parkway corridor. The new Bridges shall accommodate the following:

i. The SJAM Parkway roadway cross section, at Churchill Avenue in accordance with Clause 6.21 of this Part 2 on both the east and west Structure; and,

ii. A MUP under the Structures.

B. Install City specified modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail, including all associated transitions, terminal elements and end treatments as per the details in Appendix F, Drawings F-3 to F-5, of this Part 2 and in accordance with Clause 6.21 of this Part 2.

C. The minimum pathway width under the Structure shall be in accordance with Schedule 15-2, Part 6, Appendix A. A minimum vertical clearance of 3m unencumbered by haunches, shall be achieved over the full width of the pathway.

(xxi) SJAM Parkway at Cleary Avenue Pedestrian Overpass (SN018910)

A. Design and construct new twin Bridge Structures to provide MUP connection between Cleary Station and NCC's proposed linear pathway system on the north side of the proposed SJAM Parkway corridor. The new Bridges shall accommodate the following:

i. The SJAM Parkway roadway cross section at Cleary Station in accordance with Clause 6.21 of this Part 2 on both the east and west Structure; and,

ii. A MUP under the Structures.

B. Install City specified modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail, including all associated transitions, terminal elements and end treatments as per the details in Appendix F, Drawings F-3 to F-5, of this Part 2 and in accordance with Clause 6.21 of this Part 2.

C. The minimum pathway width under the Structure shall be in accordance with Schedule 15-2, Part 6, Appendix A. A minimum vertical clearance of 3m, unencumbered by haunches, shall be achieved over the full width of the pathway.

(xxii) Lincoln Fields Station Pedestrian Bridge (SN018400)

A. Structure to be decommissioned in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal.

(xxiii) Carling Avenue Bridge at Lincoln Fields Station (SN016070)

A. Design and construct and a new Bridge to carry Carling Avenue over the alignment. The new Bridge shall accommodate the following:

i. The proposed Carling Avenue roadway cross section in accordance with Clause 6.19 of this Part 2 on the Structure; and,

ii. The EB and WB alignment under the Structure

B. Install Bridge Structure fencing in accordance with the requirements in Schedule 15-2, Part 6, Article 2 – Design Criteria.

(xxiv) Pedestrian Bridge at **[REDACTED]**

A. Design and construct a new pedestrian Bridge over the alignment. The new structure shall be constructed north of the existing pedestrian Bridge (SN018380) and meet the requirements in Schedule 15-2, Part 6, Article 5 – Site Specific Temporary Requirements. The new Structure shall accommodate the following:

i. A MUP connection to existing pathway at Sackville Connaught Avenue intersection on the Structure; and,

ii. Existing Transitway; EB, WB and SB alignment, including Emergency walkways, MUP and the 100 year flood plain under the Structure.

B. Remove the existing pedestrian Bridge in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal. The new structure shall be Constructed and in service prior to the decommissioning of the existing pedestrian Bridge.

(xxv) Lincoln Fields Split Structure (SN015050)

A. Design and construct a new elevated Guideway to carry the EB and WB alignment to Bayshore over the SB alignment to Baseline. The new elevated Guideway shall be a single, multi-span Structure and shall accommodate the following:

i. EB and WB alignment, including Emergency walkways on the Structure

ii. Southbound alignment, including Emergency walkways, existing Transitway roadway cross section, Pinecrest Creek and a MUP under the Structure.

B. Construction of the new Structure shall be staged in accordance with Schedule 15-2, Part 7, Article 3 – Existing Transitway System.

C. Retaining walls shall not be used between the SB alignment and Pinecrest Creek.

(xxvi) U Approach – Depressed Guideway Connaught East Portal (SN015130)

A. Design and construct and new Tunnel portal at the east end of the Connaught Tunnel. The new portal shall accommodate the EB and WB alignment, including Emergency walkways.

B. Design and construction of the portal shall be done in conjunction with the design and construction of the Connaught Tunnel.

C. Architectural concrete shall be used for all exposed concrete elements. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements of Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

(xxvii) U Approach – Depressed Guideway Connaught West Portal (SN015140)

A. Design and construct and new Tunnel portal at the west end of the Connaught Tunnel. The new portal shall accommodate the EB and WB alignment, including Emergency walkways.

B. Design and construction of the portal shall be done in conjunction with the design and construction of the Connaught Tunnel.

C. Architectural concrete shall be used for all exposed concrete elements. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements of Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

(xxviii)Pedestrian Bridge at Queensview Station (SN018460)

A. Design and construct a new pedestrian Bridge over Highway 417 in accordance with the requirements in Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria. The new Structure shall accommodate the following:

i. A pedestrian connection between the north and south side of Queensview Station on the Structure; and,

ii. The proposed Highway 417 roadway configuration in accordance with Schedule 15-2, Part 9 – Highway Works under the Structure.

B. New structure shall be designed to span over Highway 417 in one span.

C. Design of the Bridge shall be coordinated with the design of Queensview Station. Refer to Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

D. Architectural concrete shall be used for all concrete elements exposed to the adjacent Queensview Station Platforms. Architectural concrete shall be

as per ACI 347.3R and shall meet the requirements of Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

(xxix) Highway 417 Westbound Off-Ramp at Richmond Road (SN116410)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, and abutment walls.

ii. Concrete patch repairs to all spalled areas on the soffit and retaining walls.

(xxx) Richmond Road Bridge (SN116420)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, wingwalls, abutment walls, and retaining walls.

ii. Concrete patch repairs to all spalled areas on the soffit.

D. Reconfigure Richmond Road cross section in accordance with the requirements of Schedule 15-2, Part 9, Part B, Clause 1.3.

E. Complete a structural evaluation to ensure the structural capacity of the Bridge is not exceeded following reconfiguration of Richmond Road. Any required repairs or strengthening shall be performed by DB Co.

(xxxi) Richmond Road O/P Bayshore Drive (SN116110)

A. Reconfigure Richmond Road cross section in accordance with the requirements of Schedule 15-2, Part 9, Part B, Clause 1.3.

B. Complete a structural evaluation to ensure the structural capacity of the Bridge is not exceeded following reconfiguration of Richmond Road. Any required repairs or strengthening shall be performed by DB Co.

(xxxii) Highway 417 On-Ramp at Richmond Road (SN116430)

A. Repurpose the existing Underpass structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, wingwalls, abutment walls and retaining walls.

ii. Concrete patch repairs to all delaminated areas on the soffit.

iii. Stabilize southeast retaining wall.

(xxxiii) Graham Creek Culvert (SN117020)

A. Ensure the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the Structure. Any required repairs or strengthening shall be performed by DB Co.

(xxxiv) Stillwater Creek Culvert 1 (SN117440)

A. An extension to this Culvert was constructed as part of the West Transitway construction.

B. DB Co shall ensure that the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the Structure. Any required repairs or strengthening shall be performed by DB Co.

(xxxv) Stillwater Creek Culvert 2 (SN117450)

A. An extension to this Culvert was constructed as part of the West Transitway construction.

B. DB Co shall ensure that the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the Structure. Any required repairs or strengthening shall be performed by DB Co.

(xxxvi) Highway 417 E-N/S Ramp at Moodie Drive (SN116390)

A. Repurpose the existing ramp Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. The existing ramp Structure shall not be modified or removed and shall accommodate the following under the structure:

i. The proposed EB and WB alignment, including emergency walkways; and,

ii. Bus access ramp to Moodie Station.

(xxxvii) Queensway (Hwy 417) Bridge (SN014490)

A. Repurpose the existing Overpass Bridge to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. The existing Transitway Station shall be decommissioned with no alterations or impacts to the existing substructure and superstructure in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal. All components of the existing Queensway Transitway Station shall be removed, including but not limited to the following:

i. Lower Station Platforms and shelters;

ii. Upper Station Platforms and shelters;

iii. Elevator shafts and stairwells on the north side of the Structure; and,

iv. One elevator shaft and corresponding stairwell on the south side of the Structure.

C. DB Co shall have the option to repurpose one of the south elevator shafts and corresponding stairwell as an Emergency access point. One south elevator shaft and stairwell and required components for operation shall only remain to be used as an Emergency access point, otherwise both south elevator shafts and stairwells shall be removed.

(xxxviii) Iris Street Bridge (SN015210)

A. Design and construct a new Overhead Bridge to carry Iris Street over the alignment. The new Structure shall accommodate the following:

i. The proposed Iris Street roadway cross section in accordance with Clause 6.19 of this Part 2 on the Structure; and,

ii. The NB and SB alignment, east and west Train Platforms and a MUP under the Structure.

B. Install Bridge Structure fencing in accordance with Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. The new Bridge shall be designed and constructed in conjunction with Iris Station. Refer to Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria.

D. Architectural concrete shall be used for all concrete elements exposed to the adjacent Station and/or within the Station limits. Architectural concrete shall be as per ACI 347.3R and shall meet the requirements in Schedule 15-2, Part 4, Article 2 – Architectural Design Criteria.

E. Piers, if required, shall not be located on or directly adjacent to the Station Platforms.

(xxxix) Pinecrest Creek Iris Street Culvert (SN018350)

A. Structure shall be decommissioned in accordance with Schedule 15-2, Part 1, Article 14 – Demolition, Removals and Disposal and shall meet the requirements in Clause 5.7 of this Part 2.

(xl) Pinecrest Creek Culvert Under Iris (SN017710)

A. Design and construct a new Culvert under Iris Street over Pinecrest Creek. The design of the Culvert shall meet the requirements of Clause 5.7 of this Part 2. The new Culvert shall accommodate the following:

i. The proposed Iris Street roadway cross section in accordance with Clause 6.19 of this Part 2 and north and south embankment slopes over the Culvert; and,

ii. Pinecrest Creek under the Culvert.

B. The new Culvert shall:

i. Be constructed with reinforced concrete;

ii. Be open bottom; and,

iii. Convey a 100-Year Storm event.

(xli) Pinecrest Creek Culvert Under Alignment (SN017720)

A. Design and construct a new Culvert to carry the alignment over Pinecrest Creek. The design of the Culvert shall meet the requirements of Clause 5.7 of this Part 2. The new Culvert shall accommodate the following:

i. The NB and SB alignment, including Emergency walkways, a west MUP and embankment slopes over the Culvert; and,

ii. Pinecrest Creek under the Culvert.

B. The new Culvert shall:

i. Be constructed with reinforced concrete;

ii. Be open bottom; and,

iii. Convey a 100-Year Storm event.

(xlii) Pinecrest Creek Kenson Park Culvert (SN018360)

A. Complete a structural evaluation to ensure the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the structure. All required repairs or strengthening shall be performed by DB Co.

B. Ensure Culvert has adequate length to accommodate embankments, alignment and MUP. Any required Culvert lengthening shall be performed by DB Co.

C. Undergo a structural rehabilitation to address all Culvert deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the Culvert barrel, and the inlet and outlet components;

ii. Concrete patch repairs to all delaminated areas on the Culvert barrel; and,

iii. Concrete patch repairs to all spalled areas on the Culvert barrel and inlet component.

(xliii) Pinecrest Creek Baseline Road Culvert (SN018370)

A. Complete a structural evaluation to ensure the structural capacity of the Culvert is not exceeded with the application of all loads as defined in Clause 4.5 of this Part 2 and/or increase of fill over the structure. All required repairs or strengthening shall be performed by DB Co.

B. Ensure Culvert has adequate length to accommodate embankments, alignment and MUP. Any required Culvert lengthening shall be performed by DB Co.

(xliv) Baseline Road Bridge (SN016080)

A. Repurpose the existing Underpass Structure to accommodate the OCS in accordance with Schedule 15-2, Part 3, Article 14 – Overhead Contact System.

B. Install Bridge Structure fencing in accordance with Schedule 15-2, Part 6, Article 2 – Design Criteria.

C. Undergo a structural rehabilitation to address all substructure and deck soffit deficiencies. The scope of rehabilitation shall be based on the most recent OSIM inspection report and shall include the following, as a minimum:

i. Crack repairs to all medium and wide cracks on the soffit, wingwalls, ballast walls and abutment walls;

ii. Concrete patch repairs to all delaminated areas on the soffit;

iii. Concrete patch repairs to all spalled areas on the soffit; and,

iv. Replace abutment bearings.

(xlv) Pinecrest Stormwater Management Facility Inlet Chamber and Inlet Culvert

A. Design and construct a new continuous inlet chamber and inlet Culvert in accordance with the requirements in Clause 5.7 of this Part 2.

B. The inlet chamber and inlet Culvert shall form a continuous enclosed channel, with a minimum width of 3m, from the existing Baseline Storm Sewer Outfall to the sediment forebay, as shown in Appendix J of this Part 2.

C. Inlet Chamber

i. The new inlet chamber shall accommodate the following:

1 Access for maintenance personnel on the chamber; and,

2 Stormwater flow from the Baseline Storm Sewer Outfall and an 8m wide bypass weir to Pinecrest Creek in the chamber.

ii. The Structure shall be constructed of reinforced concrete walls with a reinforced concrete slab footing and a steel grate top.

iii. The steel grate top shall include two access hatches and access to stop log gains. The location of the hatch openings and access to the stop log gains shall be in accordance with Clause 5.7 of this Part 2.

iv. The existing Baseline Storm Sewer Outfall and the inlet chamber shall be structurally connected to prevent differential settlement and separation. The existing sewer and inlet chamber connection shall include the design of a grade beam at the connection interface.

v. A minimum height of 2.4m shall be provided throughout the chamber, excluding areas over the weir and weir benching.

D. Inlet Culvert

i. The new inlet Culvert shall accommodate the following:

1 A MUP and maintenance road on the Structure; and,

2 Flow from the inlet chamber to the pond.

ii. The Culvert shall be designed to support CL-625-ONT live loading in accordance with CHBDC.

iii. The Structure shall be a rigid frame concrete box Culvert with a minimum opening size of 3m wide by 2.4m high.

iv. The outlet of the Culvert shall be mitered to match the adjacent slope.

v. A steel pedestrian railing shall be installed on top of the Structure at the outlet end of the Culvert. The pedestrian railing shall continue down the mitered portion of the outlet.

(xlvi) DB Co shall design and construct retaining walls as dictated by grade and where site conditions do not allow for an embankment with a stable slope to be installed. Retaining wall locations include but are not limited to the following:

A. Directly adjacent to the abutment walls, on the north and south of the new Carling Avenue Bridge at Lincoln Fields Station.

B. On the north side of the Queensway, on the south side of Holly Acres Road

C. Directly adjacent to the wingwalls on the east and west side of the new Iris Street Bridge.

ARTICLE 5 DRAINAGE AND STORMWATER MANAGEMENT DESIGN CRITERIA

5.1 Reference Documents

(a) Drainage and Stormwater Management shall be provided in accordance with the criteria contained in this Article and the Applicable Law, the Project Agreement, including but not limited to the latest edition of the following Reference Documents:

(i) City Publications;

A. City of Ottawa Sewer Design Guidelines, including Technical bulletins

B. Stormwater Management Facility Design Guidelines

C. City of Ottawa By-Laws

D. "Stormwater Management Guidelines for the Pinecrest Creek/Westboro Area", JFSA, 2012

(ii) Federal and Provincial Codes, Acts and Regulations;

A. Fisheries Act (Canada)

B. Ontario Water Resources Act

C. Drainage Act (Ontario)

D. Ontario Regulation 525/98 - Approval Exemption

E. Ontario Building Code

F. OPSS and OPSD

(iii) Conservation Authority Publications

A. RVCA: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 174/06)

B. SNC: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 170/06), Conservation Authorities Act, R.S.O. 1990, c. C.27

C. RVCA: Solutions for Shoreline Erosion

D. TRCA/CVC: Low Impact Development Stormwater Management Planning and Design Guideline

E. CVC: Low Impact Development Construction Guide

F. RVCA: Ottawa River Flood Risk Mapping from Shirley's Bay to Cumberland

(iv) MOECC Publications;

A. Stormwater Management Planning and Design Manual

B. Design Guidelines for Sewage Works

C. Guideline B-6 – Guidelines for Evaluating Construction Activities Impacting on Water Resources

D. Environmental Activity and Sector Registry information https://www.ontario.ca/page/environmental-activity-and-sector-registry

E. Permit To Take Water Manual

(v) Ontario MNR Publications;

A. Technical Guide – River & Stream Systems: Flooding Hazard Limit

(vi) MTO Publications;

A. Drainage Management Manual

B. Highway Drainage Design Standards

C. Gravity Pipe Design Manual

D. Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects

(vii) CHBDC;

(viii) AREMA Manual for Railway Engineering;

(ix) Standards Respecting Pipeline Crossings Under Railways (Transport Canada TC E-10);

(x) NFPA 130; and,

(xi) Other applicable policies, acts and guidelines by the City, Regulators, and applicable Governmental Authorities.

5.2 General Criteria

(a) DB Co shall design and construct a drainage and SWM system such that Revenue Service operations can safely continue and such that surface ponding remains below the TOR during the 100-Year Storm event.

(b) DB Co shall evaluate the performance of the drainage and SWM system under historical storms and 100-Year Storm Plus 20% (stress test condition) and modify the design as needed in accordance with the City of Ottawa Sewer Design Guidelines and Technical Bulletins.

(c) DB Co shall design and construct Drainage and SWM systems for the Guideway and Stations such that the maximum depth of flow on local and collector streets remains below 0.35 m during the 100-Year Storm event. The depth of flow may extend adjacent to the ROW provided that the water level does not touch any part of building envelopes and shall remain below the lowest Station and building opening during the 100-Year Storm Plus 20% event (stress test condition).

(d) Runoff from at-grade and below grade segments shall be collected by trackside ditches or storm sewers. All Guideway drainage shall be captured and managed within the Guideway ROW with SWMPs that provide attenuation up to the 100-Year Storm and water quality protection that meets MOECC's 'Enhanced' standard before discharging to outlet locations. Discharge shall be to outlets at the locations identified in Clause 5.7 – Site Specific Criteria, of this Part 2.

(e) Runoff from raised Guideway, where Guideway is an embankment, may be discharged along the embankment, provided runoff is evenly distributed to prevent erosion, before being collected by SWMPs that provide attenuation up to the 100-Year Storm and water quality protection that meets MOECC's 'Enhanced' standard.

(f) Runoff from raised Guideway, where Guideway is a Structure, shall be conveyed by gutter systems to inlets. Inlets shall discharge to SWMPs that provide attenuation up to the 100-Year Storm and water quality protection that meets MOECC's 'Enhanced' standard.

(g) DB Co shall secure all permits and approvals, where necessary for the implementation of the Drainage and SWM systems for the Project, and shall be responsible for preparing and submitting all necessary drawings and supporting documentation associated with obtaining those permits and approvals in accordance with Schedule 10 – Review Procedure.

(h) DB Co shall be responsible for all costs associated with obtaining the required permits and approvals, and those associated with providing the Drainage and SWM systems.

(i) DB Co shall obtain sewer discharge permits and approvals in accordance with the City, MOECC and CA (RVCA, SNCA) requirements. Sewer discharge permits and approvals shall be obtained a minimum of two weeks prior to the anticipated discharge date.

(j) DB Co shall obtain all PTTWs and/or Environmental Activity and Sector Registry registrations, in accordance with current MOECC requirements, for the Works.

(k) All additions or modifications to existing sewers and related appurtenances will require municipal approval and shall conform to the requirements of the City.

(l) DB Co shall ensure services to adjoining properties are supported in place and maintained in operation during additions to or modifications of the existing sewers.

(m) Without limiting any other obligations of DB Co, DB Co shall be in compliance with Ontario Regulation 166/06 (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) for Works within RVCA/SNCA regulated areas.

(n) No sanitary sewer discharge shall be permitted to enter the Drainage and SWM systems supporting SI.

(o) DB Co shall design and construct Drainage and SWM systems such that existing Drainage systems and overland flow paths are free of Hazard and such that any impact to these is mitigated.

(p) DB Co shall provide complete design packages for all Drainage and SWM components submitted in accordance with Schedule 10 – Review Procedure. Design packages shall include all Drainage and SWM works including detailed drawings, calculations, reports, and related ECA applications.

5.3 Drainage Criteria

(a) The Drainage Design Criteria provided herein are considered a minimum standard. The design of drainage facilities belonging to the City or other applicable Governmental Authorities which are to be relocated or modified to accommodate SI shall conform to the Design Criteria and standards of the City or the applicable Governmental Authorities. Required relocation of existing drainage facilities shall be Replacement-In-Kind, unless otherwise instructed.

(b) Drainage and SWM systems for the Project including the Guideways, Tunnels, Stations, LMSFs, roadways, parking lots, and other SI shall be designed in accordance with City and provincial standards.

(c) DB Co shall not increase flow rates to existing combined sewers or separated sewers unless the increase is approved by the City. Flow rates shall be limited in accordance with Section 3.2 of the Ottawa Sewer Design Guidelines.

(d) New storm sewers for the Project to convey minor system flows shall be designed to capture and convey a design storm event in accordance with Section 5.10 of the City of Ottawa Sewer Design Guidelines.

(e) Where the minor system for the Project is proposed to discharge to an existing municipal storm sewer, Ottawa Sewer Design Guidelines section 8.3.7.3 shall apply.

(f) In urban areas, DB Co shall design and construct on-site controls for flows from SI runoff in excess of the design capacity of the receiving minor system, for all storms up to the 100-Year Storm. For the stress test storm (100-Year Plus 20% Storm) excess flows shall

be conveyed via the Guideway, streets, open channels and walkways to a City approved public outlet, in accordance with the City of Ottawa Sewer Design Guidelines flow spread and velocity-depth criteria, without introducing property damage, limiting Emergency vehicle access, or endangering users of the roadway.

(g) The combination of a minor system and an overland flow system shall be designed for a 100-Year Storm or larger in accordance with the City of Ottawa Sewer Design Guidelines and Technical Bulletin and not create flow depths above the TOR.

(h) DB Co shall demonstrate to the City through hydrologic/hydraulic analysis that the flow rates or the hydraulic grade line in the receiving storm sewers does not adversely affect the existing level of service, in terms of flood protection and minor system performance, as a result of the Works.

(i) Guideway runoff (up to and including the 100-Year Storm) to Tunnels (or other section of below-grade Guideway), shall be intercepted and diverted by gravity to an outlet as close as possible to each Tunnel portal (or other section of below-grade Guideway). For clarity, possible gravity drainage outlets include new or existing outlets within the Lands, including City Road Allowance Lands. In the below-grade sections of the Guideway, DB Co shall keep Tunnel portals, Tunnels and Stations free from Flooding due to all storms up to and including the 100-Year Plus 20% Storm.

(j) DB Co shall design and construct all Drainage and SWM systems required to ensure adequate Drainage during Construction of the Works. Discharges shall comply with Applicable Law and City requirements.

(k) DB Co shall comply with the following requirements for Guideway Drainage:

(i) The Guideway Drainage system shall be designed and constructed such that ponding levels do not exceed TOR elevation and such that ponding does not contribute to subgrade instability for all storms up to and including the 100-Year Storm, as applicable to East Works, West Works, and Stage 1 Connection Infrastructure;

(ii) All Drainage discharges from the Guideway shall be in accordance with Applicable Codes and the requirements of the City and other applicable Governmental Authorities;

(iii) DB Co shall provide maintenance holes (access points) outside of the Guideway on all new service connections, between the City's ROW and the Guideway, in accordance with City requirements. The maintenance holes and sewers shall be turned over to the City to enable the City to perform its maintenance responsibility for storm drain/sewer service connections located beyond the limits of the Guideway.

(l) Groundwater, fireflow discharge, and storm runoff at all underground structures and other areas without a gravity outlet, shall be collected and pumped to a municipal storm sewer in compliance with the City of Ottawa Sewer Use By-Law.

(m) All new Culverts under the Guideway, regardless of size, shall be of reinforced concrete construction.

(n) All trackside swales within the Pinecrest Creek and SJAM Parkway corridors shall have side slopes no steeper than 3:1.

5.4 Stormwater Management Criteria

(a) SWM for the Project shall be provided in accordance with the City's "Sewer Design Guidelines" and "Stormwater Management Facilities Design Guidelines", MOECC's "Stormwater Management Planning and Design Manual", and other applicable sub-watershed studies and guidelines.

(b) DB Co shall prepare complete SWM plans and design packages in accordance with the City and Provincial requirements for all drainage and SWM aspects of the Works to address at a minimum:

(i) Water balance, quantity and quality control requirements imposed by local, provincial and federal government regulations along with the Project environmental impacts and mitigations;

(ii) Impact on existing municipal drainage and storm water management systems, and natural drainage systems;

(iii) Existing ditches, watercourses, Culvert crossings, and storm sewers that will be affected or are relevant to the Project;

(iv) Potential impacts of the Project on the existing drainage system and on any environmentally sensitive areas, in consultation with applicable Governmental Authorities;

(v) Existing drainage patterns and how the proposed Drainage System design will extend the existing minor and major drainage systems;

(vi) Directions by applicable Governmental Authorities in respect to changes in drainage patterns, upgrades to drainage infrastructure or modifications, and any agreements reached with the City or applicable Governmental Authorities;

(vii) Proposed SWMPs to mitigate potential impacts of the Works, including appropriate plans and drawings to illustrate the same; and,

(viii) All pertinent background information, calculations and model output to support the proposed designs and Works.

(c) DB Co shall submit complete SWM plan and design packages to the City as part of the Works Submittals in accordance with Schedule 10 – Review Procedure.

(d) Drainage and SWM designs of Facilities that require review and approval from applicable Governmental Authorities shall be submitted in accordance with the procedures established by the respective Governmental Authority. DB Co shall comply with the Governmental Authority permit requirements and conditions.

(e) The design of stormwater detention facilities and control measures proposed as part of the Works shall be submitted to the City and other applicable Governmental Authorities for approval.

(i) Where LID measures are required, they shall be designed in accordance with the "Low Impact Development Stormwater Management Planning and Design Guidelines". Refer to Schedule 15-2, Part 6, Article 2 – Design Criteria for landscaping requirements of LID measures.

(f) Roof Drainage (above-grade structures) shall be managed in accordance with a site-specific SWMP. Roof Drainage shall not be routed to the underground Track Drainage system.

(g) Unless otherwise noted, all SWM facilities shall be designed to meet the MOECC's "Enhanced" standard.

(h) Project site components that ultimately drain to the Ottawa River or Rideau River, and are considered Infill Development, as defined in section 8.3.7.2 of the City of Ottawa Sewer Design Guidelines, shall control peak flows to the minor system as prescribed in Section 3.2.2 and 8.3.7 of the City of Ottawa Sewer Design Guidelines. Water quality SWMPs for Infill Development are to provide a net improvement over existing conditions.

(i) Extended detention or "wet-pond" SWM facilities shall be designed and constructed to prevent both losses of permanent pool due to infiltration and losses of active storage due to intrusion of groundwater, if required.

(j) OGS structures shall be designed and specified with a required performance of removal of fine sediment, oil, floating and sinking debris, and 80% removal efficiency for TSS. OGS structures located outside of the Guideway shall be accessible by rubber tire vehicle.

(k) All Drainage within the Pinecrest Creek/Westboro watersheds shall be subject to specific quantity and quality criteria as outlined in Table 2-5.1

Table 2-5.1 - SWM Guidelines for the Pinecrest Creek/Westboro

Soil Infiltration Characteristic	**Runoff Volume Reduction**	**Water Quality**	**Water Quantity**

		TSS Removal	Flooding	Erosion
A Draining to Ottawa River (Westboro)				
soil infiltration > 1mm/hr	On-site retention of 10mm of rainfall	On-site removal 80% TSS	OSDG Section 8.3.7.3 (Sept 2008)	Does not apply
soil infiltration < 1mm/hr	Best effort based on opportunity			
B Draining to Pinecrest Creek				
B1 Discharging upstream of Ottawa River Parkway (ORP) Pipe inlet				
soil infiltration > 1mm/hr	On-site retention of 10mm rainfall	On-site 80% TSS removal	More stringent of 33.5 L/s/ha (1:100 yr) or OSDG 8.3.7.3	Control peak flow (25mm) to 5.8 L/s/ha
soil infiltration < 1mm/hr	Best effort based on opportunity			
B2 Discharging directly to the Ottawa River Parkway (ORP) Pipe				
soil infiltration > 1mm/hr	On-site retention of 10mm rainfall	On-site 80% TSS removal	More stringent of 33.5 L/s/ha (1:100 yr) or OSDG 8.3.7.3	Does not apply
soil infiltration < 1mm/hr	Best effort based on opportunity			

5.5 Numerical Computational Procedures and Models

(a) All numerical computation procedures shall comply with the requirements of the City of Ottawa Sewer Design Guidelines. Computer models used shall comply with the guidelines for model selection provided in the MTO's "Drainage Management Manual."

(b) DB Co shall confirm the suitability and acceptance of any computer model nominated for use in the design and analysis of Drainage or SWM system for the Project with the City and other approving agencies.

(c) Peak flows to be used for design purposes for drainage areas greater than 40 hectares shall be verified using a method approved by the City and other applicable Governmental Authorities.

5.6 Erosion and Sediment Control Requirements

(a) DB Co shall implement stormwater control, mitigation, and ESC measures appropriate for the urban context of the Project to ensure deleterious substances and other pollutants do not leave the Site and enter watercourses or the municipal drainage infrastructure.

(b) DB Co shall prepare an ESC Plan for the Project, as a component plan of the Environmental Management Plan described in Schedule 17 – Environmental Obligations, to comply with environmental approvals and commitments and with any and all Applicable Codes. In addition, site-specific ESC Plans shall be developed to address local

potential environmentally sensitive site conditions, including watercourse crossings. The ESC Plan for the Project and the site specific ESC Plans shall be submitted to the City in accordance with Schedule 10 – Review Procedure.

(c) In addition to City and other Governmental Authority requirements, ESC Plans shall be prepared in accordance with the following documents:

(i) MNR, et al., 1987, Guidelines on Erosion and Sediment Control for Urban Construction Sites.

(ii) MTO's Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects.

(d) DB Co shall obtain all permits and approvals for all in-water works in accordance with all applicable Governmental Authorities' requirements.

(e) DB Co shall adhere to all fisheries (timing) window restrictions imposed by the RVCA, SNC, or other applicable Governmental Authorities on activities on or adjacent to watercourses associated with the Works.

5.7 Site-Specific Criteria

(a) DB Co shall comply with the following site-specific requirements to satisfy the Drainage and Stormwater Management Design Criteria outlined in this Article.

(b) Confederation Line East Extension Stations:

(i) Blair Station (Existing Confederation Line)

A. Expansion of the Station is considered Infill Development. As such, it shall comply with the provisions of Sections 3.2.2 and 8.3.7 of the City of Ottawa Sewer Design Guidelines (latest version).

(ii) Montreal Station

A. The Station shall be considered Greenfield Development. SWM requirements as per this Article.

(iii) Jeanne d'Arc Station

A. Drainage to existing outlets to the east of the Station. The Station shall be considered Greenfield Development. SWM requirements as per this Article.

(iv) Orléans Boulevard Station

A. Station drainage shall be to the existing Orléans Boulevard storm sewer, located approximately 230m west of the Station. The Station shall be

considered Greenfield Development. SWM requirements as per this Article.

(v) Place d'Orléans Station

A. Station drainage shall be to the 900mm -1350mm diameter storm sewer, which is currently located within the OR174 median. This sewer shall be relocated by DB Co as per the requirements in Article 8 – Utility Infrastructure Design Criteria, of this Part 2. The Station shall be considered Greenfield Development. SWM requirements as per this Article.

(vi) Trim Station

A. The Station and Park and Ride shall be considered Greenfield Development. SWM requirements as per this Clause.

(c) At-Grade Guideway – Blair to Trim

(i) The Guideway shall be considered Greenfield Development. SWM requirements as per this Article.

(ii) DB CO shall design and construct a Drainage system for the OR174 in accordance with the MTO GDSOH. For additional requirements of roadway design for OR174, refer to Article 6 – Roadways, Bus Terminals and Lay-bys, of this Part 2.

(iii) DB Co shall replace all existing centreline and median Culverts underneath the Guideway and OR174 unless specified otherwise in this Clause.

A. DB Co shall design the replacement of the Green's Creek culverts under the Guideway and OR174, but shall construct only the portion under the Guideway. The hydraulic capacity of the interim condition shall not be less than the existing system. The future replacement of the Culverts under the OR174 (ultimate condition) will be completed by the City.

(iv) DB Co shall replace all Culverts identified in Table 2-5.2.

(v) DB Co shall decommission existing Culverts underneath the Guideway and reconstructed OR174 that become redundant or ineffectual as a result of the Works. Culverts to be decommissioned shall be filled with non-shrink grout or concrete. DB Co shall provide access points to allow for confirmation that decommissioned Culverts have been completely filled.

(vi) Blair to Montreal

A. Between Blair Station and Gloucester High School, approximately 350m to a high point just east of the OR174 WB off ramp at Blair Road, the

Guideway shall be drained by installing a subdrain system under the Guideway. Drainage of this segment shall be to the relocated 450mm Transitway storm sewer that drains in a westerly direction. The existing 450mm Transitway sewer shall be relocated by DB Co to avoid conflict with the LRT guideway for a distance of approximately 250m as per the requirements in this Article and Article 8 – Utility Infrastructure Design Criteria, of this Part 2. No quantity or quality SWMPs are required.

B. From the high point just east of the OR174 WB off ramp at Blair Road to the high point at Gloucester High School, a distance of approximately 720m, runoff shall be collected by trackside swales.

C. From the high point at **[REDACTED]** to Montreal Station, a distance of approximately 1,960m, runoff shall be drained by installing a subdrain system under the Guideway. SWM requirements as per this Article.

D. DB Co may retain the following reinforced concrete Culverts, provided DB Co demonstrates that the Culverts comply with all requirements of this Article 5 and Article 4 – Structural Design Criteria and Requirements, of this Part 2.

i. Structure A224700 located at the approximate coordinates with an easting of 375,544.0 and a northing of 5,033,412.2.

ii. Structure A224710 located at the approximate coordinates with an easting of 375,698.0 and a northing of 5,033,517.0.

iii. Structure A224720 located at the approximate coordinates with an easting of 375,835.6 and a northing of 5,033,682.4.

iv. Structure STM80696 located at the approximate coordinates with an easting of 376,050.1 and a northing of 5,034,085.3.

v. Structure T224630 located at the approximate coordinates with an easting of 374929.4 and northing of 5033030.0.

E. DB Co may retain the following CIPP lined CSP Culvert, provided DB Co demonstrates that the Culvert complies with all requirements of this Article 5 and Article 4 – Structural Design Criteria and Requirements, of this Part 2.

i. Structure T224650 located at the approximate coordinates with an easting of 375,269.8 and northing of 5,033,252.0.

(vii) Montreal to Jeanne d'Arc

A. From Montreal Station to Jeanne d'Arc Station, a distance of approximately 3,580m, the Guideway shall be drained by installing a subdrain system under the Guideway.

B. DB Co may retain the following reinforced concrete Culvert, provided DB Co demonstrates that the Culvert complies with all requirements of this Article 5 and Article 4 – Structural Design Criteria and Requirements, of this Part 2.

i. Structure SN220420 located at the approximate coordinates with an easting of 377,161.4 and northing of 5,035,720.0.

(viii) Jeanne d'Arc to Orléans Boulevard

A. From Jeanne d'Arc Station to Orléans Boulevard Station, a distance of approximately 1,060m, the Guideway shall be drained by installing a subdrain system under the Guideway.

(ix) Orléans Boulevard to Place d'Orléans

A. From Orléans Boulevard Station to Place d'Orléans Station, a distance of approximately 2,380m, the Guideway shall be drained by installing a subdrain system under the Guideway.

(x) Place d'Orléans to Trim

A. From Place d'Orléans to Trim Station, a distance of approximately 3,340m, the Guideway shall be drained by installing a subdrain system under the Guideway.

B. DB Co may retain the following reinforced concrete Culvert, provided DB Co demonstrates that the Culvert complies with all requirements of this Article 5 and Article 4 – Structural Design Criteria and Requirements, of this Part 2.

i. Structure A894640 located at the approximate coordinates with an easting of 382,627.9 and a northing of 5,038,810.8.

C. DB Co may retain the following HDPE lined CSP culvert, provided DB Co demonstrates that the Culvert complies with all requirements of this Article 5 and Article 4 – Structural Design Criteria and Requirements, of this Part 2.

i. Structure SN898560 located at the approximate coordinates with easting 384,258.8 and a northing of 5,039,908.8.

(xi) TPSS shall not be located within RVCA or SNC regulated areas to the extent possible. DB Co shall consult and obtain approval from RVCA/SNC for any TPSS that must be located within regulated areas due to Project constraints.

(xii) **Table 2-5.2** – Confederation East Culvert Replacements

Culvert ID	Existing Structure	Northing	Easting
	Size/Material		
A224900	300 diam. CSP	5,036,832.32	379,498.87
A224902	600 diam. CSP	5,036,851.41	379,332.49
A224908	600 diam. CSP	5,036,970.09	379,425.69
A224940	850 diam. CSP	5,037,505.21	380,326.39
A224950	1000 diam. CSP	5,037,559.57	380,316.18

(d) Confederation Line West Extension Stations:

(i) Westboro, Dominion, Cleary and New Orchard Stations

A. The Westboro and Dominion Stations are located on the former Transitway. This shall be considered Infill development. Drainage from the Stations shall comply with the provisions of Sections 3.2.2 and 8.3.7 of the City of Ottawa Sewer Design Guidelines (latest version).

B. Existing 675mm diameter outfall at Dominion is in conflict with the station and shall be relocated by DB Co in accordance with the City of Ottawa Sewer Design Guidelines.

C. Cleary and New Orchard Stations are located within the Parkway Tunnel. As such, they shall comply with the quality and attenuation/retention requirements of Table 2-5.1. Pump station(s) shall be provided at low point(s) of the Tunnel to allow discharge to existing sewer(s).

(ii) Lincoln Fields Station

A. Lincoln Fields Station and Ancillary Facilities are located within the Pinecrest Creek watershed. Drainage from the Station shall comply with the quality and attenuation/retention requirements of Table 2-5.1.

B. The quality and attenuation/retention requirements for the Transitway Station shall be achieved by a combination of infiltration trenches in the traffic islands and shallow swales along the edge of the Transitway Station, designed to LID standards. Refer to Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes for landscaping requirements.

C. Discharge from the Station and Ancillary Facilities shall be via a new storm sewer. DB Co shall construct this sewer between Carling Avenue and its outfall to the ORPP, located approximately 150m north of Richmond Road.

D. DB Co shall demonstrate to the City through hydrologic/hydraulic modeling that the cumulative impacts of the Works will not increase peak flow rates or the peak hydraulic grade line of the enclosed portion of Pinecrest Creek known as the ORPP for all rain events up to the 100-Year Storm. This analysis shall be submitted in accordance with Schedule 10 – Review Procedure.

(iii) Queensview and Pinecrest Stations

A. Queensview Station is located within the Pinecrest Creek watershed. Discharge shall meet the quality and attenuation/retention requirements of Table 2-5.1. Discharge shall also meet the requirements of Clauses 5.3(i) and 5.7(e) of this Part 2.

B. Pinecrest Station is located within the Pinecrest Creek and Graham Creek watersheds. Discharge to Pinecrest Creek shall meet the quality and attenuation/retention requirements of Table 2-5.1. Discharge to Graham Creek shall be controlled to existing (pre-development) peak flow rates. SWM quality requirements as per this Article.

i. Discharge from Pinecrest Station shall be to the existing Transitway sewer that outlets to Graham Creek, or to the existing Transitway sewer that outlets to Graham Creek and the existing 1500mm diameter sewer located approximately 160m east of the Station. Discharge shall be in accordance with the requirements of Clauses 5.3(i) and 5.7(e) of this Part 2.

(iv) Bayshore Station

A. Bayshore Station and Ancillary Facilities are located on the former Transitway alignment. Discharge shall be controlled to existing (pre-development) peak flow rates. SWM quality requirements as per this Article.

(v) Moodie Station

A. Moodie Station is located on the existing Transitway Station.

B. DB Co shall design a storm drain inlet and sewer system to convey the runoff to a SWM storage system. Infiltration shall be reviewed and considered in the design of the storage system. Discharge shall be controlled to existing (pre-development) peak flow rates. DB Co shall

consider the temperature of stored runoff prior to discharge to Stillwater Creek in the design of SWM features.

C. OGS structures shall be designed and specified with a required performance of removal of fine sediment, oil, floating and sinking debris, and 80% removal efficiency for TSS at the outlet from the drainage system to an existing storm sewer that traverses the site and discharges to Stillwater Creek.

D. DB Co shall design the drainage and sewer system to maintain the existing sewer system at the Transitway Station where practical. No new additional outlets to Stillwater Creek shall be permitted.

E. DB Co shall permanently plug any existing storm sewers that are not incorporated into the drainage system design.

F. DB Co shall design and construct drainage requirements for the reconfigured Corkstown Road.

G. DB Co shall confirm the value of the loss of floodplain storage volume within the 1:100 year floodplain which will result from the placement of fill by June 1, 2020. The City will be responsible to fully compensate for this loss of floodplain storage volume through a balanced cut (or excavation) to be performed in a location selected by the City. The City will be responsible for permits and approvals for this compensation and the work will be complete by the end of 2020.

(vi) Iris Station

A. Iris Station is located within the Pinecrest Creek watershed. Drainage from the Station shall be conveyed by trackside swales to Pinecrest Creek. Runoff from below grade segments shall be collected by a storm sewer, if required, and discharged to the trackside swales. All drainage infrastructure shall be designed to LID standards. Discharge shall meet the quality and attenuation/retention requirements of Table 2-5.1.

(vii) Baseline Station

A. Baseline Station and Ancillary Facilities are located on the former Transitway alignment. Runoff shall be conveyed by existing and new storm sewers to existing non-commissioned outlet. SWMPs that are part of the existing Baseline Transitway Station shall be maintained. New SWMPs shall be installed to provide quality control for new impervious areas. Discharge shall meet the water quality requirements prescribed in Table 2-5.1. No on-site quantity control SWMPs shall be required. Quantity control for Baseline Station and Ancillary Facilities shall be provided by the Pinecrest Stormwater Management Facility to be

constructed by DB Co as per Clause 5.7 (i) of this Part 2 in lieu of on-site SWMPs.

(e) Guideway from Tunney's Pasture to Moodie

(i) Tunney's Pasture to the high point east of Dominion (approximately 200m east of the Station).

A. Discharge to existing Transitway sewer. DB CO shall limit discharge to the minor system to the 10-year event. Drainage from the Guideway shall comply with the provisions of Sections 3.2.2 and 8.3.7 of the City of Ottawa Sewer Design Guidelines (latest version).

B. Overland flow west of Goldenrod shall be collected, attenuated, retained and treated within the Lands. No increase in flow to the Existing Confederation Line drainage collection system shall be permitted.

(ii) High point east of Dominion (approximately 200m east of the station) to Parkway Tunnel portal (approximately 400m southwest of Dominion).

A. Trackside swales shall be provided where feasible within the Lands, and shall drain to the Workman Avenue outfall sewer. Attenuation/retention and quality control shall be in accordance with Table 2-5.1.

(iii) Parkway Tunnel and Portals.

A. Tunnel drainage shall be discharged to the storm system. DB Co shall ensure that all runoff is managed in accordance with Clause 5.3(i) of this Part 2. Storage of runoff in the Tunnel shall be below TOR for all events up to the 100-Year Storm. Discharge from Tunnel and portals shall meet the quality and attenuation/retention requirements of Table 2-5.1.

(iv) Parkway Tunnel West Portal to East Portal of Connaught Tunnel

A. Drainage from below grade Guideway sections shall be discharged to the storm system in accordance with Clause 5.3(i) of this Part 2. Runoff from at-grade and above-grade Guideway sections shall be conveyed and controlled by trackside swales designed to LID standards. Additional LID SWMPs shall be used in combination with the swales in order to meet quality and attenuation/retention requirements. All swales located between the Parkway Tunnel West Portal and the Lincoln Fields Station Pedestrian Bridge (SN018400) shall have side slopes no steeper than 6:1. Discharge from the swales shall meet the quality and attenuation/retention requirements of Table 2-5.1.

(v) Connaught Tunnel and east portal

A. Drainage shall be discharged to the storm system or to a LID SWMP within the Guideway ROW east of the Connaught tunnel in accordance with Clause 5.3(i) of this Part 2. Storage of runoff in the Tunnel shall be below TOR for all events. Discharge from Tunnel and portals shall meet the quality and attenuation/retention requirements of Table 2-5.1.

(vi) Connaught Tunnel west portal and Guideway from Connaught Tunnel west portal to high point approximately 120m west of Queensview Station.

A. This portion of the Guideway drains to the Connaught Tunnel west portal. Tunnel drainage shall be discharged to the storm system or to a LID SWMP within the Guideway ROW east of the Connaught Tunnel. Due to the larger catchment area, runoff up to the 25-year event shall be intercepted and diverted away from the Guideway at the Connaught Tunnel west portal. For clarity, this drainage shall not be conveyed within or parallel to the Tunnel to the same drainage system that serves the Connaught Tunnel low point. Storage of runoff in the Tunnel shall be below TOR for all events. Discharge shall meet the quality and attenuation/retention requirements of Table 2.5.1.

(vii) Pinecrest Tunnel and portals (Guideway from high point approximately 120m west of Queensview Station to approximately 60m west of Pinecrest Station).

A. Tunnel drainage shall be discharged to the storm system. DB Co shall ensure that all runoff is managed in accordance with Clause 5.3(i) of this Part 2. Storage of runoff in the Tunnel shall be below TOR for all events up to the 100-Year Storm. Discharge to Pinecrest Creek shall meet the quality and attenuation/retention requirements of Table 2-5.1. Discharge to Graham Creek shall be controlled to existing (pre-development) peak flow rates. SWM quality requirements as per this Article.

(viii) From approximately 60m west of Pinecrest Station west for approximately 360m to high point.

A. Runoff shall be conveyed by storm sewers to the existing Transitway storm sewer. SWM requirements as per this Article.

(ix) From high point approximately 420m west of Pinecrest Station to Bayshore Station

A. Existing drainage is to the minor system to the 10-year event. Runoff shall be conveyed by trackside swales where feasible within the Lands. SWM requirements as per this Article.

(x) From Bayshore Station to Moodie Station

A. Existing drainage is to the minor system to the 10-year event. Runoff shall be conveyed by trackside swales, with no additional outlets to Stillwater Creek. SWM requirements as per this Article.

(f) From Moodie Station to LMSF

(i) Existing drainage is to the minor system to the 10-year event. Runoff shall be conveyed by trackside swales. SWM requirements as per this Article.

(ii) DB Co shall design and construct a pumping station to convey drainage from below grade Guideway sections. The pumping station shall be located within the S-W Ramp connecting Moodie Drive to Highway 417. Stormwater shall be conveyed to a SWM storage system, where it shall be allowed to dissipate energy and cool prior to being discharged through the Moodie Station drainage system to Stillwater Creek. DB Co shall determine all parameters of the proposed stormwater storage basin, including the appropriate location, configuration, and type.

(g) Guideway from split (approximately 300m south of Lincoln Fields Station) to Baseline Station

(i) Split to Baseline Road:

A. Runoff from at-grade and above-grade Guideway sections shall be conveyed and controlled by trackside swales designed to LID standards. Additional LID SWMPs shall be used in combination with the swales in order to meet quality and attenuation/retention requirements. All drainage infrastructure shall be designed to LID standards. Discharge shall meet the quality and attenuation/retention requirements of Table 2-5.1.

(ii) Baseline Road to Baseline Station

A. Runoff shall be conveyed by existing and new storm sewers to existing non-commissioned outlet to Pinecrest Creek. SWMPs shall be installed to meet the water quality requirements prescribed in Table 2-5.1. No quantity control SWMPs are required on-site. Quantity control shall be provided by the Pinecrest Stormwater Management Facility as per Clause 5.7 (i) of this Part 2 in lieu of on-site SWMPs.

(h) Pinecrest Creek Realignment

(i) Pinecrest Creek shall be realigned between approximately 110m north and 200m south of the Iris Street crossing of the alignment. The purpose for the realignment is to allow for the combined construction of the Iris Street overpass, the LRT Guideway, Iris Station, and the related removal of the existing 120m long Culvert under Iris Street. As part of the re-alignment, two new single cell Culverts shall be

constructed to allow the realigned Pinecrest Creek to cross the Guideway and Iris Street:

A. A 10m span x 32m long concrete frame structure that crosses the alignment approximately 200m south of Iris Street. See Article 4 – Structural Design Criteria and Requirements, of this Part 2 for additional information.

B. A 12m span x 41.8m long concrete frame structure that crosses Iris Street west of the LRT alignment and approximately 25m east of the private property line that abuts the western border of the NCC land. See Article 4 – Structural Design Criteria and Requirements of this Part 2 for additional information.

(ii) Iris Street shall be considered an Urban Major Collector road. The LRT Track shall be classified as an Urban Arterial road for the purpose of drainage design. Culverts shall be designed according to section 5.10 of the City of Ottawa Sewer Design Guidelines.

(iii) Both Culverts shall be designed as single-cell open bottom Culverts with the spans described above to ensure proper creek functioning through the structures.

(iv) Both Culverts shall be designed with a minimum clearance of 1.0m between the design water level and the low chord. Erosion protection and fish passage shall be included in the design.

(v) The channel re-alignment shall be designed and constructed in accordance with Natural Channel Design Principles and with the fluvial-geomorphological criteria for Pinecrest Creek provided in Table 2-5.3.

Table 2-5.3 – Fluvial Geomorphological Criteria for Pinecrest Creek Channel Design

Bankfull Characteristics of the Low Flow Channel	
Channel slope	0.4%
Left and right side slopes	1:1
Minimum Bottom width	4.0m
Minimum Top width	6.0m
Manning's *n*	0.035
Depth	1.0m
Floodplain Corridor Characteristics	
Channel slope	0.4%
Left and right side slopes*	2:1 – 3:1
Minimum Bottom width	28.0m
Minimum Top width	40.0m
Manning's *n*	0.055
Minimum Depth	2.0m

*Side slopes steeper than 3:1 shall be avoided where possible and combined with additional bank protection.

(vi) The channel re-alignment design is constrained by the LRT alignment along its east bank and a 1500mm watermain. The top of rail and the Iris Station shall be protected from a 100-year flood. A minimum 3m separation shall be provided between the outer edge of the 1500mm watermain and the top of the channel embankment and/or the limit of any grading changes as a result of the channel re-alignment.

(vii) It shall be demonstrated that the 100-year flow will be contained within the floodplain corridor by the completion of a hydraulic analysis using a HEC-RAS model of Pinecrest Creek. The HEC-RAS hydraulic model of the existing Pinecrest Creek is available in the reference document (Pinecrest Creek Realignment at Iris Station – Functional Channel Design prepared by CTP2, January 31, 2017). The future conditions HEC-RAS model will be available as part of the City of Ottawa Pinecrest Creek Cumulative Impact Study (CIS).

(viii) The hydraulic analysis shall demonstrate that the channel design not increase water levels above existing, and that the alignment, private property and roadways are protected from the 100-year flood level.

(ix) Design of the realignment of Pinecrest Creek shall follow hydraulic and sedimentological principles of fluvial process in such a manner that risk to infrastructure and property upstream and downstream of the realignment site is avoided.

(x) The channel realignment shall be designed by a fluvial geomorphologist who can demonstrate a Master's degree in fluvial processes (or equivalent), and who has at least 10 years of experience designing channels in urban environments.

(xi) DB Co shall submit a Preliminary and Final design report of the Pinecrest Creek Realignment in accordance with Schedule 10 – Review Procedure.

(xii) The Pinecrest Creek Channel realignment design and construction shall meet environmental and landscaping requirements described in Schedule 17 – Environmental Obligations and in Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes.

(xiii) DB Co shall design and construct the channel realignment in compliance with Ontario Regulation 174/06 (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses).

(i) Pinecrest Stormwater Management Facility

(i) Order of Precedence

A. For the design and construction of the Pinecrest Creek SWM Pond, in the event of a conflict between the criteria contained in this Article and any other City reference document(s), the following shall apply in descending order of precedence:

i. All criteria and requirements specified in this Clause 5.7(i);

ii. All criteria and requirements specified in other pertinent parts of this Part 2;

iii. Drawings and Stage-Storage Curve in Appendix J of this Part 2.

(ii) Background Documents

A. DB Co shall review and make itself aware of the conclusions and recommendations of studies completed in relation to the planning and design of the SWM pond, which include but may not be limited to:

[REDACTED]

(iii) General Requirements

A. The Pinecrest Creek SWM Pond shall be located on NCC lands to the northeast of the Baseline Road and Woodroffe Avenue intersection.

B. The site and pond layout as presented in Appendix J of this Part 2 has been agreed to in principle by the NCC and is subject to a FLUDTA. Any deviations from this layout shall require additional consultation and approval by the NCC.

C. DB Co shall complete the design of and construct a SWM pond that, at a minimum, achieves the following criteria:

i. Provides a minimum 70% TSS removal for drainage area of 446 ha with full capture of 25 mm Chicago 3h-hour storm.

ii. Attenuates the 100-year peak flow to offset the increase in peak flows from a 14.4 ha drainage area with 86% imperviousness. This attenuation covers the quantity control required for the new Baseline station as defined in Clause 5.7(d)(vii), plus an allowance for future City transit projects.

iii. Provides additional quantity control for all storms up to the 100-Year event as further described within this Clause 5.7(i) to the greatest extent possible considering site constraints, as specified within this Clause 5.7(i). The main objective of additional quantity control is to reduce the peak overland flow on the SJAM Parkway between Carling Avenue and Richmond Road.

iv. Maintains the overall geomorphic stability / balance within Pinecrest Creek.

v. Mitigates thermal impacts of the pond to Pinecrest Creek using a bottom-draw outlet design and any other measures identified herein.

vi. Does not increase the peak hydraulic gradeline under all normal operating conditions for the 2-year Soil Conservation Service 12-hour storm up to and including the 100-year Soil Conservation Service 12-hour storm peak flow at existing storm maintenance hole MHST27014.

D. The SWM pond shall incorporate a sediment forebay, wet cell 1, and wet cell 2 configured in accordance with the drawings and stage-storage curve in Appendix J of this Part 2.

E. The SWM pond shall incorporate the measures identified herein to discourage geese and gulls from frequenting the pond. Any changes to the measures identified herein would require verification by the City.

F. The length of dry channel in Pinecrest Creek resulting from implementation of the pond shall not exceed that shown on the drawings in Appendix J of this Part 2.

(iv) Permits and Approvals

A. DB Co shall obtain all PLAA for the pond in accordance with Schedule 17 – Environmental Obligations and Schedule 35 – Permits, Licences, Approvals and Agreements.

(v) Submittals

A. Design submittals shall be in accordance with Schedule 10 – Review Procedure and shall comprise all submittals required by Schedule 10 – Review Procedure and other parts of the Project Agreement, including but not limited to:

i. SWM Pond Design Brief Addendum.

ii. Design Drawings (all applicable disciplines).

iii. Construction Specifications (all applicable disciplines).

iv. Copies of all submittals to Governmental Authorities.

v. Copies of all required permits and approvals.

vi. Hazardous Bird Deterrence Plan.

vii. Operation and Maintenance Manual.

B. Submittals shall be made as comprehensive packages containing documents from all applicable disciplines, and shall be made at the following stages:

i. Final design;

ii. Permit applications; and,

iii. Construction documents.

(vi) DB Co shall not modify the hydraulic design or performance of facility components specified herein. Any such changes shall require verification by the City.

(vii) General Layout

A. The pond layout shall incorporate a sediment forebay, cell 1, and cell 2 configured in accordance with the drawings in Appendix J of this Part 2. The pond volume and design elevations shall be as listed in Table 2-5.4.

Table 2-5.4 – Pinecrest Creek SWM Pond volume and design elevations

Design elevations, mASL	**Sediment forebay**	**Cell 1**	**Cell 2**
100 year water surface elevation	80.97		
Extended detention water surface elevation	80.09		
Permanent pool water surface elevation	78.90		
Invert elevation	75.90	76.90	76.40
Water storage volume (total up to specified elevation), m³			
100 year water surface elevation	24,643	37,789	26,733
Extended detention water surface elevation	18,478	27,518	19,555
Permanent pool water surface elevation	10,317	14,143	10,191

B. The grading of the pond shall be in accordance with the the stage-storage table in Appendix J of this Part 2.

C. The SWM pond site shall be developed with MUP and landscaping as specified in Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(viii) SWM Pond Components

A. Pond Cells

i. The pond cells shall be curvilinear with variable side slopes, with a maximum slope of 3 horizontal to 1 vertical.

ii. A 3m-wide submerged aquatic bench shall be provided around the pond, with maximum permanent water depth of 0.3m. The 3m bench shall be 1.5m flat and 1.5m at 5:1 slope.

iii. The base of the sediment forebay shall be lined with a minimum of 400mm depth Granular 'B' type II compacted to 95% SPMDD on woven geotextile class II to OPSS 1860.

B. Inlet Chamber and Culvert

i. The inlet chamber and Culvert shall be configured as shown in the drawings in Appendix J of this Part 2 and as follows:

1 The inlet Culvert to the pond shall incorporate a bypass weir to the creek within an enclosed inlet chamber.

2 The inlet Culvert shall be a continuous Culvert, 3m in width, from the existing Baseline Storm Sewer Outfall to the sediment forebay. The Culvert shall have a transition from an internal height of 1.8m to a minimum internal clear height of 2.4m immediately downstream of the Baseline Storm Sewer Outfall. The internal clear height shall be a minimum of 2.4m from the transition to the outlet into the sediment forebay.

ii. The inlet Culvert shall have a continuous slope, a minimum cross-sectional area of 7.2m^2 and minimum clear height of 2.4m maintained throughout the Culvert and inlet chamber, and no obstructions to flow other than bends, each of which shall be no greater than 48 degrees.

iii. The inlet chamber shall incorporate a concrete weir transverse to the existing Baseline Storm Sewer Outfall with a crest height at 80.20m. The projected length of the weir as measured

perpendicular to the existing Baseline Storm Sewer Outfall shall be 8m. Up to the height of the weir crest, the inlet Culvert and chamber shall be designed to avoid any expansions or contractions in flow.

iv. The downstream face of the weir shall be sloped, no steeper than 1 horizontal to 1 vertical.

v. Hydraulic modelling reported by **[REDACTED]** has identified that upstream hydraulic gradeline impacts are sensitive to the configuration of the inlet chamber and Culvert, including but not limited to details of the weir (location, height, alignment, length, downstream slope), Culvert (bend angles, lengths, dimensions, slope), and inlet chamber (size, opening dimensions, benching, safety grille). Any deviation from the information provided in Appendix J of this Part 2 shall therefore be accompanied by a detailed numerical analysis demonstrating that the design remains compliant with Clause 5.7 (i)(iii)C(vi).

vi. A 600mm diameter opening covered by a removable stainless steel plate shall be included in the transverse weir for use as a low flow maintenance bypass.

vii. The inlet chamber shall extend downstream of the weir for a minimum distance of 2m prior to an opening to the creek. Benching shall be included on the downstream side of the weir with minimum slope 4:1 and maximum slope 1:1. The opening to the creek shall be flanked with concrete wing walls and an apron with baffle blocks to direct the flow into the creek and mitigate the potential for scour and bank erosion. The opening to the creek shall be minimum 6.4m wide by 1.5m high at invert 78.9m.

viii. The opening to the creek shall be equipped with a lockable, hinged, outwards opening, safety grate with horizontal bars at 150mm spacing.

ix. Openings and ladders shall provide access from the roof of the inlet chamber upstream and downstream of the weir.

x. Stop log gains shall be provided to allow isolation of the inlet Culvert at the outlet of the inlet chamber. The stop log gains shall be designed and located to require the stop logs to be no more than 3m in length. Access for stop log operations shall suit equipment currently used by the City. DB Co shall confirm access requirements with the City.

xi. Steel safety railing shall be installed along all segments of the inlet chamber perimeter where adjacent grading is higher or lower than the top of the structure.

xii. Refer to Article 4 - Structural Design Criteria and Requirements of this Part 2 for structural requirements.

C. Existing Gabion Basket Retaining Wall

i. All sections of the existing gabion basket retaining wall at the Baseline Storm Sewer Outfall (and extending along the north bank of Pinecrest Creek for approximately 40m) shall be abandoned in place or removed. Abandonment in place shall be by placement of sufficient compacted fill against the face of the retaining wall, separated by geotextile, to maintain a stable slope assuming complete failure of the gabion baskets.

D. Pinecrest Creek Channel Downstream of Inlet Chamber

i. The creek channel downstream of the inlet chamber shall be realigned as shown by the drawings included in Appendix J of this Part 2 to form a gentle bend downstream of the inlet chamber. The realigned channel shall have a minimum bottom width of 5m.

ii. The north bank of the creek downstream of the inlet chamber shall be stabilized to protect from flows that overtop the weir and then travel along the outside bend of the creek as it realigns with the existing creek path. This stabilization shall be provided as shown on Drawing C011 in Appendix J of this Part 2.

iii. Flow that overtops the weir (i.e. flow in excess of 25mm return storm volumes) shall cascade down to a concrete apron which shall be provided as a component of the inlet chamber to protect from scour. This apron shall be designed based on the bed elevation and the elevation included on Drawing C011 in Appendix J of this Part 2 shall be adjusted to match bed elevations in the creek at the time of construction.

iv. Scour protection shall be provided on the channel bed downstream of the concrete apron as shown on Drawing C011 in Appendix J of this Part 2.

v. The design and construction of work within Pinecrest Creek downstream of the inlet chamber shall be under the supervision of the site fluvial geomorphologist (who shall be satisfy the qualifications required by Clause 5.7(h)(x).

E. Mid-pond MUP Crossing

i. The sediment forebay shall be divided from cell 1 by an embankment carrying a MUP across the pond. The same embankment shall also divide cell 1 from cell 2. The MUP shall be at existing grade and shall be aligned with the existing **[REDACTED]** buried cables, which shall remain on this alignment following construction.

ii. A 2.6 m wide by 1.2 m high concrete Culvert (upstream invert 78.40 m and downstream invert 78.30) shall connect the sediment forebay to cell 1. A 1.8 m wide by 1.2 m high Culvert (upstream invert 78.40 m and downstream invert 78.30) shall connect cell 1 to cell 2. Each Culvert shall be no longer than 31 m. These Culverts shall be installed below the existing **[REDACTED]** cables.

iii. DB Co shall protect the existing **[REDACTED]** buried cables during construction in accordance with the requirements of Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

iv. The crossing shall incorporate an electrical conduit to allow for future pathway lighting.

v. Between existing grade and elevation 83 m, slopes towards the pond either side of the MUP shall be no steeper than 3 horizontal to 1 vertical. Below this, armourstone retaining walls shall be constructed to minimize the overall width of the embankment.

F. Peninsula

i. Cell 2 shall be separated from the sediment forebay by a peninsula with a width between 7m of 12m above the permanent pool water level.

ii. The minimum crest elevation of the peninsula shall be 80.15m, such that the water level does not overtop the peninsula during the 25mm Chicago 3-hour storm.

G. Pond Outlets

i. The pond outlet, comprising the outlet structure, quantity outlet Culvert, outlet channel, and quality outlet pipe shall be designed in accordance with the layout shown by the drawings in Appendix J of this Part 2.

ii. The outlet structure shall comprise a single reinforced concrete structure with two compartments; one housing the quantity outlet and one housing the quality outlet.

iii. The quantity outlet shall incorporate a 1.8m long quantity weir at elevation 80.15m, from which flow shall discharge to Pinecrest Creek via a 26m length 1800mm diameter pipe at upstream invert 78.30m and downstream invert 78.20m.

iv. The quality outlet shall incorporate a 0.6m by 0.6m bottom-draw opening with invert 76.50m. This opening shall be equipped with a sluice gate. Flow shall discharge to a location within Pinecrest Creek no more than 60m downstream of the inlet chamber via a 600mm diameter quality outlet pipe with upstream invert 78.75m and downstream invert 78.60m. A removable 500mm wide by 300mm high marine grade aluminum orifice plate with invert 78.90m shall be installed within the outlet structure at the upstream end of the quality outlet pipe.

v. A debris basket shall be incorporated on a rail and cable system fixed to the outside wall of the outlet structure. The debris basket shall have a total surface area no smaller than that shown by the drawings in Appendix J of this Part 2, and shall incorporate sloped bars at 150mm spacing as a safety feature.

vi. The quality outlet pipe shall be designed in accordance with the Ottawa Sewer Design Guidelines. All maintenance holes required on the pipe shall be located above the 100-year water level, and adjacent to the access road.

H. Pond Outlet Channels

i. Two proposed outlet pipes will connect to the creek. These are referred to as the quality outlet (releasing flows to approximately 380 l/sec) and the quantity outlet (releasing flows in excess of approximately 380 l/sec).

ii. The quality outlet shall be angled to join the creek at an angle less than 60 degrees to flow to prevent scour erosion. At the terminus of the pipe, flow shall follow a riverstone-lined channel to join. The channel shall be as shown by Drawing C012 in Appendix J of this Part 2.

iii. The quantity outlet channel shall join the creek at an angle not exceeding 45 degrees to flow, and shall be as shown by Drawing C012 in Appendix J of this Part 2.

iv. The design and construction of the outlet channels shall be under the supervision of the site fluvial geomorphologist (who shall be satisfy the qualifications required by Clause 5.7(h)(x).

I. Pond Drains

i. A 400mm diameter sediment forebay drain shall be provided between the base of the sediment forebay and cell 2. To allow the sediment forebay to be drained by pumping between maintenance holes, two maintenance holes shall be provided on the drain, with a sluice gate installed on the outlet of the upstream maintenance hole.

ii. The sediment forebay drain shall be designed in accordance with the Ottawa Sewer Design Guidelines. All maintenance holes required on the pipe shall be located above the 100-year water level, and adjacent to the access road.

iii. Draindown of cell 2 will be via the bottom-draw opening of the quality outlet structure. A 400mm by 400mm opening at invert 78.30m equipped with a sluice gate shall be provided between the quality and quanity compartments of the outlet structure, to allow the draindown flows to outlet to the creek via the quantity outlet Culvert.

J. Access Roads and MUPs

i. General Requirements

1 All pavements and reinforced grass surfaces shall be designed considering site-specific geotechnical data, and shall incorporate all necessary measures to ensure drainage of the granular sub-base.

2 Pavements and surfaces required to be designed to a 'heavy duty' standard shall be in accordance with Drawing C015 (detail 1) in Appendix J of this Part 2 and shall be suitable for use by SWM pond and **[REDACTED]** operation and maintenance vehicles, including vehicles necessary for SWM pond sediment removal.

3 All paved access roads and MUPs shall be at longitudinal grades no steeper than 5% and have cross-fall of 2%.

4 CSP cross-Culverts (minimum diameter 400mm) shall be installed where roads and pathways cross overland drainage

paths to prevent flow across the paved surface and/or ponding uphill of the road or pathway.

5 Swales shall be constructed on the upslope side of roads and pathways as necessary to capture and direct overland flow to cross-Culverts.

6 Erosion protection comprising of rip-rap or geogrid-reinforced grass shall be provided for all swales on slopes 3 horizontal to 1 vertical or greater.

ii. Pond Access Road

1 The MUP forming a loop around the sediment forebay and cell 1 of the SWM pond, plus the northernmost connection to Woodroffe Avenue, shall be described as the pond access road.

2 The pond access road shall be constructed to a 'heavy duty' standard as defined above.

3 The asphalt surface of the pond access road shall be 3m in width. The granular base shall extend 1m beyond both sides of the asphalt surface.

4 The existing curb depression at the intersection of the pond access road shall be widened and reconfigured as necessary, complete with tactile walking surface indicators, to provide a permanent vehicle entrance from Woodroffe Avenue to the SWM pond site, suitable for the vehicles identified above. The permanent vehicle entrance shall have a minimum clear width of 3m to the south of the existing traffic signal pole located within the existing MUP. Removeable bollards shall be installed within the permanent vehicle entrance.

5 A minimum 80m length of the paved access road between the SWM pond and Pinecrest Creek shall be at a constant elevation of 82m, to serve as an emergency overflow.

iii. MUPs

1 DB Co shall design and construct MUPs in accordance with the requirements of Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes.

iv. Access to Structures

1 All structure access hatches/covers, maintenance holes and safety or debris grates shall be accessible by asphalt or reinforced grass access roads. Access roads shall be within 1m vertical and 2m horizontal of the top of the item requiring access.

v. Access Ramp to sediment forebay

1 A 5m-wide access ramp with a minimum 3m-wide reinforced grass surface at a maximum slope of 5:1 with 2% crossfall shall be provided from the pond access road to the base of the sediment forebay.

2 The access ramp shall have a reinforced grass surface, and shall be suitable for use by the SWM pond maintenance and sediment removal traffic described above.

vi. Signage

1 Signage shall be installed close to access points and at high visibility locations around the SWM pond to warn the public of the common hazards and prohibitions associated with the facility.

2 All signs shall conform to City standards.

3 In accordance with commitments made to Transport Canada, signage prohibiting littering and feeding of wildlife shall be installed.

K. Sediment Management Area

1 A sediment management area with a minimum area of 2300 m² shall be provided adjacent to the sediment forebay for future use in sediment removal, handling and storage.

2 The sediment management area shall be sloped towards the sediment forebay at 1 to 5% slope.

3 No structures, pavements, hard landscaping, shrubs or trees shall be located within the sediment management area.

L. Structure Ancillaries

i. Access to Structures

1 The Inlet Chamber and Outlet Structure shall be provided with access hatches located to provide maintenance access

to all spaces within the structure, and to facilitate removal and replacement of all sluice gates, stop logs, orifice plates and other installed equipment.

2 Access hatches shall be a minimum dimension of 600mm by 600mm.

3 All access hatches shall be commercially available.

4 All access hatches shall be lockable with locking hasps recessed to avoid trip hazard.

5 Access to the floor of spaces within the structure shall be provided by permanent ladders.

6 Internal safety platforms shall be provided within all structures deeper than 5m, and within the quality outlet chamber of the outlet structure.

ii. Safety Grates

1 Safety grates similar in design to OPSD 804.050 shall be installed on all openings on the inlet chamber, outlet structure and associated Culverts, with the exception of openings which are fully submerged at permanent pool water level other than the bottom draw outlet.

2 Safety grates on outlets shall be hinged and shall open in the direction of flow.

iii. Safety Railings

1 Safety railings shall be installed on the perimeters of all structures where the top of the structure is higher than adjacent grades.

M. Monitoring Equipment

i. DB Co shall design, supply, install and commission monitoring equipment in accordance with the following requirements. Final design drawings and instrumentation specifications shall be submitted for City in accordance with Shedule 10 – Review Procedure, prior to construction. To maintain compatibility with existing City equipment, all instrumentation shall be supplied as specified with no substitutions.

ii. Monitoring Sheds

1 A monitoring shed shall be provided adjacent to each of the SWM pond inlet chamber and outlet structure in the locations shown by the drawings in Appendix J of this Part 2.

2 Each shed shall have minimum internal dimensions of 2.4m long by 1.8m wide by 2.1m high, and shall be constructed of precast concrete with a vandal-resistant exposed aggregate finish. Shop drawings for the shed and a sample of the exposed aggregate finish shall be provided for City approval prior to beginning fabrication. Each shed shall have one 914mm-wide metal door. The locking mechanism shall follow the current standard specification of the City.

3 Sheds shall be placed on a compacted granular A base over minimum 50mm rigid high-density Styrofoam insulation, and shall be insulated internally with minimum 19mm high-density Styrofoam and 6.35mm sealed, primed and painted plywood on strapping.

4 DB Co shall coordinate with **[REDACTED]** to provide electrical services to both monitoring sheds. All new electrical services on the Site shall be buried.

5 Each shed shall be provided with internal lighting (minimum of one 4ft fluorescent strip light), electrical heating, and electrical outlets. A minimum of four spare outlets shall be provided in addition to any required for equipment. The electrical heater shall be sufficient to maintain the internal temperature of the shed above the minimum operating temperatures specified by the manufacturers of all installed equipment, considering the climate data specified in Clause 4.3(b) of Schedule 15-2, Part 1 – General Requirements.

6 Buried rigid PVC electrical conduits shall be installed between each monitoring instrument and the nearest monitoring shed (one conduit per cable/tube).

iii. The following equipment shall be installed at the pond inlet. Equipment shall be complete with all require ancillaries and accessories, including but not limited to mounting brackets, power cables, and data cables:

1 **[REDACTED]** refrigerated sampler, 2-bottle configuration, with refrigerator battery backup kit. Intake located approximately mid-way along inlet culvert;

2 **[REDACTED]** flow meter system base meter with battery backup, installed in monitoring shed;

3 **[REDACTED]** ultrasonic level sensor, installed in inlet chamber directly above bypass weir, with stainless steel protective hood;

4 **[REDACTED]** sensor with surcharge kit and built-in ultrasonic level sensor, installed adjacent to access maintenance hole, approximately mid-way along inlet culvert; and,

5 **[REDACTED]** sensor for Signature flow meter installed as backup to LaserFlow sensor.

iv. The following equipment shall be installed at the pond outlet. Equipment shall be complete with all require ancillaries and accessories, including but not limited to mounting brackets, power cables, and data cables:

1 **[REDACTED]** refrigerated sampler, 2-bottle configuration, with refrigerator battery backup kit. Intake located within quality outlet pipe.

2 **[REDACTED]** flow meter system base meter with battery backup.

3 **[REDACTED]** ultrasonic level sensor, installed in quality compartment of outlet structure, with stainless steel protective hood.

(ix) Construction

A. All MUP connectivity across the site shall be maintained throughout construction. The access road along the north-west periphery of the pond between Woodroffe Avenue, the northern extent of construction and Navaho Drive, shall be constructed and placed into service prior to taking the existing MUP out of service.

B. DB Co shall maintain fencing at all times around the boundaries of the construction site and shall develop hoarding plans as specified in Schedule 15-2, Part 1, Article 4 – Design and Construction.

C. Construction traffic shall only cross the MUP at defined gates in the site fencing, where appropriate signage and traffic control persons shall be deployed.

D. Construction traffic shall only enter and exit the site from Woodroffe Avenue. A dedicated temporary access shall be constructed. The presence of existing overhead cables, other utilities, the need to accommodate pedestrians and cyclists, and the location of existing bus stops shall be considered in the design, location and operation of this access.

E. DB Co shall prepare and implement an ESC Plan in accordance with Clause 5.6 of this Part 2.

F. Deterrence of geese, gulls, and waterfowl during construction

i. The location of the proposed SWM pond is within the Ottawa International Airport Bird Hazard Zone. DB Co shall implement measures as necessary to minimize the potential for geese, gulls, and waterfowl (birds considered to pose a hazard and risk to aircraft) frequenting the site at any time during construction.

ii. DB Co shall prepare and submit a hazardous bird deterrence plan prior to construction. The plan shall be subject ro review by the City and shall detail measures to be implemented during construction to ensure that the site does not become attractive to hazardous birds. The plan shall address each phase of construction, including but not limited to site clearing, excavation, commissioning, and landscaping, through to full establishment of landscaping including deterent plantings.

iii. DB Co shall implement regular monitoring of the site to identify and rectify any situations or areas that could result in hazardous birds frequenting the site, including but not limited to gentle, grass or barren slopes adjacent to waterbodies, emergent vegetation accessible to waterfowl, and inadequate on-site litter management.

iv. DB Co shall erect and maintain a silt fence at the top of the aquatic bench immediately after the bench has been planted and before the water level in the pond reaches 78.0m to protect emergent vegetation from geese. The silt fence shall remain in place until emergent vegetation is fully established, for not less than one full growing season. Removal of the fence shall be carried out between November and April to minimize damage to the aquatic bench and plant material.

G. DB Co shall maintain a baseflow to the existing creek (downstream of the pond outlet) at all times, including while filling the pond.

(x) Commissioning and Handover

A. DB Co shall not redirect flows from the creek into the pond until the following criteria are met:

i. All construction complete, with the following exceptions:

1 Landscaping works above 81.0m; and,

2 MUP's and access roads.

ii. All sluice gates installed and commissioned;

iii. All orifice plates and similar control elements installed;

iv. ESC measures in place to prevent silt-laden runoff entry into the pond;

v. Operations and Maintenance Manual submitted and reviewed in accordance with Schedule 10 – Review Procedure.

vi. Locks installed on all access hatches and safety grates.

vii. Pre-commissioning inspection completed by the City and all deficiencies rectified to the satisfaction of the City.

B. Acceptance and handover of the SWM pond to the City shall be completed in accordance with the Project Agreement Section 11.27.

(j) Overland Drainage Swale: Carling Avenue to Richmond Road

(i) An overland drainage swale shall be constructed as per Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes where the Transitway and existing Lincoln Fields Station are being decommissioned between Carling Avenue and Richmond Road.

(ii) The swale shall be designed to convey the flood spill from the ORPP during the 100-year Storm, without Flooding adjacent properties, or endangering or inconveniencing users of the SJAM Parkway.

(iii) Discharge from the swale shall be via the existing storm sewer on the SJAM Parkway at the crossing of Richmond Road.

(iv) DB Co shall use flows from the modelled future development scenario in Table 4b in the **[REDACTED]**, as the starting point for analysis. The proposed overland swale design and its dynamic interaction with the ORPP may result in a different flow split and associated water depths than those presented in the December 2017 report. The final design shall be validated using appropriate overland flow assessment techniques. The existing conditions 1-D steady-state HEC-RAS model and associated technical memo that is available in the **[REDACTED]**, should

inform the starting point for these analyses. The future (interim and ultimate) conditions HEC-RAS models and associated technical memos are also available in the Background Information, from the City of Ottawa Pinecrest Creek Cumulative Impact Study, for reference and to assist with design.

(k) Green's Creek Culvert Replacement

(i) DB Co shall complete the design of a full Culvert replacement and install a portion of the new Culvert Structure within the Green's Creek Culvert (SN227110) located beneath the Confederation Line Track portion of OR174. The installation is considered the initial phase of a future replacement of the entire Culvert. DB Co shall complete this initial phase to the limits to enable the complete replacement of the Culvert (by others) without the need to interrupt the Confederation Line operations in the future. The installed Culvert portion shall be a single-span open-bottom Structure with a minimum span of 16.46m. See Article 4 – Structural Design Criteria and Requirements, of this Part 2 for additional information. **[REDACTED]**.

A. DB Co DB Co shall be permitted to remove sections of the existing Culverts as needed to construct the permanent Culvert section under the alignment, provided that the Culvert sections are reinstated and that the final installation is hydraulically sufficient and is intended to be permanent until such time that the final installation of the Culverts is performed by others.

(ii) As part of the initial phase of the Culvert installation, erosion protection shall be provided and fish passage and wildlife passage shall be maintained to meet regulatory requirements.

(iii) DB Co shall complete the design of the full replacement culvert as per the following parameters:

A. A wildlife passage bench shall be designed to be located within the Culvert in the form of a dry ledge with a minimum dry area of 1.5m wide by 1m high (vertical clearance). The wildlife bench shall be extended beyond the Culvert to match the top of the floodplain upstream and downstream of the Culvert, to provide a transition to natural overbanks of creek for access/egress. Refer to the report **[REDACTED]** for additional design and construction considerations.

B. As part of this Culvert installation, mitigation measures for fish and fish habitat as well as freshwater mussels and mussel habitat shall be implemented. For a preliminary assessment of impacts, recommended mitigation measures, as well as design and construction considerations, refer to the following memorandums: **[REDACTED]**. The assessment of impacts and recommended mitigations related to fish and mussels, as well

as their habitats, shall be revised and updated accordingly by DB Co prior to design completion.

C. A low flow/bankfull channel shall be designed to be within the Culvert. The channel shall be designed to extend upstream and downstream and shall connect seamlessly to the natural low flow channel of the creek. The channel shall be designed in accordance with Natural Channel Design Principles and with the fluvial-geomorphological criteria provided below in Table 2-5.5. See **[REDACTED]** technical memorandum for additional design requirements.

D. Fish passage shall be designed for a maximum velocity of 0.8 m/s within a 0.8m deep migration zone under 2-year flow as per the MTO Drainage Design Guidelines

Table 2-5.5 - Fluvial Geomorphological Criteria for Green's Creek Channel Design

Bankfull Channel Characteristics - Average Conditions – Green's Creek at Highway 174			
Top Width (m)	15.00	**Area (m^2)**	27.09
Depth (Max) (m)	2.10	**Hydraulic Radius (m)**	1.62
Bottom Width (m)	10.80	**Wetted Perimeter (m)**	16.74
Side Slopes (L:H)	1:1	**Average Velocity (m/s)**	0.95
Average Manning 'n'	0.030	**Estimated Q (m^3/s)**	25.81

(iv) The design shall include erosion protection to ensure the stability of the channel banks and channel bed during extreme flow events. Erosion protection shall be designed in accordance with the methodology outlined in the US Army Corps of Engineers (USACE) HEC23 Guidelines (USACE Engineering Manual No. 1110-2-1601 and EM 1601 equation).

i. The extreme flow event for erosion protection shall be the 50-year flow. Additionally, a minimum freeboard of 0.5m shall be provided.

ii. Erosion protection shall be designed according to the design parameters listed below in Table 2-5.6:

Table 2-5.6 - Green's Creek RipRap Design Parameters

HEC RAS Station	**Location**	**Average Velocity (50yr**	**Channel Width**	**Water Depth at Toe of**	**Bank Slope**	**Radius of Curvature**

		flow)		**Slope**		
		(m/s)	(m)	(m)	(°)	
3899	Upstream	1.71	95.0	2.0	30	65
3805	Culvert Outlet	2.84	20.0	1.8	30	200
3582	Downstream	1.86	103.0	4.7	36	200

(v) Bank protection shall be designed for a minimum of 110m upstream of the Culvert and 50m downstream of the Culvert. Erosion protection shall be designed to be extended at an elevation of 0.5m above the 50-year water level or to the top-of-bank, whichever is lower.

(vi) Bed protection shall be designed for the Culvert inlet to ensure channel stability and allow the formation of a natural channel. The top of the bed protection at the inlet shall be located at a minimum of 0.5m below the invert of the low flow channel. Bed protection shall extend a minimum of 5m upstream of the inlet and 2m downstream of the inlet.

(vii) Bed protection shall be designed for the Culvert outlet to prevent excessive downstream movement of the erodible bed material and to recreate an existing riffle at the outlet. Bed protection at the outlet shall extend 2m inside of the Culvert outlet and 5m downstream. The top of the bed protection shall be flush with the invert of the low flow channel.

(viii) Additional bed protection shall be designed to extend 5m upstream and 10m downstream of the outlet protection as described in Clause 5.7 (k) (xiv). The top of the bed protection here shall be located at a minimum of 0.5 m below the invert of the low flow channel.

(ix) Design of any channel realignment shall follow hydraulic and sedimentological principles of fluvial process in such a manner that risk to Infrastructure and property upstream and downstream of the realignment site is avoided.

(x) Any channel realignment shall be designed by a fluvial geomorphologist who can demonstrate a Master's degree in fluvial processes (or equivalent), and who has at least 10 years of experience designing channels in urban environments.

(xi) The Culvert replacement and any channel realignment design shall meet environmental and landscaping requirements described in Schedule 17 – Environmental Obligations and in Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes.

(xii) DB Co shall design any channel realignment in compliance with Ontario Regulation 174/06 (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses).

(l) SJAM Parkway – Cleary to Dominion and Churchill MUP Underpass

(i) For Roadway requirements, refer to Article 6 – Roadways, Bus Terminals and Lay-bys of this Part 2.

(ii) DB Co shall design and construct a new storm sewer system to service the SJAM Parkway, sized to convey the 10-year storm flow from the 4-lane arterial roadway, consistent with City of Ottawa Sewer Design Guidelines for arterial roadways.

(iii) DB Co shall identify and locate all existing Ottawa River outfalls servicing the reconstructed segment of the SJAM Parkway as described in Clause 6.21 – Federal Roads Improvements of this Part 2. DB Co shall replace these outfalls with concrete storm sewers and headwalls that shall be designed in accordance with Article 4 – Structural Design Criteria and Requirements, of this Part 2. The new storm sewer under SJAM shall outlet to the replacement outfalls. Existing City of Ottawa storm sewers and outfalls shall not be used as outlets from the new storm sewer on SJAM Parkway. Replacement outfalls that are not utilized for the new storm sewer system shall extend from the Ottawa River to the north side of the MUP that is located north of the SJAM Parkway, and shall be terminated with a cap and a clean-out extending to the surface. The minimum size for the replaced outfalls and sewers shall be 300mm diameter.

(iv) The SJAM shall include a stormwater treatment system capable of providing 80% removal of TSS. This system shall be provided by means of bio-retention swales to be located within the proposed median of the SJAM Parkway where feasible. Where the median is less than 4m wide, or where superelevation of the Roadway prevents surface drainage to the median, bio-retention swales shall be located as close as possible to the SJAM eastbound or westbound lane. The bio-retention swales shall be designed in accordance with the TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guidelines. The design constraints for the bio-retention swales shall be as follows:

A. The roadway design shall include side-inlet catch basins on the roadway to allow capture of runoff directly to the storm sewer during winter conditions and during storm events that exceed the capacity of the bio-retention swales.

B. The roadway shall be designed to allow for both lanes of traffic to drain toward opening in the inner (median) and outer curbs of the Roadway to capture all of the runoff in the bio-retention system.

C. DB Co shall convey runoff to the bio-retention swales using a combination of the two following methods:

i. Provide concrete spillways between the curb openings and bio-retention swales where erosion protection is required. River stone

riprap shall be placed at the bottom of bio-retention swales where additional erosion protection is required. Angular riprap shall not be used. Concrete spillways shall have a maximum length of 2m.

ii. Where the length of erosion protection between the Roadway and the bioswale exceeds 2m, runoff shall be captured by a catch basin and conveyed by a sewer to the bioswale.

D. Bio-retention swales shall have a maximum longitudinal slope of 0.5%. Checkdams constructed of clay with a reinforced grass revetment shall be used as required to meet the maximum longitudinal slope requirement. Checkdams shall not be constructed of riprap.

E. Bio-retention swales shall be underlain by an infiltration trench, lined with geotextile filter fabric, 50mm stone, and a perforated 200mm diameter storm sewer which connects to the storm sewer system. Raised, beehive-type catch basins within the bio-retention swale will allow direct discharge of runoff to the storm sewer for events that exceed the volume of the swale. The bio-retention swale shall be completed with a 0.5m media filter bed composed of shredded hardwood mulch layer (75mm depth) placed over an engineered mixture of sand, soil, and organic material, the design of which must consist of the following:

i. Sand (2 to 0.05mm grain size) making up 85 to 88% of the weight;

ii. Fines (grain size <.050mm) making up 8 to 12 % of weight; and,

iii. Leaf compost making up 3 to 5% of weight.

F. Media shall be tested to confirm design specifications and approved by the owner prior to installation.

G. The edges of the raised, beehive type catch basins located in bio-retention swales shall be covered by river stone with minimum diameter of 100mm such that only the cover of the catch basin is visible

(v) DB Co shall design and construct drainage systems to service the Cleary and Churchill MUP underpasses at the SJAM. The underpasses shall be designed to drain to the Ottawa River. At the Churchill MUP underpass, the MUP surface shall have a minimum elevation of 56.0m to maintain ponding depth on the MUP to 600mm during a 1:2 year flood of the Ottawa River, according to the RVCA Ottawa River Floor Risk Mapping report. Refer to Clause 6.21 of this Part 2.

(vi) Overland flow spillways shall be provided at low points of the SJAM Parkway to allow for major flows to spill out of the Roadway toward the Ottawa River. Overland flow spillways shall be designed such that the maximum depth of flow on the SJAM Parkway meets the City guidelines for arterial Roadways, and such

that the flow is distributed evenly across the spillway to minimize erosion potential. Reinforced grass slopes shall be provided to prevent erosion of the overland flow spillway. Refer to Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes, for landscaping requirements of spillways from the SJAM.

(m) **[REDACTED]**

(i) DB Co shall implement all recommendations of **[REDACTED]** necessary for the implementation of the Confederation Line, currently being completed by the City.

(n) Richmond Road Complete Streets Improvements

(i) DB Co shall design and construct localized grading and new Drainage facilities including but not limited to catch basins, maintenance holes, curb and gutters, and storm sewers to ensure positive Drainage along and across the reconstructed Richmond Road and Byron Avenue in accordance with the City of Ottawa Sewer Design Guidelines and with Clause 8.10 of this Part 2.

(ii) DB Co shall design and construct the site grading of Byron Avenue such that the existing ditches along the south side of Byron Avenue are maintained and continue to capture runoff from catchments external to the Byron Avenue roadway as per existing conditions. The existing ditches shall be re-graded and re-vegetated, along with replacement of driveway entrances within the Byron Avenue ROW, to accommodate a new sidewalk on the south side of Byron Avenue as outlined in Part 6, Article 4 – Site Specific Desired Outcomes. Culverts under driveways shall also be replaced.

(iii) DB Co shall design and construct a stormwater treatment system capable of providing 80% removal of TSS for a minimum of 1.4ha of the Richmond Road Complete Streets road reconstruction area. This system shall be provided through the design and construction of bioswale and bio-retention LID facilities to be located on the reconstructed segment of Richmond Road. The bioswale and bio-retention facilities shall be designed in accordance with the TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guidelines. The design of the facilities shall be as follows:

A. The roadway design shall include side-inlet catch basins on the roadway to allow capture of runoff directly to the storm sewer during winter conditions and during storm events that exceed the capacity of the LID facilities.

B. Bioswale and bio-retention facilities shall be located between the cycle track and the roadway, and shall immediately precede all bus stops in the direction of travel of the cycle track.

C. Bioswale and bio-retention facilities shall extend to the adjacent curb of private or public access to Richmond Road where the difference in offset

is 20m or less. Refer to Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements, for landscaping requirements.

D. Bioswale and bio-retention facilities' width shall extend from the back of curb to the cycle track and shall not be less than 1.8m.

E. DB Co shall construct bio-retention facilities where bedrock is 2.2m or greater below the finished ground surface. The bio-retention facility shall consist of an infiltration trench, lined with geotextile filter fabric, a minimum 300mm layer of clear stone, and a perforated sub-drain which connects to the storm sewer system. The invert of the perforated sub-drain shall be at least 100 mm above the bottom of the clear stone layer to allow infiltration of the 10mm rainfall event. The bio-retention facility shall be completed with a 500mm media filter bed composed of shredded hardwood mulch layer (75mm depth) placed over an engineered mixture of sand, soil, and organic material, the design of which must consist of the following:

i. Sand (2 to 0.05mm grain size) making up 85 to 88% of the weight;

ii. Fines (grain size <.050mm) making up 8 to 12 % of weight; and,

iii. Leaf compost making up 3 to 5% of weight.

F. DB Co shall construct bioswale facilities where bedrock is less than 2.2m below the finished ground surface. The bioswale shall consist of a trench, lined with geotextile filter fabric, a perforated sub-drain which connects to the storm sewer system, and a clear stone layer with depth equal to or greater than the outside diameter of the perforated sub-drain. The bioswale shall be completed with a 500mm media filter bed composed of shredded hardwood mulch layer (75mm depth) placed over an engineered mixture of sand, soil, and organic material, the design of which must consist of the following:

i. Sand (2 to 0.05mm grain size) making up 85 to 88% of the weight;

ii. Fines (grain size <.050mm) making up 8 to 12 % of weight; and,

iii. Leaf compost making up 3 to 5% of weight.

G. Raised catch basins within the bioswale and bio-retention facilities will allow direct discharge of runoff to the storm sewer for events that exceed the volume of the facility. The maximum rate of capture to the storm sewer shall not exceed the peak flow from a 2-year event.

H. Media shall be tested to confirm design specifications and approved by the City prior to installation.

(iv) DB Co shall design and construct bioswale LID facilities in Byron Linear Park such that runoff from the park is managed in accordance with the Pinecrest Creek SWM criteria. The bioswale facilities shall be designed in accordance with the TRCA/CVC Low Impact Development Stormwater Management Planning and Design Guidelines. The design constraints for the facilities shall be as follows:

A. The design shall include catch basins to allow capture of runoff directly to the storm sewer during winter conditions, and during storm events that will exceed the capacity of the LID facilities. The maximum rate of capture to the storm sewer shall not exceed the peak flow from the 2-year storm.

B. Where the bioswale facility crosses a pedestrian pathway, DB Co shall design and construct a footbridge for the crossing and shall not use any Culverts.

C. DB Co shall design the bioswales with maximum 3:1 side slopes.

(o) Moodie LMSF

(i) DB Co shall design a storm drain inlet and sewer system to convey the runoff to an underground storage system which permits infiltration. Discharge shall be controlled to existing (pre-development) peak flow rates.

(ii) OGS structures shall be designed and specified with a required performance of removal of fine sediment, oil, floating and sinking debris, and 80% removal efficiency for TSS at the outlet from the drainage system prior to discharge to Stillwater Creek.

(iii) DB Co shall construct any box Culvert extensions as open bottom.

(iv) DB Co shall confirm the value of the loss of floodplain storage volume within the 1:100 year floodplain which will result from the placement of fill by June 1, 2020. The City will be responsible to fully compensate for this loss of floodplain storage volume through a balanced cut (or excavation) to be performed in a location selected by the City. The City will be responsible for permits and approvals for this compensation and the work will be complete by the end of 2020.

(v) DB Co shall design the site considering future expansion requirements outlined in Schedule 15-2, Part 5 – LMSF and to demonstrate that expansion of the site does not require the removal of underground storage facilities constructed as part of the DB Co site construction. DB Co shall demonstrate how the expansion of drainage facilities can be achieved.

ARTICLE 6 ROADWAYS, BUS TERMINALS AND LAY-BYS

6.1 Reference Documents

(a) DB Co shall complete the Work in accordance with the criteria contained within this Article, the Applicable Law, all the City of Ottawa's by-laws, regulations, policies, standards, guidelines and practices applicable to the Project, including but not limited to the following Reference Documents:

(i) The criteria in this Article, as well as Appendices to this Part 2;

(ii) AASHTO, Guide for the Design of Pavement Structures;

(iii) City of Ottawa, Standard Tender Documents;

(iv) City of Ottawa, Transportation Master Plan;

(v) City of Ottawa, Official Plan;

(vi) City of Ottawa, OC Transpo - Transitway and Station Design Guidelines (June 2013);

(vii) City of Ottawa, Municipal Road Activity (By-law No. 2003-445) and Guidelines For Completing the Application for Road Cut Permit;

(viii) City of Ottawa, Municipal Traffic and Parking (By-law No. 2003-530) - City of Ottawa Regulating Traffic and Parking on Highways;

(ix) City of Ottawa, Municipal Zoning (By-law No. 2008-250) Consolidation;

(x) City of Ottawa, Transit-Oriented Development Guidelines;

(xi) City of Ottawa, Pedestrian Crossover Program and Examples Documents 1 and 2;

(xii) City of Ottawa, CADD Standards;

(xiii) City of Ottawa, Urban and Rural Truck Routes Maps;

(xiv) City of Ottawa, Road Corridor Planning & Design Guidelines - Urban and Village Collectors / Rural Arterials and Collectors;

(xv) City of Ottawa, Right-of-Way Lighting Policy;

(xvi) City of Ottawa, Accessibility Design Standards;

(xvii) City of Ottawa, Transportation Impact Assessment Guidelines;

(xviii) Region of Ottawa-Carleton, Regional Road Corridor Design Guidelines;

(xix) MTO, Ontario Pavement and Rehabilitation Manual;

(xx) MTO, Ontario Provincial Standard Drawings;

(xxi) MTO, Ontario Provincial Standard Specifications;

(xxii) MTO, Materials Information Report MI-183 "Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions";

(xxiii) MTO, Ontario Traffic Manual Books 1 through 18;

(xxiv) MTO, Roadside Safety Manual;

(xxv) MTO, Sign Sheeting Memorandum, February 21, 2008;

(xxvi) MTO, King's Highway Guide Signing Policy Manual;

(xxvii) TAC, Geometric Design Guide for Canadian Roads;

(xxviii) TAC, The Canadian Road Safety Audit Guide;

(xxix) TAC, Guide to Bridge Traffic and Combination Barriers;

(xxx) US Department of Transportation, Roundabouts: An Informational Guide (FHWA-RD-00-067);

(xxxi) MTO Design Supplement to TAC Geometric Design Guide for Canadian Roads, June 2017;

(xxxii) Other relevant City of Ottawa Operation Policy, Procedures and Guidelines.

(b) DB Co shall design and construct all Roadways under the scope of Works in accordance with the geometric Design Criteria contained in this Article and applicable appendices, and standards and manuals included in Clause 6.1(a) of this Part 2, and if there is any conflict between the criteria contained in this Part 2 and standards and manuals included in Reference Documents, the following shall apply in descending order of precedence:

(i) The criteria contained in Schedule 15-2, Part 2, Appendices A, B, C and D;

(ii) The criteria contained in this Article;

(iii) The applicable City of Ottawa Standard Tender Documents and applicable standards and guidelines;

(iv) TAC, Geometric Design Guide for Canadian Roads;

A. In all cases for OR174 and Hwy 417, including all associated interchanges, DB Co shall also reference the MTO Design Supplement to TAC Geometric Design Guide for Canadian Roads.

(v) TAC, The Canadian Road Safety Audit Guide;

(vi) MTO, Roadside Safety Manual.

6.2 General Requirements

(a) DB Co shall provide the design, including obtaining all necessary approvals, and supply the materials, labour, equipment, inspection and testing in order to fulfill the requirements for the execution and commissioning of the Works.

(b) The overall engineering design and construction requirements of the Works, including typical cross-sections and geometric Design Criteria, are primarily based on the contents of this Part 2, and the Reference Documents from the City of Ottawa, TAC and MTO.

(i) DB Co shall design the proposed improvements on all Works according to the Design Criteria included in Appendix A of this Part 2. In all cases where a specific Design Criteria is not provided for a Roadway and/ or interchange in Appendix A of this Part 2, DB Co shall undertake a detailed survey and review of the existing conditions, confirm the Roadway and/or interchange ramps geometric Design Criteria by referencing the existing, appropriate standard and proposed design parameters, in order to address the necessary improvements.

A. Under the circumstances whereby an existing interchange ramp, impacted by the Works, does not meet current standards, DB Co shall design and construct the necessary ramp improvements to maximize the radius used so that the impacted ramp will be upgraded to meet the standards. Under circumstances where upgrading the ramps to current standards is not feasible within the available Lands, DB Co shall design the improvements so that current ramp geometry will be maintained.

B. DB Co shall also undertake a detailed intersection operations and level of service analysis associated with the necessary improvements on all impacted signalized intersections and interchange ramps. DB Co shall demonstrate that the traffic operations and levels of service are acceptable and feasible using projected traffic volumes, expected transit operations for 2031 horizon year per the requirements of the City of Ottawa Transportation Impact Assessment guideline, including pedestrian and cyclist movements.

i. For all permanent Roadway improvements within MTO's jurisdiction, DB Co shall demonstrate that the traffic operations and LOS are acceptable and feasible considering three scenarios

forecasting traffic volumes and expected transit operations for 5, 10 and 20 year horizons beyond the Substantial Completion.

C. DB Co shall submit to the City the results of above-noted investigations by submitting an existing conditions report, a preliminary design report including the proposed Design Criteria and design synopsis, and a separate traffic analyses report and seek approval from the City at least 20 calendar days prior to initiating the development of geometric design.

(ii) DB Co shall undertake all necessary traffic and transit assessments, modelling and analysis including vehicular and non-vehicular road user needs, using projected traffic volumes as specified in Appendix A of this Part 2 for a horizon year of 2031 to determine the necessary Roadways and traffic improvements and provide the requisite design and construction of such works, as per the requirements of the City of Ottawa's TIA guidelines and other applicable standards.

A. All traffic data used for analysis for traffic management purposes shall be based on the most current data and shall be no older than two years. The information to be collected shall include, but not be limited to, all of the hourly traffic volumes and AADTs for all modes of travel on all Roadways, bus Facilities, bike facilities and pedestrian facilities, which will be affected by the Project and as a part of the permanent Works. DB Co shall be responsible for obtaining or collecting all traffic data necessary for its traffic analysis if traffic data less than two years old is not relevant to the traffic analysis due to temporary conditions that existed at the time the data was collected. DB Co shall confirm with the City that the data is appropriate prior to conducting an analysis using said data.

B. DB Co shall undertake a traffic management study to determine the traffic impacts on other intersections and local road networks that are impacted as the result of the Project permanent Works and to determine appropriate mitigation measures, if road capacity and level of service is reduced. The traffic management study shall involve area wide traffic modeling to determine impacts to all modes of transportation, including adjacent corridors impacted by the permanent Works. The study shall include DB Co's forecast for, but not limited to, changed traffic volumes, speeds, and travel times for all modes of travel on all routes subject to the study. The traffic management study shall be submitted as a part of the DB Co's traffic report document in accordance with Schedule 10 – Review Procedure.

C. All vehicle, transit customer, pedestrian, and cycling data used for analysis for traffic management purposes shall be based on the most current data, and no older than two years with growth factors acceptable to the City. DB Co shall be responsible for obtaining any vehicle, pedestrian, and cycling data necessary for its traffic management analysis.

(iii) Appendix B of this Part 2 demonstrates only the minimum lane requirements and lane configurations at certain intersections that DB Co is responsible for in their design and construction. Shall DB Co's traffic and transit assessment, modelling and analysis determine that additional traffic lanes and improvements are required in addition to the information shown in Appendix B of this Part 2, DB Co shall be responsible for the design and construction of all such improvements.

(c) Basic ROW widths and protection requirements shall reference the City of Ottawa's Transportation Master Plan and Official Plan (Annex 1).

(d) Design Criteria, Road Classifications and Design Speed Considerations

(i) Design Criteria parameters, based on the Roadway classifications, shall reference:

A. City of Ottawa Transportation Master Plan – Annex B Maps

B. City of Ottawa Official Plan – Schedule B and Annex 1

C. City of Ottawa Road Design Guidelines:

i. Region of Ottawa-Carleton, Regional Road Corridor Design Guidelines;

ii. City of Ottawa Road Corridor Planning & Design Guidelines - Urban and Village Collectors / Rural Arterials and Collectors; and,

D. Appendix B of this Part 2.

(ii) In general, the designation of design speeds shall be based on the speed limits currently posted for the respective Roadways, unless specified otherwise in this Article. DB Co shall design the modifications intended on the existing urban collectors or arterials that have design speed of 60 km/hr or lower as per the TAC GDGCR guidelines applicable to low-speed roads subject to retrofit conditions. The design of new or existing arterial roads and highways with design speeds greater than 60 km/hr shall meet the requirements of high-speed roads as per TAC GDGCR requirements accordingly.

(iii) In the absence of City of Ottawa adopted standards, Design Criteria parameters shall reference the TAC GDGCR.

(e) DB Co shall obtain the approval of the City for all Works, including construction Works that involve the modification of existing City infrastructure, contained within the scope of Works.

(f) DB Co shall determine the road cross-slope based on the road classification using the City standards and TAC requirements and to match the existing cross-slope of the undisturbed section.

(g) Superelevations shall satisfy the pertinent requirements as per the road classification, and City of Ottawa's Design guidelines and standards and TAC GDGCR requirements.

(h) DB Co shall design and construct all necessary requirements for landscape, road furniture and streetscape elements required in all Works as per the requirements of Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(i) DB Co shall design and construct the necessary utilities and associated underground and aboveground infrastructures for the Works per the requirements of Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

(j) DB Co shall design and construct all necessary temporary improvements, traffic staging detours, and all associated improvements necessary to support the construction of permanent Works as per the requirements of Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access.

(k) DB Co shall design and construct all Roadway improvements to meet the applicable accessibility requirements, including but not limited to COADS or AODA.

(l) DB Co shall refer to Article 4 – Structural Design Criteria and Requirements, of this Part 2, for any structural requirements associated with the Roadway improvements specified in this Article 6.

(m) DB Co shall set the criteria for total and differential post-construction settlements of the Pavement to satisfy the requirements of Clauses 6.10 through 6.13 of this Part 2 including Embankment Settlement Criteria for Design, July 2010, MTO.

6.3 Horizontal Alignment

(a) The geometric characteristics of the horizontal alignment shall meet the requirements of the TAC GDGCR, unless otherwise specified in this Article. In particular, the following requirements shall apply:

(i) Minimum radius and maximum superelevation rate requirements shall correspond to the existing road characteristics as per the road classifications in Clause 6.2 of this Part 2. For urban collectors, the maximum superelevation rate (e_{max}) shall be limited to 2% and no superelevation is required on urban local roads. For new construction road improvements, the maximum superelevation rate (e_{max}) shall be 0.04 m/m for low-speed urban arterial roads with design speed of 60 km/hr or lower. For new rural roads and new high speed urban arterial applications (i.e. urban roads with design speeds greater than 60 km/hr) the maximum superelevation rate shall be 0.06 m/m. DB Co shall follow the criteria specified in TAC GDGCR (Clause 2.1.2.2) for all other retrofit conditions.

(ii) For urban conditions, the minimum length of curve shall be between 30m to 60m.

(iii) For high-speed urban roads (i.e. Urban roads with design speeds greater than 60 km/hr) and all rural roads, DB Co shall apply spiral curves to the design of the horizontal alignment.

(iv) DB Co shall provide a shy line offset from edge of road lane to Station walls, portal walls, bridge railings, barriers, stop structures, retaining walls and any other obstruction located within the road clear zone for the safe operation of vehicular traffic in the road ROW. The shy line offset values shall be to TAC standards and treatment within the shy line distance and shall be to the guidelines specified in TAC Guide to Bridge Traffic and Combination Barriers and MTO Road Side Safety Manual.

6.4 Vertical Alignment

(a) Vertical alignment shall meet the requirements of the TAC GDGCR, unless specified otherwise in this Article. The following main geometric parameters pertinent to the vertical alignment shall apply:

(i) Minimum gradient: Minimum grades shall satisfy the requirements of TAC GDGCR Section 2.1.3 under Minimum Grades: Design Domain Application Heuristics - Urban Areas.

(ii) Equivalent minimum "K" Values: The vertical curve geometry shall reference the requirements of the TAC GDGCR Section 2.1.3.3 – Item 2:

A. "K" value for crest curves shall satisfy the upper limits of the SSD requirements. In all cases, DB Co shall confirm appropriate SSDs by calculating the distance travelled during deceleration and perception and reaction time, considering the effect of grades on deceleration and verified against available sight lines according to TAC GDGCR;

B. "K" value for sag curves shall satisfy the upper limit of the requirements of headlight control and comfort control.

6.5 Sight Distance Requirements

(a) DB Co shall satisfy the upper limit of the required sight distances beyond the minimum sight distance requirements at all intersections and in particular in situations where there are increased interactions between vehicular traffic and non-vehicular modes of traffic, such as areas within 150 m of Stations entrances.

(i) DB Co shall determine visibility sight triangles and SSD for road horizontal and vertical geometry. DB Co shall ensure that the sight distances provided in the design meet or exceed the minimum sight distance requirements of the TAC GDGCR based on calculations considering the corresponding Design Criteria parameters.

(ii) DB Co shall design DSD in accordance with requirements of the TAC GDGCR.

(b) DB Co shall determine all ISD design requirements, including approach, departure, and crossing ISDs, and visibility triangles using the appropriate design vehicle(s) at all intersections according to the criteria specified in the TAC GDGCR.

6.6 Access and Intersection Layout

(a) DB Co shall design and construct Pavement markings, traffic signs, traffic control signals and underground traffic plants in accordance with the requirements of the applicable Reference Documents.

(b) DB Co shall design all intersection layouts and lane configurations to address all system user's requirements, including pedestrian, cyclist, transit and vehicular traffic. DB Co shall give precedence to intersection design characteristics which preserve and enhance public Safety, minimize the area impacts, and respond to traffic demands.

(c) DB Co shall design and construct street lighting in accordance with Clause 6.16 – Street Lighting of this Part 2.

(d) DB Co shall design and construct all intersection layouts, lane widths, ramp throats, and Pavement widths using the appropriate design vehicle as defined in Clauses 6.8 and 6.9 of this Part 2, and Appendix A of this Part 2.

(i) DB Co shall design intersection geometry such that the turning radius of the selected design vehicles is applied from traffic lane to traffic lane.

(ii) DB Co shall design intersection layouts so that turning movements will not encroach on cycling lanes.

(e) DB Co shall design specific intersection improvements to include typical characteristics and requirements of Protected Intersections, according to site-specific application of these elements, such as the following:

(i) Crossing setback;

(ii) Cyclist crossing;

(iii) Cyclist queuing area/ safety refuge;

(iv) Pedestrian crosswalk;

(v) Pedestrian queuing area/ safety refuge;

(vi) Pedestrian crossing of bike lane;

(vii) Advanced stop bar;

(viii) Yield lines;

(ix) Corner safety island;

(x) Minimum curb radius (considering the appropriate design vehicle); and,

(xi) Lateral approach/ departure taper.

(f) All pedestrian and cycling crossing facilities shall meet City requirements and reference OTM Book 15 and OTM Book 18.

(g) DB Co shall not design raised intersections, except at locations where they are specifically prescribed in this Part 2, or Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

6.7 Cross-Section Elements

(a) DB Co's design of typical cross-sections for Roadways shall be in accordance to the requirements of City of Ottawa Design standards and TAC GDGCR, unless specified otherwise in the Roadways corresponding Design Criteria (Refer to Clause 6.19 – Municipal Roads of this Part 2);

(i) Auxiliary lane width, where applicable, shall satisfy the requirements of Special Purpose Lanes as specified under Clause 2.2.3 of TAC GDGCR; and,

(ii) DB shall provide a cross-slope of 2% toward the curbs or shoulders in order to provide improved surface drainage runoff on paved tangent Roadways, unless specifically noted otherwise in the specific municipal Roadway improvements in Clause 6.19 – Municipal Roads of this Part 2.

6.8 Design Vehicles

(a) DB Co shall use the appropriate design vehicles to design the intersection layout geometry, and to accommodate the applicable sight distances and horizontal and vertical Roadway clearance requirements. For additional requirements pertinent to horizontal and vertical clearances under Overhead structures, refer to Article 4 – Structural Design Criteria and Requirements, of this Part 2. Selection of the largest design vehicle for each Roadway, bus facility, ramp, etc. shall follow the subsequent criteria:

(i) Commercial Trucks, including WB-20 shall govern the design for all intersections, roads, and streets that are designated as a truck route in the City of Ottawa's Urban and Rural Truck Route Maps.

(ii) Commercial Heavy Single Unit Trucks, and the largest emergency vehicles, including fire and paramedic vehicles shall govern the design for all other intersections, roads, and streets that are listed as non-truck routes.

(iii) All roads and streets that are a designated transit bus routes shall accommodate the turning movement requirements of the City's B-12 standard bus, articulated bus, double decker bus, and Para Transpo vehicles.

(iv) Where applicable, Inter-City bus and school bus shall govern the design of roads, streets, and intersections.

(v) Where applicable, maintenance vehicles including snow removal vehicles and garbage trucks shall govern the design of roads, streets, and intersections.

(vi) Clearance requirements for opposing left-turn design: in design of intersections with multiple left-turn lanes, especially where simultaneous opposing left turns exist, DB Co shall ensure that design vehicle is appropriately selected. In the design of intersection layouts with double turn left lanes, the design shall accommodate the simultaneously turning manoeuvers of the largest design vehicle with a second Light Single Unit truck. Under extremely constrained conditions, as a minimum, a simultaneous double left-turn design shall accommodate the largest design vehicle turn with a passenger car.

(vii) DB Co shall design and construct all improvements on intersection layouts, and Roadways geometry using turning simulation software (Transoft AutoTURN) with the appropriate design vehicle turning templates to allow for simple turning movements using the generate corner path method.

A. Minimum turning speed of a design vehicle shall not be assumed less than 15 km/hr. Only in extremely constrained conditions, where DB Co can demonstrate that no feasible design solution can be developed considering a 15 km/hr turning speed, a minimum 10 km/hr turning speed may be acceptable.

B. The design of OC Transpo bus turning paths shall satisfy the requirements of the OC Transpo - Transitway and Station Design Guidelines. Bus design turning speeds at intersection corners and curb returns shall not be less than 15 km/hr. Also refer to Clause 6.9 of this Part 2.

(b) DB Co shall have regard to the Official Plan and Policy designations for the affected areas and Roadways, including the City of Ottawa Multi-Modal LOS targets which are affected by curb radii. Pedestrian and cycling LOS targets are especially high in the central area, near schools and rapid transit stations and every effort shall be made to achieve these targets within the context of the City of Ottawa Complete Streets Implementation Framework.

6.9 Facilities Operated by OC Transpo

(a) DB Co shall design and construct all OC Transpo Roadways and Facilities to meet the interim and ultimate operational requirements of the City during all construction stages

and following Revenue Service. DB Co shall obtain the City's approval prior to advancing the design of all Roadways and Facilities operated by OC Transpo.

(b) DB Co's design and construction of all temporary or permanent bus stop Facilities, station amenities, infrastructure and shelters shall meet the requirements of Schedule 15-2, Part 7, Appendix E and Schedule 15-2, Part 4, Appendix E and shall comply with City of Ottawa accessibility design standards and features, including but not limited to COADS requirements.

(c) Unless specified otherwise, DB Co shall accommodate the following requirements:

(i) The primary reference for the design, construction and operational requirements of all roads, accesses, bus Platforms, PPUDO and Park and Ride facilities operated by OC Transpo is OC Transpo's Transitway and Station Design Guidelines.

(ii) The primary reference for the design of all Roadways and bus transit facilities operated by OC Transpo including but not limited to the design speeds, geometric Design Criteria, horizontal and vertical alignments, auxiliary lanes, intersection geometry, cross-section components, drainage requirements, ramp design, pedestrian and cyclists connectivity, safety and security, accessibility, bus station Platform layouts and turnaround circulation geometry and other Roadways, facilities, and structural details shall meet the requirements of OC Transpo's Transitway and Station Design Guidelines. For specific Station site design layout requirements with respect to pedestrian and cyclists' connectivity refer to Schedule 15-2, Part 4 – Stations, and Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

(iii) For the design and construction of Park and Ride Facilities, in the event of a conflict between the criteria contained in this Article and any other City or OC Transpo's reference document(s), the following shall apply in descending order of precedence:

A. All criteria and requirements specified in this Article and in other pertinent parts and clauses of this Part 2;

B. City of Ottawa, OC Transpo - Transitway and Station Design Guidelines (June 2013);

C. COADS;

D. City of Ottawa, Municipal Traffic and Parking (By-law No. 2003-530) - City of Ottawa Regulating Traffic and Parking on Highways;

E. City of Ottawa, Municipal Zoning (By-law No. 2008-250) Consolidation;

F. City of Ottawa, Transit-Oriented Development Guidelines.

(iv) Sidewalks associated with bus stops and Station Platform areas shall accommodate positive drainage and have a minimum grade of 0.5% towards the curb.

(v) Bus shelters, bus stop pad, shelters with sidewalk and boulevard shall satisfy the requirements of both the City's Standard Tender Documents and the OC Transpo's Transitway and Station Design Guidelines, unless specifically noted otherwise in Schedule 15-2, Part 4 – Stations, and/or in Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements. In particular, for additional landscape site design provisions such as bus shelters, lighting, and shade tree requirements refer to Schedule 15-2 Part 4 – Stations, and Schedule 15-2 Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

(vi) Design of bus loops, bus driveway accesses, bus stops, bus Platforms, and bus lay-bys in bus Station Facilities shall meet the following requirements:

A. DB Co shall design and construct the bus Facilities, Station amenities and infrastructure that will be used for the operation of buses as per the standard established in this Part 2. DB Co shall submit the design of all bus Station Facilities for review in accordance with Schedule 10 - Review Procedure. The bus Station Facility submission shall include sufficient detail to allow the City to understand the full operation of the bus Facility, including interface with any other activities on the site, all station amenities and infrastructure.

B. DB Co shall run AutoTURN analysis to confirm the suitability of the design. DB Co shall obtain the dimensions and characteristics of a typical OC Transpo bus vehicle prior to performing the AutoTURN analysis for the appropriate bus design vehicles. DB Co shall submit the turning movement results for review and approval in accordance with Schedule 10 – Review Procedure and shall consider the following requirements:

i. Buses shall line up parallel to the bus Platforms with a distance of no more than 150mm (preferred)/ 300mm (absolute maximum) from Platform curbs.

ii. All bus turning manoeuvres in the swept path analysis shall ensure a smooth, continuous movement, without instantaneous steering movements. The swept path analysis shall not include 0m radius turns, with the exception of the first turn away from a parking spot under constrained conditions.

iii. DB Co shall perform field tests for compliance and functionality of bus movement clearance through the means of a bus test on mock-up facilities (demarcating curbs and other features using traffic

cones and or paint lines) with dimensions identical to the proposed bus Facilities.

iv. DB Co shall design bus loops and driveways for one way circulation at bus terminals. Exceptions to the above requirement may be acceptable where a two-way circulation offers better transit operations, for which DB Co shall consult with and seek approval from the City prior to proceeding with such alternative design.

v. All bus loops and driveway accesses shall allow buses to safely pass stalled or parked buses.

vi. DB Co shall ensure a bus can maneuver parallel to the Platform curbs and depart independently of parked busses with the assistance of vehicle turning movement simulation software or the appropriate turning movement templates. DB Co shall submit the turning analysis to the City for review and approval in accordance with Schedule 10 – Review Procedure.

vii. DB Co shall provide a clearance of 0.5m between bus movements and all obstructions, including the worst case stopping positions of buses in bus bays and lay-by areas.

viii. DB Co shall simulate the appropriate bus turning movements considering the minimum outside turning radius (wall to wall radius) to allow for simple turning movements using the "Generate Corner Path" function (Transoft AutoTURN) at the appropriate turning speeds referenced in Clause 6.8 of this Part 2 for operating efficiency.

C. DB Co shall design and construct bus Platforms, Station amenities, and associated infrastructure located on the Platforms so that these elements are unobstructed and appropriately sized to accommodate the volume of Passengers boarding and exiting the buses. DB Co's design shall provide for additional area to accommodate peak load volumes, not less than the minimum stated as per the OC Transpo's Transitway and Station Design Guidelines.

D. DB Co shall design and orient bus stops to allow Passengers to load and unload from the right side of a bus, providing Passengers with direct access to pedestrian pathways and / or into the bus terminals or Station entrance, without having to cross the front or rear of a bus. DB Co shall not provide pedestrian crossings within bus Facilities without written consent and approval from the City. The design shall preclude such behaviour in addition to placing appropriate and accessible TCDs. Under exceptional circumstances, where the above requirements cannot be met due to constrained conditions and a crossing facility is required, DB Co

shall confirm the appropriate traffic control requirements and demonstrate that the pedestrian crossing facility is safe and meets bus operational requirements. DB Co shall present a risk analysis developed by a certified traffic Safety auditor prior to design and implementation and seek approval from the City.

E. DB Co shall locate bus stops, designated as drop-off Platforms, as close as possible to the driveway entrances and Station entries.

F. DB Co shall consult with and seek approval from the City and OC Transpo with respect to the dimensions, layout, and location of all bus stops and bus lay-by areas and the preferred bus stop grouping and arrangements at Platform locations (i.e. single, double, or triple stops).

G. Bus Platforms shall not be located on curved laneways.

H. DB Co shall design and construct all permanent and temporary bus stops during staged construction to include safe and secure pedestrian access from / to bus stops and all bus stop shelters as per the requirements specified in COADS and Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access. DB Co shall reference Schedule 15-2, Part 4, Appendix E and Schedule 15-2, Part 7, Appendix E for the requirements of both permanent and temporary bus terminal requirements, respectively.

6.10 Pavement - Municipal Roads

(a) Order of Precedence

(i) DB Co shall provide the Pavements in compliance with the criteria contained in this Article, the Applicable Law, standards, guidelines or practices applicable to the Project and including but not limited to each of the following Reference Documents.

(ii) In the event of a conflict between the criteria contained in this Article and any Reference Document(s), the following shall apply in descending order of precedence for design and construction of Pavements:

A. The criteria contained within this Article;

B. OPSS;

C. OPSD;

D. The City's Current Version of Design Guidelines, Standard Tender Documents and Specifications

E. Ontario Provincial Standards for MTO Designated Source of Materials (DSM);

F. Procedures for Estimating Traffic Loads for Pavement Design, 1995, MTO;

G. MTO Materials Information Report MI-183 "Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions";

H. MTO Ontario's Default Parameters for AASHTOWare Pavement ME Design Interim Report, 2014;

I. AASHTO Guide for the Design of Pavement Structures;

J. Canadian Portland Cement Association – Thickness Design for Streets and Highways;

K. MTO Directive PHM-C-001 The Use of Surface Course Types on Provincial Highways;

L. MTO Pavement Design and Rehabilitation Manual (Second Edition);

M. The criteria contained within Schedule 15-2, Part 2, Article 7 – Geotechnical Design Criteria and Requirements;

N. Embankment Settlement Criteria for Design, July 2010, MTO;

O. ASTM Standards; and,

P. MTO Laboratory Standards.

(iii) For the design of rigid concrete Pavements, DB Co shall use both MTO's Routine Method as described in the Pavement Design and Rehabilitation Manual and the Canadian Portland Cement Association's Simplified Design Procedure in addition to the foregoing AASHTO guide for Design of Pavement Structures.

(b) General Requirements

(i) In general, the design of Pavement structure(s) shall be the responsibility of DB Co's and be based on the City's current Pavement design practices.

A. DB Co shall follow the requirements of the OC Transpo's Transitway and Station Design Guidelines for Pavement design of paved areas subject to bus traffic, Park and Ride lots, and facilities operated by OC Transpo vehicles.

B. Pavement structure shall be of a flexible (asphalt) Pavement design outside bus Station Platform areas, where paved areas are subject to bus traffic, unless otherwise approved by the City.

C. DB Co shall incorporate a rigid (concrete) Pavement structure within, at a minimum, the limits of the concrete Platforms. OC Transpo's Transitway and Station Design Guidelines shall be utilized for the approximate limits for concrete Pavement for a typical side loading Station. DB Co shall review the concrete Pavement limits for Stations with center loading Platforms, based on the Station layout, bus access and operational requirements, recommend an appropriate Pavement design and seek approval from the City prior to advancing the design. DB Co shall provide an extension of concrete Pavement 30m exceeding the Platform. A proper transition treatment shall be provided from one Pavement type to another.

(ii) DB Co shall be responsible for design of all new Pavements and all existing paved areas that are subject to upgrade or reinstatement as a part or result of the Work both during temporary staged construction and in post construction. DB Co shall reinstate the Pavement to match the standards of either the existing adjacent Pavement structure or the current City and OC Transpo's standards and requirements specified in this Article, whichever is more stringent. In all cases, the Pavement reconstruction shall be in accordance with the following requirements:

A. Where the existing Pavement structure adjacent to a localized widening is greater than current City standards and requirements specified in this Article, the new Pavement structure shall match the existing Pavement structure; and,

B. Where the existing Pavement structure adjacent to a localized widening is the same or less than the current City Standards, the new Pavement structure shall match the current City standards and requirements specified in this Article.

(iii) DB Co shall design and build all Pavement structures in compliance with City standards in areas where Pavement structures will be built as NMI, in City ROW. DB Co shall be responsible to obtain the acceptance from the City of all works within the City ROW prior to construction. In areas where the Pavement structures will be built as NMI on Federal lands, DB Co shall complete Pavement designs following City standards for review and approval from applicable Governmental Authorities in accordance with the procedures established by the respective Governmental Authority. DB Co shall comply with the Governmental Authority permits requirements and conditions.

(iv) DB Co shall ensure that any roads or sections of roads with unfinished Pavement including, but not limited to, milled Pavement or Pavement without a surface course opened to traffic, including but not limited to public or construction traffic,

are designed to carry the expected traffic and to prevent water penetration. DB Co shall maintain and ensure all unfinished pavement opened to traffic are in compliance with the City standards prior to final paving. For milled pavement surfaces, DB Co shall follow the requirement of Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access.

(v) DB Co shall ensure that design and construction of flexible and rigid Pavement structures for all paved Roadways and paved bus Facilities such as lanes, ramps, lay-bys, and Park and Ride Facilities, and paved storage areas, as per the following:

A. For the bus terminals and loops, DB Co shall design and construct the Pavement of the bus Facilities for uninterrupted operation of the OC Transpo's buses in light of the expected bus volumes. DB Co shall submit a Pavement Design Report in accordance with Schedule 10 – Review Procedure for all paved facilities stating their consideration of the bus volumes and assumptions of private vehicles. DB Co's report shall also include a site-specific recommendation for the periodical maintenance and rehabilitation of the paved facility considering the facilities Design Life.

B. DB Co shall consider factors such as traffic volumes, subgrade conditions, environmental effects, construction traffic, availability and suitability of construction materials and performance of similarly loaded Pavements in the area, and economics when determining a suitable Pavement Design.

C. DB Co shall provide site-specific Pavement design reports for the Project in accordance with Schedule 10 – Review Procedure.

D. DB Co shall consider the influence of heavy equipment and delivery vehicles during construction during the design process, particularly with respect to the thickness of sub-base material and the native subgrade conditions.

E. DB Co's Pavement design report shall provide localized Pavement designs that shall mitigate potential Pavement sliding or rutting in areas along bus Platforms, within access ramps, bus stops, and bus lay-by locations, which are subject to repeated bus turning movements.

(vi) Byron Avenue Pavement improvement requirements:

A. DB Co shall design and construct an appropriate Pavement improvement treatment for the full width of the existing Byron Avenue in the sections between west of Richardson Avenue and east of Redwood Avenue, so that the Pavement shall meet the requirements of Schedule 15-2, Part 2, Clause 6.10 and associated requirements outlined in Schedule 15-2, Part 1, Table 1-4.1. DB Co shall design and construct all improvements required to reinstate the existing Pavement sections that are impacted due to above

ground and underground Works on Byron Avenue. DB Co shall design and rehabilitate an appropriate thickness of milling and resurfacing treatment to improve the Byron Avenue's existing Pavement structure. For the purpose of Pavement design and analysis of Byron Avenue:

i. DB Co shall consider the section of Byron Avenue west of Woodroffe Avenue as a 2-lane local road and use 1% annual traffic growth rate to calculate the projected traffic volumes for the intended traffic horizon assuming the 2017 AADT is 500.

ii. DB Co shall consider the section of Byron Avenue east of Woodroffe Avenue as a 2-lane collector road and use 1% annual traffic growth rate to calculate the projected traffic volumes for the intended traffic horizon assuming the 2016 AADT is 3,170.

(c) Design and Performance Requirements

(i) DB Co shall ensure that the Roadway Pavement structure conform to the latest standards of the applicable Governmental Authorities.

(ii) DB Co shall ensure that designed Pavement structure have a Pavement life cycle as specified in Schedule 15-2, Part 1, Article 4 – Design and Construction. In the absence of City standards, DB Co shall comply with the following specific OPSS requirements related to the Pavement works, where applicable:

A. OPSS 510 for Removals;

B. OPSS 206, and 514 for Excavation;

C. OPSS 212 for Filling;

D. OPSS 501, 1010 for Granular Material. Thickness shall be suitable for the Roadway's intended use;

E. OPSS 310, 311, 312 for Hot Mix Asphalt paving. Thicknesses shall be suitable for the Roadway's intended use;

F. OPSS 350 for concrete Pavement and Concrete base. Thickness shall be suitable for its intended use;

G. OPSS 353 and 312 for Concrete/Asphalt, curb and gutter, and medians, where applicable;

H. OPSS 405 for Pipe Subdrains; and,

I. OPSS 355 for Interlocking concrete pavers suitable for its intended use.

(iii) DB Co shall ensure that all the Pavement surfaces in areas drivable by vehicles shall have paved surfaces and comply with all expected performance characteristics for safe use by the public.

(iv) DB Co shall design and construct appropriate drainage systems that meet the City's standard when Pavement type is transitioned from interlocking pavers to flexible Pavement.

(v) DB Co shall ensure that the grading conform to the requirements of OPSS 206 (Construction Specification for Grading) for work within municipal jurisdictions. The Compaction shall conform to the requirements of OPSS 501 (Construction Specification for Compacting) for work within municipal jurisdictions. Granular Base and Sub-base shall be according to OPSS 314.

(d) Smoothness and Other Ride Quality

(i) Following Substantial Completion, the completed Pavements shall meet the smoothness criteria provided in SP 103F31 for hot mix asphalt Pavements.

6.11 Pavement – OR174

(a) DB Co shall ensure that the design and construction of Pavements be in accordance with the criteria contained in this Article and the following Reference Documents, and if there is any conflict between the criteria contained in this Article and any Reference Document(s), the following shall apply in descending order of precedence for design and construction of Pavements:

(i) The criteria contained in this Article;

(ii) MTO Special Provisions as identified in this Article;

(iii) OPSS;

(iv) OPSD;

(v) DSM;

(vi) Procedures for Estimating Traffic Loads for Pavement Design, 1995, MTO;

(vii) MTO Materials Information Report MI-183 "Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions";

(viii) MTO Ontario's Default Parameters for AASHTOware Pavement ME Design Interim Report, 2014;

(ix) 1993 AASHTO Guide for the Design of Pavement Structures;

(x) Canadian Portland Cement Association – Thickness Design for Streets and Highways;

(xi) Pavement Design and Rehabilitation Manual – Second Edition (MTO);

(xii) Embankment Settlement Criteria for Design, July 2010, MTO;

(xiii) MTO Directive PHM-C-001 The Use of Surface Course Types on Provincial Highways;

(xiv) Manual for Condition Assessment of Flexible Pavements – Pavement Performance Monitoring using Automated Pavement Distress Data (Nov 2015) (MTO);

(xv) The Formulations to Calculate Pavement Condition Indices, September 2009, MTO;

(xvi) American Society for Testing and Materials (ASTM) Standards;

(xvii) MTO Laboratory Standards; and,

(xviii) AASHTO Materials Specifications and Standards.

(xix) For the design of rigid concrete or composite Pavements, both MTO's Routine Method as described in the Pavement Design and Rehabilitation Manual and the Canadian Portland Cement Association's Simplified Design Procedure shall be used in addition to the foregoing AASHTO guide for Design of Pavement Structures.

(b) General Requirements

(i) DB Co shall ensure that all products used on the Pavement construction meet applicable Project Agreement requirements and, where specified in Schedule 15-2 – Design and Construction Requirements, be in accordance with the MTO Designated Sources of Materials List. The use of products that are not on the MTO Designated Sources of Materials List shall require the prior written approval of the City, in its sole discretion, and acceptance shall be subject to DB Co demonstrating in its submission sufficient experience with the proposed product and acceptable performance for the proposed product under conditions and applications similar to those existing for this Project.

(ii) DB Co shall be responsible for the investigation and subsequent design and construction of all Pavements.

(iii) The soil boreholes advanced by DB Co shall be in accordance with the requirements of the *Ontario Water Resources Act* (Ontario).

(iv) DB Co shall be responsible for the design of all proposed slopes in cut and fill areas, including slope geometry, drainage treatments and erosion control measures for embankments and ditches.

(v) DB Co shall be responsible for effective subsurface drainage and frost protection, including the provision of subdrains or any other drainage treatments.

(vi) DB Co shall ensure that design of new Pavement structures be in accordance with the "1993 AASHTO Guide for the design of Pavement Structures" and AASHTOWare Pavement ME Design software. The AASHTO 93 method will provide structural Pavement thickness design based on traffic volumes. BD Co shall use the ME Design method to assess the suitability of the chosen AASHTO Design for meeting Pavement performance parameters described elsewhere in this Part 2. DB Co shall select AASHTO Pavement Design parameters as described in the MTO Materials Information Report MI-183 "Adaptation and Verification of AASHTO Pavement Design Parameters for Ontario Conditions". DB Co shall implement calibrated models for the AASHTOWARE Pavement ME design software or default parameters for any non-calibrated models as described in MTO Ontario's Default Parameters for AASHTOware Pavement ME Design Interim Report, 2014. DB Co shall submit the use of alternate design methods and parameters in accordance with Schedule 10 - Review Procedure.

(vii) Within a segment of OR174, a composite Pavement structure is found. DB Co shall remove the entire width and length of the existing concrete Pavements under all OR174 lanes in the EB and WB lanes, including auxiliary lanes along the following sections and where they are impacted as the result of the Works. DB Co shall not leave any intermediate section of the existing concrete slabs in place, where adjacent sections of concrete slab are removed as the result of the Works.

A. In the EB direction, the entire section from 450 m east of Blair Road, through the Montreal Interchange, to the most easterly limits of the existing concrete slabs where it ends in the EB direction.

B. In the WB direction, the entire section from a location west of the Montreal Road interchange, where the existing concrete Pavement would become in conflict with the proposed median barrier and / or with any and all Works associated with the Montreal Road Interchange reconstruction all the way to its east end limit, so that:

i. Upon the completion of Works, no sections of the existing concrete Pavement shall remain within 1m of the face of the proposed median barrier in any sections.

ii. DB Co shall demonstrate that the removal of the remaining sections of composite Pavement within the limits of Works, can be accomplished in the future without any impacts to the concrete median barrier constructed by DB Co.

(viii) DB Co shall incorporate these changes in the design reports with detailed information about lateral and longitudinal limits, transition treatments, drainage considerations as a minimum and seek approval from the City prior to advancing the design.

(ix) If any roads will be opened to traffic prior to completing the surface course paving, DB Co shall ensure that the Pavement design of the unfinished Pavement including, but not limited to, milled Pavement or Pavement without a surface course is designed to carry public and construction traffic and to prevent water penetration until the surface course is placed. For milled pavement surfaces, DB Co shall follow the requirement of Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access.

(x) DB Co shall ensure that the Pavement surface course is in accordance with MTO's Directive PHM-C-001. This shall be applicable to all flexible Pavements

(c) Pavement Structures

(i) DB Co shall not discharge materials containing contaminants and that could have an adverse effect on the natural environment (including air, land or water, and human plant or animal life) into the environment. DB Co shall ensure that granular materials conform to the requirements of Ontario Provincial Standards Specifications OPSS.PROV 1010 and Special Provision SP110S13.

(ii) DB Co shall ensure that all Flexible Pavements on the highway through lanes and interchanges incorporate a minimum compacted thickness of 100 mm OGDL layer immediately under the hot mix. This requirement shall be applicable to the widening portion of OR174 where the existing Pavement includes an OGDL layer.

(iii) DB Co shall ensure that Asphaltic concrete conform to the requirements of OPSS.PROV 1151 – Material Specification for Superpave and Stone Mastic Asphalt Mixtures.

(iv) DB Co shall ensure that Grading and compaction conform to the requirements of OPSS.PROV 206 – Construction Specification for Grading, and OPSS 501 – Construction Specification for Compacting. Granular base and subbase shall be according to OPSS 314.

(v) DB Co shall design and construct drainage of the Pavement structure in accordance with the OPSD 300 series.

(vi) DB Co shall use subdrains whenever an OGDL is used. DB Co shall ensure that subdrains are provided in accordance with OPSS 405

(d) Smoothness and Other Ride Quality

(i) Following Substantial Completion, DB Co shall ensure that the completed Pavements meet the smoothness criteria provided in SP 103F31 for hot mix asphalt Pavements.

(e) Traffic Volume for Pavement Design

(i) DB Co shall design all Pavements based on traffic data provided by the City. DB Co shall be responsible for developing forecasted traffic volumes for Pavement design. DB Co shall submit all forecasted data and supporting methodology to the City for Review in accordance with Schedule 10 - Review Procedure.

6.12 Grading

(a) DB Co shall design and construct all earthworks and grading requirements so that all such work conforms to the relevant City Standards and Specifications, or in absence of such standards to the following:

(i) OPSS 206 - Earth and Rock Excavation;

(ii) OPSS 212 – Borrow;

(iii) OPSS 501 - Compacting;

(iv) OPSS 511 - Rip-Rap, Rock Protection and Gravel Sheeting;

(v) OPSS 570 – Topsoil;

(vi) OPSS 572 - Seeding and Mulching;

(vii) OPSS 803 – Sodding.

(b) DB Co shall meet the requirements of Schedule 15-2, Part 1, Article 5 – Implementation Constraints, in the design and construction of all earthworks and rock excavations.

(c) Grading includes excavation of native material and fill of approved materials as required for construction in accordance with the recommendations resulting from Pavement design reports.

(d) DB Co shall manage all excess and imported material per the requirements described in Schedule 17, Part 4 – Contaminated and Excavated Material Management.

(e) DB Co shall maintain positive drainage during construction on all areas subject to grading at all times. DB Co shall treat any cut or fill slopes, left unattended for 30 calendar days or more, with temporary hydraulic mulch, erosion control blankets or vegetative cover.

(f) DB Co shall minimize and control the amount of dust generated by construction operations at all times within and outside the construction zone. DB Co shall remove any

mud, debris and dust deposited outside of the construction zone, on Roadways and in boulevards, resulting from the Works.

(g) DB Co shall provide the design, approvals, and supply of materials, labour, equipment, inspection and testing associated with application of dust suppressants in accordance with the City of Ottawa Standards and Specifications and OPSS 506.

(h) Rip Rap Protection and Gravel Sheeting

(i) DB Co shall provide the design, approvals, and supply of materials, labour, equipment, inspection and testing associated with rip-rap and rock protection in accordance with the City of Ottawa Standards and Specifications and OPSS 511.

(i) Dewatering

(i) DB Co shall provide the design, approvals (permits to take water, where required), supply of materials, labour, equipment, inspection and testing associated with all the dewatering Works.

(j) Temporary Measures

(i) DB Co shall adjust all roadway infrastructure, including but not limited to catch basins, maintenance holes, valve chambers, and any other structures in the Roadway, flush with the base asphalt lift in order to provide snowplow protection in areas where the final lift of asphalt is not paved in advance of winter shutdown. DB Co shall design and construct temporary asphalt curbs to contain Roadway drainage at the proposed curb line of catch basins and maintenance holes. DB Co shall remove and make final adjustments immediately before the placement of surface course asphalt.

(ii) DB Co shall restore all trenches to match the existing original conditions or the new construction cross-section within 24 hours of the completion of the trench. In situations where the trench is Constructed in consecutive stages with a delay in between, DB Co shall restore the trench in stages within 24 hours after the completion of each stage.

(iii) DB Co shall provide temporary conditions design drawings to specify all temporary measures and are responsible for all costs associated with the above noted work.

6.13 Drainage

(a) DB Co shall provide the drainage in accordance with the criteria contained in this Article and in Article 5 – Drainage and Stormwater Management Design Criteria of this Part 2, and the applicable Reference Documents.

6.14 Traffic and Transit Signals

(a) General

(i) DB Co shall liaise and coordinate with the City and the City's designated traffic control signal contact person, with regards to all modifications that may be required at municipal traffic signals during the design and construction period. DB Co shall support all proposed modifications with traffic engineering analysis to meet the City's traffic signal requirements and standards.

(ii) DB Co shall define the coordination scheme, and coordinate all work with the City for municipal traffic signals that are included in the traffic signal coordination scheme.

(iii) DB Co shall reference the information provided in Schedule 15-2, Part 7, Clause 1.11, and coordinate with the City of Ottawa to identify and confirm the location of all existing and new traffic cameras, ITS devices, and all associated infrastructure 60 calendar days in advance of the design stage. DB Co shall require the approval of the City of Ottawa's traffic service group for all relocations, design and construction requirements, and types and specifications of such facilities that are impacted or required as the result of Works.

(b) Design and Performance Requirements

(i) DB Co shall coordinate the design, approvals and construction requirements for temporary and permanent traffic signals with the City.

(ii) For temporary and permanent traffic signals that are within MTO's jurisdiction, DB Co shall prepare PHM-125 drawings, and shall coordinate review and approval by MTO prior to commencing construction.

(iii) For permanent new traffic and transit signal facilities, or new permanent configurations at existing signalized intersections, with the exception of PXOs, the City shall supply and install all above ground traffic signal equipment as required by the governing road authority including but not limited to controller, poles, pedestrian and traffic signal heads with push buttons, audible displays, etc. The City shall supply, install and make all required terminations for the traffic signal wiring. The City shall provide all equipment and labour associated with the installation of permanent above-ground traffic signal infrastructure. DB Co shall coordinate with the City the design of electrical power feeds for all alterations to existing traffic signals, and new traffic signals; the cost of obtaining new electrical power feeds shall be a City responsibility.

A. For all permanent signalized intersections, the City shall design the vehicle detection system and specify the type of detection equipment to be used. DB Co shall only be responsible for the cost and coordination of the

installation of inductive loop detectors; any other detection equipment specified by the City's design shall be supplied and installed by the City

B. DB Co shall construct all permanent underground traffic infrastructure, including the supply and construction of concrete encased ducts, direct buried ducts, pole foundations, maintenance holes, maintenance hole frames & covers, vehicle loop detection and concrete pads.

C. Where the location selected for a traffic signal pole is not suitable for a standard pole foundation, as per City of Ottawa Standard Detail Drawings (e.g., where the pole is designed to go on top of pre-existing utilities), DB Co shall be responsible for the design of the non-standard foundation, in addition to the construction requirement in B above.

(iv) For all temporary traffic and transit signals, or temporary modifications to existing signalized intersections, the City shall supply and install all above ground traffic signal equipment as required by the governing road authority including but not limited to controller, poles (with the exception of wood poles), pedestrian and traffic signal heads with push buttons, audible signals, etc. The City shall also supply and install and make all required terminations for the traffic signal wiring. The City shall provide all equipment and labour associated with the installation of temporary above-ground traffic signal infrastructure. DB Co shall coordinate with the City the design of electrical power feeds for all temporary traffic signals or temporary modifications to existing signalized intersections; the cost of obtaining new electrical power feeds shall be a City responsibility.

A. For all temporary signalized intersections, the City shall design the vehicle detection system and specify the type of detection equipment to be used. DB Co shall only be responsible for the cost and coordination of the installation of inductive loop detectors; any other detection equipment specified by the City's design shall be supplied and installed by the City.

B. Where temporary signal infrastructure requires the use of wood poles and/or span wire, the City shall be responsible for the design of signal head placement only. DB Co shall design the location of the wood poles, guy wires, and span wires based on the City’s signal head placement.

C. DB Co shall construct all temporary underground traffic infrastructure, including the supply and construction of concrete encase ducts, direct buried ducts, pole foundations, maintenance holes, maintenance hole frames & covers, vehicle loop detection and concrete pads. DB Co shall construct all above ground infrastructure Work, including but not limited to installation, removals and reinstatement of wood poles, all aerial strand support and suspension cables, guys, anchors, ground rods and plates, along with any required underground Civil Work including conduit, foundations, maintenance holes/hand holes, frames & covers etc., as required to accommodate the staged construction of Work, with the

exception of traffic signal equipment as described above, which shall remain the responsibility of the City.

(v) For all PXOs, DB Co shall supply and install all above ground equipment, including but not limited to poles, hardware, arms, RRFBs, etc. DB Co shall provide the labour associated with the installation of the PXOs.

A. The design and installation of PXOs shall be in accordance with OTM Book 15, City of Ottawa Pedestrian Crossover Program and Examples Documents 1 and 2, and Appendix K – Pedestrian Crossover Infrastructure Requirements of this Part 2.

(vi) For all temporary and permanent traffic signals, DB Co shall provide interconnection ensuring that all signals can communicate with the City's Traffic Operations Center. Interconnection duct shall be designed by the City and installed by DB Co. The City will consider City-owned system-connectivity infrastructure prior to private-owned infrastructure to establish this connectivity.

(c) Notification Requirements and Timelines

Table 6-1: Permanent/temporary new traffic signals or permanent/temporary modification to existing traffic signals

Item	Description	Notification (Calendar Days)	Prior to	Information to be supplied to City	Information to be supplied to DB Co
1	Design	30	Desired receipt of signal design	1:250 CADD for the intersection, including pavement markings on all approaches	City provides traffic signal design, including traffic signal displays, traffic signal plant design, detection system design, etc., within 30 calendar days
2	Commencement of civil works (prerequisite – signal design	30	construction of civil works	Date when works are to begin, schedule of work	None

	completed)				
3	Electrical work involving the City (prerequisite – signal design completed)	30	construction of civil works	Meeting date regarding electrical works, schedule of work	Contact names and telephone numbers of relevant staff
4	Scheduling of installation date by City forces (prerequisite – signal design completed)	30	Desired signal installation date	Desired installation date by City forces	Scheduled date for installation to be provided to DB Co within eight calendar days of the notification. Scheduled date shall be within 10 calendar days of DB Co's request
5	City Inspection of civil work completed by DB Co (pre-requisite – signal installation date scheduled)	14	Scheduled signal installation date	Confirmation of work being completed	Confirmation that the work was completed to City satisfaction, within 7 calendar days of DB Co's notification that work was completed

(i) DB Co shall provide 30 calendar days' notice to the City where modification of an approach to a signalized intersection beyond OTM Book 7 applications is being proposed. DB Co shall submit 1:250 scale CADD drawings for all such modifications, as required.

(ii) DB Co shall prepare and submit TCPs, which show the signal design for the installation of, or modification of a traffic control signal, in accordance with Schedule 10 – Review Procedure. DB Co shall submit these particular TCP at least 45 calendar days before the start of any construction Work related to the installation or modification. Note however, that in the case of multiple simultaneous traffic control signal installations or modifications, the City may require more than 45 calendar days for submission review. DB Co shall meet with the City at least 60 calendar days in advance of these types of scheduled Works in order to discuss the submission schedule, and DB Co shall adjust the submission lead time to a timeframe acceptable to the City.

(iii) DB Co shall address the City's comments and changes on signs and Pavement marking plans developed as a part of DB Co's TCPs and incorporate the revised plans as applicable. DB Co shall submit the revised drawings to the City at least 30 calendar days prior to the scheduled placement of said signs and Pavement markings, all in accordance with Clause 6.15 of this Part 2 and Schedule 10 – Review Procedure.

(iv) Per Item 2 from Table 6-1, DB Co shall provide a minimum of 30 calendar days advanced notice to the City prior to commencing the following works:

A. Permanent Traffic Signals: Underground construction of the permanent traffic signals including concrete encased ducts, direct buried ducts, pole foundations, maintenance holes, vehicle loop detection and concrete pads;

B. Temporary Traffic Signals: Installation of the temporary traffic signal controller cabinet onto the wood pole; wood poles, double span and anchors along with any required Civil Works including conduit, foundations, maintenance holes/hand holes, etc.

(v) Per item 3 from Table 6-1, a minimum of 30 calendar days prior to construction, DB Co shall arrange a meeting with the City to coordinate the requirements of the electrical work involving the City. DB Co shall provide a schedule of the work to the City.

(vi) In accordance with the scheduled installation date established per Item 4 from Table 6-1, City forces shall perform all traffic signal activations and deactivations in accordance with OPSS 106.

(vii) Per Item 5 from Table 6-1, at least 14 calendar days prior to the date scheduled for the City to install the traffic signal equipment, DB Co shall have completed their portion of the Work for permanent and/ or temporary traffic signals modification/installation, and have provided the City with notice that the DB Co Work is complete.

6.15 Pavement Marking and Signing

(a) General

(i) DB Co shall provide the design drawings and obtain approvals from the City for all permanent and temporary Pavement marking and Roadway signs.

(ii) DB Co shall provide the design drawings and obtain approvals from the City for all permanent and temporary Pavement marking and signage at the locations of bus Transitway and facilities operated by OC Transpo.

(iii) Unless specified otherwise in this Article, DB Co shall provide all signing and Pavement markings in accordance with the criteria contained in this Article, the requirements of OPSS, and the applicable Reference Documents.

(iv) DB Co shall refer to Schedule 15-2, Part 9, Part B, Article 8 for all Pavement marking and signage requirements within MTO jurisdictions.

(b) Design and Performance Requirements

(i) DB Co shall design, obtain approvals, and comply with construction requirements for permanent Pavement markings as per the City of Ottawa's standards and specifications and applicable OPSS.

(ii) DB Co shall provide for the supply of materials, labour, equipment, inspection and testing associated with the requirements for all temporary Pavement markings during construction.

(iii) The City shall supply all labour, equipment and materials for the supply and installation of all permanent Pavement markings between April 16 and November 14. DB Co shall supply all labour, equipment and materials for the supply and installation of permanent Pavement markings between November 15 and April 15.

(iv) DB Co shall supply all labour, equipment, materials, inspection and testing associated with the requirements for all temporary and permanent non-regulatory signing.

(v) The City shall supply all labour, equipment and materials for the supply and installation of all temporary and permanent regulatory signing requirements.

(vi) DB Co shall ensure the Pavement surface is prepared, clean and free of debris.

(vii) DB Co shall complete final grading prior to installation of all permanent and temporary signs. DB Co shall also be responsible for the reinstatement of all areas disturbed during the installation of new or relocated signs.

(viii) DB Co shall provide a minimum of 10 Business Days advanced notice to the City for the installation of the permanent Pavement markings and regulatory signing to be completed by the City as illustrated on DB Co's construction documents.

(ix) DB Co shall make all submissions in relation to the requirements of this section in accordance with Schedule 10 – Review Procedure.

A. DB Co shall submit Pavement markings and signage CADD drawings formatted in Microstation V.8i at a scale of 1:500.

(x) DB Co shall obtain the library of symbols from the City prior to commencing any work.

(xi) DB Co shall contact the appropriate municipal and/ or provincial road authorities to confirm, in writing, the official municipal road names as well as Civic Address Signs (911 Identification Numbers and signing) requirements and incorporate such signs in the permanent and temporary Pavement and signing design drawings. DB co shall indicate the location, size and type of each sign on the TCPs. DB Co shall ensure that the above noted signs are in place and visible at all times. If the placement of the signs conflict with DB Co's construction, DB Co may temporarily relocate the signs, provided the sign will remain unobstructed and within the affected property limits for the duration of the Project. DB Co shall replace any damaged signs immediately.

(xii) DB Co shall prepare and submit a permanent signing plan and a permanent signing table a minimum of 30 calendar days prior to the implementation of the plan. The permanent signing table shall include, but not be limited to information detailing sign location (station of final location, removal location and on which side of the road to be installed in relation to the direction of travel), height to bottom of sign, lateral offset to post, support type with dimensions, alpha-numeric sign code with dimensions and the message/description, etc.

(xiii) DB Co shall prepare sign details for the following types of ground-mounted guide Signs: Roadway identification, direction & destination, and location identification. DB Co shall design and provide all overhead sign structures, ground-mounted sign break-away steel supports and associated sign footings.

6.16 Street Lighting

(a) General

(i) For all the temporary and permanent street lighting, DB Co shall design, obtain approvals, and supply of materials, labour, equipment, build, provide inspection and testing associated with the City's requirements for Street lighting standards and best practices.

(b) Design and Performance Requirements

(i) DB Co shall design and construct all permanent and temporary street lighting including power feeds. Street lighting shall meet the requirements of the City of Ottawa Right of Way Lighting Policy. DB Co shall prepare and submit the lighting design together with the lighting calculation summary in accordance with Schedule 10 – Review Procedure.

A. For the design and construction of luminaires, DB Co shall supply and install the appropriate **[REDACTED]** dimming and monitoring nodes. All other equipment, including but not limited to software, programming, configuration and licensing, required to make the supplied luminaires fully operational and integrated into the existing street lighting system shall be the responsibility of the City. DB Co shall be responsible for the supply and installation of all new utility poles.

(ii) DB Co shall illuminate cycle lanes based on the required Roadway lighting levels stipulated in the City of Ottawa Right of Way Lighting Policy. Any illumination requirements are governed by the strategy for Roadway lighting.

(iii) All activities related to Roadway lighting systems (i.e. design, construction) shall meet the Conditions of Service set out by the local Electrical Supply Authorities, the ESA, and any other entity having jurisdiction.

(iv) The installation of luminaires shall utilize existing above ground utility poles located within public ROW where appropriate. DB Co shall coordinate the use of these joint use **[REDACTED]**/street light poles with the local Electrical Supply Authority and shall satisfy the requirements of Ontario Regulation 22/04 Electrical Distribution Safety (Electricity Act 1998) for third party equipment mounted on **[REDACTED]** utility poles. DB Co shall be responsible to cover any costs associated with the use of existing above ground utility poles.

(v) DB Co shall coordinate with the City the design of electrical power feeds for all alterations to existing street lighting, temporary lighting and new street lighting; the cost of obtaining new electrical power feeds shall be a City responsibility.

(vi) The City shall perform all work impacting existing City owned street lighting within the contract limits, including pole removal (concrete foundations to be removed by the DB Co), wiring, luminaire replacement and aerial cables. DB Co shall coordinate its work with the City.

(vii) DB Co shall provide a minimum of 15 Business Days advanced notice to the City for the installation of temporary Roadway illumination and removal of existing Roadway illumination.

(viii) DB Co shall arrange a meeting with the City, a minimum of 10 Business Days prior to construction, to coordinate the requirements of the electrical work involving the City. DB Co shall provide a schedule of its proposed work to the City in this meeting.

(ix) Lighting shall not contain an upward component and minimize light trespass and disability glare for drivers.

(x) DB Co shall design and construct all Roadway luminaries to be LED and meet the full cut-off type and specifications.

(xi) All permanent Roadway lighting levels shall meet the appropriate standard for the Roadway classification.

(c) Refer to Article 10 – OR174 Street Lighting, of this Part 2 for requirements for street lighting on OR174.

6.17 Passenger Pick Up and Drop Off Facilities

(a) DB Co shall design and construct PPUDO facilities for the location and number of PPUDO spaces specified in Schedule 15-2, Part 4, Appendix A. DB Co shall obtain approval from the City for the location of all PPUDO locations prior to advancing any Roadway designs.

(b) DB Co shall satisfy the requirements of OC Transpo's Transitway and Station Design Guidelines, including City of Ottawa By-laws and reference material included in Clause 6.1 of this Part 2.

(c) The following general requirements shall apply to all PPUDO facilities:

(i) DB Co shall limit the location of curbside PPUDO facilities to tangent Roadway segments, offset from adjacent intersections and accesses as per the City of Ottawa By-law 2003-530.

(ii) DB Co shall satisfy the upper limit of all geometric dimensions for the design of PPUDO facilities including, but not limited to, parking space dimensions and aisle widths as per the City of Ottawa By-law 2008-250.

(iii) DB Co shall ensure the locations and design of PPUDO facilities will avoid conflicts with cycling facilities, bike racks, bus access and egress and operations, and Station operations.

(iv) PPUDO facilities shall include a fully accessible, direct, and barrier-free pedestrian access from / to all bus stops and Station access and egress. Each PPUDO facility shall include provisions for boarding and alighting from an accessible parking space as per the accessibility requirements and best practices specified under sections 3.1 and 3.2 of COADS.

(v) DB Co shall design and construct PPUDO facilities physically separated from fare paid zones.

(vi) DB Co shall ensure all curbside recessed PPUDO stalls can accommodate the safe entry and exit manoeuvres with the use of curb transitions as per the City of

Ottawa Standard Detail Drawing R8 – Typical Intersection Narrowing (Single) and/or R9 – Typical Mid-Block Narrowing.

6.18 Road Safety Audits and Road Design Safety Reviews

(a) Order of Precedence

(i) DB Co shall have independent Road Safety Audits and Road Design Safety Reviews completed in accordance with the criteria set out in this Article and the following reference documents. If there is any conflict between the criteria contained in this Article and any of the reference documents, the following shall apply, in descending order of precedence:

A. The criteria contained in this Article;

B. TAC, Geometric Design Guide for Canadian Roads;

C. TAC, The Canadian Road Safety Audit Guide;

D. MTO, Roadside Safety Manual;

E. MTO, Ontario Traffic Manual Books 1 through 18;

F. AASHTO, Roadside Design Guide.

(ii) DB Co shall perform the necessary Road Safety Audits and Road Design Safety Reviews in the context of the traditional Road Safety Audit processes but shall expand the processes in order to include human factors, the review of drawings and plans (Reviews).

(b) General Requirements

(i) Road Safety Audits shall include the Road Safety Audit processes as identified in The Canadian Road Safety Audit Guide, and shall for clarity, include human factors considerations.

(ii) DB Co shall provide to the City of Ottawa with the Road Safety (Review and) Audit team's individuals' qualifications, experience, and knowledge, and letters of reference from the relevant governmental authorities where prior audits were performed, 60 calendar days in advance of any safety review or audit work. DB Co shall receive the City's approval for the proposed Safety Audit team in accordance with the requirements of the Review Procedure specified in Clause 6.18 of this Part 2 and prior to any safety review or audit work being initiated.

(iii) The Road Safety Audits and Road Design Safety Reviews team's individuals shall not be an employee of any of the companies on DB Co's design and construction team, other than being paid for services rendered to DB Co in their capacity as Road Safety Auditor. The auditing team shall remain fully

independent and at arm's length from any company participating on DB Co's team.

(iv) All DB Co's Road Safety Audits and Road Design Safety Reviews shall include a human factors expert experienced in road and highway design and construction, who shall provide input and review of the safety and operation of the work from a human factors perspective.

(v) DB Co shall immediately correct any "as constructed" element that does not conform to the design, does not meet the required safety standards, or deemed not to meet a reasonable level of safety by the Road Safety Auditor. DB Co shall prepare the corrective measures and rectification recommendations noted above and shall ensure a licensed Professional Engineer stamps and seals the appropriate recommendations for the review and acceptance by the Road Safety Audits and Road Design Safety Reviews team and to the City of Ottawa.

(vi) DB Co shall assume responsibility for any existing or proposed site conditions found not to meet a reasonable level of safety, and shall rectify the condition immediately, or otherwise construct temporary works to address the safety concern until repairs are made.

(c) Road Safety Audits and Road Design Safety Reviews Team

(i) The Road Safety Audits and Road Design Safety Reviews individual and supporting team is more generally referred in this context as the Road Safety Auditor.

(ii) DB Co's Road Safety Audits and Road Design Safety Reviews team shall consist of a team of auditors, with a minimum of three qualified personnel, who are independent of the DB Co's design and construction team, and shall meet the following minimum criteria:

A. Be Professional Engineers trained in the area of road and public safety, with over 20 years of engineering experience and demonstrated experience or resume working in the area of public safety and undertaking formal Road Safety (Review and) Audits, with references from government agency;

B. Demonstrated experience in undertaking formal safety reviews and experience with The Canadian Road Safety Audit Guide, and Canadian and Ontario roadside safety standards;

C. Demonstrated experience in road safety analysis, traffic engineering, geometric design, and demonstrated expertise with human factors in design and safety reviews and audits;

D. Participated in at least two recent formal road safety audits with criteria similar to the Road Safety Reviews and Audits in this Work, where such previous participation was on projects delivered using design build or public private partnership project delivery methods; and,

E. Demonstrated professional independence in undertaking Road Safety Reviews and Audits in this Work**.**

(d) DB Co's Responsibility:

(i) DB Co shall undertake Road Safety Audit and Road Design Safety Review as per the requirements of Clause 6.18 of this Part 2 on all temporary and permanent roadway improvements listed below.

A. All facilities operated by OC Transpo including, but not limited to, all bus loops and associated accesses, lay-bys, bus stops, PPUDOs, Park and Ride facilities, as specified in Clause 6.9 of this Part 2;

B. All Roadway improvements listed under Clause 6.19 of this Part 2 and Clause 6.21 of this Part 2. For Road Safety Audit and Road Design Safety Review requirements for provincial road improvements, including Hwy 417, DB Co shall refer Schedule 15-2, Part 9, Part B, Article 10 – Road Safety Review and Audits.

C. All staging detour routes, Lane Shifts, lane closures, and temporary conditions designed and constructed by DB Co as part of the Works per the requirements specified in the Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access.

(ii) DB Co shall assume responsibility for the following items:

A. Scheduling, initiating, allowing access to the applicable site and managing the Road Safety Audits and Road Design Safety Reviews process at the appropriate times during the course of the Works;

B. Providing all necessary design drawings and supporting documentation for the Road Safety Audit team to conduct the Road Safety Audit and Design Safety Review;

C. Ensuring that the Design Safety Review and Road Safety Audit is conducted in accordance with good industry practice;

D. Receiving and reviewing the Road Safety Audit team's report with the City of Ottawa representative;

E. Responding to the Road Safety Audit team's report, including presenting rectification alternatives to address deficiencies;

F. Implementing required re-design as a result of the corrective suggestions as described in the sub clause noted above in an expeditious and timely manner;

G. Updating changes on the required design drawings; and,

H. Providing all draft and final documentation related to the Road Safety Audits and Road Design Safety Reviews to the City of Ottawa's representative.

(iii) DB Co shall accept responsibility for and account for all costs associated with Road Safety Audits and Road Design Safety Reviews, including any re-design and increased costs to the Works that result from the Road Safety Audits and Road Design Safety Reviews.

(iv) After each Road Safety Audit and Road Design Safety Review, except as otherwise expressly agreed in writing by the City of Ottawa's representative, DB Co shall address all recommendations made by the Road Safety Audit team.

(e) Road Design Safety Review

(i) DB Co shall undertake an initial Road Design Safety Review at the outset of the Works and no later than 60 calendar days after Commercial Close of the Works in order to assess DB Co's proposed design elements including both temporary and permanent improvements that may have any bearing on public, maintenance or operational safety from the point of view of any user within the Lands.

(ii) In each Road Design Safety Review, DB Co shall review, identify and resolve any safety concerns prior to advancing the design of both temporary and permanent improvements such that the design can be modified in a timely fashion to address the safety concerns within the Works. DB Co shall plan, schedule and execute the review, together with providing a report that addresses any safety concerns and the recommendation or resolution of the initial Road Design Safety Review. The initial Design Safety Review shall precede the design activity and the subsequent design stages shall accommodate any required recommendation or resolution of this initial Road Design Safety Review.

(iii) DB Co shall undertake Road Design Safety Reviews on an ongoing basis through the different stages and duration of all designs and all to be Constructed elements, both temporary and permanent improvements that may have any bearing on public, maintenance or operational safety from the point of view of any users within the Lands.

(f) Road Safety Audit Process

(i) DB Co shall complete the Road Safety Audit process in accordance with The Canadian Road Safety Audit Guide. References to "review" or "response" from

the owner agency, or other qualifying phrase with similar connotation in the process, shall be construed as the responsibility of DB Co in accordance with the requirements in Clause 6.18 of this Part 2.

(ii) DB Co's Road Safety Audit team shall prepare a report to document the audit findings and submit the Road Safety Audit reports to the Design Team for the stages identified in the clause that follows. The Road Safety Audit reports shall clearly identify safety hazards that need to be addressed by DB Co along with recommendations for remediation. DB Co shall respond to the identified hazards and recommendations with remediation counter-measures or provide appropriate reasons why the safety issue may not be addressed as recommended in the reports. Under any circumstances, DB Co's response and remediation countermeasures shall address the safety issue to the satisfaction of the Road Safety Audit team.

(iii) For all temporary conditions and temporary roadway improvements to accommodate staged construction under long duration Works as specified under clause 2.5.4 Long Duration (LD) in the MTO's OTM Book 7, DB Co shall perform Stage 3a and Stage 3b audits for all temporary roadway improvement according to the requirements outlined in Clause 6.18 (f) of this Part 2.

(iv) DB Co shall perform Stage 3b audits for all Station construction Sites according to the requirements outlined in Clause 6.18(f)(v) of this Part 2.

(v) DB Co shall submit the Road Safety Audit reports to the City of Ottawa's representative in accordance with the review procedures specified in Schedule 10 – Review Procedure for review at all the stages identified below:

A. Stage 1: Pre-Final Design Road Safety Audit

i. DB Co shall conduct a Stage 1 Road Safety Audit immediately before submission of the Pre-Final Design Development Submittals in accordance with the requirements of Schedule 10 – Review Procedure of the Project Agreement. DB Co shall undertake a detailed review of the pre-final design development submittals to identify any potential safety-related enhancements that might have an impact on the design and construction of Works. Issues considered shall include, but not be limited to, the following:

1 Design consistency;

2 Site conditions and visibility;

3 Drivers' work load and perceived road information;

4 Vehicular traffic speed management and associated safety risk factors;

5 Traffic control devices;

6 Human factors;

7 Horizontal and vertical alignment;

8 Cross section design;

9 Interchange/intersection design and configuration;

10 Access location;

11 Sight distance including, but not limited, to stopping sight distance and turning sight distance, sight distances to traffic control devices, Bullnoses, etc.;

12 Operation of public transit;

13 Operational and maintenance safety;

14 Traffic operations;

15 Environmental factors;

16 Clearances to roadside objects;

17 Safety barriers; and,

18 Provision for vulnerable road and all multi-modal road ROW users.

B. Stage 2: Final Design Road Safety Audit

i. DB Co shall conduct a Stage 2 Road Safety Audit immediately before submission of the final design development submittals in accordance with Schedule 10 – Review Procedure of the Project Agreement. The audit shall undertake a detailed review of the completed final design development submittals to identify any potential safety-related enhancements that might have an impact on the operational safety of the Works. DB Co shall consider in the audit and address issues such as the items included, but not be limited to the following items:

1 Signing and Pavement markings;

2 All interface with adjacent design disciplines (rail track corridors and LRT facilities; tunnel, civil, facilities

including stations and landscaping, utilities and bridges, etc.)

3 Traffic signal configuration;

4 Intersection details;

5 Municipal services;

6 Drainage and SWM elements;

7 Lighting;

8 Fencing;

9 Clearances to roadside objects;

10 Safety barriers;

11 Surface standards including treatments and structures;

12 Traffic control devices;

13 Streetscape and road furniture;

14 Provision for vulnerable road and all multi-modal road ROW users;

15 Accommodation of design vehicles;

16 Emergency responses requirements;

17 Road maintenance

18 Traffic staging plan; and,

19 Any other Stage 1 Road Safety Audit results affected by the final design.

C. Stage 3a: Temporary Traffic Control On-site Road Safety Audit

i. DB Co shall conduct Stage 3a Road Safety Audits on the applicable sites within Lands before implementation of temporary traffic and transit control set-ups that meet one or more of the following criteria:

1 Two or more individual temporary work zones in close proximity to each other such that one would influence the traffic and transit operation of the other. The spacing

between the termination area of one work zone and the advance warning area of the next work zone for which one temporary traffic control set-up influences the traffic operations of the next temporary traffic control set-up is 2.0 km or less.

2 Temporary staging are required within the existing Roadways and the duration of temporary traffic control set-ups is five calendar days or more. The set-up does not necessarily have to be in place for the entire time but can be one of a number of repeating set-ups that are active at different times.

3 The duration of temporary traffic control set-ups is ten calendar days or more on roads other than those identified (2) above. The set-up does not necessarily have to be in place for the entire time but can be one of a number of repeating set-ups that are active at different times.

D. Stage 3b: Construction Road Safety Audit

i. DB Co shall conduct Stage 3b Road Safety Audits on the applicable sites within Lands during construction of Works. These audits shall examine the field conditions of the Work under construction and assess any circumstances that may have a bearing on public safety from the point of view of any user and public areas that are within the Lands, or are modified and Constructed as a part of the Works. The audits shall meet the following criteria:

1 DB Co shall undertake two of the Stage 3b Road Safety Audits annually within the high construction season, between June and September (i.e. two audits to be performed annually between June and September) and one in the winter season, annually between December and February. DB Co shall preplan for only one of the audits, while DB Co shall perform the other audits unannounced.

E. Stage 4: Post-Construction Road Safety Audit

i. DB Co shall carry out a Stage 4 Road Safety Audit prior to opening any portions of the Roadway Works for traffic operation. DB Co's audit shall investigate and identify potential safety enhancements that may reduce the frequency and/or the severity of collisions. The Road Safety Auditor shall also check for safety deficiencies that result from using particular combinations of design elements not previously detected or any synergistic effects

of using minimum Design Criteria for multiple design elements that may compromise users' safety.

ii. DB Co shall plan for and conduct Stage 4 Road Safety Audits prior to and as a condition of the issuance of the substantial completion certificate.

iii. Pursuant to the requirements of the two clause (i) and (ii) of the intended Stage 4 Road Safety Audit noted-above, the Road Safety Audit team shall fully examine the Works by:

1 Meeting with DB Co to review any issues relating to the Works, in particular design changes that may affect the safety of Roadway Works included in this Article;

2 Checking to ensure that safety issues identified in the Stage 2 Road Safety Audit are addressed and the resulting design changes do not create further safety issues;

3 Reviewing any design changes that occurred during the relevant Works to ensure they do not create safety issues; and,

4 Conducting field reviews of such Works, under both daytime and night time conditions.

(g) City-requested Safety Audit

(i) The City of Ottawa reserves the right to request site-specific Road Safety Audits at any time in addition to the audits required in all other Road Design Safety Reviews and Road Safety Audits specified in Clause 6.18 of this Part 2. Such request may be for any site conditions, design element, design concern or Constructed element of Works that is of concern to the City of Ottawa. The City's written request will outline the safety concern and the issues required to be investigated and addressed by DB Co.

(ii) DB Co shall demonstrate that the design and proposed Constructed Works meet a reasonable level of safety for all affected users. DB Co shall provide supporting research or engineering rationale and analyses for the design decisions, and for the support of the proposed design and Constructed Works that are subject to investigation.

(iii) DB Co shall address the concerns and/or modify the proposed design and Constructed Works accordingly and provide all available technical information to the Road Safety Audit team for consideration.

(iv) The Road Safety Audit team will render an opinion with the safety issue, and DB Co shall address the safety issue to the satisfaction of the Road Safety Audit team and the City of Ottawa. The disposition and rectification of the safety concern is DB Co's full responsibility and obligation based on full and due consideration of input from the City of Ottawa and the Safety Audit team.

(h) Road Safety Audit Certificates

(i) DB Co shall submit to the City of Ottawa's representative a Road Audit Safety Certificate called in the form attached as Appendix H - Form of Road Safety Audit Certificates to Schedule 15-2 – Design and Construction Requirements in respect of the Stage 1, Stage 2, and Stage 4 Road Safety Audits respectively. Each Road Safety Audit Certificate shall be signed by DB Co's Design Manager, DB Co's construction contractor representative, DB Co's Project Manager representative, and the Road Safety Audit team.

(ii) DB Co shall provide the Independent Certifier with the Stage 4 Road Safety Audit Certificate. The Substantial Completion Certificate shall not be issued unless a Stage 4 Road Safety Audit Certificate has been submitted and signed by the DB Co's Design Manager, DB Co's construction contractor representative, DB Co's Project Manager representative, and the Road Safety Audit team.

(i) Random Audits

(i) The City of Ottawa retains the right to perform additional independent audits on any part of design and construction Works at any time.

6.19 Municipal Roads Improvements

(a) OR174

(i) General Requirements

A. DB Co shall design and construct all OR174 improvements and new Roadway construction, including all impacted interchanges and associated ramp intersections at cross roads. All associated construction activities with the OR174 shall include the completion and Commissioning of the Works, carried out in strict accordance with Schedule 15-2 – Design and Construction Requirements, and in such a manner as to comply with all applicable Project Agreement requirements.

B. DB Co shall design and construct OR174 travel lanes, impacted interchange ramps, and crossing road intersections and permanent improvements to satisfy the requirements of the TAC GDGCR.

C. Unless specifically noted otherwise in this Article, DB Co shall design the necessary improvements of OR174 and interchange ramps based on the

OR174 basic Design Criteria parameters noted in Table 1 and Table 3 included in Appendix A of this Part 2.

(ii) OR174 improvements include the design and construction of all and any modifications necessary on the existing OR174 and associated infrastructures in order to support the construction.

(iii) OR174 improvements include but are not limited to all permanent improvements, realignment and/ or reconstruction of OR174 travel lanes and shoulders and all necessary earthworks, Pavements, traffic signs, traffic signals, barriers and Pavement marking, and all associated infrastructure modifications on OR174 interchange ramps and cross roads.

A. DB Co shall maintain existing lane configuration including number of through travel lanes and speed change lanes as a minimum for all permanent improvements required on OR174 throughout unless specifically noted otherwise in this Article or in Appendix A of this Part 2.

B. DB Co shall provide standard Pavement widths for all travel lanes, ramps, and shoulders throughout as per the requirements of Appendix A of this Part 2, unless specifically noted otherwise in this Article.

C. DB Co shall repurpose the existing Bus Only Lanes back to outside paved shoulders as Remaining Works. DB Co shall assume responsibility for the design, approvals and construction associated with updating the existing Pavement markings in accordance with OTM requirements. DB Co shall also assume responsibility for removing all bus-only signing. DB Co will be responsible for making any arrangements with the City of Ottawa to ensure the schedule and process for decommissioning the shoulder buses meets OC Transpo service and operational requirements.

D. DB Co shall design and construct a TL-5 barrier between the LRT and OR174 median shoulders that meets the applicable structural and safety requirements for the intended use as per the requirements of Article 4 - Structural Design Criteria and Requirements of this Part 2. The design and construction of the TL-5 barrier and median shoulders shall accommodate a future HOV lane in each direction.

E. DB Co shall design traffic staging plans in accordance with the requirements of OTM Book 7 and Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access.

F. DB Co shall investigate, design and construct all Pavements. DB Co shall design and construct flexible Pavements that meets or exceeds the requirements of Clause 6.11 of this Part 2.

G. DB Co's design of the section of the OR174 west of the Montreal Road interchange improvements shall maintain the existing horizontal alignment of the WB lanes and provide for a 3.0 m median shoulder.

H. DB Co's design of OR174 west of Montreal Road interchange improvements shall realign the EB lanes as required to accommodate the LRT infrastructure and the TL-5 barriers. DB Co's design shall provide for a 3m median shoulder.

I. DB Co's design shall include the full depth removal of the existing concrete road base in some sections of the OR174 travel lanes within the area of the Works as specified under Clause 6.11 of this Article 6.

J. DB Co shall design and construct a new signalized intersection to the east of the existing OR174 and Trim Road intersection, such that the intersection is beyond the east terminus of the Tail Tracks, including associated Track bumper stop and other Trackwork appurtenances.

K. DB Co shall design and construct localized grading adjacent to existing ditches and new drainage facilities including but not limited to catch basins, maintenance holes, oil and grit separators, curb and gutters, storm sewers, and correction of road cross falls to ensure positive drainage along and across OR174 so that OR174 drainage requirements are satisfied according to the criteria specified in the City of Ottawa Sewer Design Guidelines. For overall drainage requirements criteria refer to Article 5 - Drainage and Stormwater Management Design Criteria, of this Part 2.

L. DB Co shall design and construct all impacted Roadway elements at tie-in locations and use appropriate transitions to match existing conditions. DB Co shall also design and construct all necessary road realignments, widenings, and relocation of any interchange exit and entrance ramp sections, loops, and ramp junctions that may be impacted as a result of OR174 improvements or in order to support the construction staging of the Works.

(iv) DB Co shall design and construct all and any modifications, relocation, and reconstruction of the aboveground and underground utilities, lighting, and traffic signal improvements necessary to support the OR174 road improvements and construction of Works. All such utility works shall satisfy the City's utility circulation and permit approval requirements as required under Article 8 - Utility Infrastructure Design Criteria of this Part 2.

(v) DB Co shall ensure that any improvement on OR174 will not compromise the vertical clearance under the existing and new Overhead structures over OR174. For minimum clearance criteria acceptable for Overhead structures refer to Article 4 – Structural Design Criteria and Requirements of this Part 2.

(vi) Requirements for new MUP in OR174 corridor are referenced in Schedule 15-2, Part 6, Article 3 – Connectivity Requirements. At locations along OR174 corridor, where DB Co shall construct a new MUP, or realign existing MUPs, the location and design of the intended MUP shall not compromise OR174 improvements including its grading and drainage requirements noted in this Part 2. DB Co shall also take into consideration the future ultimate OR174 HOV widening grading and drainage requirements in determining the appropriate location and design of the intended MUPs. DB Co shall demonstrate that a feasible and economical design solution can be achieved without requiring the intended MUPs to be reconstructed or drainage and grading requirements compromised when OR174 is widened to accommodate HOV lanes in the future.

(vii) DB Co shall undertake a detailed field survey and investigate the existing conditions along the entire OR174 corridor within the Project limits. This review shall include but not be limited to the location and type of the existing concrete barriers, guiderails, structures, traffic signs, poles, creek crossings Culverts, bridge Culverts, ditches, steep slopes, areas of deep excavation and steep grades, all underground and above-ground utilities, and all and any other road side safety Hazard items and issues associated with the existing conditions along and across the road corridor. DB Co shall record the results and findings of the existing conditions survey in a comprehensive existing conditions report and submit a copy of the report to the City, in accordance with Schedule 10 – Review Procedure prior to advancing the design.

(viii) DB Co shall review all roadside hazard conditions on OR174 and provide adequate mitigation in conformity with current MTO standards including the MTO's Roadside Safety Manual. DB Co shall identify the roadside safety hazards, and substandard conditions due to the widening and realignment of OR174 and interchange ramp modifications. The reduction in length of barriers and guide rails required throughout the OR174 corridor shall consider slope flattening as the preferred method of disposing of excess material. DB Co shall evaluate the design along with the Design Criteria, property constraints, and all roadside safety hazard conditions in the early stages of design development and develop maximum roadside safety design. Where current design guidelines cannot be achieved, DB Co shall identify and provide proposed countermeasures. After receiving endorsement from the City, DB Co shall incorporate the proposed improvements into the design. DB Co shall present and provide documentation of the existing conditions and proposed improvements decisions throughout the length of the Works with respect to roadside safety design in the form of roadside safety review reports stamped by a licensed professional engineer with over 15 years freeway safety review experience and seek approval from the City 30 calendar days prior to completing the preliminary design.

(ix) There is a +/-150m section of OR174 located approximately +/-680m west of the existing OR174 / Trim Road intersection (at the approximate location of Taylor Creek Culvert crossing) on which a Pavement surface distress is observed on the

existing OR174 travel lanes in both the EB and WB directions of traffic. DB Co shall undertake necessary geotechnical investigations and determine the cause of this pavement distress and design and construct appropriate pavement rehabilitation solutions and necessary improvement countermeasures in order to rectify this Pavement surface distress so that the OR174 pavement and road profile will be improved and meet the appropriate pavement performance requirements, service life, and Design Criteria required under both Clause 6.11 and Article 7 - Geotechnical Design Criteria and Requirements of this Part 2.

(x) DB Co shall design and construct highway shoulder rumble strips on both outside shoulders and median shoulders of OR174 and all necessary transitions and treatments at the location of exit and entrance ramp terminals as per the requirements of the MTO's directive PLNG-B-004 "Highway shoulder rumble strip application and installation policy, issued by policy and planning branch on 2000-10-23" and its associated appendices.

(xi) DB Co shall design and construct the OR174 alignment and cross section at the location of Green's Creek Culvert such that the edge of pavement for the ultimate WB outside lane (Lane 3 as defined in Table 3 of Appendix A of this Part 2) will match the existing edge of pavement of the existing WB outside lane. All the necessary roadway widening to accommodate the Green's Creek Culvert replacement shall be constructed to the south of the above noted WB outside lane and contained within the Lands.

(xii) DB Co shall design and construct the OR174 / Montreal Road interchange Bridge Structure and associated road cross-section elements and speed change ramps to their ultimate requirements to accommodate the ultimate widening and improvements required for HOV lane improvements and as specified under Appendix A, Table 3, of this Part 2. For added clarity, DB Co shall demonstrate in the preliminary design stage how DB Co's proposed OR174 design can accommodate the future HOV lanes widening and improvements without any modifications or alterations to DB Co's proposed OR174 / Montreal Road interchange Bridge Structure when the HOV lanes are implemented along OR174 corridor. For additional information, DB Co shall refer to requirements of Clause 6.19(c) and Article 4 – Structural Design Criteria and Requirements, of this Part 2.

(b) Blair Road

(i) DB Co shall design and construct all improvements and modifications for Blair Road, including the existing intersections, and interchange ramps that are necessary in order to support the construction of Works. Refer to Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access, for the description of necessary site-specific improvements on affected Roadways, intersections and interchange ramps, in order to accommodate the appropriate traffic and transit operations under staged conditions, including conditions for final reinstatement requirements.

(c) Montreal Rd / OR174 Interchange

(i) DB Co shall design and construct the Montreal Road/ OR174 interchange, including all associated ramp terminals, to meet the Design Criteria requirements and corresponding minimum lane configuration diagrams shown in Appendix A and Appendix B of this Part 2, respectively. Refer to Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access, for the description of necessary site specific improvements on affected Roadways, ramps, and intersections in order to accommodate the appropriate traffic and transit operations under staged conditions.

A. DB Co shall coordinate the design of traffic signals with the City for the interchange, in accordance with Clause 6.14 of this Part 2 as well as undertake a detailed intersection multi-modal operation and level of service analysis.

i. DB Co shall demonstrate the traffic operations impacts associated with the necessary improvements on the existing signalized intersections and interchange ramps do not cause traffic queues that reach the mainline of OR174 and are acceptable and feasible considering projected traffic volumes, expected transit operations, and pedestrian and cyclist movements.

ii. DB Co shall develop a Synchro model based on existing conditions that includes the two ramp intersections and the intersection of Montreal Road and Shefford Road at the interchange. DB Co shall use the City supplied existing signal timing, phasing, and volumes for the existing Synchro model.

iii. DB Co shall perform peak hour field observations and calibrate the Synchro/Sim Traffic model to reflect observed conditions. DB Co shall develop models for all phases of construction and the ultimate condition, using the calibrated existing Synchro model.

iv. DB Co shall prepare a traffic signal analysis report documenting the existing conditions to compare to the proposed construction phasing and ultimate conditions.

v. The results of the intersection operations analysis shall include, intersection layout configuration, traffic control types, and auxiliary storage lane requirements as per the requirements of the City of Ottawa TIA guidelines.

vi. DB Co shall submit to the City of Ottawa the results of above-noted investigations by submitting a traffic analyses report and seek approval from the City of Ottawa at least 20 calendar days prior to initiating the development of geometric design.

vii. DB Co shall include the existing channelized right turn lane between the WB OR174 off ramp and the WB direction of Montreal Road in the above noted investigations. DB Co shall use the results of the investigations to determine if this channelized right turn lane is necessary to achieve required LOS. If the results of the investigation determine that the existing channelized right turn lane is necessary to achieve required LOS, then DB Co shall include the existing channelized right turn lane in the lane configuration diagrams shown in Appendix A of this Part 2.

(ii) DB Co shall design and construct Utility Infrastructure and Utility relocations and conflicts in accordance with the requirements of Article 5 – Drainage and Stormwater Management Design Criteria, and Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

(iii) DB Co shall upgrade the Montreal Road cross-section as per the requirements of the corresponding Design Criteria and lane configuration diagrams specified in Appendices A and B of this Part 2, respectively.

(iv) DB Co shall design and construct appropriate crossing treatments for pedestrian and cyclists across all Montreal Road/OR174 interchange ramps and Montreal Road intersections.

A. The improved Montreal Road cross-section shall accommodate new unidirectional raised cycle tracks within the limits of construction.

B. In the WB direction, the raised cycle track shall begin east of the EB on/off ramp intersection, and terminate west of the WB off ramp (connecting back into the existing on road cycling lane).

C. In the EB direction, the cycle track shall begin just west of the WB on/off ramp intersection, and terminate just east of the EB intersection, connecting back into the existing on road cycling lane.

D. DB Co shall segregate the proposed raised cycle tracks from the outside (curbside) lane on either side of the Roadway by a 0.6m wide hard surface boulevard.

E. For additional requirements related to pedestrian and cyclist connectivity treatments and Station facilities used by pedestrians refer to Schedule 15-2, Part 4 – Stations, and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(v) DB Co's design shall accommodate and reconstruct to current standards all accesses from / to the adjacent properties including **[REDACTED]** that are impacted as the result of Works on Montreal Road.

(d) Jeanne d'Arc Boulevard/OR174 Interchange

(i) DB Co shall design and construct the necessary improvements on the above-noted interchange ramps intersecting Jeanne d'Arc Boulevard as follows:

A. DB Co shall remove the northern portion of the existing free flow N-W ramp, and direct traffic through the existing signalized intersection. DB Co shall design and construct a modification to the existing bus ramp to receive and redirect the N-W ramp traffic back to OR174 speed change lane in the WB direction.

i. DB Co shall repurpose a portion of the land vacated by the removal of the free-flow portion of the N-W ramp to extend the SB right turn lane northerly towards the existing diverge point of the existing free-flow N-W ramp, including pavement markings and signage, as required, to allow the northern portion of this auxiliary lane to function as a bus lay-by area to accommodate transit vehicles during the afternoon peak period, including relocating the west sidewalk and associated utilities as necessary to maintain connectivity. The total length of the SB auxiliary lane shall be a minimum of 40m in length for transit vehicle lay-by storage, in addition to the length required for the SB right turn lane based on the results of the traffic analysis as noted below. The 40m storage noted above should be provided on the northern portion of the above noted SB right turn auxiliary lane.

B. DB Co shall remove the southern portion of the Jeanne d'Arc Boulevard NB free flow off-ramp that currently leads the traffic to the existing free flow S-W loop ramp, and direct traffic through the existing signalized intersection. DB Co shall replace the above-noted free flow off-ramp with an urbanized ramp intersection that involves a tighter yet feasible curb turning radii and loop ramp geometry considering the governing geometric Design Criteria.

C. For additional improvements required to enhance pedestrian and cyclist connectivity on both intersections at Jeanne d'Arc Boulevard interchange location refer to Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

D. In order to address the above-noted improvements, DB Co shall also undertake a detailed traffic/ transit analysis and demonstrate the traffic impacts associated with the necessary improvements on the existing signalized intersections and interchange ramps are feasible and acceptable considering projected traffic volumes considering a 2031 traffic horizon, expected transit operations, and pedestrian and cyclist movements. DB Co shall submit to the City of Ottawa the results of the above-noted investigations by submitting a traffic analysis report and seek approval

from the City of Ottawa at least 20 days prior to initiating the development of preliminary design.

(e) Champlain St / OR174 Interchange

(i) DB Co shall design and construct all interchange ramp modifications necessary to accommodate the OR174 widening or realignment as required for the Work.

(f) Tenth Line / OR174 Interchange

(i) DB Co shall design and construct all interchange ramp modifications necessary to accommodate the OR174 widening or realignment as required for the Work.

(g) Trim Road / OR174 Intersection and Trim Park and Ride

(i) DB Co shall design and construct a realigned Trim Road that extends from the eastern leg of the roundabout at the existing Trim Road and Taylor Creek Drive/ Dairy Drive, runs along the south and east sides of the proposed Trim Park and Ride facility, intersects at-grade with the OR174 at a new location east of the existing Trim Road / OR174 intersection, and terminates at an intersection with Jeanne d'Arc Boulevard North, north of OR174. For added clarity, all references to Jeanne d'Arc Boulevard North, hereinafter, in this Article 6 and Part 2 Appendices shall include the Roadway sections of Jeanne d'Arc Boulevard North extended from the west of Trim Road towards Inlet Private. All Roadway Works shall be contained within the Lands as defined in Schedule 20 – Lands.

(ii) DB Co shall design and construct a new signalized intersection for the proposed realigned Trim Road / OR 174 at-grade crossing, which shall be located at a feasible location beyond the east terminus of the Tail Tracks and east of the Trim Park and Ride to replace the existing signalized intersection for Trim Road and OR174. The design and construction of the proposed signalized intersection shall meet the applicable reference documents and design requirements specified in this Part 2, applicable Design Criteria specified in Appendix A and shall accommodate the requirements of the proposed minimum lane configurations specified in Appendix B.

A. DB Co shall design and construct all the necessary Pavement widening and new improvements to accommodate the appropriate merging and diverging transitions for the westbound through lanes on either side of the realigned Trim Road/ OR174 signalized intersection per the requirements of the TAC GDGCR.

i. DB Co shall perform additional traffic analysis in order to determine the optimal length for the development and termination of the outer WB through lanes on either side of the realigned Trim Road/ OR174 signalized intersection in order to maximize the

operational performance of both the northbound triple left turn and westbound through movements.

B. DB Co shall provide pedestrian crosswalks and bi-directional cycling crossride facilities on both the east and south legs of the intersection of realigned Trim Road / OR174;

C. DB Co shall design and construct appropriate channelized concrete islands as per the City's standards to accommodate the right turning traffic and pedestrian and cyclists' movements, as a minimum, at the northeast and southeast quadrants of the intersection; and,

D. DB Co shall design and construct the necessary improvements of the proposed realigned Trim Road and OR174 intersection so that all the EB right-turning traffic will be prohibited at the signalized intersection and instead shall be accommodated through the proposed OR174 W-S ramp junction at the existing Trim Road located west of the proposed Park and Ride Facility.

i. DB Co shall accommodate the EB right turn movements via a new proposed W-S ramp from the OR174 to the existing Trim Road, intersecting with the west general traffic access to the Trim Park and Ride facility. The design of the proposed OR174 W-S ramp shall provide for a "free-flow" southbound movement into a dedicated southbound lane on the existing Trim Road.

(iii) DB Co shall design and construct the intersection of the realigned Trim Road and Jeanne d'Arc Boulevard North to accommodate the Design Criteria specified in Appendix A of this Part 2 and, as a minimum, the proposed minimum lane configurations specified in Appendix B of this Part 2.

(iv) DB Co shall decommission the existing free flow W-S ramp that is located in the SW quadrant of the existing OR174 / existing Trim Rd intersection and design and construct a new W-S free flow ramp as per the appropriate standards referenced in this Article 6 that shall be located south of the existing SWM pond in that same quadrant. DB Co shall also design and construct a controlled intersection at the location where the proposed OR174 W-S ramp intersects with the existing Trim Road and west general traffic access to the Trim Park and Ride to accommodate, as a minimum, the configuration illustrated in Appendix B of this Part 2.

(v) DB Co shall decommission the section of the existing Trim Road located between the existing access to 1125 Trim Road, through the existing Trim Road and OR174 intersection.

A. DB Co shall maintain and provide for a 2-way access to and from the existing City yard property located at 1125 Trim Road at all times both

during construction and ultimately post commissioning to the satisfaction of the City.

B. DB Co shall design and construct all necessary improvements on the adjacent local networks including but not limited to the upgrades required on the intersections of Jeanne d'Arc Boulevard with existing Trim Road and realigned Trim Road to accommodate the **[REDACTED]** facility's yard operation and traffic access to / from OR174.

(vi) DB Co shall undertake necessary traffic and transit analysis including but not limited to level of service, capacity and delay analysis using the projected vehicular traffic for 2031 horizon, and movements of pedestrians and cyclists for the existing roundabout at the intersection of Trim Road and Taylor Creek Drive/ Dairy Drive. DB Co shall submit to the City and seek City's approval at least 20 days prior to PFDD submission regarding the findings and recommendations of the above-noted traffic analysis including all improvements necessary to ensure the roundabout will operate in an acceptable level of service. Upon the City's approval of the proposed improvements, DB Co shall design and construct all necessary improvements and modifications on the existing roundabouts including but not limited to additional widening and reconstruction required on the roundabout and on the approach and exit lanes, and upstream and downstream tapers and transitions as required.

(vii) DB Co shall design and construct all necessary improvements on the existing and proposed roads and intersections to accommodate the termination of the Dairy Drive in the form of a cul-de-sac facility at an appropriate location in the close proximity of the existing Dairy Drive / South Frontage T-intersection within Lands as defined in Schedule 20 – Lands

(viii) The proposed intersections and road network design for the existing and realigned Trim Road and all other new or impacted intersections and accesses shall accommodate all traffic movements accessing OR174 and the local road network including, but not limited to, Trim Road, Jeanne d'Arc Boulevard North, Inlet Private, Trim Park and Ride, South Frontage, Dairy Drive, Taylor Creek Drive and associated property accesses that are affected as the result of Works. DB Co shall undertake necessary traffic analysis and confirm the geometry, lane configuration, and traffic control types for all new and impacted Roadways, accesses, intersections, and roundabouts within the local road network can feasibly accommodate the existing, staged construction and future traffic demand considering projected traffic and transit volumes for a 2031 horizon year, including pedestrian and cyclist movements.

A. The analysis shall include, but not be limited to, a network analysis and intersection operation analysis, including traffic operations for the existing Trim Road and OR174 intersection, new proposed signalized intersection for Trim Road and OR174, Trim Park and Ride and existing roundabouts, including area Roadways (including, but not limited to, Jeanne d'Arc

Boulevard North, Inlet Private, Trim Park and Ride, South Frontage, Dairy Drive and associated property accesses).

B. DB Co's traffic and transit analysis shall address all vehicular access, traffic and transit requirements associated with the existing and realigned Trim Road / OR174 intersection improvements as a whole. The analysis shall also consider existing and potential developments in the area, and connectivity for pedestrians and cyclists.

i. DB Co shall also consider any transit priority measures required along both the existing and realigned Trim Road and the associated intersections that are impacted as the result of the Works in order to optimize transit operations in/out of Trim station and in/out of Trim Park and Ride facility. DB Co shall seek the approval of the City and OC Transpo prior to proceeding with the implementation of any proposed transit signal priority measures.

C. The results of the intersection operations analysis shall include, but not be limited to intersection layout configuration, traffic control types, and auxiliary storage lane requirements as per the requirements of the City of Ottawa TIA guidelines.

D. DB Co shall summarize and submit the findings/ recommendations from the analysis in a detailed report to the City of Ottawa for approval in the early stages of the preliminary design, a minimum of 20 Business Days prior to initiating the detailed design.

(ix) The design and construction of the Trim Road and OR174 intersection modifications shall account for and include all modifications necessary to accommodate the requirements for the OR174 widening or realignment and Trim Park and Ride Facility improvements, as required to construct the Works.

(x) DB Co shall confirm through the traffic analysis noted above that the existing intersections at Trim Road and Jeanne d'Arc Boulevard North / Inlet Private and at Trim Road and Dairy Drive have sufficient traffic capacity for the projected traffic volumes. Based on the results of the traffic analysis, DB Co shall design and construct the required modifications, including intersection control type, to the intersections to provide for the additional capacity required..

(xi) DB Co shall design and construct all pedestrian and cycling facilities per the requirements of Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

(xii) Trim Park and Ride Facility:

A. DB Co shall design and construct the Trim Park and Ride Facility to include a bus station Facility with dedicated space for public parking. The

bus station Facility shall include a bus loop, bus bays, bus lay-bys, and bus station Platforms, ensuring all necessary bus movements are accommodated per OC Transpo's Transitway and Station Design Guidelines.

i. The proposed improvements, and the specific functional and performance requirements, such as number of parking spaces, bus Platforms, and bus lay-bys and bus bays required for the Trim Park and Ride Facility shall meet the requirements of Schedule 15-2, Part 4, Article 3 – Station Specific Architectural Design Criteria and Schedule 15-2, Part 4, Appendix A.

B. DB Co shall design and construct all the proposed improvements at the Trim Park and Ride as per the standards and requirements specified in Clause 6.9 of this Part 2, unless specified otherwise in Clause 6.19 of this Part 2.

C. DB Co's design and construction of the Roadway improvements for Trim Park and Ride shall meet the requirements of Clause 6.18 of this Part 2.

D. Refer to Schedule 15-2, Part 6, Article 2 – Design Criteria for the connectivity, landscape, and streetscape requirements for the Trim Park and Ride Facility.

E. DB Co shall design and construct all temporary bus detours, temporary transit operations, traffic staging and access management strategies to ensure access and current functionality of the existing Park and Ride Facility is maintained during staged construction and temporary conditions. Refer to Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access, for the specific improvements noted above.

F. DB Co shall design and construct all internal access road layouts to accommodate all mixed traffic access from the existing and realigned Trim Road. The layout of the Park and Ride Facility shall accommodate the turning movements of the appropriate design vehicle according to Clauses 6.8 and 6.9 of this Part 2.

G. DB Co shall design and construct an access/egress to the mid-block of the proposed realigned Trim Road on the east side of the Trim Park and Ride facility in the form of a signalized T-intersection. The lane configuration for the T-intersection with the realigned Trim Road shall meet the requirements of Appendix A and Appendix B of this Part 2.

i. In addition to the lane diagrams shown in Appendix B of this Part 2, DB Co's design and construction of this intersection shall

prohibit the NB left turn movements from the realigned Trim Road in the Trim Park and Ride through this T-intersection

H. DB Co shall design and construct the Trim Park and Ride Facility to include an exclusive bi-directional bus-only connection including designated single bus lanes, one in each NB and SB directions to accommodate OC Transpo's transit vehicle access/egress to the proposed Trim Park and Ride bus loop facility. The above-noted exclusive bus-only connection shall be located within the existing Trim Road corridor south of OR174 and connect the proposed controlled intersection of OR174 W-S ramp and west general access to the west side of the Trim Park and Ride bus loop in such a way that transit delays resulting from operating in mixed traffic (including pedestrian and cyclist traffic) are minimized. DB Co shall also design and construct a secondary bus access / egress to the bus loop internally through Trim Park and Ride. The secondary bus access / egress to the bus loop shall connect to the proposed signalized T-intersection at realigned Trim Rd located east side of the Trim Park and Ride and include appropriate lane configurations and traffic control improvements to accommodate the necessary Transit operations, at a minimum.

I. DB Co shall evaluate the existing conditions and provide any widening or Pavement improvements requirement of the existing roads to accommodate safe bi-directional operation of transit vehicles. DB Co shall design and construct the widening within the existing ROW and within the Lands identified in Schedule 20 - Lands.

J. DB Co shall design and construct all intersections to accommodate transit bus access and operations between the local road networks and the proposed bus station at Trim Park and Ride facility.

i. With the exception of the proposed Trim Road / OR174 intersection and the proposed T-intersection to the mid-block of the proposed realigned Trim Road on the east side of the Trim Park and Ride facility for which DB Co shall design and construct signalized intersections, for all other accesses from / to the Trim Park and Ride new intersections, and intersections that are impacted as the result of Works, DB Co shall determine the appropriate traffic control type and necessary intersection improvements required at all existing and proposed intersections and, where warranted, install new transit priority measures to provide precedence to transit operations.

ii. DB Co shall develop and confirm type of transit priority measures for each intersection, and shall seek approval from the City and OC Transpo prior to proceeding with the implementation of the proposed transit priority measures.

K. DB Co shall design and construct the Trim Park and Ride Facility so the development meets the intersection capacity requirements based on the City of Ottawa's TIA guidelines.

L. DB Co's design and construction of the Trim Park and Ride Facility shall not reuse the existing Pavement structure either partially or totally in the new improvements unless DB Co can satisfy the following conditions:

i. DB Co shall undertake a traffic assessment, detailed field survey, geotechnical investigation to evaluate the existing ground conditions, Pavement structure, and associated drainage conditions of the existing parking site.

ii. DB Co shall identify any risks associated with the substandard drainage and underlying ground conditions, evaluate the existing Pavement failure patterns and report on the adequacy of the existing subgrade and Pavement structure, and calculate the remaining service life of the existing Pavement structure using appropriate lab and field tests and design methods. DB Co shall develop site specific improvements and Pavement rehabilitation strategies in the proposed design and construction of Trim Park and Ride Facility to demonstrate that an acceptable design service life of the Pavement can be achieved that can meet or exceed the requirements of Clauses 6.10, 6.12, and 6.13 of this Part 2, and Clause 4.3 - Table 1-4.1 of Schedule 15-2, Part 1 – General Requirements.

iii. DB Co shall submit the findings, results, and recommendations of the above-noted investigations in the form of a comprehensive report and receive approval from the City of Ottawa prior to advancing the design that would make use of the existing Pavement in the proposed design and construction of the Trim Park and Ride Facility.

M. DB Co shall design and construct the SWM requirements associated with the improvements to the Trim Park and Ride per Article 5 – Drainage and Stormwater Management Design Criteria, and Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

(h) Richmond Road Complete Streets Improvements

(i) The Works cover a section of Richmond Road, approximately 1,925m long, between a point 225m west of the existing McEwen Avenue / Richmond Road intersection and a point 140m east of the existing Cleary Avenue / Richmond Road intersection. The construction shall include the full reconstruction of all existing intersections impacted by the Richmond Road Complete Streets improvements.

A. DB Co shall coordinate and make necessary arrangements with the City to ensure a feasible transition at the extents of the Works, integrating the proposed Richmond Road Complete Streets improvements with the existing lane configurations.

(ii) DB Co shall design and construct the proposed improvements on Richmond Road according to the Design Criteria and minimum auxiliary storage length requirements included in Appendix A of this Part 2.

(iii) DB Co shall limit the impacts to existing properties as a result of the design and construction of the vertical alignment in accordance with Clause 6.4 of this Part 2 and grading requirements in accordance with Clause 6.12 of this Part 2.

(iv) DB Co shall ensure all grading along Richmond Road will contain all overland stormwater flows originating from within the City's ROW, maintaining positive drainage towards the appropriate municipal stormwater infrastructure, avoiding overflow onto adjacent private properties.

(v) DB Co shall design and construct municipal infrastructure and utility relocations and conflicts in accordance with the requirements of Article 5 – Drainage and Stormwater Management Design Criteria, and Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

(vi) DB Co shall design and construct the intersections along Richmond Road impacted by the Works to meet the corresponding minimum lane configuration diagrams shown in Appendix B of this Part 2. DB Co shall design and construct the Richmond Road corridor and all intersections, including the improvements required on all impacted cross-roads, to meet the requirements of Complete Street standards. DB Co's design shall accommodate the following specific intersection improvements:

A. DB Co shall realign McEwen Avenue with Richmond Road to eliminate the skew angle at the existing intersection location, as per the TAC GDGCR.

B. DB Co's design shall accommodate feasible traffic operations, including fully protected left-turn signal phases, in both the EB and WB directions at the intersection of Richmond Road / Woodroffe Avenue. DB Co shall design and construct all the necessary Roadway and intersection improvements to avoid conflicting with opposing traffic movements and the bi-directional cycling facility specified on the southern (NB) approach to the intersection.

C. DB Co shall design and construct Ancaster Avenue between Richmond Road and Byron Avenue to prohibit the northbound left turn movement from Ancaster Avenue onto Richmond Road, including traffic signs.

D. As per Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements, Redwood Avenue shall be closed at Richmond Road. In addition, DB Co shall realign Redwood Avenue to form a T-intersection with Byron Avenue at a right angle, eliminating the existing direct vehicular access between Richmond Road and Byron Avenue using Redwood Avenue. DB Co shall realign the new intersection at Redwood Avenue in-line with the proposed bi-directional cycling crossing on the northern (SB) approach to Cleary Avenue as per Clause 6.19(h)(vii)(C) of this Part 2.

E. DB Co shall formally close vehicular access from Edgeworth Avenue to Richmond Road. DB Co shall design and construct a 3.0m paved bi-directional bike lane and sidewalk connecting Edgeworth Avenue with Richmond Road.

F. For additional related road closures as a result of the Byron Linear Park improvements, DB Co shall refer to Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(vii) Cycling facilities on Richmond Road shall be in the form of unidirectional raised cycle tracks on the north and south side of Richmond Road, unless otherwise specified in the segments along Richmond Road noted below:

A. DB Co shall design and construct bi-directional raised cycle tracks on the south side in the section of Richmond Road between NCC's Pinecrest Creek Pathway connection to Richmond Road immediately west of **[REDACTED]** to the existing western dead-end limit of Byron Avenue, west of where Byron Avenue turns to Richardson Avenue.

B. DB Co shall design and construct bi-directional raised cycle tracks on the south side in the section of Richmond Road between the SW and SE quadrants at the intersection of Richmond Road and Woodroffe Avenue.

C. DB Co shall design and construct a bi-directional cycling pathway between the proposed cross-ride on Richmond Road, east of Cleary Avenue and the realigned Redwood Avenue intersection at Byron Avenue as per Clause 6.19(h)(vi)(D) of this Part 2, forming a north-south cycling facility connection between Richmond Road and Byron Avenue / Redwood Avenue.

(viii) Refer to Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements, for additional design and construction requirements, including but not limited to, access modifications, landscaping, road furniture, and streetscapes elements along the Richmond Road and Byron Avenue.

(ix) DB Co shall design and construct the signalized intersections along Richmond Road to include the improvements illustrated in Appendix D of this Part 2, but not

limited to, intersection widenings and realignments, travel lanes and auxiliary lanes, Pavement markings, intersection crossing treatments, and provisions for all pedestrian and cycling facilities and connections. The signalized intersections along Richmond Road include McEwen Avenue, New Orchard Avenue, Woodroffe Avenue, and Cleary Avenue.

A. DB Co shall design and construct the above-noted intersection improvements to include the typical characteristics and elements for Protected Intersections as per Clause 6.6 (e) and Appendix D of this Part 2.

B. DB Co shall design and construct raised intersections at the intersections of New Orchard Avenue and Cleary Avenue on Richmond Road per the requirements of Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(x) DB Co shall design and construct signalized mid-block pedestrian crossing facilities in the form of City's typical "Type B – PXO" as per the City of Ottawa's Document 1 - Examples for PXO Types and Document 2 - City of Ottawa PXO Program at the following locations on Richmond Road:

A. Approximate mid-lock location between Hartleigh Avenue and Richardson Avenue;

B. Immediately across from the Allison Avenue / Byron Avenue intersection;

C. Approximately 20m east of the existing Lockhart Avenue / Richmond Road intersection; and,

D. Approximately 166m east of the existing Lockhart Avenue / Richmond Road intersection.

(xi) DB Co shall design and construct raised pedestrian and cycling crossings scross all private approaches and crossroads listed below:

A. Ancaster Avenue, and,

B. Lockhart Avenue.

(xii) DB Co shall design and construct the necessary temporary improvements on Richmond Road as required to support unobstructed pedestrian access and uninterrupted traffic and transit operations during staged construction and temporary conditions. For the details of such temporary improvements, refer to Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access.

(xiii) In extremely constrained conditions, such as the EB right turning movement at the intersection of Richmond Road and Woodroffe Avenue, where accommodations for the controlling design vehicle turning movements may not be feasible within

available ROW and/or without compromising planning, and design requirements specified in this Part 2 and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements, DB Co shall identify and closely coordinate with the City to develop a feasible alternative design solution.

A. The development of the design solution shall include the evaluation of other feasible design solutions to consider the advantages and disadvantages of each alternative.

B. DB Co shall demonstrate to the City, early in the preliminary design stage, how the necessary turning movements can be accommodated by compromising some design elements without compromising public safety or putting vulnerable users at risk. DB Co's proposed design solution shall be subject to the requirements of Schedule 15-2, Part 2, Article 6.18 – Road Safety Audits and Road Safety Design Reviews.

C. For any alternative design solutions, DB Co shall receive approval from the City 60 calendar days prior to issuing their Pre-Final Design Development submission per the requirements of Schedule 10 – Review Procedure for any such design compromises required in order to accommodate the controlling design vehicle turning movement.

(xiv) DB Co's design and construction of Richmond Road shall reference Schedule 15-2, Part 4, Appendix E for permanent bus stop locations and meet the requirements of Article 6.9 of this Part 2.

(i) Carling Avenue

(i) DB Co shall design and construct the necessary temporary improvements on Carling Avenue as required in the section between the west of Edgeworth Avenue and the east of Connaught Avenue to support the pedestrians' accesses and uninterrupted traffic and transit operations during staged construction and temporary conditions. For the details of such temporary improvements refer to Schedule 15-2, Part 7- Traffic and Transit Management and Construction Access.

(ii) DB Co shall design and construct the necessary permanent improvements on Carling Avenue cross-section and on all accesses, ramps and intersections between the west of Edgeworth Avenue and the east of Connaught Avenue that are impacted as the result of Works as follows:

A. DB Co's design shall accommodate and improve all accesses from / to the adjacent properties including **[REDACTED]** that are impacted as the result of Works on Carling Avenue.

B. DB Co shall upgrade the Carling cross-section as per the requirements of the corresponding Design Criteria and lane configuration diagrams specified in Appendices A and B of this Part 2, respectively. The

improved Carling Avenue cross-section shall accommodate new raised cycle tracks for both the EB and WB directions of traffic. DB Co shall segregate the proposed raised cycle tracks from both the adjacent sidewalks and the adjacent curb lane by at least minimum 0.3m hard surface buffer. For additional requirements related to pedestrian connectivity treatments and LRT and bus station facilities used by pedestrians refer to Schedule 15-2, Part 4 – Stations, and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

C. DB Co's design shall improve the proposed Lincoln Fields bus station and PPUDO access from / to Carling Avenue so that the existing signalized intersection layout and geometry will be improved as required in order to feasibly accommodate necessary bus and general traffic operations as well as non-vehicular movement and access including appropriate travel lanes, auxiliary lanes, sidewalk, median improvements, crosswalks and cross-rides and necessary transitions to tie-in to the existing conditions. For the proposed Lincoln Fields Bus station and PPUDO functional requirements refer to Schedule 15-2, Part 4 – Stations.

D. DB Co shall design and construct a new signalized mid-block pedestrian crossing facility with associated cross-rides, crosswalk and a mid-block refuge treatment to allow for a 2-stage pedestrian crossing operation. DB Co shall locate the proposed pedestrian crossing facility at an approximate mid-block location between Lincoln Fields bus station access and the existing SJAM Parkway ramps, across the existing pathway (**[REDACTED]**) connection to the Carling Avenue southern sidewalk. The proposed pedestrian crossing signal shall accommodate the necessary signal heads and push buttons at all necessary locations and shall meet the requirements of the OTM (OTM Book 15, OTM Book 18, and OTM Book 12) guidelines.

E. In all cases noted above, the intersections geometry layout shall accommodate the appropriate design vehicle and the intersection Pavement marking design shall provide for cross-ride facilities as per the requirements of the OTM Book 18 guidelines.

(j) Iris Street

(i) DB Co shall design and construct the necessary temporary improvements on Iris Street and its impacted intersections, and bus transit facilities between north of Carling through to Baseline that are impacted as the result of Works as required to support the pedestrians' accesses and uninterrupted traffic and transit operations during staged construction and temporary conditions. For the details of such temporary improvements refer to Schedule 15-2, Part 7- Traffic and Transit Management and Construction Access.

(ii) DB Co shall design and construct the necessary permanent improvements on Iris Street geometry and layout and on all Iris Street intersections and private property driveways that are impacted as the result of Works.

A. DB Co shall design and construct a road / rail grade separated facility including approach embankments under Iris Street at the mid-block location between Iris Street intersections with Adirondack Drive and Parkway Drive, where the proposed Iris Street crosses over the proposed LRT corridor. For the details of the proposed bridge structure requirements refer to Article 4 – Structural Design Criteria and Requirements of this Part 2.

B. DB Co's design shall accommodate the necessary permanent road cross-section improvements proposed for the Iris Street as per the requirements of the corresponding Design Criteria and lane configuration diagrams specified in Appendices A and B of this Part 2, respectively.

i. DB Co's design shall accommodate a new mid-block controlled pedestrian crossing on Iris Street in order to connect the proposed MUPs on the south side and north side of Iris Street. The design of the proposed pedestrian crossing facility shall meet the requirements of the OTM (OTM Book 15, and OTM Book 12) guidelines. DB Co shall select the optimum location of the proposed pedestrian crossing facility on Iris Street to enhance vehicular and non-vehicular traffic safety, operations and connectivity at this location considering the Iris Street vertical profile geometry, the PPUDO locations, the MUP realignments and grades, the bus stop locations, and the necessary stopping sight distance requirements as per the Iris Street corresponding Design Criteria. In particular, the location of the proposed pedestrian crossing facility shall maintain the grades of the proposed MUPs not to exceed 5%. For additional requirements for the proposed MUPs, PPUDOs and pedestrian connectivity refer to Schedule 15-2, Part 4 – Stations, and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

C. DB Co shall design the Iris Street/LRT grade separated facility so that the Iris Street grade raise profile would be constructed on an embankment and the Track profile would be partially constructed in a cut section. The recommended profile for Iris Street grades shall be limited to a range between 3.5% and 5%. Only under constrained conditions and in short length sections less than 15m, maximum grades greater than 5% up to an absolute maximum of 6% may be acceptable. In all cases, DB Co's proposed profile design shall meet all the requirements of vertical curve geometry as per this Appendix A and applicable vertical curve and profile geometries and sight distance requirements as per this Article 6 as well as

the vertical clearance required underneath the bridge deck as per Article 4- Structural Design Criteria and Requirements of this Part 2.

D. DB Co shall design and construct the necessary grading, SWM and drainage facilities, and vertical support systems for the proposed Iris Street in order to minimize the area impacts associated with the road embankment footprint and consistent with the requirements of the proposed Pinecrest Creek realignment including its associated grading and the proposed Pinecrest bridge Culvert. For additional requirements for the proposed Pinecrest Creek realignment and its associated grading refer to Article 5 – Stormwater Management and Drainage of this Part 2. For additional requirements for the proposed Pinecrest Creek bridge Culvert structure under Iris Street refer to Article 4 – Structural Design Criteria and Requirements of this Part 2. For the specific landscaping requirements of Pinecrest Creek realignment refer to Schedule 15-2, Part 6, Article 4 – Site Specific Desired Outcomes.

(k) Scott Street

(i) In addition to all the necessary temporary improvements including traffic staging detours intersections, and bus transit facilities required on Scott Street as specified in Schedule 15-2, Part 7- Traffic and Transit Management and Construction Access, DB Co shall also design and construct the following final improvements and reinstatements as a part of the Scott Street reinstatement Works at the western leg of the Churchill Ave. / Scott Street, in order to meet the requirements of the existing **[REDACTED]** business property located at **[REDACTED]**:

A. DB Co shall design and construct all the reinstatements and improvements as required for the section of Scott Street west of Churchill Avenue as described below:

i. DB Co shall design and construct Scott Street west of Churchill Avenue to a minimum 6.0m wide urban cross section approaching the existing cul-de-sac. The cross section shall include a new 1.8m wide sidewalk along the south side and maintain all existing connections to existing pathways and sidewalks. This section of Scott Street shall be signed as a fire route.

ii. DB Co shall reinstate and improve the existing or reconstruct a new paved cul-du-sac that meet the requirements of the above-noted restaurant facility's general traffic and emergency and maintenance vehicular access using the appropriate design vehicles as specified in Appendix A of this Part 2.

iii. DB Co shall design and construct five perpendicular parking spaces on the north side of Scott Street and two perpendicular parking spaces on the south side of Scott Street, between Churchill

Avenue and the Scott Street cul-de-sac, per the requirements of the City of Ottawa's Parking By-Law No. 2003-530. DB Co's design shall include paved parking spaces.

iv. DB Co shall design and construct all necessary improvements required at Scott Street / Churchill Avenue intersection associated with the above noted reinstatement and new construction.

(ii) In addition to all the necessary temporary improvements including traffic and transit staging detours, and bus transit facilities required on Goldenrod Driveway and Scott Street / Goldenrod Driveway intersection as specified in Schedule 15-2, Part 7- Traffic and Transit Management and Construction Access, DB Co shall also design and construct the following final improvements and reinstatements as a part of the Scott Street and Goldenrod Driveway improvement Works:

A. DB Co shall design and construct all necessary improvements required on an approximately +/-140m section of Goldenrod Driveway between north of Goldenrod Driveway / Yarrow Driveway intersection and south of Scott Street / Smirle Avenue intersection.

i. DB Co's design of horizontal alignment and vertical profile geometry of the proposed Goldenrod Driveway shall accommodate the location and vertical clearance requirements of the new Goldenrod Bridge as per Schedule 15-2, Part 2, Article 4 – Structural Design Criteria and Requirements.

ii. DB Co's design shall include and accommodate all necessary vehicular and pedestrians and cyclist accesses and sidewalk and pathway connections along and across Goldenrod Driveway and from / to the proposed bus terminal at Tunneys Pasture Station in accordance with Schedule 15-2, Part 4 – Stations.

B. DB Co shall design and construct Scott Street between Ross Avenue and Caroline Avenue to meet the requirements of Appendices A and B of this Part 2. DB Co shall design and construct the widening on Scott Street to the north, which shall include all necessary intersection improvements, sidewalk, cycling facilities and pathway connections, to accommodate the movement of all road users, including vehicular traffic, pedestrians and cyclists, within the Scott Street corridor.

C. DB Co shall design and construct a new signalized intersection at the location of the Scott Street / Goldenrod Driveway intersection to accommodate all the necessary vehicular, pedestrian, and cyclists movements. DB Co shall design and construct Scott Street / Goldenrod Driveway/ Smirle Avenue to meet the requirements of a typical Protected Intersection as per Clause 6.6(e) of this Part 2.

i. DB Co shall design and construct a 1.8m raised EB cycle track on the approach and departure from the above-mentioned intersection. On the approaches to the above-mentioned intersection in the WB direction, DB Co shall construct a 1.8m wide WB bike lane. For additional connectivity requirements, refer to Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access.

(iii) In extremely constrained conditions where accommodations for the controlling design vehicle turning movements may not be feasible within available ROW and/or without compromising planning, and design requirements specified in this Part 2 and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements, DB Co shall identify and closely coordinate with the City to develop a feasible alternative design solution.

A. The development of the design solution shall include the evaluation of other feasible design solutions to consider the advantages and disadvantages of each alternative.

B. DB Co shall demonstrate to the City, early in the preliminary design stage, how the necessary turning movements can be accommodated by compromising some design elements without compromising public safety or putting vulnerable users at risk. DB Co's proposed design solution shall be subject to the requirements of Schedule 15-2, Part 2, Article 6.18 – Road Safety Audits and Road Safety Design Reviews.

C. For any alternative design solutions, DB Co shall receive approval from the City 60 calendar days prior to issuing their Pre-Final Design Development submission per the requirements of Schedule 10 – Review Procedure for any such design compromises required in order to accommodate the controlling design vehicle turning movement.

(l) Woodroffe Avenue

(i) DB Co shall design and construct all temporary improvements and modifications to Woodroffe Avenue from Baseline Road to north of Iris Street, including all affected driveway accesses and intersections in order to support the construction of Works. Refer to Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access, for the description of necessary site-specific improvements on affected Roadways, ramps, and intersections in order to accommodate the appropriate traffic and transit operations under staged conditions.

(ii) DB Co shall design and construct all permanent improvements and modifications to Woodroffe Avenue from Baseline Road to north of Iris Street, including all affected driveway accesses, intersections, boulevards, sidewalks and cycle tracks, in order to support the construction of Works as follows:

A. DB Co shall maintain the existing lane configuration, including number of through lanes and auxiliary lanes, at all the affected intersections along Woodroffe Avenue from Baseline Road to north of Iris Street. DB Co shall maintain the existing storage lengths along Woodroffe Avenue and intersecting roadways.

B. Where opportunities exist, DB Co shall maximize the width of ultimate urban cross sectional elements on Woodroffe Avenue and provide for the following width requirements:

i. The minimum width of the inside lane shall be 3.25m and the minimum width of outside lane shall be 3.5m.

ii. The minimum width of auxiliary left turning lanes shall be 3.4m.

iii. The desirable minimum width of the boulevard shall be 1.5m between the cycle track and travelled lanes.

1 Where physical constraints exist at the intersection of Iris Street and Woodroffe Avenue, the minimum width of the boulevard shall be 0.5m.

iv. The desirable minimum width of the raised cycle track shall be 1.8m.

1 Where physical constraints exist at the intersection of Iris Street and Woodroffe Avenue, the minimum width of the cycle track shall be 1.5m.

v. The desirable minimum width of the adjacent sidewalk shall be 2.0m, delineated from the adjacent cycle track by a minimum 0.3m wide hard surfaced buffer.

1 Where physical constraints exist at the intersection of Iris Street and Woodroffe Avenue, the minimum width of the sidewalk shall be 1.5m. Under constrained conditions, the width of the buffer may be incorporated into the width of the sidewalk.

C. DB Co shall design and construct a new pedestrian crosswalk and crossride facility at the location of the existing midblock crossing between Baseline Road and Adirondack Drive as per OTM Book 15 and Book 18.

i. The new midblock crossing facility shall be signalized and include 2 separate sets of pedestrian crosswalk and crossride facilities that are offset from each other on opposite sides (north and south) of

the driveway at the fire station, located at 1300 Woodroffe Avenue.

ii. The above-noted midblock crossing facility shall be designed and constructed to operate under one coordinated crossing signal operation as per the requirements of Article 6.14 – Traffic and Transit Signals to the satisfaction of the City.

D. The pedestrian and cycling facilities constructed on Woodroffe Avenue as part of the staged construction improvements specified in Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access shall remain following the construction of Works.

E. DB Co shall design and construct appropriate transition to tie the new improvements into existing conditions between Baseline Road to north of Iris Street.

F. DB Co shall ensure all required turning movements are accommodated as per the requirements of Article 6.8 – Design Vehicles to the satisfaction of the City.

(m) Corkstown Road

(i) DB Co shall design and construct all the necessary temporary improvements on Corkstown Road, associated accesses and intersections, and adjacent Transitway and bus station facilities as required to accommodate pedestrian accesses and uninterrupted traffic and transit operations during staged construction and temporary conditions. For the details of such temporary improvements, refer to Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access.

(ii) DB Co shall undertake a TIA study, including a detailed intersection operations and level of service analysis considering vehicular and non-vehicular road users needs on all new and existing intersections on Corkstown Road that are impacted as the result of Works. DB Co shall demonstrate that the traffic and transit operations and associated levels of service are acceptable and feasible using projected traffic volumes and expected transit operations for 2031 horizon year, including pedestrian and cyclist movements.

A. The results of the intersection operations analysis shall include, but not be limited to intersection layout configuration, traffic control types, and auxiliary storage lane requirements as per the requirements of the City of Ottawa TIA guidelines.

B. DB Co shall submit to the City the results of above-noted traffic analysis report and seek approval from the City at least 20 calendar days prior to initiating the development of the geometric design.

(iii) DB Co shall design and construct all the permanent improvements for the Corkstown Road corridor, including existing and new intersections and accesses, the adjacent Transitway, bus station facilities and associated bus accesses that are impacted or required as a result of the Works, according to the requirements of this Article 6 and Appendix A and Appendix B of this Part 2.

A. DB Co shall be responsible for the design and construction of all such improvements if DB Co's traffic and transit assessment, modelling and analysis determine that additional traffic lanes and improvements are required at any of the new or existing intersection(s) on Corkstown Road corridor in addition to the information shown in Appendix B of this Part 2.

(iv) DB Co shall design all Transitway bus access requirements from / to Moodie Station to meet the requirements of the City and seek approval from the City as a part of the above-noted traffic analysis report.

(v) DB Co shall design and construct two PPUDOs on Corkstown Road, one on either side of Moodie Station, per the requirements of Schedule 15-2, Part 4 – Stations.

A. If the walking distance between the proposed location of the PPUDO west of Moodie Station and the entrance to Moodie Station is greater than 200m, DB Co shall design and construct an eastbound and westbound bus stop in accordance with the requirements of Schedule 15-2, Part 4, Appendix E, a controlled intersection and PXO across Corkstown Road.

i. As a minimum, DB Co shall design and construct a PXO – Type C across Corkstown Road as per OTM Book 15 and the City of Ottawa, Pedestrian Crossover Program and Examples Documents 1 and 2, and Appendix K of this Part 2, to accommodate safe and direct pedestrian access from / to the proposed Transitway bus access at Moodie Station and the surrounding community. DB Co shall complete a traffic study to finalize the traffic control type and lane configuration and review with the City with respect to the type of controlled crossing device to be implemented (pedestrian signal, full traffic signal, or PXO Type B, or C). DB Co shall implement the type of controlled crossing device selected by the City.

B. For improvements required on the existing PXO across Corkstown Road east of Moodie Station, DB Co shall refer to Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements. In the design and construction of the above-noted controlled crossings.

C. DB Co shall ensure the crossing facilities meet the appropriate sight distance requirements as per the TAC GDGCR and the safety audit requirements as Clause 6.18 of this Part 2.

D. DB Co shall coordinate with the City to determine the appropriate traffic control type traffic control devices location and bus stop locations at least 20 calendar days prior to the submission of the PFDD and design and construct the controlled intersection to meet the OC Transpo's service and operational requirements accordingly.

(vi) For additional requirements related to pedestrian connectivity treatments and Station facilities used by pedestrians from to Moodie Station and from / to the PPUDO, refer to Schedule 15-2, Part 4 – Stations, Appendix A of Schedule 15-2, Part 4, and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

(vii) DB Co shall design and construct Corkstown Road to permit one-way general traffic in the westbound direction, with general traffic in the eastbound direction limited to between Moodie Drive and the west PPUDO.

A. DB Co's design shall accommodate full inbound and outbound bus access at the east bus turnaround for Moodie Station to/ from existing Corkstown Road. At the west end of Moodie Station, bus access shall be provided from the intersection of Moodie Drive and Corkstown Road.

(n) Moodie Extension Improvements

(i) All temporary and permanent improvements associated with the Confederation Line between Bayshore Station and the Moodie LMSF, including Holly Acres Road, Moodie Drive, interchange ramps and intersections, which interfaces between Highway 417 and municipal roadways, shall satisfy the requirements of Schedule 15-2, Part 9, Part B.

6.20 Provincial Roads Improvements

(a) Highway 417

(i) DB Co shall refer to Schedule 15-2, Part 9 – Highway Works for all the design and construction requirements interfacing with MTO's Hwy 417.

6.21 Federal Roads Improvements

(a) SJAM Parkway – north of **[REDACTED]** to Dominion

(i) DB Co shall design and reconstruct approximately +/- 1,650m of the SJAM Parkway corridor from a section north of **[REDACTED]**, across SJAM Parkway to a section east of the proposed Dominion Station.

(ii) DB Co shall design and construct the temporary improvements on the SJAM Parkway eastbound and westbound travel lanes in the form of traffic detours and lane realignments in order to accommodate the construction of the proposed SJAM Parkway improvements specified in Clause 6.21(a) of this Part 2. For the

details of such temporary improvements refer to Schedule 15-2, Part 7 - Traffic and Transit Management and Construction Access.

(iii) DB Co's design and construction of the Roadway improvements for the proposed SJAM Parkway in this section shall meet the requirements of Clause 6.18 of this Part 2.

(iv) DB Co shall reference the design information noted in this Clause 6.21(a) and develop a consistent and compliant Roadway corridor design meeting the following specific requirements:

A. DB Co shall design and construct the proposed SJAM Parkway within the limits of construction with the objective of enforcing a lower operating speed such that the intended design speed and posted speed limit of the SJAM Parkway shall meet the requirements of Appendix A of this Part 2.

i. DB Co shall demonstrate, in the design submittals as per Schedule 10 – Review Procedure, how their proposed detailed design meets the requirements of Clause 6.21(a) of this Part 2 and all other improvements required for SJAM Parkway corridor under this PA within Lands. DB Co shall undertake additional design coordination and provide early documentation as specified in the Basis of Design reports submittals requirements for Federal Roadways as per Schedule 10 – Review Procedure to ensure a compliant design can be achieved that meets the City's requirements at an early stage of the preliminary design.

B. DB Co shall design the horizontal alignment, vertical profile, and cross section of the proposed SJAM Parkway corridor according to the Design Criteria specified in Appendix A and Appendix C of this Part 2.

i. Appendix C of this Part 2 includes the horizontal and vertical geometry and curve data for the proposed control line of the proposed SJAM Parkway.

ii. Appendix A and Appendix C of this Part 2 includes the basic elements of the SJAM Parkway's typical cross-section.

iii. DB Co shall design and construct appropriate cross falls and superelevations for the proposed SJAM Parkway as per the TAC GDGCR with consideration for the requirements of the applicable clauses of Article 5 - Drainage and Stormwater Management Design Criteria of this Part 2.

iv. DB Co shall determine the appropriate superelevation parameters for the proposed SJAM Parkway and demonstrate in the PFDD submission that DB Co's design satisfies the requirements of

Clause 3.2.4 - Development of Superelevation in the TAC GDGCR

v. DB Co shall design and construct the SJAM Parkway so that the depth of earth cover under the SJAM Parkway compared to the top of Tunnel concrete slab shall be greater than 2.5m at any location where Roadway crosses over the LRT Tunnel, in order to accommodate the design and construction of the Roadway and stormwater management requirements of this Part 2

vi. DB Co shall design and construct the appropriate grading to allow (minimum) 6:1 side slopes at all locations where it is physically possible to do so and design and construct all surface drainage elements such as curb and gutters, outlets, bio swales, catch basins, maintenance holes, sewer pipes, ditches, and Culverts for the proposed SJAM Parkway improvements and MUP Overpass facility and consistent with the requirements of Article 5 – Drainage and Stormwater Management Design Criteria, of this Part 2. For additional grading requirements, DB Co shall meet Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

C. For all road hazards that may be located in the vicinity of the proposed SJAM Parkway corridor within the limits of construction, DB Co shall undertake a roadside design analysis according to the design criteria specified in Chapter 7 – Roadside Design of the TAC GDGCR and develop appropriate improvement measures that meet the requirements of this Article 6 and also seek the City's approval prior to submitting the PFDD submittal.

(v) DB Co shall design and construct a pedestrian Overpass bridge including approach embankments under the proposed SJAM Parkway corridor that can accommodate direct pedestrian access via a MUP connection between the proposed MUP network located south of the SJAM Parkway and the NCC's proposed linear park MUP(s) network located north of the proposed SJAM Parkway corridor. For the site-specific requirements for the proposed MUP connection, refer to Article 4 – Structural Design Criteria and Requirements, of this Part 2 and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements.

A. Appendix C of this Part 2 provides the approximate location of the proposed Cleary pedestrian Overpass.

(vi) DB Co shall accommodate all the requirements of Clause 6.14 of this Part 2 for the design and construction of the following two at-grade signalized pedestrian crossing facilities located:

A. The Rochester Field pathway crossing that is located between the NCC's Rochester Field MUP network, south of the proposed SJAM Parkway corridor and the NCC's proposed linear park MUP(s) network located north of SJAM Parkway corridor as shown in Appendix C of this Part 2; and,

B. The Dominion pathway crossing that is located between the proposed Dominion Station MUP network, south of the proposed SJAM Parkway corridor and the NCC's proposed linear park MUP(s) network located north of proposed SJAM Parkway corridor as shown in Appendix C of this Part 2.

(vii) The City will supply and install all temporary and permanent aboveground traffic signal infrastructure at both of the Rochester Field and Dominion at-grade pedestrian crossing facilities as required by the NCC, per the requirements of Clause 6.14 of this Part 2.

A. The City shall supply all traffic signal posts, arms and accessories/hardware painted glossy black.

B. The City shall supply traffic signal heads and back boards with yellow fronts and black backs.

(viii) The at-grade pedestrian crossings shall not be located where the Roadway crossfall or superelevation exceeds +2% or -2%. For additional information regarding the location and site-specific requirements of the above-noted at-grade pedestrian crossing facilities refer to Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements and all associated NCC's proposed landscape plans that are included in the pertinent Part 6 appendices.

A. All Pavement markings, Roadway signs and traffic signals shall accommodate separate pedestrian crosswalk and cycling Crossrides, pedestrian and cyclists signal head push buttons, and loop detectors, including full actuation and accessible pedestrian signal design that is fully compliant with AODA requirements and as per the requirements of the City of Ottawa's Standard Tender Documents and MTO's OTM books.

B. DB Co shall provide automatic detection facilities, as required, for all the proposed signalized intersections in the SJAM Parkway corridor within the limits of Works. The acceptable detection facility types and specifications shall meet the requirements of the appropriate inductive loop detectors, or radar detectors facilities approved by the City.

(ix) In addition to the specific lighting requirements specified for the SJAM Parkway pedestrian crossing intersections in Clause 6.21 of this Part 2, DB Co shall also undertake a corridor-long lighting design study on SJAM Parkway corridor in the section between the west of the Rochester Field pedestrian crossing facility

through to the east of Kitchissippi lookout intersection in order to determine the adequacy of the lighting transitions between each two lit intersections and to ensure intermediate unlit gap sections on SJAM Parkway will not cause any safety concern, will not impact driver's work load or visibility due to variable or inconsistent lighting conditions. This study shall include specific countermeasures, warrant analysis, and recommendations for new construction, where applicable, and shall meet the requirements of the City of Ottawa's Right of Way Lighting Policy guideline. DB Co shall complete this study and receive the City of Ottawa's approval prior to the initiation of the design stage.

(x) DB Co shall design and construct both the Rochester Field and Dominion pedestrian crossing facilities to be lit using LED-type luminaire NXT 48M 2ES 7 (Type 2 Distribution, 48W LED, 700mA Consumption, 4000k Colour Temperature) elements and consistent with the requirements of the NCC design drawings, standards and specifications per Appendix F of this Part 2. DB Co shall design and construct the infrastructure to accommodate the proposed illumination light levels specified below:

A. The proposed illumination light level on the SJAM Parkway in approach to pedestrian crossing facilities in the section between Cleary and Dominion section shall conform to 9 lux, 3:1 average/min uniformity.

i. For added clarity, other than transition sections in approach to pedestrian crossings on SJAM Parkway noted above, the remaining mid-block sections of SJAM Parkway in the sections between pedestrian crossings shall not be illuminated.

B. DB Co shall provide a proposed illumination light level of 15 lux, 3:1 average/min uniformity, at the Rochester Field pedestrian crossing facility.

C. DB Co shall provide a proposed illumination light level of 15 lux, 3:1 average/min uniformity, on the SJAM Parkway at Dominion pedestrian Crossing facility.

D. All street light posts located at the signalized intersections shall follow Street Lighting Standard Detail Drawings from the City of Ottawa's Standard Tender Documents for Material Specifications and Standard Detail Drawings complete with a glossy black powder coat finish.

E. Street light posts located at the approaches to intersections shall have a concrete aggregate base and follow approved NCC drawings found in Appendix F of this Part 2.

(xi) DB Co shall submit a design report including the detailed Design Criteria and seek approval from the City a minimum of 20 Business Days prior to initiating the design.

(xii) DB Co shall install modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail as per details provided in Appendix F of this Part 2.

A. DB Co shall install the above noted guiderails and all transitions, terminal elements and end treatments on curbs for the lengths of need in both approach and leaving sections.

B. DB Co shall design and construct all terminal elements and end treatments to fall outside of the SJAM Parkway clear zones and be no closer than 3m to the edge of adjacent travel lane, whichever is greater. Paved shoulders shall separate end treatments installed on concrete curbs from the travel lanes.

(xiii) DB Co shall install vehicle/cyclist steel railing to be attached on top of the modified Wyoming guiderail at the SJAM Parkway WB and EB pedestrian underpass structures as per detail provided in Appendix F of this Part 2.

(xiv) DB Co shall reference Appendix G of this Part 2 for the site specific utility servicing requirements of the Rochester Field Pathway.

(xv) DB Co shall reference Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements, including associated appendices, for the urban design and landscape requirements of the Rochester Field Pathway.

(b) SJAM Parkway at Churchill Avenue MUP Overpass

(i) DB Co shall design and reconstruct approximately +/- 450m of the SJAM Parkway corridor at an approximate location where the Churchill Avenue ROW extends further north and intersects with SJAM Parkway corridor.

(ii) DB Co shall design and construct the temporary improvements on SJAM Parkway EB and WB travel lanes in the form of traffic detours and lane realignments in order to accommodate the construction of the proposed Churchill Avenue MUP Overpass and associated MUP realignments. For the details of such temporary improvements refer to Schedule 15-2, Part 7- Traffic and Transit Management and Construction Access.

(iii) DB Co's design and construction of the Roadway improvements for the proposed SJAM Parkway in this section shall meet the requirements of Clause 6.18 of this Part 2.

(iv) DB Co shall reference the design information noted in this Clause 6.21(b) and develop a consistent and compliant Roadway corridor design, meeting the following specific requirements:

A. DB Co shall design and construct the proposed SJAM Parkway within the limits of construction with the objective of enforcing a lower operating

speed such that the intended design speed and posted speed limit of the SJAM Parkway shall meet the requirements of Appendix A of this Part 2.

i. DB Co shall demonstrate, in the design submittals as per Schedule 10 – Review Procedure, how their proposed detailed design meets the requirements of Clause 6.21(b) of this Part 2 and all other improvements required for SJAM Parkway corridor within Lands. DB Co shall undertake additional design coordination and provide early documentation, as specified in the Basis of Design reports submittals requirements for Federal Roadways as per Schedule 10 – Review Procedure, to ensure a compliant design can be achieved that meets the City's requirements at an early stage of the preliminary design.

B. DB Co shall design the horizontal alignment, vertical profile, and cross section of the proposed SJAM Parkway corridor according to the Design Criteria specified in Appendix A and Appendix C of this Part 2.

i. Appendix C of this Part 2 includes the horizontal and vertical geometry and curve data for the proposed control line of the proposed SJAM Parkway.

ii. Appendix A of this Part 2 specifies the basic elements of the SJAM Parkway's typical cross-section.

1 DB Co shall design and construct the basic cross-section elements of SJAM Parkway at Churchill Avenue MUP Overpass consistent with those of the section of SJAM Parkway – north of **[REDACTED]** to Dominion as specified in Appendix C of this Part 2.

iii. DB Co shall design and construct appropriate cross falls and superelevations for the proposed SJAM Parkway as per the TAC GDGCR with consideration for the requirements of the applicable clauses of Article 5 - Drainage and Stormwater Management Design Criteria of this Part 2.

iv. DB Co shall determine the appropriate superelevation parameters for the proposed SJAM Parkway and demonstrate in the Pre-Final Design Development submission that DB Co's design satisfies the requirements of Clause 3.2.4 - Development of Superelevation in the TAC GDGCR.

(v) For all road hazards that may be located in the vicinity of the proposed SJAM Parkway corridor within the limits of construction, DB Co shall undertake a roadside design analysis according to the design criteria specified in Chapter 7 – Roadside Design of the TAC GDGCR and develop appropriate improvement

measures that meet the requirements of this Article 6 and also seek the City's approval prior to submitting the Pre-Final Design Development submittal.

(vi) For the construction of the proposed Churchill Avenue MUP Overpass, DB Co shall design and construct the vertical profile geometry of the SJAM Parkway to include a grade raise to accommodate the clearance requirements of Article 4 – Structural Design Criteria and Requirements, of this Part 2. DB Co's design shall not change the existing horizontal alignment for the SJAM Parkway at this location.

A. The proposed SJAM Parkway shall meet the requirements of the SJAM Parkway Design Criteria in Appendix A of this Part 2.

B. DB Co's design and construction of the roadway improvements for SJAM Parkway shall meet the requirements of Clause 6.18 of this Part 2.

C. DB Co shall design and construct a pedestrian Overpass including approach embankments under SJAM Parkway at an approximate location where the Churchill Avenue right of way extends further north and intersects with SJAM Parkway corridor. The proposed MUP Overpass location shall not impact the existing underground utilities including but not limited to the existing 600mm sanitary sewer and 1500mm storm sewer pipes that are currently located along the northerly extension of the Churchill Avenue right of way corridor across SJAM Parkway. For the details of the proposed Overpass Structure requirements refer to Article 4 – Structural Design Criteria and Requirements, of this Part 2.

D. DB Co shall design and construct the proposed Roadway improvements according to the requirements of Appendix A of this Part 2. DB Co shall design and construct the horizontal and vertical geometry of SJAM Parkway as per Appendix C of this Part 2.

i. For additional pedestrian connectivity requirements for the proposed MUP Overpass and for the realignment of the adjacent MUP network that are impacted as the result of Works refer to Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

ii. DB Co shall design and construct the appropriate grading to allow (minimum) 6:1 side slopes at all locations where it is physically possible to do so and design and construct all surface drainage elements such as catch basins, maintenance holes, sewer pipes, ditches, and Culverts for the proposed SJAM Parkway improvements and MUP Overpass facility and consistent with the requirements of Article 5 – Drainage and Stormwater Management Design Criteria, of this Part 2. For additional grading requirements

DB Co shall meet Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements

(vii) DB Co shall install modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail as per details provided in Appendix F of this Part 2.

A. DB Co shall install the above noted guiderails and all transitions, terminal elements and end treatments on curbs for the lengths of need in both approach and leaving sections.

B. DB Co shall design and construct the all terminal elements and end treatments to fall outside of the SJAM Parkway clear zones and be no closer than 3m to the edge of adjacent travel lane, whichever is greater. Paved shoulders shall separate end treatments installed on concrete curbs from the travel.

(viii) DB Co shall install vehicle/cyclist steel railing to be attached on top of the modified Wyoming guiderail at the SJAM Parkway WB and EB pedestrian Overpass Structures as per detail provided in Appendix F of this Part 2.

(ix) DB Co shall design and construct the MUP pathway underneath the SJAM Parkway to have a minimum elevation of 56.0m. DB Co shall reference Article 4 – Structural Design Criteria and Requirements, of this Part 2, for the Structure, including the minimum clearance requirements.

(c) SJAM Parkway at Kitchissippi Lookout Intersection

(i) DB Co shall design and construct a new signalized intersection to provide access to the future parking areas that will be located north and south of the SJAM Parkway. Refer to Clause 6.21 of this Part 2, for the Kitchissippi Lookout signalized intersection. For the proposed MUP and pathway connections, refer to Schedule 15-2, Part 6 - Urban Design, Landscape Architecture and Connectivity Requirements.

A. DB Co shall design and construct the final lane configuration, including auxiliary lanes, Pavement markings and location of the proposed signalized intersection and receive approval from the City of Ottawa. Layout drawing F-1 in Appendix F of this Part 2, is for demonstration purposes only and is non-reliant. DB Co shall undertake a TIA study and determine the auxiliary lanes storage requirements at this signalized intersection. DB Co shall determine the appropriate location and layout of the proposed intersection and SJAM Parkway realignment considering the recommendations of the above-noted TIA study, so that efficient and safe accesses can be provided from / to the proposed parking sites with appropriate sight lines, and the proposed utility improvements can be feasibly designed and constructed as per the requirements of Article 8 – Utility Infrastructure Design Criteria, of this Part 2. The design shall not

involve any additional bridge widening work, with the exception of the 3.0m MUP requirement for the WB SJAM Parkway pedestrian underpass structure in Clause (iv) below. Refer to Article 4 – Structural Design Criteria and Requirements, of this Part 2 for the modifications to the SJAM Parkway WB pedestrian underpass structure.

B. DB Co shall demonstrate, in the design submittals as per Schedule 10 – Review Procedure, how their proposed detailed design meets the requirements of Clause 6.21(c) of this Part 2 and all other improvements required for SJAM Parkway corridor within Lands. DB Co shall undertake additional design coordination and provide early documentation as specified in the Basis of Design reports submittals requirements for Federal Roadways as per Schedule 10 – Review Procedure, to ensure a compliant design can be achieved that meets the City's requirements at an early stage of the preliminary design.

(ii) DB Co's design of SJAM Parkway shall meet the requirements of a 4-lane urban arterial divided cross-section (4L-UAD) as per TAC GDGCR. SJAM Parkway Design Criteria and geometry shall correspond to the following:

A. For the proposed Design Criteria specific to SJAM Parkway at Kitchissippi Lookout Intersection refer to Appendix A of this Part 2.

B. For the proposed intersection lane configuration of the SJAM Parkway at Kitchissippi Lookout Intersection refer to Appendix B of this Part 2.

i. DB Co shall design and construct the eastern leg of the Kitchissippi Lookout intersection, including the curb return radii, to provide for a future roadway access. In the interim, DB Co shall install temporary precast concrete barriers, per OPSD 911.140, to prohibit vehicular access to this leg of the intersection to the satisfaction of the City.

ii. DB Co shall design and construct the western leg of the Kitchissippi Lookout Intersection to provide a realigned connection/ access road to the existing western parking lot as shown in Appendix F of this Part 2.

iii. In the design and construction of temporary and ultimate improvements intended on Kitchissippi Intersection and SJAM Parkway, DB Co shall maintain and provide for access to the abandoned site located east of the SJAM parkway at its current location.

iv. DB Co shall design and construct one marked pedestrian cross-walk, including sidewalk and TWSIs, per City of Ottawa Standard Tender Documents for Material Specifications and Standard Detail

Drawings, located at the southern limit of the Kitchissippi Lookout intersection as per drawing F-1 in Appendix F of this Part 2

(iii) DB Co shall design the new SJAM Parkway horizontal and vertical alignment as per the proposed Design Criteria. DB Co shall design and construct the vertical profile of the SJAM Parkway in this section so that the new grades and Pavement elevations will remain as close as practically possible to the existing Pavement elevations and shall ensure positive Drainage is maintained within the limits of construction of Works. The proposed alignment of the EB SJAM Parkway lanes shall remain as close as practically possible to their current location while the proposed WB lanes will shift east, closer to the EB lanes, while maintaining a minimum 1.5m wide median separation at the proposed Kitchissippi Lookout signalized intersection.

(iv) DB Co's design shall accommodate all the improvements required to ensure a safe and efficient traffic operations considering the intended reduction in the posted speed limit (from the existing speed limits of 60 km/hr to the proposed speed limit of 50 km/hr) in the sections of SJAM Parkway that are affected as the result of Works. DB Co shall ensure that appropriate speed transition zones are established as required and all pertinent improvements are included in the design of the realignment with appropriate traffic signage and pavement marking as per the requirements of MTO's OTM Books.

(v) DB Co shall design and construct all modifications to the existing SJAM Parkway WB pedestrian underpass structure as required in order to accommodate a 3.0m MUP with 0.5m boulevard between the MUP and outside WB lane. Refer to Article 4 – Structural Design Criteria and Requirements, of this Part 2.

(vi) DB Co shall install modified Type Wyoming 830WYBRAIL 2-Tube Curb Mounted (PL-2) guiderail as per details provided in Appendix F of this Part 2.

A. DB Co shall install the above noted guiderails and all transitions, terminal elements and end treatments on curbs for the lengths of need in both approach and leaving sections.

B. DB Co shall design and construct the all terminal elements and end treatments to fall outside of the SJAM Parkway clear zones and be no closer than 3m to the edge of adjacent travel lane, whichever is greater. Paved shoulders shall separate end treatments installed on concrete curbs from the travel lanes.

(vii) DB Co shall install vehicle/cyclist steel railing to be attached on top of the modified Wyoming guiderail at the SJAM Parkway WB and EB pedestrian underpass structures as per detail provided in Appendix F of this Part 2.

(viii) DB Co shall design and construct the surface Drainage system in the form of storm sewer network including storm sewer pipes, catch basins, maintenance

holes and all other SWM elements in order to maintain positive Drainage for the Kitchissippi Lookout signalized intersection and the realignment of SJAM Parkway, as per Article 5 – Drainage and Stormwater Management Design Criteria .and Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

A. DB Co shall undertake a detailed site survey and confirm the location and conditions of all existing SWM elements within the limits of construction. DB Co shall clean and undertake CCTV inspections on existing storm sewer pipes, outlets and structures prior to altering the existing Drainage system, per City of Ottawa inspection standards. DB Co shall prepare a detailed existing conditions report, provide recommendations for the substandard conditions observed in the assessment and receive the City's approval 30 Business Days prior to advancing the design stage.

(ix) Grading requirements shall conform to the SJAM Parkway Design Criteria as outlined in Appendix A of this Part 2 and relevant City Standards and Specifications as per Clause 6.12 of this Part 2.

(x) DB Co shall undertake a TIA study and determine the level of service at the proposed signalized intersection considering projected traffic volumes, and pedestrian and cyclist movements. DB Co shall prepare and submit a traffic report to and receive the City's approval 20 Business Days prior to initiating the design. DB Co's design and construction shall provide for all intersection improvements including but not limited to left turn lane queue storage and taper length requirements to accommodate projected traffic volumes for year 2031.

(xi) DB Co shall accommodate all the requirements of Clause 6.14 of this Part 2 for the design and construction of the Kitchissippi Lookout Intersection.

A. For added Clarity, the City shall supply and install all above ground traffic signal equipment including controller, poles, pedestrian and traffic heads, video detectors, push buttons, and audible displays for the Kitchissippi Lookout Intersection to meet the following specifications:

i. The City shall supply all traffic signal posts, arms and accessories/hardware painted glossy black.

ii. The City shall supply traffic signal heads and back boards with yellow fronts and black backs.

(xii) DB Co shall provide automatic detection facilities, as required, for all the proposed signalized intersections in the SJAM Parkway corridor within the limits of Works. The acceptable detection facility types and specifications shall meet the requirements of the appropriate inductive loop detectors, or radar detectors facilities approved by the City.

(xiii) DB Co shall design and construct all above and underground utilities and municipal services (water, sanitary and electrical), including underground ducts, maintenance holes, street lighting, and joint use poles as required and shall coordinate utility layout designs for hydro, gas and communications with all relevant utility companies as per the requirements of Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

A. DB Co shall reference Appendix G of this Part 2, for the site specific utility servicing requirements for the NCC's Kitchissippi Lookout intersection.

B. DB Co shall provide all necessary underground traffic plant to accommodate for possible future crossing movements by the City and shall meet the requirements of Clause 6.14 of this Part 2.

(xiv) Pavement markings for the SJAM Parkway and Kitchissippi Lookout Intersection shall conform to Clause 6.15 of this Part 2 and the proposed Signage for the SJAM Parkway realignment and Kitchissippi Lookout Intersection shall conform to City standards and specifications.

(xv) DB Co shall design and construct SJAM Parkway at Kitchissippi Lookout Intersection to be lit using LED-type luminaire NXT 48M 2ES 7 (Type 2 Distribution, 48W LED, 700mA Consumption, 4000k Colour Temperature) elements and consistent with the requirements of the NCC design drawings, standards and specifications per Appendix F of this Part 2. In particular, DB Co shall design and construct the infrastructure to accommodate the proposed illumination light levels specified below:

A. The proposed illumination light level on the SJAM Parkway in approach to the Kitchissippi Lookout Intersection shall conform to 9 lux; 3:1 average/min uniformity.

i. For added clarity, other than transition sections in approach to pedestrian crossings on SJAM Parkway noted above, the remaining mid-block sections of SJAM Parkway in the sections between pedestrian crossings shall not be illuminated.

B. The proposed illumination light level at the SJAM Parkway Kitchissippi Lookout Intersection shall conform to 15 lux; 3:1 average/min uniformity.

C. All street light posts at the signalized intersection shall follow Street Lighting Standard Detail Drawings from the City of Ottawa's Standard Tender Documents for Material Specifications and Standard Detail Drawings complete with a glossy black powder coat finish.

D. Street light posts located at the approaches to the intersection shall have a concrete aggregate base and follow approved NCC drawings found in Appendix F of this Part 2.

(xvi) DB Co shall design and construct detailed traffic staging drawings and traffic control plans as per the requirements of OTM (OTM Book 7) and ensure travel lanes are maintained during staged construction at all time. For the minimum number of travel lane required during construction refer to Schedule 15-2, to Part 7 – Traffic and Transit Management and Construction Access.

(xvii) DB Co shall undertake geotechnical investigations for the SJAM Parkway and Kitchissippi Lookout Intersection site in order to verify existing site conditions, soil contamination, ground water levels and provide asphalt Pavement designs. The geotechnical investigation and asphalt Pavement designs shall meet the requirements of Article 7 – Geotechnical Design Criteria and Requirements, of this Part 2. The proposed Pavement design shall meet the requirements of Clause 6.10 of this Part 2.

(xviii) DB Co shall follow landscape drawings and Schedule 15-2, Part 6 – Urban Design, Landscape Architecture and Connectivity Requirements, for landscape, road furniture and streetscape elements, and pathway connections required along the SJAM Parkway corridor and Kitchissippi Lookout Intersection.

(xix) DB Co's design and construction of the roadway improvements for SJAM Parkway shall meet the requirements of Clause 6.18 of this Part 2.

ARTICLE 7 GEOTECHNICAL DESIGN CRITERIA AND REQUIREMENTS

7.1 Reference Documents

(a) Design and construction of all geotechnical and foundation Work shall comply with the criteria contained in this Article, and the Applicable Law, guidelines or practices applicable to the Project, including but not limited to the following Reference Documents. In the event of a conflict between the criteria, commitments or requirements contained within one document when compared with another, the more stringent shall apply:

(i) Criteria contained in this Article;

(ii) Article 9 – Protection of Existing Adjacent Structures, of this Part 2;

(iii) Article 4 – Structural Design Criteria and Requirements, of this Part 2;

(iv) Schedule 15-2, Part 8 –Underground Structures;

(v) Schedule 17 – Environmental Obligations;

(vi) Municipal Standards according to Master Agreement including Schedule B, Appendix 2, Standard and Guidelines

(vii) OBC;

(viii) NBCC;

(ix) CHBDC;

(x) MTO, OPSS/OPSD;

(xi) CSA;

(xii) ASTM;

(xiii) CFEM;

(xiv) MOECC Regulations;

(xv) PEO, Guideline for Professional Engineers Providing Geotechnical Engineering Services

(xvi) AREMA

(xvii) OHSA and Applicable Law.

(b) DB Co shall comply with the Applicable Law, design manuals or practices applicable to the Project, issued by all relevant third parties including MTO and the City. DB Co shall submit design and construction plan for all geotechnical and foundation works including excavation, backfilling, underpinning, modifications, monitoring and mitigation plans for review and acceptance by all relevant third parties including City, MTO, Utility Companies, other third party owners. DB Co shall comply with the following documents and requirements:

(i) Schedule 10 – Review Procedure.

(ii) To prevent impact to third parties' structures in the alignment, all construction activities such as groundwater control, excavation, underpinning, modification, and support of excavation systems shall meet third party stakeholders' requirements. In particular, for construction within or in the vicinity of the NCC land, specific design approaches shall be considered to avoid adverse impacts of construction dewatering operations on NCC land and other existing Structures.

7.2 General Requirements

(a) Geotechnical and foundations design shall be performed in accordance with design concepts used in the reference documents listed in Clause 7.1 of this Part 2 such as the principles of LSD based on Load-and-Resistance Factor Design and WSD based on ARMEA. The factors of safety and allowable stress for the Track supports shall be based on the functional requirements of the Structure.

(b) DB Co shall perform a geotechnical subsurface soil and groundwater conditions assessment using available data for the entire Guideway and shall provide a detailed and complete set of geo-engineering design reports including geo-engineering Design Criteria with a tabulated list of geotechnical and hydrogeological design parameters. The basis for selection of the Design Criteria shall be provided for all components of any Underground Structures, all components of any retaining and support of excavation structures, and at grade and elevated Structures. In addition, DB Co shall prepare stratigraphic profiles along the Guideway with proper cross-sections particularly for the underground sections along the alignment that shall be constructed by DB Co. The stratigraphic profiles shall include anticipated distribution of the various ground types and hydrogeological regimes and conditions, and Reports shall be submitted in accordance with Schedule 10 – Review Procedure.

(c) DB Co shall consider the following in the design of all Structures during the Service Life specified in Table 1-4.1 in Schedule 15-2, Part 1 – General Requirements.

(i) Groundwater recharge or rebound that may occur after temporary groundwater control, unwatering, dewatering, and depressurization.

(ii) Groundwater condition changes including those caused by extreme weather events.

(d) DB Co shall review all existing geo-environmental data and information and develop an Excess Materials Management Plan. Further details on environmental compliance and management requirements are provided in Schedule 17 – Environmental Obligations.

(e) DB Co shall retain the services of qualified consultants who hold a Professional Engineers of Ontario Certificate of Authorization and practice as a geotechnical consultant. Geotechnical laboratories shall be certified by CCIL and shall have participated and met the MTO correlation program for soil testing. Environmental laboratories shall be accredited by the CALA for analytical tests.

(f) DB Co shall retain the services of qualified consultants who hold an Association of Professional Geoscientists of Ontario Certificate of Authorization and practice as a hydrogeological consultant.

(g) DB Co shall submit details of any proprietary geo-engineering systems, for review by the City in accordance with Schedule 10 – Review Procedure.

(h) The frost penetration depth for Ottawa is 1.8 m. DB Co shall consider this and ensure sufficient frost protection is provided for all Structures.

(i) DB Co shall demonstrate project experience designing and constructing Structures founded on the sensitive marine clays in the Ottawa area, locally known as Leda Clays, and shall retain personnel who have verifiable local design and construction experience with Leda Clay.

7.3 Foundations

(a) Foundations for Structures shall be designed such that their displacements (Serviceability Limit States, as defined in the Relevant Codes and standards) are compatible with the structural design, function and performance requirements, and clearance envelope requirements over their Design Life. When a WSD is used, the allowable stress shall be checked under the various loading combinations defined in the relevant Codes and Standards.

(b) DB Co shall assess and mitigate short-term and long-term adverse impacts to all Foundations for Structures including Tracks due to the swelling and degradation of shale rock that may occur during the Service Life specified in Table 1-4.1 in Schedule 15-2, Part 1 – General Requirements.

7.4 Permanent Cut and Fill Slopes

(a) Permanent cut and fill slopes and geo-structures shall be designed according to applicable Standards and with adequate safety margin (such as factor of safety), as described in the relevant Codes and Standards.

(b) Total and differential post-construction settlements along the Track bed or Pavement including those that may result from frost heave shall meet the requirements of Article 3

– Trackwork, and Article 6 – Roadways, Bus Terminals and Lay-Bys, of this Part 2. DB Co shall ensure that the smoothness and cross-slope requirements are met, ponding and sheeting of water is prevented, Pavement drainage is maintained, and the function of constructions and ditches is preserved.

(c) No vertical offset at longitudinal joints in Pavement surfaces shall be permitted after construction.

(d) No vertical offset at longitudinal or transverse joints along Station Platforms, interior walkways or at building connections shall be permitted after construction.

7.5 Permanent Retaining Structures and Cut-and-Cover Structures

(a) The following requirements apply to new Cut-and-Cover structures, new retaining systems, and existing retaining walls and Cut-and-Cover structures:

(i) Permanent water-tight underground structures on the alignment shall be designed to resist groundwater pressures and shall account for the Project flood level requirements provided in Article 5 – Drainage and Stormwater Management Design Criteria, of this Part 2.

(ii) The lateral earth pressure coefficient corresponding to the characteristic at-rest (Ko) conditions and appropriate to the adjacent native ground or backfill soils shall be applied to determine the magnitude of the characteristic earth pressure distribution. The Ko conditions shall be determined and then reduced according to the proposed structure's characteristics (stiffness, deformability, etc.). DB Co shall estimate, or measure Ko by conducting testing using the appropriate standard methods in the field and in the laboratory.

(iii) Consideration of friction piles, micropiles and anchored systems for resisting uplift forces shall be incorporated into the Cut-and-Cover foundations design, provided redundancy is built in the design. For micropiles, the required redundancy shall be achieved by using adequate resistance factor provided that a testing program as indicated in OPSS 903 is followed. For frictional piles, adequate resistance factors with or without a load test shall be used in accordance with relevant design Codes and Standards. For anchored systems, the requirements as indicated in OPSS 942 shall be followed. The design reduction factor to be applied to the uplift resistance capacity of the friction piles and micropiles shall be based on the type of Structure, loading, allowable displacements, and soil and groundwater conditions.

(iv) DB Co shall not utilize side friction between the soil and Underground Structure walls to resist uplift, unless DB Co can demonstrate that side friction can be relied upon and will not induce detrimental effects to the Underground Structure. DB Co shall not utilize side friction between the soil and structure walls that have an exterior waterproofing system, to resist uplift.

(v) All temporary excavation support systems for permanent Cut-and-Cover structures shall be performed in accordance with Clause 7.7 of this Part 2.

(vi) The upper 1.8m, as measured from lowest adjacent grade, shall be discounted in any axial and lateral load analyses to account for possible future excavations around the pile group.

(b) If DB Co engage in blasting as part of the Works within the Lands, DB Co shall provide the following:

(i) A BAR: This risk assessment report shall include but not be limited to the following details:

A. Work plan showing details of the proposed blasting operations;

B. Types of explosive and detonation to be adopted;

C. Protection against damage to the adjacent Structures in accordance with Article 9 – Protection of Existing Adjacent Structures, of this Part 2, underground and above-ground Utilities, and protection of the public safety including a blast damage mitigation plan and procedures including the proposed methods of remedial measures for damages caused by blasting;

D. Determination of the ZOI due to blasting, and assessment of the blasting effects to all Structures and Utilities within the ZOI;

E. Document all measures proposed to minimize blast waves regardless of when blasting will take place

F. Details of vibration monitoring;

G. Emergency responses to blasting damage; and,

H. Qualifications and experience of the individuals and specialists who are responsible for the blasting design and operations.

(ii) A production rate comparison showing the benefits for blasting over conventional rock excavation methods in terms of cost and schedule.

(c) DB Co shall ensure that all blasting activities will conform to the City Special Provisions F-1201 and OPSS 120 entitled Use of Explosives, as amended. Prior to any blasting activities, a pre-blast survey shall be prepared as per City Special Provisions F-1201 for all existing and proposed Structures and underground structures including, but not limited to, buildings, Utilities, water wells, and facilities likely to be affected by the blast, in particular, those within 75m of the location where explosives are to be used. The standard inspection procedure shall include the provision of an explanatory letter to the owner or occupant and owner with a formal request for permission to carry out an inspection. DB

Co shall submit blasting limits to the City for review and approval. The City may require changes to ensure the integrity of adjacent Structures. DB Co shall submit the pre-blast survey and full blasting strategy to the City for review and approval at least ninety days prior to any blasting.

(d) DB Co shall account for additional loads such as increase in lateral earth pressure due to fractured rock or weakened rock or soil zones resulting from blasting operations for the Works or for local developments outside the Works.

7.6 Services

(a) All services, including installation and reconstruction of water and sewer lines, engineering fill application, pipe bedding, cover and trench backfill material, shall conform to the City requirements, including but not limited to requirements of Article 8 – Utility Infrastructure Design Criteria, of this Part 2.

7.7 Temporary Slopes and Retaining Structures

(a) The performance of each temporary works shall be sufficient for its service life. All temporary Work shall comply with the OHSA, relevant design Codes and Standards and the Project requirements applicable at the time of excavation and the additional criteria:

(i) Temporary retaining structures shall meet the requirements of limiting Ground Movements, such as surface settlement, as stipulated under this Article.

(ii) Protection of Existing Adjacent Structures in accordance with Article 9 – Protection of Existing Adjacent Structures, of this Part 2.

(iii) Design, installation, and testing of tie backs shall follow OPSS 942;

(iv) DB Co shall comply with third party requirements for tie-back de-stressing as stated in this Article. Removal of temporary support system shall follow OPSS 539.

(v) All elements of temporary retaining structures within the upper 2m of the ground surface shall be removed and properly disposed of upon completion of backfilling.

7.8 Earthwork and GeoEnvironmental

(a) Backfilling and reuse of excavated material on City property and ROW shall follow City Standards, Schedule 17 – Environmental Obligations and Third Party standards.

(b) Buoyancy corresponding to inundation of the fill to the flood level shall be considered in the design of using lightweight fills. Permanent flood protection shall be provided for the area in which the fill is to be used. Fuel spills, salt, wheel loading, penetration from landscaping, and penetration from sign foundations shall also be considered.

(c) Geo-Environmental requirements are specified in Schedule 17, Part 4 – Contamination and Excavated Material Management.

(d) DB Co shall assess and mitigate adverse impacts to Structures including drainage components arising from the deformation of ground caused by swelling and degradation of the shale rock leading to drainage-related maintenance issues.

7.9 Geotechnical Instrumentation

(a) DB Co shall determine and install geotechnical instrumentation in the key and critical areas described as follows where special attention or continued monitoring is required. As a minimum, DB Co shall determine instrumentation requirements, frequency and duration of monitoring for construction-induced noise and vibration, displacement and strains for fill embankments, groundwater elevation and pressure, Ground Movements adjacent to deep excavations, temporary retaining structures (including piles, struts and tiebacks), Tunnel and Tunnel portals, permanent retaining structures, Utilities Infrastructure, hydro towers, existing rail tracks, highways, Roadways and pathways, existing buildings, Bridges or other Structures along the alignment that shall remain in service.

(b) Design of the geotechnical instrumentation and monitoring program shall be under the direct supervision of a Professional Engineer licensed in Ontario.

(c) Staff for the design and implementation of the geotechnical instrumentation and monitoring program shall include personnel who have verifiable design and construction experience with similar programs.

(d) In accordance with all applicable laws, regulations, and by-laws (as amended), DB Co shall decommission and dispose of all geotechnical, hydrogeological, and/or geo-environmental instrumentation installed by DB Co or the City for the purposes of this Project, at the end of construction or after the instrumentation is no longer required for Project activities. DB Co shall decommission and dispose of any existing geotechnical, hydrogeological, and/or geo-environmental instrumentation, that is documented in the Background Information or that may not be documented and otherwise encountered by DB Co during construction, used for monitoring/not used for monitoring, on, in, or under the Lands. DB Co shall obtain acceptance from the City prior to decommissioning and disposal of any existing geotechnical, hydrogeological, and/or geo-environmental instrumentation, that is documented in the Background Information or that may not be documented and otherwise encountered by DB Co during construction, used for monitoring/not used for monitoring, on, in, or under the temporary Lands as defined in Schedule 20 - Lands. DB Co shall provide decommissioning records to the City.

(e) GIMP: DB Co shall prepare a comprehensive GIMP and submit to the City for review in accordance with Schedule 10 - Review Procedure. The GIMP shall be applicable for the duration of construction, testing, and Commissioning. As a minimum, the GIMP shall include the following:

(i) A DMP which shall be a GIS-based system using a secure internet connection capable of receiving and visualizing near real time monitoring data. The DMP shall be used to create and send alarm reports/notifications and create monitoring reports including batch reports if Response Levels defined by DB Co and indicated in Article 9 – Protection of Existing Adjacent Structures, of this Part 2 are exceeded. DB Co shall provide access credentials to the City for simultaneous users for the DMP. DB Co shall set up the DMP such that the City is immediately notified of exceedances.

(ii) Appropriate geotechnical instrumentation for Stations, Structures and Tracks. The instruments shall be capable of collecting and transmitting continuous real time monitoring data to be incorporated and visualized in the DMP. Collecting and transmitting real time monitoring data shall not be required when monitoring Structures that will not experience adverse impacts due to dewatering induced settlement as a result of construction excavation, such as Structures founded directly on intact bedrock or deep foundations extended to bedrock.

(iii) All instruments including existing instruments turned over to DB Co by the City and instruments to be installed by DB Co.

(iv) Typical installation details and location of additional instruments.

(v) Schedule for installation, taking baseline readings, frequency and duration of monitoring for each phase of construction.

(vi) Construction-induced noise and vibration control and monitoring plan.

(vii) The plan and schedule for decommissioning and disposing of all additional instruments installed by DB Co as well as all existing instruments turned over to DB Co. DB Co shall notify the City of the intention to decommission instruments.

(viii) All Response Levels (refer to Article 9 – Protection of Existing Adjacent Structures, of this Part 2), as specified and defined by DB Co.

(ix) A Response Action Plan, which shall consist of methods and means to respond to various Review and Alert Level scenarios as outlined in Article 9 – Protection of Existing Adjacent Structures, of this Part 2 based on types of geotechnical instruments that indicate Review and Alert Levels. DB Co shall inform the City of subsequent response actions in accordance with the Response Action Plan. At a minimum, a Response Action Plan shall include the following:

A. Names, telephone numbers, and locations of persons responsible for implementation of contingency plans.

B. Materials and equipment required to implement contingency plans.

C. Location on Site of all required materials and equipment to implement contingency plans.

D. Step-by-step procedure for performing works involved in implementation of the contingency plans.

E. Specific actions related to the Alert Level values for all instruments, including means of reducing or eliminating movements and rates of movements.

F. Inspection of affected facilities, structures and utilities and performance of acceptable corrective and restorative measures.

G. Clear identification of objectives of contingency plans and methods to measure plan success.

(x) All measures and specific instrumentation and monitoring requirements to protect Existing Adjacent Structures in accordance with Article 9 – Protection of Existing Adjacent Structures, of this Part 2.

(xi) All measures and specific instrumentation and monitoring requirements for protecting heritage buildings identified in the Project Assessment Study Environmental Project Report and relevant updated revisions which are within the Project ZOI as defined in Article 9 – Protection of Existing Adjacent Structures, of this Part 2.

(xii) For all Underground Structures, DB Co shall provide, install, maintain, and monitor for the duration of construction, testing, and Commissioning a system of instruments that will indicate the pressures and deformations imparted to the permanent Structures. The instrumentation shall include:

A. Two arrays of pressure cells with one array on each long side of the Station. Each array shall consist of three cells installed at three different elevations (top, middle and bottom levels along the vertical side walls and away from end walls). Pressure cells shall be installed behind the water proofing system on the overburden side, including soil and rock, prior to start of concrete pouring for the walls.

B. An instrument on both sides of the longest side of the Station to measure the deformations. This instrument shall consist of an array of either MEMS gravity sensors separated by special joints to measure tilt along three axes, or IPI, or equivalent.

C. Install a minimum of three equally spaced surface settlement monitoring points on both sides of the excavation along a line perpendicular to the excavation, with the first monitoring point located at the edge of the excavation, the second monitoring point located at the farthest point no

further away than the limits of the Project ZOI outlined in Article 9 – Protection of Existing Adjacent Structures, of this Part 2, and the third monitoring point located equally between the first and second monitoring points. These lines of monitoring points shall be spaced a maximum of every 30m running parallel to the excavation.

D. Install In-Place-Inclinometers on both sides of the excavation spaced a maximum of 50m running parallel to the alignment. Inclinometers to be placed a maximum allowable distance of 1m from the edge of excavation.

E. Install piezometers on both sides of the excavation spaced a maximum of every 50m. DB Co to locate and monitor piezometers to ensure the groundwater drawdown restrictions of Clause 7.11 of this Part 2 are followed.

F. Install utility monitoring points, spaced a maximum of every 30m, for the 1500mm diameter West Nepean Collector.

G. At locations where the 1500mm diameter WNC is exposed, install structure monitoring points spaced every 3m, crack gauges at existing crack locations and strain gauges spaced every 3m. The limiting strain for the WNC shall be determined by DB Co and accepted by the City.

H. All the above instruments shall be connected directly or indirectly to permanent data loggers. Connecting instruments to permanent data loggers shall not be required when monitoring Structures that will not experience adverse impacts due to dewatering induced settlement as a result of construction excavation, such as Structures founded directly on intact bedrock or deep foundations extending to bedrock.

I. All of the above instruments shall have a minimum daily reading frequency when located less than or equal to 30m from the edge of excavation and a weekly reading frequency (a minimum of once per week) when located greater than 30m from the edge of excavation.

J. DB Co shall submit an updated monitoring report in electronic format, in accordance with requirements of Schedule 10 – Review Procedure every week.

(f) DB Co shall establish permanent reference monuments and deep surveying benchmarks as required along the alignment, in accordance with the requirements of this Article 7.

(g) Provide a demonstration of the features of the instrumentation DMP to the City prior to the start of construction and afterwards as modifications are made to the website.

(h) Meet with the City as needed to discuss instrumentation levels and necessary actions to protect EAS.

(i) Replace damaged or malfunctioning instrumentation. The City may order a temporary work stoppage in areas where there is insufficient working instruments to ensure the protection of EAS.

(j) Accommodate the City in inspecting the installation of geotechnical instrumentation, related hardware, and in verifying the proper functioning of the instrumentation monitoring system including, but not limited to the collection, transmission, storage, backup, and reduction of data.

7.10 Monitoring Requirements

(a) DB Co shall integrate the following monitoring requirements, in addition to other monitoring requirements outlined in Clause 7.9 of this Part 2.

(b) DB Co shall incorporate into the monitoring program, data from existing condition surveys, including data provided by the City.

(c) The monitoring reports prepared and submitted by DB Co shall be in accordance with Schedule 10 – Review Procedure.

(d) Monitoring shall include logs and survey notes which contain the following information:

(i) Record of measurements of in-Tunnel or other deformations;

(ii) Construction staging, loading or other construction activities associated with the works in the vicinity of instruments; and,

(iii) Record of any cracks in, or damage to any Structures.

(e) DB Co shall indicate locations where, due to contractual interfaces or changes in the extent of the Project ZOI outlined in Article 9 – Protection of Existing Adjacent Structures, of this Part 2, re-baselining of instrumentation readings shall be conducted.

7.11 Groundwater Control – Dewatering/Unwatering and Depressurization

(a) For the purposes of this Clause, unwatering is defined as the removal of water that has accumulated in an excavation or Tunnel and is an element of groundwater control. Groundwater control is defined as dewatering/unwatering and/or aquifer depressurization.

(b) DB Co shall develop and submit plans and procedures for groundwater control (including effluent discharge), in accordance with Schedule 10 – Review Procedure. The plans and procedure shall include, but not be limited to the following items:

(i) detailed shop drawings of the entire dewatering system(s) that bear the seal and signature of a professional engineer licensed in Ontario, and include, but not be limited to, details, and calculations of proposed type of dewatering system(s), showing arrangement, location, and depths of components of system including

details of screens and filter media, complete description of equipment and materials to be used, procedure to be followed, standby equipment, standby power supply, and proposed location(s) of points of discharge of water and abandonment of dewatering system(s), a description of any permits and approvals that pertain to the groundwater control activities;

(ii) a discharge plan that includes: discharge location(s) including methods; procedures and equipment to convey water to discharge locations; location and dimensions of treatment equipment; procedures for water testing; water quality laboratory analyses procedures, test results or analyses, and water treatment methods; location and construction details of monitoring observation wells, and a description of any permits and approvals that pertain to the discharge activities.

(c) DB Co shall apply for Permits, Licences and Approvals, including PTTW and/or Environmental Activity and Sector Registry, and discharge permits (e.g., Municipal, conservation authority and/or ECA).

(d) Design, construction, and operation of groundwater control measures shall not induce detrimental short- and/or long-term movements of surrounding Structures, infrastructure and ground surface. Evaluation of detrimental movements shall follow provisions included in Article 9 – Protection of Existing Adjacent Structures, of this Part 2.

(i) DB Co shall develop plans and procedures for groundwater control (including effluent discharge), establish monitoring requirements, and perform a hydrogeological impact assessment and associated risk assessment and submit to the City. This process shall consider all required project Permits and Approvals. DB Co shall ensure that any groundwater control, effluent discharge, and subsequent effects during construction or during the Design Life shall have no adverse impact on the following features within the Project ZOI: properties, adjacent Structures, infrastructure, active groundwater supply wells, and environmental features. Specifically, the following potential impacts shall be managed/mitigated such that they are not/do not become adverse:

A. Groundwater drawdown effects including impacts on the quantity and quality of groundwater available for groundwater dependent ecosystems and existing groundwater users;

B. Groundwater drawdown effects which may cause settlement of existing Structures or Utilities within the Project ZOI as required in Article 9 – Protection of Existing Adjacent Structures, of this Part 2; and,

C. Appropriate quantity and quality of dewatering effluent with respect to the receiver (e.g., municipal sewer, natural environment, off-site receiver, etc.), in accordance with all applicable Project permits and approvals.

(e) Water level drawdown resulting from construction dewatering between the approximate coordinates with an easting of 362384.080 and a northing of 5027868.080 and an easting

of 362076.750 and a northing of 5027452.320 using MTM Zone 9 horizontal datum referenced to WGS84 (NAD 83), shall be limited to a maximum of 1m at an outward distance of 30m from the edge of excavation in this area.

(f) Water level drawdown outside of the excavation footprint between the approximate coordinates with an easting of 362076.750 and a northing of 5027452.320 and an easting of 361947.010 and a northing of 5027195.440 using MTM Zone 9 horizontal datum referenced to WGS84 (NAD 83) shall not be permitted.

(g) Water level drawdown resulting from construction dewatering between the approximate coordinates with an easting of 360996.150 and a northing of 5025700.750 and an easting of 361048.440 and a northing of 5025253.660 using MTM Zone 9 horizontal datum referenced to WGS84 (NAD 83), shall be limited to a maximum of 3m at the outward edge of excavation in this area.

(h) Water level drawdown resulting from construction dewatering between the approximate coordinates with an easting of 361140.890 and a northing of 5024428.420 and an easting of 360821.350 and a northing of 5023869.960 using MTM Zone 9 horizontal datum referenced to WGS84 (NAD 83), shall be limited to a maximum of 3m at the outward edge of excavation in this area.

(i) Any activity within RVCA or SNCA regulated area shall be performed in agreement with the applicable requirements and regulations and will require RVCA or SNCA review and approval.

(j) DB Co shall design, install, operate, monitor, maintain, and decommission (as required) the project-specific groundwater control systems, as necessary to meet Project requirements and shall continue proper discharging of effluent according to the relevant City's Sewers Use By-law, as well as any other applicable regulatory (e.g., conservation authority and MOECC) approvals without any interruption or negative impact on existing Structures. It shall be the sole responsibility of DB Co to verify the condition of the groundwater control systems and operate them as required.

(k) DB Co shall submit, on a quarterly basis, the data obtained from all instrumentation utilized for monitoring including hydrogeological and geotechnical instrumentation to the City for review in accordance with Schedule 10 – Review Procedure.

(l) DB Co shall conduct all monitoring required by the obtained permits and approvals (including daily pumping volumes).

(m) DB Co shall submit the monitoring results to the applicable agencies as stated in the obtained permits and approvals.

(n) DB Co shall respond to/address any complaints received that are potentially related to groundwater control activities.

7.12 Seismic Design

(a) DB Co shall design all Structures in compliance with this Schedule 15 including Underground Structures, partially buried, at grade, and elevated Structures.

(b) DB Co shall perform an assessment of lateral displacement, liquefaction susceptibility, and cyclic softening and cyclic mobility of the soils for all the Lands.

(i) DB Co shall perform a detailed site-specific seismic Hazard Analysis for sites where soils have been identified as susceptible to liquefaction and lateral displacement in accordance with the CHBDC and AREMA. DB Co shall consider liquefaction and lateral displacement in the design of all Structures on these sites and shall provide mitigation measures as required.

(ii) DB Co shall consider cyclic softening and cyclic mobility and provide mitigation measures as required in the design of all Structures and slopes, for the sites for which soils will experience cyclic softening and cyclic mobility. DB Co shall utilize local experience and a case-history review combined with in-situ testing and analyses for this assessment.

(c) Seismic Site classification

(i) DB Co shall complete a site classification and seismic response study and provide a report to the City. Site classification and seismic response shall follow NBCC and OBC as applicable.

(d) Seismic Load

(i) The design of the Underground Structures shall use a dual-level seismic design criterion with an upper level design earthquake to provide a life safety performance objective and a lower level design earthquake for operational performance objective. The design shall conform to Clause 3.3 of Schedule 15-2, Part 8 – Underground Structures and the following:

A. The upper level design earthquake is an MDE where the probability of exceedance is approximately 4% in the 100-year Design Life, which corresponds to the 2% probability of exceedance in 50 years that is specified in the NBCC. The Underground Structures shall be designed with adequate strength and ductility to resist loads and deformations imposed on the structures during the MDE, thereby preventing Structure collapse and maintaining life safety; and,

B. The lower level design earthquake shall be the ODE where the probability of exceedance is approximately 20% in the 100-year Design Life, which corresponds to the 10% probability of exceedance in 50 years that is defined by the GSC using the NBCC seismic Hazard maps. When subjected to ODE, the Underground Structures shall be designed to

respond essentially in elastic manner. There shall be no collapse, and no damage to primary structural elements. The Structure shall remain fully operational immediately after the earthquake, at a full operational status.

(ii) For partially buried Structures (Structures partially above ground and partially below ground surface), the design shall account for the effect of the above-ground portion.

(iii) The design shall use ground deformation methods that account for soil-structure interaction in assessing the seismic effect on Underground Structures. DB Co shall perform rigorous numerical modeling methods such as dynamic finite element and finite difference methods (as required). Interior Structure not rigidly connected to the exterior Tunnel Structure shall be analysed using the response spectra method. Restrained Structures that oscillate in phase with or are rigidly attached to the Tunnel shall be analysed using ground deformation methods.

7.13 Subsurface Investigations and Testing Prior to Construction

(a) DB Co shall review all provided geo-engineering data and shall be responsible to undertake additional subsurface investigations to enable the design and construction of the Project. Results of investigations shall be provided to the City. The actual design basis shall conform to the available and additional geo-engineering data. Copies of any reports and interpretations provided by DB Co for design shall be submitted to the City to review for design consistency purposes;

(b) All field and laboratory testing shall be performed in accordance with Applicable Law including but not limited to CSA, MTO or ASTM standards. The locations and elevations of all boreholes, test pits, cone penetration tests, and other field testing or sounding locations shall be surveyed in accordance with the requirements of Schedule 15-2, Part 1, Article 4 – Design and Construction.

ARTICLE 8 UTILITY INFRASTRUCTURE DESIGN CRITERIA

8.1 DB Co General Responsibility

(a) The timing of Utility Work including relocations shall be subject to operational constraints. DB Co shall coordinate the scheduling of all Utility Work including relocation work with the relevant Utility Companies.

(b) DB Co shall be solely responsible for identifying the actual locations and condition of all existing Utility Infrastructure to complete the Utility Work, identifying all Utility Infrastructure relocation requirements, developing and preparing a Utility Infrastructure Relocation Plan, and performing all required work to protect, safeguard, remove, and relocate Utility Infrastructure as required and obtaining requisite consents from and with all Utility Companies with respect to the design, construction, installation, servicing, operation, repair, preservation, relocation, and or Commissioning of Utility Infrastructure in, on, under, over, or adjacent to the Lands. The Utility Infrastructure Relocation Plan shall include:

(i) identification of existing Utilities;

(ii) recommended Utilities Work;

(iii) assumptions and considerations;

(iv) approach to, and documentation of, communication and coordination with Utility Companies including articulating an understanding of Utility Companies' operational constraints;

(v) approach to communication and coordination with other Stakeholders including businesses and property owners;

(vi) approach to managing service interruption to Utilities customers including property owners;

(vii) providing early identification and approach to mitigation of impacts to critical Utility Work;

(viii) identification of, and applications for, Permits, Licences, and Approvals required for Utility Work;

(ix) evidence of coordination with all other Utility Infrastructure relocations in the same area; and,

(x) approach to supplying Utility services to the Project.

(c) DB Co shall prepare and submit a Utility Infrastructure Relocation Plan to each Utility Company and a fully coordinated overall Utility Infrastructure Relocation Plan to the City, in accordance with Schedule 10 – Review Procedure.

(i) DB Co shall submit at a minimum submit Utility Relocation Plans, without limitation for the following areas:

A. Utilities on Richmond Rd and Byron Ave in conflict with the Guideway;

B. Utilities on Carling Ave. and in proximity to Lincoln Fields Station;

C. Utilities located on the existing BRT, and between the BRT and Bayshore Shopping Centre;

D. Utilities impacted by the Connaught Tunnel; and,

E. Utility Work otherwise identified under Clause 8.10 of this Part 2.

(d) DB Co shall provide to the City, copies of transmittals only, for all submittals provided to and from Utilities Companies within two Business Days of the date of each transmittal. For clarity, transmittals shall be provided to the City for information purposes only.

(e) DB Co shall provide within two Business Days all documentation to and from Utilities Companies upon the City's request.

(f) DB Co shall prepare and submit a written workplan and schedule that addresses the Utility Infrastructure Relocation Plan including:

(i) durations and timelines for each Utility relocation and or other strategies, by location; and,

(ii) identifying dependencies and conflicts with overall Works Schedule.

(g) DB Co shall be solely responsible for identifying the requirements for and obtaining all consents and approvals, including without limitation, crossing and other agreements in favour of the City from Utility Companies and others having rights over and an interest in the Lands, whether below, at, or above grade.

(h) All Utility Work shall conform with all relevant codes and standards, of each Utility Company and with the requirements of all federal, provincial, municipal, and safety approving authorities/organizations, and with the requirements of this Project Agreement.

(i) The Utility Work shall preserve the existing Utility Company network performance and existing capacity subject to relevant codes and standards, of each Utility Company and with the requirements of all federal, provincial, municipal, and safety approving authorities/organizations, where DB Co has identified that Utility Infrastructure shall be relocated or removed and replaced.

(j) DB Co shall provide access within two hours of request from all Utility Companies to their respective Utilities. DB Co shall provide the City uninterrupted access to watermain valves.

(k) DB Co shall coordinate Utility Work with the overall system design such that any operations, maintenance, repair and/or replacement activities undertaken by the Utility Company shall not interrupt the operation of the system.

(l) DB Co shall not construct, install or permit the construction or installation of any Utility Infrastructure on, in, under or over the Lands or any part thereof without the prior written consent of Utility Companies, the City, and any other entity whose consent is required and without obtaining all required permits and approvals.

(m) Without limiting the generality of the foregoing, at no time shall DB Co use or permit the use of the Lands or any other Project infrastructure for the purpose of protecting, safeguarding, removing and/or relocating Utility Infrastructure (other than Utility Infrastructure, if any, located within the Lands at Commercial Close) without the prior written consent of the City (which may be given or withheld at the discretion of the City).

(n) DB Co shall replace all surface and subsurface features and Utility Infrastructure disturbed, damaged or temporarily removed during the activities related to Utility Work and reinstate in accordance with the requirements of this Part 2.

(o) All lane closures, detour routes, Lane Shifts and diversions required to undertake Utility Work shall be in accordance with the requirements of Schedule 15-2, Part 7 – Traffic and Transit Management and Construction Access.

8.2 General Provisions for Utility Work

(a) DB Co shall coordinate and perform Utility Work so as to minimize impact to continuity of service and disruption to property owners and customers of the Utility Companies to the satisfaction of the Utility Companies, private Utility owner and the City.

(b) Utility Infrastructure shall be relocated such as to provide access, acceptable to the Utility Company, for maintenance and repairs. Sufficient width shall be provided to accommodate all required Utilities and provide the necessary clearances as determined by the Utility Companies and any applicable City standards;

(c) The demarcation point between any Utility service and the system shall be defined as the point where the responsibility of ownership transitions from the Utility Company to the owner. The location and configuration of demarcation points between any Utility service and the system shall comply with relevant Utility Company standards and industry practices between the Utility Company and its customers. Where no such appropriate Utility Company standards and industry practices exists, the location and configuration of demarcation points shall be mutually agreed upon between the Utility Company and DB Co.

(i) For **[REDACTED]**, the civil demarcation point shall be defined as the point where the ownership of the civil infrastructure associated with electrical services transitions from **[REDACTED]** to the City. The location and configuration of the civil demarcation shall comply with **[REDACTED]** Conditions of Service. The

electrical ownership demarcation point may not be the same as the electrical demarcation.

(ii) For **[REDACTED]**, the electrical demarcation point shall be defined as the point where the ownership of electrical infrastructure transitions from **[REDACTED]** to the City. The location and configuration of the electrical demarcation shall comply with **[REDACTED]** Conditions of Service.

(iii) For **[REDACTED]** at the LMSF facility, the demarcation point shall be at the secondary side of the gang operated load break overhead switches. All equipment beyond the demarcation point shall be purchased and installed by DB Co and owned by the City.

(iv) Trim Road Station is within the **[REDACTED]** distribution boundaries. The proposed Supply Point is at the overhead pole line located at N45.494989°, E -75.483315°. For **[REDACTED]** the demarcation point shall be at the designated overhead Supply Point disconnect.

(d) DB Co shall not construct new maintenance holes, water valve box assemblies or locate valve chamber frame(s) and cover(s) on OR174 paved surfaces, shoulders, median or interchange ramps, except:

(i) Catch basin maintenance holes dedicated to highway drainage shall be permitted on the shoulder of the Highway.

(e) DB Co shall relocate existing maintenance holes, water valve box assemblies, valve chamber frame(s) and cover(s) where located in the OR174 median, median shoulders, paved surfaces, or interchange ramps to outside of the median, median shoulder and paved surfaces of the Roadway. Existing maintenance holes, water valve box assemblies, valve chamber frame(s) and cover(s) in the outside shoulder shall be permitted to remain.

(f) DB Co shall use trenchless methods where constructing new or relocating utilities beneath the paved surfaces, shoulders, median or interchange ramps of OR174 that are otherwise only to be resurfaced.

(g) DB Co shall provide or maintain access to maintenance holes and watermain valves, located outside the Guideway by rubber tire vehicle.

(h) DB Co shall not attach, construct or relocate any fluid carrying Utilities to new, reconstructed or existing City owned Bridge Structures.

(i) DB Co shall be permitted to reinstate non-fluid carrying Utilities into existing conduit on existing City owned Bridge Structures that are otherwise not reconstructed.

(j) DB Co may attach new non-fluid carrying Utilities to new, existing or reconstructed City owned Bridge Structures. Utilities shall not be permitted under sidewalks, in parapet walls or directly suspended from thin deck slabs.

8.3 Protection of Utilities

(a) DB Co shall be responsible for protection and all repairs as a result of any damages caused by any actions, or neglect of any actions, by DB Co or any DB Co Party to Utility Infrastructure. DB CO shall further be responsible for ancillary costs related to maintaining normal levels of service or incurred by the Utility Company as a result of these damages. Refer to Article 9 – Protection of Existing Adjacent Structures, of this Part 2, for the minimum CIAR requirements for existing Utility Infrastructure within the ZOI and the baseline performance criteria for Utility Infrastructure impact mitigation to be used in the development of the GIMP Response Action Plan.

(b) All Utility Infrastructure located at Commercial Close or thereafter on, in, under, over, or adjacent to the Lands (including Utility Infrastructure within any excavation) shall remain in service and be protected and preserved by DB Co throughout the construction unless otherwise agreed upon by the Utility Company.

(c) DB Co shall be responsible for any damage done by DB Co or any DB Co Party to Utility Infrastructure throughout the construction.

(d) For all existing and new Utilities crossing the Lands, utilize and adhere to all requirements of the Transport Canada document titled Standard Respecting Pipeline Crossings Under Railways TC E10. This document shall be utilized for all Utilities regardless of the age of the Utility.

(e) DB Co shall maintain the existing OC Transpo optical fibre feed to the Transitway Stations during construction Any temporary communications arrangements to maintain the OC Transpo communications network during construction shall not disrupt OC Transpo operations or degrade existing OC Transpo network performance.

8.4 Project Utilities Services

(a) DB Co shall be responsible for all Utility Work for all temporary and permanent Utilities services for the Project necessary to comply with the requirements of relevant standards, codes and approvals, as described in this Project Agreement.

8.5 Location and Condition of Utility Infrastructure

(a) DB Co shall be responsible for identifying and ascertaining the locations and conditions of all Utility Infrastructure, located on, in, under, over or adjacent to the Lands and ensuring compliance at all times with the provisions of this Project Agreement. DB Co shall not rely solely on previous engineering work, location plans, as-built or record drawings supplied by Utility Companies or other similar documents for confirming locations of Utility Infrastructure.

8.6 DB Co Responsibilities for Utility Work

(a) All Utility Work shall be performed by, or under the supervision of, and at the risk and expense of DB Co subject to the rights of Utility Companies to specify who will perform the Utility Work. Without limiting the generality of the foregoing, DB Co shall be responsible for:

(i) obtaining all rights of entry or access to the relevant Utility Infrastructure in connection with the Utility Work and providing access to the relevant Lands if such Utility Work is to be performed by the Utility Company;

(ii) identifying all requirements in respect of the Utility Work, including determining the most effective strategies for undertaking the Utility Work;

(iii) liaising, arranging, coordinating, and entering into all necessary agreements with relevant Utility Companies in connection with the Utility Work, including obtaining any necessary consents or approvals in connection therewith, providing access for inspections and providing information and plans during and following completion of the Utility Work;

(iv) obtaining all Permits, Licences, and Approvals for the Utility Work;

(v) observing and complying with any instructions or directions relating to the Utility Work that may be issued by the City on its own behalf or on behalf of a relevant Utility Company;

(vi) securing or causing to be secured the entry into or execution of all relevant design, construction, crossing, and maintenance agreements, service contracts, and other agreements in connection with the Utility Work;

(vii) DB Co shall complete any Utility Infrastructure abandonment as per the standards of relevant Utility Company and City standards, guidelines and specifications. Abandoned underground utility infrastructure which results from the relocation of utility plant, shall be removed up to the first utility structural chamber beyond the abandoned sections;

(viii) For telecommunication Utility Companies, DB Co shall design and install all necessary temporary and/or permanent Civil Works associated with the relocation of the Utility Infrastructure, which may include duct banks, maintenance holes, handwells, vaults, pads, etc. for the purpose of the installation of the relevant telecommunication utility company's plant. The Civil Works shall be installed as per the standards and specifications of the corresponding Utility Company;

A. General requirements for telecommunication Utility Company duct banks shall be as follows:

i. Duct banks under Roadway, sidewalk, MUPs and boulevards, or where a duct bank requires three ducts or more, the duct bank shall be concrete encased;

ii. Duct conduit shall be permitted to be direct buried under parkland; and,

iii. Ducts shall be permitted to be direct buried for any lateral duct bank, (max two ducts) going to a pole, pedestal or building.

(ix) For **[REDACTED]**, DB Co shall install all necessary temporary and/or permanent Civil Works associated with the relocation or protection of the Utility Infrastructure, which may include duct banks, maintenance holes, handwells, vaults, pads, groundling grids, etc. for the purpose of the installation of the **[REDACTED]**'s plant.

(x) For **[REDACTED]**, DB Co shall install all necessary temporary and/or permanent Civil Works associated with the supply of power to stations and/or Traction Power Systems beyond the **[REDACTED]** Supply Point and **[REDACTED]** civil demarcation point.

(xi) For **[REDACTED]** and **[REDACTED]**, Civil Works design for specialty structures inclusive of Bridges, vaults, viaducts, buildings, pipe chases, utility protective structures and vent shafts shall be DB Co's responsibility and shall be coordinated with other **[REDACTED]** or **[REDACTED]** Civil Works design.

(xii) The new installation, modification, relocation, and/or upgrade all Utility services and related assets for Stations and other systems as necessary to meet Project requirements; and,

(xiii) The provision of new Utility services for Track switches and switch heaters where required.

(xiv) The provision of new or alteration of existing low voltage electrical services for streetlighting and traffic signals as coordinated by City signals and streetlighting departments.

(b) The Utility Companies shall be individually responsible for the following work which will be covered in the Utility Company Works Cash Allowance as noted in Project Agreement Section 11.29. For clarity, only Utility Work up to the Utility demarcation point and where explicitly described here shall be subject to Utility Company Works Cash Allowance. Work by the Utilities beyond the Utility ownership demarcation point shall not attributable to Utility Company Works Cash Allowance:

(i) Telecommunication Utility Companies shall be responsible for the design and installation of any temporary and/or permanent plant works including wiring, cables, fibres, equipment, etc., installed or placed in, on, over, under or through

the Civil Works including connections to existing Utility Infrastructure that is associated with Utility relocation. Utility Works performed associated with new telecommunication services is not attributable to Utility Company Works Cash Allowance;

(ii) **[REDACTED]** shall be responsible for the design of all necessary temporary and/or permanent Civil Works, excluding specialty structures as per Clause 8.6 of this Part 2, associated with the relocation of the Utility Infrastructure, which may include duct banks, maintenance holes, handwells, pads, etc. for the purpose of the installation of the **[REDACTED]**'s plant.

(iii) **[REDACTED]** shall be responsible for the design and construction of all temporary and/or permanent plant works required including wiring, cables, equipment, etc., installed or placed in, on, over, under or through the Civil Works including connections to existing Utility Infrastructure for their plant;

(iv) **[REDACTED]** in coordination with DB Co shall be responsible for the design, supply and installation of all wiring and connection assets including primary switchgear, **[REDACTED]** metering and Station transformers which are before the **[REDACTED]**/customer demarcation point. Refer to Schedule 15-2, Part 4, Article 6 – Electrical Design Criteria, for further clarity on **[REDACTED]**/customer demarcation points.

(v) **[REDACTED]** shall be responsible for design and construction of all necessary temporary and/or permanent Utility poles, line cover-ups and associated wiring with the relocation of Utility Infrastructure;

(vi) **[REDACTED]** shall be responsible for the design and construction of all necessary temporary and/or permanent Civil Works, excluding specialty structures as per Clause 8.6 of this Part 2, associated with the relocation of the Utility Infrastructure, which may include duct banks, maintenance holes, handwells, vaults, pads, etc. for the purpose of the installation of the **[REDACTED]**'s plant.

(vii) **[REDACTED]** shall be responsible for the design and construction of all temporary and/or permanent plant works required including wiring, cables, equipment, etc., installed or placed in, on, over, under or through the Civil Works including connections to existing Utility Infrastructure for their plant;

(viii) **[REDACTED]** shall be responsible for design and construction of all necessary temporary and/or permanent Utility poles, line cover-ups and associated wiring with the relocation of Utility Infrastructure.

(ix) **[REDACTED]** shall be responsible for all design and construction of all temporary and/or permanent works associated with required relocation for their plant. Works associated with new natural gas services is not attributable to Utility Company Works Cash Allowance.

(x) The City shall be responsible for final connections for watermains equal or less than 406 mm in diameter. The City shall also be responsible for installation of new water services and water meters, and disinfection of new water infrastructure where required.

(c) Within the limits of excavation at Underground Stations, DB Co shall be responsible for:

(i) removal of City Utility Infrastructure that is abandoned as a result of Utility Work;

(ii) removal and disposal of existing abandoned City Utility Infrastructure that is exposed by DB Co or any DB Co Party;

(iii) DB Co shall complete any abandonment of City Utility Infrastructure in accordance with City standards and guidelines; and,

(iv) DB Co shall not be responsible for removal and disposal of existing abandoned City Utility Infrastructure outside of the limits of excavation.

8.7 Watermain Requirements

(a) All watermain design and construction shall conform to all relevant codes, standards and City of Ottawa Design Guidelines – Water Distribution 2010 and Technical Bulletins.

(b) DB Co shall coordinate the scheduling of all watermain relocation work with the City.

(c) DB Co shall be responsible for City of Ottawa drinking water permits related costs for final connections, testing, chlorination and commissioning of all water related works.

(d) All watermain designs are subject to review and final approval by the City.

(e) Timing for the temporary removal of watermains from service for relocation, protection, or facilitating other construction shall be subject to operational constraints. The City will review requests for isolations on a case by case basis with consideration to :

(i) Hydraulic modelling performed by the City to verify that adequate supply of water can be maintained;

(ii) Seasonal demand variations, where typically Maximum Daily Demands are realized May 15th to Oct 15th of any calendar year, and Basic Day Demands are realized elsewhere. Exact dates are dependent on recent climatic conditions and vary from year to year;

(iii) Other capital works or maintenance activities which may impact the water distribution network;

(iv) Available redundancy in water distribution system to ensure acceptable levels of risk to normal service delivery are maintained;

(v) Unforeseeable conditions due to system failures or maintenance which may impact water service delivery.

(vi) Winter potable water treatment and production operation capacities which may be reduced with colder water temperatures.

(vii) For large diameter watermains (greater than 406mm) , isolation requests shall be made a minimum of 60 days in advance of the date required, specifying the extents and duration of the isolation.

(viii) Known constraints on watermain isolations and the removal of watermains from service. Refer to the "Confederation Line Extension Project Drinking Water Operational Constraints Matrix" for specific references in this Article and other background information.

(f) Construction of, or near large diameter watermains (greater than 406mm), in a pressurized or non-pressurized state shall be subject to requirements of CIAR submittals. The City retains the right to reject construction means and methods where in the City's opinion there is unacceptable potential for impacting feedermain integrity and or threatening normal service levels in ongoing water service delivery. Requirements for construction monitoring including but not limited to settlement and vibration monitoring may be imposed by the City as deemed necessary and shall be accommodated by DB Co.

(g) DB Co shall provide full time qualified inspection services where constructing or altering large diameter watermains (greater than 406mm) and related infrastructure (valves, chambers. etc.) to witness and ensure quality control activities are completed at prescribed intervals, materials, material handling and construction are as per design specifications and is completed in accordance with industry standards, manufacturer and City standard specifications, report and take corrective action to remedy deficiencies where required.

(h) DB Co shall engage a company that can demonstrate a minimum of 10 years of experience in large diameter watermain installation, three references where large diameter watermain installation has been provided within the last five years, and describe the experience of said company, as well as the individuals who shall be responsible for the management and services delivery and their relevant experience and qualifications, to the City in accordance with the requirements of Schedule 10 – Review Procedure.

(i) For pre-stressed concrete pressure pipe watermains with diameter greater than or equal to 610mm, the following coating, lining and mortar special provisions shall apply:

(i) The concrete mortar exterior coating mix shall have properties that limit the potential for chloride-induced corrosion by reducing the permeability of the concrete coating. The exterior pipe mortar shall be type 10HSF cement with high quality 9% silica fume additive in accordance with AWWA C205. The high quality silica fume shall comply with C.S.A A23.5-M98. The exterior mortar shall have a thickness of 25mm measured from the outer edge of the prestressed wires.

The cement coating shall be able to withstand occasional freezing/thawing cycles during the lifetime of the pipe.

(ii) The pipe exterior surface shall be completely coated in the factory with a polyurethane coating 40 mils DFT Corrotec, as manufactured by **[REDACTED]** or an equivalent approved by the City. The coating shall pass an A.C. Holiday Detector Test set at a voltage of 4000 Volts. The adhesion of the Corrotec onto the concrete shall exceed 700 psi (4830 kPA).

(iii) All piping with coatings and linings delivered to the site shall be inspected for defects and cracks. Any repairs to coatings and linings shall comply with the applicable AWWA and ASTM standards. Any damages to the pipe exterior surface shall be repaired by cleaning the area affected and completely coating with a polyurethane coating 40 mils DFT Corrotec, as manufactured by SICO Inc. or an equivalent approved by the City. A pipe shall be deemed as extensively damaged and the pipe will be rejected, if defects or damages in any section of a pipe are numerous or severe enough that, in the City's judgement, it would be unsatisfactory to make separate repairs to the coating or linings.

(iv) The exterior pipe joints shall be made using a pre-packaged grout consisting of one part type 10HSF cement with high quality 9% silica fume additive, in accordance with AWWA C205, to two parts of chloride free sand. The high quality silica fume shall comply with C.S.A A23.5-M98. The installation of the field grout shall follow the manufacturer's recommendations. The joint shall be poured using a "Stretch Coat" bitumous diaper that will remain in place after pouring the grout. The addition of excessive water to the grout mix will reduce strength and shall not be tolerated. In order to seal the joints, the diaper shall overlap the pre-stressed concrete pressure pipe Corrotec coating by a minimum of 50mm. The exterior polyurethane coating shall be cut back (not applied) 60mm from both pipe ends to ensure that the poured diaper grout be in contact with the pipe exterior mortar cover for optimal adhesion.

(v) Pipe interior joints shall be mortar lined to completely fill the gap with an NSF 61 compliant mortar. All interior exposed steel shall also be similarly mortar lined with an NSF 61 compliant mix. An NSF 61 compliant epoxy coating shall be factory applied to the exposed steel of the bell interior and spigot exterior at the pipe joint (around the gasket area), where interior joints cannot be mortar lined due to size restrictions. The epoxy shall have a minimum thickness of 20 mils.

(vi) At the tie-in connection closure piece, the welded split sleeve and any exposed steel shall be grouted. The joint shall be mortar covered with grout using a "Stretch Coat" bitumous diaper or shall be concrete encased with the encasement covered with a Bituthene 3000 waterproof membrane which shall be formed in place.

(j) DB Co shall not construct Foundations above or within 3m horizontally of watermains or valve chambers.

(k) DB Co shall not construct or relocate watermains or valve chambers to underneath or within 3m of any Station, Platform or Foundation. DB Co shall not construct valve chambers within 3m of Bridges.

(l) DB Co shall relocate all water valves and valve chambers out of the Guideway.

(m) DB Co shall not construct Bridges within 3m horizontally of valve chambers.

(n) DB Co shall not construct Platforms above or within 3m horizontally of watermains or valve chambers.

(o) DB Co shall sleeve new and relocated watermains located beneath the Highway 174 paved surfaces, shoulders and median. DB Co shall sleeve new and relocated watermains beneath the Highway 174 a minimum of 5m horizontally past the edge of paved surfaces.

8.8 Storm and Sanitary Sewerage System Requirements

(a) All storm and sanitary sewer design and construction shall conform to all Applicable Codes, standards and City of Ottawa Sewer Design Guidelines 2012 and Technical Bulletins.

(i) DB Co shall relocate all sanitary sewer maintenance holes out of the Guideway.

(ii) DB Co shall conduct a precondition survey by way of CCTV on all storm and sanitary sewers within the ZOI as per the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2.

(iii) DB Co shall conduct post construction condition survey by way of CCTV within 90 calendar days on all storm and sanitary sewers within the ZOI as per the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2.

(iv) DB Co shall conduct post construction condition survey by way of CCTV at a minimum of one year following completion of construction on all storm and sanitary sewers within the ZOI as per the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2.

(v) DB Co shall conduct post construction condition survey by way of CCTV within 90 days for all newly constructed or modified storm and sanitary sewers as per the City of Ottawa Standard Tender Documents for Unit Price Contracts, Volume 1 and 2.

(vi) All CCTV condition surveys shall include sonar sensing technology, for sanitary or combined sewers greater than 1500 mm diameter.

(vii) DB Co, at the City's request, shall conduct additional CCTV surveys or other condition assessments where in the City's opinion may be impacted by construction activities.

(viii) Where CCTV reports are received and, in the opinion of the City, pipe sections are not of satisfactory cleanliness to adequately assess the condition of the pipe, DB Co, at the City's request, shall be required to clean the respective pipe sections and re-inspect.

(ix) DB Co shall not construct Foundations over or within 3m horizontally of sewers.

(x) DB Co shall not construct or relocate sewers beneath or within 3m of any Platform or Foundation.

(xi) DB Co shall relocate all storm sewer maintenance holes out of the Guideway unless the maintenance hole is part of a storm sewer system dedicated to Guideway drainage.

(xii) DB Co shall not construct Platforms over or within 3m horizontally of sewers.

(xiii) DB Co shall not construct Bridges within 3m horizontally of sewer maintenance holes.

(xiv) DB Co shall not construct sewer maintenance holes within 3m horizontally of Bridges.

(b) All sewer designs shall be subject to review and final approval by the City.

(c) The employment of inverted siphons shall be prohibited other than where specified below:

(i) There is a conflict of the proposed Tunnel through the SJAM Parkway with the existing 600mm storm water outfall at Mansfield Avenue and Skead Street. An acceptable resolution shall be the construction of a 600mm inverted siphon beneath the existing 1220mm watermain, at an elevation allowing an open channel gravity outfall above the Tunnel to the Ottawa River.

(ii) The existing 675mm storm sewer inverted siphon crossing the Transitway corridor from Dominion Street to Workman Avenue, may be lowered and or extended as an acceptable means to deal with further conflicts to the LRT alignment.

(d) Construction of, or near large diameter sanitary or combined sewers (greater than 750mm), shall be subject to the requirements of CIAR submittals. The City retains the right to reject means and methods where in the City's opinion there is potential for impacting sewer integrity and or threatening normal service levels. Requirements for construction monitoring including but not limited to settlement and vibration monitoring may be imposed by the City as deemed necessary.

(e) DB Co shall develop a CIAR for construction over, under or near the WNC, in accordance with Schedule 10 - Review Procedure.

(f) DB Co, in conjunction with the City shall develop an ERP for constructive works over, under or near the WNC, as readiness to mitigate any environmental or service delivery impacts as a result of any damage to the sewer.

8.9 [REDACTED]

(a) Refer to the "**[REDACTED]** Information to Support the City of Ottawa's Proposed light Rail System – Stage 2 Confederation Line" for specific references in this Article and other background information.

(b) **[REDACTED]** shall designate the Supply Point locations for the project's electrical connections and the ownership, control, & maintenance demarcation points between **[REDACTED]**'s distribution system and the Ottawa Light Rail Transit system. The proposed Supply Points and available capacities are listed in Tables 1-1 and 1-2 of Appendix I. **[REDACTED]**will designate the final Supply Point.

(c) **[REDACTED]** will operate up to the electrical ownership demarcation point and may operate the customer's first protective device in from **[REDACTED]**'s distribution system. **[REDACTED]** clarifies the customer's interface responsibilities with the connection agreement. **[REDACTED]** defines three areas of responsibility between itself and the customer's interface: ownership demarcation ('O'), electrical control authority ('C'), and maintenance authority ('M'). All electrical devices and support structures on **[REDACTED]**'s distribution system receive unique identifying nomenclature with the required 'OCM' suffix indicating the defined roles.

(d) In the **[REDACTED]**'s Offer to Connect, Installation & Service agreement and operation & maintenance agreement associated with each project electrical connection, the on-going roles, responsibilities, and ownership shall be defined between the Utility Company, the City, and DB Co. These agreements shall be executed between the three parties within 30 Business Days after the electrical detail design is approved for each Project electrical connection and before construction starts for each Project electrical connection.

(e) **[REDACTED]** shall purchase, install and own Supply Point connection assets including primary switchgear, metering equipment, and Station transformers, where there are no TPSS or ventilation loads connected to the Station electrical service.

(f) For Stations with a TPSS, revenue class **[REDACTED]** metering shall be provided downstream of the customer owned main breaker in the TPSS.

(g) DB Co shall file detailed maximum Supply Point loading schedule and its assumptions with **[REDACTED]** at least two years before energization of the Confederation Line facility is required.

(h) DB Co shall ensure that **[REDACTED]**'s control authority and staff has 24/7 access to its primary circuits to control the distribution system, ensure public safety, and replace failed components, and a maximum field emergency response time of 60 minutes not

withstanding a force majeure. Typical circuit restoration times are outlined in the "**[REDACTED]**" report. DB Co shall ensure it has only one control authority over the Project's electrical system.

(i) Other than the Utility Work identified to be paid by the City, DB Co shall pay for any Utility Works for additional Supply Points over those identified in Tables 1-1 and 1-2 of Appendix I.

(j) Other than the Utility Works identified in this Project Agreement to be paid by the City, DB Co shall pay for the Utility Works that may occur where DB Co requests a change in the Utility Owner's Supply Point location.

(k) Automatic load transfer schemes may be deployed by DB Co where redundant electrical servicing is required. Such schemes are subject to **[REDACTED]** approval and any such scheme will be required to be break before make (open transition of greater than 100 milliseconds) configuration. Automatic transfer schemes shall have provisions for remote monitoring and blocking to the **[REDACTED]** control centre. Procedures related **[REDACTED]** ATS blocking shall be developed with consultation to **[REDACTED]** and included in the **[REDACTED]** Operations and Maintenance Agreement

(l) DB Co shall ensure rubber tire vehicle access suitable for **[REDACTED]** maintenance vehicles ouside the Guideway is maintained to existing **[REDACTED]** underground plant along the north side of the BRT between Holly Acres Road and Woodridge Crescent for the final design and constructed Works.

(m) DB Co shall be responsible for the costs associated with any temporary electrical services and associated energy accounts.

8.10 Utility Works Special Provisions

(a) Shefford Road OR174 Watermain

(i) DB Co shall undertake Utility Work to replace the existing 406mm watermain that crosses the OR174 from Shefford Road to the 406mm branch valve on the south side of OR174 with a 610mm watermain. Construct a 406mm to 610mm increaser on the existing 406mm branch valve on the south side of the OR174. Construct a new 610mm valve on the new 610mm watermain north of the OR174. Construct a 610mm to 406mm reducer after the new 610mm valve and connect to the existing 406mm watermain on Shefford Road.

(b) Richmond Road Complete Streets Utility Upgrades

(i) DB Co shall undertake Utility Work to design and reconstruct the existing drinking water, sanitary sewer and storm sewer Utility Infrastructure on Richmond Road, Byron Avenue, and their respective connecting cross streets.

A. General design and construction requirements are as follows:

i. Refer to "Cleary and New Orchard Planning Study Area Future Buildout – Buildling Population" for specific references in this Article and other background information.

1 DB Co shall perform design calculations and modelling to determine the required size of reconstructed and new drinking water and sanitary sewer Utility Infrastructure on Richmond Road, Byron Avenue, and their respective connecting cross streets. Calculations shall include the 20-year building population forecasts, the design of Richmond Road Complete Streets, and the design of the Confederation Line West Extension. This investigation shall be submitted in accordance with Schedule 10 – Review Procedure.

2 DB Co shall perform design calculations to determine the required size for replacement and new storm sewer infrastructure on Richmond Rd, Byron Ave, and their respective cross streets. Storm sewers shall be sized with capacity for the 5-year storm. The capacity of the catch basin inlets shall be restricted to the 2-year storm. This investigation shall be submitted in accordance with Schedule 10 – Review Procedure.

ii. DB Co shall reconstruct all water, sanitary, and storm services within the City ROW to the property line.

B. Refer to "Richmond Road Complete Streets – Prescribed Water, Sanitary and Storm Replacements" for specific references in this Article. Specific drinking water requirements shall be as follows:

i. Hydrant spacing shall be reviewed and hydrants added or removed as required to provide coverage in accordance with the Drinking Water Guidelines.

ii. DB Co shall design and reconstruct drinking water system Utility Infrastructure as follows:

1 Richmond Road from the Sir John A. McDonald Parkway (360025V247) through to Midway Avenue (360025V084);

2 McEwen Avenue / Edgeworth Avenue from McEwen Avenue (360025V064) through to Edgeworth Avenue (360025V069);

3 Richmond Road / Byron Avenue from Hartleigh Avenue (360025V080) through to Redwood Avenue (360026V095);

4 Richardson Avenue from Richardson Avenue (360025V094) through to Byron Avenue;

5 Ambleside Drive from Ambleside Drive (360026V003) through to New Orchard Avenue;

6 New Orchard Avenue from New Orchard Avenue (360026V002) through to Richmond Road (360026V007);

7 Richmond Road from Richmond Road (360026V007) through to Redwood Avenue (360027V001);

8 Woodland Avenue from Woodland Avenue (360026V015) through to Byron Avenue;

9 Harcourt Avenue from Harcourt Avenue (360026V013) through to Byron Avenue;

10 Allison Avenue from Allison Avenue (360026V043) through to Byron Avenue;

11 Ancaster Avenue from Ancaster Avenue (360026V040) through to Byron Avenue;

12 Compton Avenue from Compton Avenue (360026V036) through to Byron Avenue;

13 Woodroffe Avenue from Woodroffe Avenue (360026V033) through to Woodroffe Avenue (360026V026);

14 Woodroffe Avenue from Woodroffe Avenue (360026V26) through to Woodroffe Avenue (360026V025);

15 Lockhart Avenue from Lockhart Avenue (360026V070) through to Byron Avenue;

16 Lockhart Avenue from Lockhart Avenue (360026V065) through to Byron Avenue;

17 Sherbourne Avenue from Sherbourne Avenue (360026V088) through to Byron Avenue;

18 Cleary Avenue from Cleary Avenue (360026V142) through to Richmond Road; and

19 Redwood Avenue from Redwood Avenue (360026V098) through to Richmond Road (360027V001).

C. Refer to "Richmond Road Complete Streets – Prescribed Water, Sanitary and Storm Replacements" for specific references in this Article. Specific sanitary sewer requirements shall be as follows:

i. DB Co shall replace the sewer laterals for **[REDACTED]** to the building foundation;

ii. DB Co shall construct a new additional maintenance hole structure outside of the Byron Avenue ROW on New Orchard Avenue, Woodland Avenue, Harcourt Avenue, Allison Avenue, Compton Avenue, and Sherbourne Avenue. New maintenance hole structures shall be located less than 10m from the Byron Avenue ROW. Connect to existing Utility Infrastructure.

iii. DB Co shall design and reconstruct sanitary sewer system Utility Infrastructure as follows:

1 Richmond Road from the Sir John A. McDonald Parkway (MHSA01248) through to Midway Avenue (MHSA26107);

2 McEwen Avenue / Edgeworth Avenue from McEwen Avenue (MHSA25339) through to Edgeworth Avenue (MHSA25343);

3 Byron Avenue from Richardson Avenue (MHSA25389) through to Ancaster Avenue (MHSA25395);

4 Richmond Road from Richmond Road (MHSA25381) through to New Orchard Avenue (MHSA26049);

5 New Orchard Avenue from the new maintenance hole structure on New Orchard Avenue through to Byron Avenue (MHSA25390);

6 New Orchard Avenue from New Orchard Avenue (MHSA25391) through to New Orchard Avenue (MHSA25380);

7 Richmond Road from New Orchard Avenue (MHSA25382) through to Woodroffe Avenue (MHSA26110);

8 Woodland Avenue from the new maintenance hole structure on Woodland Avenue through to Byron Avenue (MHSA25392);

9 Harcourt Avenue from the new maintenance hole structure on Harcourt Avenue through to Byron Avenue (MHSA25393);

10 Allison Avenue from the new maintenance hole structure on Allison Avenue through to Byron Avenue (MHSA25394);

11 Ancaster Avenue from Ancaster Avenue (MHSA25428) through to Byron Avenue (MHSA25395);

12 Compton Avenue from the new maintenance hole structure on Compton Avenue through to Byron Avenue (MHSA26191);

13 Byron Avenue from Compton Avenue (MHSA26191) through to Redwood Avenue (MHSA26311);

14 Woodroffe Avenue from Woodroffe Avenue (MHSA26200) through to Byron Avenue (MHSA26193);

15 Woodroffe Avenue from Woodroffe Avenue (MHSA26162) through to Richmond Ave (MHSA26160);

16 Richmond Avenue from Woodroffe Avenue (MHSA26160) through to Richmond Avenue (MHSA01725);

17 Lockhart Avenue from Lockhart Avenue (MHSA26157) through to Richmond Avenue (MHSA26163);

18 Sherbourne Avenue from the new maintenance hole structure on Sherbourne Avenue through to Richmond Avenue (MHSA01725);

19 Richmond Road from Richmond Road (MHSA61485) through to Richmond Road (MHSA01725);

20 Cleary Avenue from Cleary Avenue (MHSA26169) through to Richmond Avenue (MHSA01724); and

21 Richmond Avenue from Richmond Avenue (MHSA26171) through to Cleary Avenue (MHSA26170).

D. Refer to "Richmond Road Complete Streets – Prescribed Water, Sanitary and Storm Replacements" for specific references in this Article. Specific storm sewer requirements shall be as follows:

i. DB Co shall utilize CCTV, smoke/fog testing, and/or dye testing to determine all storm sewers connected and contributing to the sanitary sewer system. The investigation shall include all flat roofs, depressed laneways, parking garages, parking lots, and private catch basins to determine connection points. Known flat roofs include but are not limited to **[REDACTED]**. This investigation shall be submitted in accordance with Schedule 10 – Review Procedure. Where storm sewers are connected to sanitary sewer systems, DB Co shall:

1 Construct new storm lateral sewers to separate sanitary and storm services. All new storm laterals shall include backwater valves. Connect to storm sewers to City storm sewer Infrastructure; or

2 Where extraneous flow is quantified and is unable to be directed to a new or existing storm sewer due to private property constraints, DB Co shall account for the additional flow in the design and construction of the new sanitary sewer as per the City of Ottawa Sewer Design Guidelines.

ii. DB Co shall design and reconstruct storm sewer system Utility Infrastructure at the intersections of Richmond Road, Byron Avenue, and Woodroffe Avenue. DB Co shall construct additional catch basins to eliminate the current ponding and drainage issues at this intersection. List of reconstructed storm sewers are as follows:

1 Richmond Road from Richmond Road (MHST53979) through to Woodroffe Avenue (MHST53982); and

2 Woodroffe Avenue from Woodroffe Avenue (MHST78275) through to Woodroffe Avenue (MHST26040).

iii. DB Co shall design and construct new storm sewers on Byron Avenue and Richmond Road with capacity for the 5-year storm. Flows to the minor system shall be restricted to the 2-year peak flow rate. Major system flows shall be designed to pond on the street consistent with requirements in this Article and the City of Ottawa Sewer Design Guidelines. Design and construction shall conform to Article 5 – Drainage and Stormwater Management Design Criteria, and Article 6 – Roadway, Bus Terminals and Lay-Bys of this Part 2. List of new storm sewers is as follows:

1 Byron Avenue from Richardson Road to Woodroffe Avenue, to provide minor system drainage of the roadway, and to accept minor system flows from the tributary areas to the south;

2 Byron Avenue from Lockhart Avenue to Woodroffe Avenue, with drainage connections to properties on the south side of Byron, to provide minor system drainage of the roadway and to accept minor system flows from tributary areas to the south; and

3 Richmond Road from Cleary Avenue to Woodroffe Avenue to provide drainage for the arterial roadway, the Byron linear park, tributary areas to the south, and properties on the north side of Richmond Road.

iv. As part of Richmond Road Complete Streets and Byron Avenue reconstruction, DB Co shall design and construct SWMPs as outlined in Clause 5.7 of this Part 2.

(c) NCC Specific Utility Servicing Requirements

(i) DB Co shall undertake Utility Work to provide drinking water, sanitary and storm services to the Rochester Fields site (**[REDACTED]**) and Kitchissippi Lookout for future development and use by the NCC. Elements of the Utility Works shown on the drawings provided by the NCC in Appendix G of this Part 2, shall form part of the requirements as described below.

A. General construction requirements shall be as follows:

i. All construction on NCC lands shall follow the City of Ottawa Drinking Water Guidelines and City of Ottawa Sewer Design Guideline;

ii. DB Co shall provide sufficient appurtenances to flush stagnant water from constructed watermains. DB Co shall be responsible for water flushing during construction until the site is transferred back to the land owner as per City of Ottawa Standard Specification F-4491. The land owner shall be responsible for flushing post-construction.

iii. Sanitary sewer grading shall allow for gravity drainage of buildings.

B. Prescriptive requirements of the Utility Works shown on the provided drawings shall be as follows:

i. The routing of all Utility Works.

ii. Minimum clearances prescribed between Utility Works and existing infrastructure.

iii. All connections points into municipally or privately owned Infrastructure. All termination points capped for future use;

iv. All drinking water pipe sizes and type. All sanitary and storm sewer sizes and type;

v. The location and features of all maintenance holes, valve chambers, tees, reducers, subdrains, catch basins, infiltration based LID, inlet control devices, curb stops, hydrants;

vi. The features and routing of all joint utility crossing ducts and joint utility crossing duct banks. For the location and additional requirements of the proposed Kitchissipi Lookout Intersection, refer to Clause 6.21 of this Part 2.

vii. The water and sanitary services at Westboro Beach/Atlantis shall cross the SJAM Parkway in the Kitchissipi Lookout Intersection. For the location and additional requirements of the proposed Kitchissipi Lookout Intersection refer to Clause 6.21 of this Part 2.

(d) Lawn Avenue Parkette & Community Garden Servicing Requirements

(i) DB Co shall undertake Utility Work to improve the storm water services at the intersection of Edgeworth Avenue and Lawn Avenue and to provide drinking water services to the proposed Lawn Avenue parkette community garden.

A. General requirements shall be as follows:

i. All Utilities constructed beneath the Lawn Avenue parkette shall be located no greater than 4.5m from the centreline of the park.

ii. DB Co shall demonstrate to the City through hydrologic/hydraulic modeling that the cumulative impacts of the Works will not increase peak flow rates or the peak hydraulic grade line of the enclosed portion of Pinecrest Creek known as the ORPP for all rain events up to the 100-Year Storm. This analysis shall be submitted in accordance with Schedule 10 – Review Procedure.

B. Specific drinking water requirements shall be as follows:

i. Provide a 50mm drinking water service on municipal lands at the NCC property line south of the proposed park pathway. construction shall follow the City of Ottawa Standard Design

Drawing W31.1 to provide water to the proposed community garden. The curb stop shall be located at the intersection of Edgeworth Avenue and Lawn Avenue.

C. Specific storm water requirements are as follows:

i. Clean, repair and re-grade ditches and storm water Culverts along Edgeworth Avenue from **[REDACTED]** (300m) and along Lawn Avenue from Hartleigh Avenue to Edgeworth Avenue (160m). Grading shall flow towards the intersection of Edgeworth Avenue and Lawn Avenue;

ii. Upsize the storm Culverts at the intersection of Edgeworth Avenue and Lawn Avenue to 500mm diameter;

iii. Re-grade the intersection of Edgeworth Avenue and Lawn Avenue towards the catch basin and inlets at the intersection of Edgeworth Avenue and Lawn Avenue. Reinstate road features affected by the work of replacing and upsizing the Culverts. Install the frost tapers;

iv. Provide a below-grade storm sewer beneath the Lawn Avenue parkette. Connect the storm water Culvert catch basin at the intersection of Edgeworth Avenue and Lawn Avenue to the Lawn Avenue parkette storm water sewer. No overland flow shall be permitted through the Lawn Avenue parkette up to the 5-Year storm event;

v. Connect the Lawn Avenue parkette storm sewer to the ORPP.

(e) Southwest Transitway Storm Culvert replacements

(i) DB Co shall undertake Utility Works to reconstruct the storm sewers (STM64602, STM64606, STM64613 and STM64599) between Baseline Road and Iris Street. Existing headwalls and wingwalls shall remain.

(f) Moodie LMSF

(i) DB Co shall be permitted to construct the LMSF Vehicle storage Tracks and roof Structure above the existing 900mm West Nepean trunk sanitary sewer. Where the West Nepean trunk is located beneath the LMSF Vehicle storage Tracks and roof Structure:

A. DB Co shall demonstrate the proposed LMSF design, construction and operation does not impose unacceptable operational, life-cycle or access risk to the trunk sewer to the satisfaction of the City in the pre-final design submission.

B. DB Co shall maintain a 3m horizontal clearance to maintenance hole structures from the storage Tracks and roof Structure.

(ii) DB Co shall designate a natural gas supply point location on Corkstown Road. DB Co shall file forecasted demands and required gas service date for the LMSF facility. The City shall cover the costs of **[REDACTED]** system expansion up to the designated supply point.

(g) Moodie Station Watts Creek Relief Sewer

(i) DB Co shall not construct a pedestrian Bridge overpass crossing the alignment of the 1950mm Watts Creek Relief Sewer sanitary sewer at Moodie Station.

(ii) DB Co shall not construct or maintain maintenance holes for the Watts Creek Relief Sewer within the Moodie BRT loop or travelled lanes.

(h) Iris Grade-Separation Bridge Sanitary Sewer

(i) DB Co shall abandon the 300mm sanitary sewer on Iris Street from Parkway Drive to Adirondack Drive.

(i) **[REDACTED]**

(i) No permanent utility easements shall be permitted on the property parcel at **[REDACTED]** except:

A. A storm sewer easement within 9m of the property parcel at **[REDACTED]** shall be permitted.

(j) McRae Avenue Bridge **[REDACTED]** Transmission Cables

(i) **[REDACTED]** maintains high voltage transmission cables over the existing BRT supported by a steel structure. DB Co shall design OCS elements and an insulating barrier to protect against arching and grounding of the OCS to the steel structures. The design shall be approved by **[REDACTED]**. Refer to **[REDACTED]** located in the Background Information.

8.11 Enabling Utility Works

(a) The City, in conjunction with **[REDACTED]**, has initiated and will complete the following **[REDACTED]** relocations. Further information can be found in the **[REDACTED]** planning report:

(i) Montreal Road and OR174 Interchange: The **[REDACTED]** pole line on the north side of Montreal Road will be relocated over the extents from Shefford Road to approximately 300m east of Montreal Road. Relocation is complete.

(ii) LMSF: **[REDACTED]** overhead lines crossing Highway 417 at the LMSF facility will be relocated underground immediately east of their current overhead location. Civil works are expected to commence in spring 2020.

(b) The City, in conjunction with **[REDACTED]**, will complete the relocation of the **[REDACTED]** direct buried ducts approximately located at station 303+110 of Confederation East. The ducts and fibers be will relocated south and away from the proposed Hwy 174/Montreal Bridge abutments as shown in the Reference Concept.

(c) The City, in conjunction with **[REDACTED]**, has initiated and will complete the following **[REDACTED]** relocations. Further information can be found in the **[REDACTED]**:

(i) Lincoln Fields: The **[REDACTED]** underground transmission line, which crosses the SJAM Parkway immediately south of Carling Avenue is anticipated to be relocated by August 2020. Schedule and relocation requirements will be finalized with DB Co.

(ii) Trim Rd: The **[REDACTED]** overhead transmission cables, which cross Trim Rd. parallel to Hwy 174 are to be elevated to meet clearance requirements for the proposed pedestrian Bridge. Schedule and relocation requirements will be finalized with DB Co.

ARTICLE 9 PROTECTION OF EXISTING ADJACENT STRUCTURES

9.1 Scope

(a) This Article provides requirements for the following:

(i) Determination of the Project ZOI, as defined below, to assess the potential impacts to EAS due to the construction activities associated with the Works;

(ii) Criteria for evaluating impacts on EAS;

(iii) Development of mitigation measures as necessary to ensure safety and continued operation of the EAS; and,

(iv) Pre- and post-construction condition surveys.

(b) Project ZOI shall refer to the area within and adjacent to the Works, including EAS, that potentially may be impacted by construction activities associated with the Works including dewatering.

9.2 General Requirements

(a) DB Co shall:

(i) Assess the effects of construction related Ground Movements including dewatering on EAS. Prepare and submit for the City review a report in accordance with Schedule 10 – Review Procedure documenting anticipated impacts. Integrate the pertinent requirements of this Article into the report.

(ii) Based upon the report conclusions, design and implement mitigation measures as necessary to ensure that the structural integrity of EAS is maintained and that the appearance, functionality, operability, and durability of EAS are unimpaired.

(iii) Receive condition survey reports conducted by other parties where available and perform pre and post-construction condition surveys to document the condition of the EAS. Surveys shall be submitted in accordance with Schedule 10 - Review Procedure.

(iv) Remedy all damage caused by construction activities associated with the Works, including demolition, to pre-existing conditions. A complete report, that includes all temporary and permanent corrective measures, shall be submitted after completion of construction confirming all damages had been remedied.

(v) DB Co shall obtain necessary Permits, Licences, Approvals and Agreements from third party owners of the EAS to perform necessary works. For communication protocols, DB Co shall follow Schedule 18 - Communications and Stakeholder Engagement Obligations. DB Co shall not use any existing permits to enter to the EAS that had been granted for other projects or other purposes.

(vi) Ensure that utility isolation or relocations do not affect the electrical safety grounding of EAS.

9.3 Qualifications

(a) Determination of the ZOI, evaluation of impacts on EAS and the design and implementation of mitigation measures shall be undertaken by staff who have verifiable design and construction experience with similar programs and be directly supervised by a Professional Engineer.

(b) The individual responsible for the surveyors shall be a registered land surveyor in the Province of Ontario with experience in measurements of the types of accuracies that shall be required for geotechnical instrumentation monitoring.

9.4 Design Requirements

(a) DB Co shall:

(i) Obtain pertinent information of EAS and utilities.

(ii) Obtain all specific design, protection and monitoring requirements from third party owners including but not limited to City requirements for excavations adjacent to the structures including bridge components and other structures, Utility Companies, and other third party owners.

(iii) More specifically, prior to undertaking any excavations, DB Co shall provide the predicted movements (vertical, horizontal, rotational, tilt, relative movement) for review by the City. For such excavations, a detailed real time (24/7) monitoring plan to monitor settlements, Ground Movements and tilting/movement of adjacent bridge components shall be implemented in the GIMP and made available on DMP. If blasting is considered as a means of rock excavation in accordance with the restrictions of Schedule 15-2, Part 1, Clause 5.2, the anticipated ground vibrations shall be determined based on DB Co's blasting design and blasting plan to ensure compliance with the blasting limitations of Article 7 of this Part 2. City structures staff shall be notified, according to the communication protocols stipulated in Schedule 18 - Communications and Stakeholder Engagement Obligations, if any Alert Levels are exceeded. For further negotiations with City, DB Co shall provide modelling and assessment of the anticipated settlement in a CIAR-2 level report as well as a sensitivity analysis of the impact of varying settlement levels on the City bridges to be undertaken in 5mm increments.

(iv) Complete EAS verification study to include confirming information related to EAS locations, dimensions, elevations, foundations, structural details, materials, and other information necessary to complete a deformation analysis of the structures. Perform field surveys, utility locates, and foundation test pits as needed

(v) Deformation Analysis

A. DB Co shall consider the available Site specific geotechnical reports and reference documents to identify the Project ZOI. The Project ZOI shall be determined by DB Co using engineering analyses and shall include all sources of Ground Movements that may be caused by construction activities associated with the Works including dewatering for temporary and permanent structures. At a minimum the Project ZOI shall be as follows:

i. A horizontal distance from the edge of any supported excavation or temporary slope equal to twice the excavation depth as measured from the existing ground surface.

B. Design Reports:

i. Prepare and submit CIAR-1 and CIAR-2 in accordance with the requirements of Schedule 10 – Review Procedure. CIAR-1 and CIAR-2 shall include magnitude and distribution of Ground Movements as well as potential impacts on EAS. CIAR-1 is applicable to:

1 First level of assessment and screening for all EAS.

2 EAS such as low rise commercial buildings and single family residences that are assumed to be flexible small frame buildings.

3 EAS which are absent of any large rigid grade beam elements, which may have the potential to attenuate ground settlements.

4 Small, low-rise non-critical EAS where the predicted impact poses no risk to public safety or loss of functionality.

5 Utilities within the Project ZOI.

ii. To assess the magnitude of impact to EAS and facilities, CIAR-1 analysis shall include the following tasks as a minimum:

1 Review of literature on impact assessment methodologies.

2 Conduct building, bridge and utility inventory by identifying buildings, bridges and utilities within the settlement trough using building type and use survey.

3 Overall evaluation of EAS and facilities potentially at risk.

4 Detailed definition of damage levels.

5 Determine strain, settlement, and angular distortion limits for each building.

6 Determine joint rotation, joint pull-apart, and tensile strain limits for each utility.

7 Determine EAS or locations requiring a further CIAR-2 analysis.

iii. CIAR-2 analysis is generally appropriate for EAS that meet any of the following criteria:

1 EAS recommended by the findings of CIAR-1.

2 Exterior cladding systems that generally consist of non-load bearing masonry, precast concrete or glass.

3 EAS that generally include deep, multi-storey basements which could possibly alter the slope of the ground settlement profile

4 Mid-rise and high-rise EAS.

5 Critical EAS that are considered to be of historical or cultural significance, heritage buildings or essential services buildings and utilities that exceed a CIAR-1 predicted impact levels.

iv. The representative EAS for CIAR-2 analysis, as a minimum, shall be selected based on the following criteria:

1 Results of CIAR-1.

2 Proximity to the cut-and-cover excavation zone or dewatering zone.

3 Potential to sustain cut-and-cover excavation or dewatering induced settlement impacts.

4 Type and sensitivity of superstructure and cladding.

v. As a result of this selection process, the CIAR-2 analyses are expected to provide an estimate of the potential structural impacts due to cut-and-cover excavations. The results of these CIAR-2 analyses shall be used to predict excavation induced settlement impact to other similar EAS within the Project limits.

vi. DB Co shall use established numerical simulation methods such as finite element method or finite difference method. Simplified numerical methods and empirical methods may be used only for CIAR-1 for screening purposes.

(b) Impact Mitigation Design

(i) Design Structure-specific mitigation measures needed to prevent a loss in appearance, structural integrity, functionality, operability and durability of potentially impacted EAS and ensure safety and continued operation of the EAS. Demonstrate the effectiveness of the proposed mitigation measures by engineering analysis. Confirm and document that the proposed mitigation is acceptable to all potentially affected EAS owners which shall also include but will not be limited to City structures and Utility Companies. Determine instrumentation monitoring requirements, include Review and Alert Levels in the GIMP (refer to Article 7 – Geotechnical Design Criteria and Requirements, of this Part 2) for evaluating the effectiveness of the mitigation measures during construction that is consistent with the means and methods for construction. The DMP, as stated in this Article, shall be used to create and send alarm reports/notifications if Alert Levels are exceeded. DB Co shall inform the City of subsequent response actions taken by DB Co.

(ii) DB Co shall prepare a Response Action Plan, as stated in Article 7 – Geotechnical Design Criteria and Requirements, of this Part 2, which shall consist of preliminary methods and means to respond to various Review and Alert Level scenarios based on types of geotechnical instruments that indicate Review and Alert Levels. Review and Alert Levels shall be determined based on the predicted Ground Movements and the results of the CIAR and shall also comply with the following criteria,

A. The Review Level is a geotechnical instrument reading that triggers a set of review and mitigation actions to ensure that the Alert Level is not exceeded. Review Level shall not exceed 10mm movement.

B. The Alert Levels is maximum permissible geotechnical instrument reading that triggers consideration of temporary work stoppage to prevent damage to EAS. Alert Levels shall not exceed 25mm movement.

C. DB Co shall adhere to the allowable joint pull-apart, joint rotation and tensile strain in table below for utilities within the Project ZOI.

Material	Joint Pull-Apart (mm)	Joint Rotation (rad)	Tensile Strain (με)
Cast Iron	15 [1]	0.0075 [2]	150 [1]
Steel	25 [2]	0.0075 [2]	550 [2]
Ductile Iron	25 [2]	0.0075 [2]	500 [1]
RCP	25 [2]	12.5mm/diam. [2]	300 [3]
Brick & Concrete	NA	NA	150 [3]
Precast Concrete	25 [2]	12.5mm/diam. [2]	300 [3]

1 Bracegirdle et al. (1996)
2 CIRIA No. 30 (1992)
3 North American Tunneling Proceedings (2014)

i. DB Co shall develop limits for Concrete Pressure Pipe joint pull-apart, joint rotation and tensile strain in accordance with the pipe manufacturer's recommendations and industry standards, whichever is the more stringent.

ii. If blasting is used for rock excavation in accordance with the restrictions of Schedule 15-2, Part 1, Clause 5.2 and the requirements of Article 7 of this Part 2, the CIAR shall demonstrate that the tensile strain limits of brick and concrete Utilities listed above are not exceeded for the WNC based on DB Co's blasting design and plans. The minimum stand-off distance for rock blasting between the WNC and Parkway Tunnel shall not be reduced from that specified in Schedule 15-2, Part 1, Clause 5.2 but may be increased based on the results of this CIAR and as determined by the City.

(iii) DB Co shall include in the GIMP all measures and specific instrumentation and monitoring requirements for protecting EAS within the Project ZOI as defined by DB Co.

(c) Pre, during- and post-construction condition surveys

(i) DB Co shall be solely responsible to perform required condition surveys for the purpose of inspecting and documenting the existing condition of EAS prior to, during and after construction. Record information about EAS damage or repairs, defects, unusual aspects of construction, presence of sensitive equipment, and similar pertinent information. Perform this work in accordance with Applicable Law, relevant standards, regulations and by-laws including but not limited to the City municipal code. Survey information shall be submitted according to Schedule 10 – Review Procedure.

(ii) Where pre-construction condition surveys for EAS are performed by DB Co, survey reports shall be prepared and submitted for review in accordance with the requirements of Schedule 10 – Review Procedure. The survey reports shall consist, at a minimum, of the completed standard form, photographs with photo description log sheet, and DVD of digital video and digital photographs. The report shall be stamped by the Professional Engineer licensed in Ontario responsible for performing the survey.

(iii) Perform during- or post-construction condition surveys for EAS where the Response Levels of structure movements or deformation have been exceeded, or a damage claim has been received.

9.5 Existing Adjacent Structures Owner Interactions

(a) DB Co shall:

(i) Follow communication protocols established in Schedule 18 - Communications and Stakeholder Engagement Obligations, for interactions with EAS owners and other impacted or potentially impacted parties.

(ii) Work with owners of EAS to perform required inspections. Develop and implement, where required, acceptable mitigation measures and geotechnical instrumentation monitoring requirements and perform pre- and post-construction condition surveys.

(iii) The process of identifying impacts to EAS and developing monitoring and mitigation requirements shall generally be as follows:

A. Step 1: Owners of potentially affected EAS, as identified in the CIAR-1, shall be briefed of the CIAR-1 findings by DB Co.

B. Step 2: CIAR-2 shall be prepared and provided to potentially affected EAS owners and the City.

i. DB Co shall consider each of the above steps as iterative depending on specific requirements of individual EAS owners including but not limited to the City, Utility Companies and other third party owners. DB Co shall be proactive and thorough in their approach.

ii. Develop and maintain a schedule of the EAS and other stakeholders that rely on EAS. This document shall be updated as required and shall be used to track the completion of the impact assessments and obtaining acceptances of the monitoring and mitigation plans including review and approval by all relevant third parties including but not limited to the City, Utility Companies and other third party owners. Submit the updated

document to the City on a quarterly basis in accordance with Schedule 10 – Review Procedure requirements.

9.6 Future Adjacent Construction Requirements and Protection of Project Infrastructure

(a) At the City's request DB Co shall be required to review the existing Developer's Guide prepared by the City as it relates to proximity of proposed Third Party development in relation to the Confederation Line East Extension and Confederation Line West Extension alignment, Lands and Facilities, and provide comments regarding the defined Development ZOI compared with the Project ZOI.

(b) Assist the City with the review of submitted documentation for proposed development throughout the construction. DB Co review comments will be used by the City for approval of DB construction and implementation procedures required prior to construction of future adjacent projects to ensure that no adverse impacts will be caused to the system. DB Co shall coordinate and cooperate with the City with respect to the established development review process recognizing that:

(i) The City will be responsible for performing development reviews in accordance with the process;

(ii) The City will retain an independent consultant and/or utilize internal staff resources to undertake the development reviews;

(iii) The City will be responsible for screening development applications that require a development review;

(iv) DB Co shall be responsible for reviewing and commenting on the draft development review findings; and,

(v) DB Co's contributions to the review process will be formalized in a City by-law to be enacted by the City.

ARTICLE 10 OR174 STREET LIGHTING

10.1 Introduction

(a) This Article presents the roadway lighting Design Criteria and lighting performance requirements for transition highway lighting at the Stations. Transition lighting shall be provided at Station locations and shall be compatible with anticipated future lighting requirements for the full highway. Full lighting shall be provided at the Montreal Road interchange and the new Trim Road intersection.

10.2 Reference Documents

(a) The road lighting design and construction shall comply with the criteria contained in this Article, and all standards, regulations, policies, Applicable Law, guidelines or practices applicable to the Project, including but not limited to each of the following Reference Documents. In the event of a conflict between criteria, commitments or requirements contained within one document when compared with another, the more stringent shall apply:

(i) The criteria contained in this Article;

(ii) Ontario Electrical Safety Code, Electrical Safety Authority – Last Edition;

(iii) MTO – Electrical Engineering Manual;

(iv) Road interchanges Lighting Policy;

(v) Right-of-way lighting policy;

(vi) Roadway lighting ANSI/IES RP-8-14;

(vii) Illumination Warrant Policies PLNG-B-05 & PLNG-B-06;

(viii) Ontario MTO Provincial Highway Directives, MTO;

(ix) MTO accepted luminaire Photometric list;

(x) Policy for spill light beyond MTO Right-of-away and for Light Trespass onto the MTO Right-of-way;

(xi) MTO Drawings (MTOD);

(xii) OPS;

(xiii) DSM;

(xiv) TAC – Guide for design of roadway lighting

(xv) Highway Element Investment Review Guidelines (HEIR);

(xvi) Roadside Safety Manual, MTO;

(xvii) Geometric Design Standards for Ontario Highways, MTO;

(xviii) City of Ottawa standards;

(xix) Other relevant municipal standards;

(xx) NEMA;

(xxi) CSA;

(xxii) IESNA Lighting Handbook;

(xxiii) IEEE;

(xxiv) IEC;

(xxv) **[REDACTED]** Specifications;

(xxvi) **[REDACTED]** Specification.

10.3 Basis for Design

(a) All lighting within the ROW of OR174 including on and off ramps to the OR174 shall conform to MTO Standards, specifications and drawings. Lighting design for all other City ROWs shall conform to the requirements in Article 6 - Roadways, Bus Terminals and Lay-Bys of this Part 2.

(b) Calculations

(i) Lighting level calculations around the Stations shall be completed in conjunction with the final retained concept. DB Co shall use one of the following modeling software programs to develop and verify the design of all the photometric aspects.

A. AGI 32 version 2.36

B. Autolux version 8.05

(ii) Calculations shall include luminaire locations, mounting heights, manufacture's catalog data sheet with product selections and options indicated, lamp data sheet, wattage lumens, color rendering index, light loss factors, and photometric file used.

(iii) DB Co shall provide modeling simulations for each Station. The calculations shall show the calculated lighting levels.

(iv) Voltage drop calculations shall be completed for maximum loads, long run circuits and feeders. Voltage drop shall not exceed 5 %.

(v) DB Co shall submit the lighting calculation results to the City of Ottawa for review in accordance with Schedule 10 – Review Procedure.

(c) General requirements

(i) All lighting poles shall be base mounted with underground ducts and wiring.

(ii) All Roadway lighting Design Criteria shall meet the TAC and MTO requirements.

(iii) DB Co shall design a roadway illumination concept for the following locations :

A. Montreal Road Station

B. Jeanne d'Arc Boulevard Station

C. Orléans Boulevard Station

D. Place d'Orléans Station

E. Trim Road Station

(iv) DB Co shall determine the need for any additional illumination within the Lands, interchanges, crossing roads and adjacent highways if applicable.

(v) DB Co shall design and construct full interchange lighting for the Montreal Road/OR174 and lighting as appropriate for the Trim Road/OR174 intersection, including interchange ramps. The lighting identified above for Montreal Road Station and Trim Road Station and Park and Ride shall be designed in conjunction with the interchange/intersection lighting.

(vi) The products or materials used for the illumination on OR174 shall be as per the MTO standards and shall be LED fixtures.

(vii) Lighting system shall be designed so that the failure of any single luminaire or lighting circuit in areas accessible to the public does not leave an area in total darkness.

(viii) Lighting system shall be energy-efficient using high-efficiency light sources and auxiliary equipment and shall be LED equipment.

(ix) Lighting equipment shall be vandal-resistant where accessible to the general public.

(x) The design of the illumination systems shall provide safety, reliability, and continuous operation.

(xi) Lighting design and construction shall be coordinated with other building elements so as not to affect the expected works.

(d) Design Criteria

(i) The DB Co design shall meet the minimum illumination levels listed below:

A. Luminance

i.	Minimum average maintained	0.6 cd/m2
ii.	Average to Minimum Uniformity ratio	≤ 3.5
iii.	Maximum to Minimum Uniformity ratio	≤ 6

B. Illuminance

i.	Minimum average maintained	9 lux
ii.	Average to Minimum Uniformity ratio	≤ 3.0

C. Veiling luminance

i.	Recommended	≤ 0.3

(ii) DB Co shall perform a detailed illumination analysis for the Station locations.

(iii) The lighting design shall meet the illumination levels and uniformity requirements for both day and night time operations.

10.4 Functional requirements

(a) Luminaires

(i) All roadway lighting fixtures shall be LED type III, cut-off or full cut-off.

(ii) Luminaire housing/refractor assembly shall be designed and fabricated to prevent the ingress of moisture, dirt and other foreign materials.

(iii) Luminaire shall have a minimum of 10 years warranty.

(b) Poles

(i) DB Co shall provide poles in accordance with the City of Ottawa or MTO requirements and the requirements of Clause 10.1 (a) of this Part 2.

(ii) Poles shall be direct buried.

(iii) Poles shall be base mounted.

(iv) Poles shall be installed in Earth. When rock is encountered, the method of installation shall be chosen from those specified in the contract documents. Each method of installation in rock shall be approved by the Engineer prior to construction.

(v) All poles shall be inspected for any obvious flaws, prior to erection.

(c) Cables and wiring

(i) Cables and wiring shall be installed in accordance with the City or MTO Standards.

(d) Grounding

(i) The roadway lighting electrical distribution system shall be solidly grounded, designed to meet the City or MTO Standards.

(ii) The system ground wire and the service ground wire shall be connected to the same neutral bus.

(e) Electrical ducts and fittings

(i) Two different types of ducts shall be permitted. All of them shall meet the City requirements.

A. Rigid PVC ducts using a rigid PVC coupling sleeve;

B. Flexible Polyethylene ducts joined by cutting a sleeve from the next larger size

(ii) Rigid PVC electrical ducts shall be direct buried and installed in trench.

(iii) The materials shall meet the requirements of the City and MTO.

(f) Power distribution

(i) The power distribution system shall provide enough power for the illumination components that require electrical power.

(ii) DB Co shall undertake all coordination with Utility Companies for all required servicing and shall provide a list of all electrical loads to the power Utility Companies.

(iii) DB Co shall provide power installations and connections to all illumination components that require electrical power.

(g) Power supply

(i) Power supply equipment shall comply with the City and MTO Standards.

(ii) Supply control cabinets shall be mounted securely on poles using stainless steel strapping.

(iii) DB Co shall inspect the power supply equipment to ensure that it meets the requirements of the contract. A visual inspection of all the power supply equipment is preferable prior to its delivery.

(h) Coordination with local utilities

(i) DB Co shall coordinate along the DB construction staging with all the involved local utilities.

(ii) DB Co shall plan measures to protect existing underground utilities.