

Document 4: Environmental Impact Assessment and Mitigation Measures

The Brian Coburn Boulevard (BCB) extension and Cumberland Transitway (CTW) will be designed and implemented with the benefit of current planning, engineering, and environmental management practices with regard for the legislation, policies, regulations, guidelines, and best practices of the day. Mitigation measures will be prescribed in the construction contracts and specifications. Descriptions of the practices that should be employed, based on current standards, are provided below. They will be updated and refined during the pre-construction, construction, and operation phases of the project.

“Built-in mitigations” are actions or design features incorporated into the pre-construction, construction, and operational phases that have the specific objective of lessening the significance or severity of environmental effects that may be caused by the project. These can manifest as monitoring plans prepared before construction commences, design elements, or general site recommendations. The plans listed below are considered as standard industry practice for infrastructure construction projects of this nature.

- Air Quality, Noise and Vibration
- Communications Plan
- Construction Waste Management Plan
- Dewatering Management Plan
- Environmental Protection Plan
- Erosion and Sediment Control Plan
- Emergency Response Plan
- Excavated and Imported Materials Management Plan
- Management of Contaminated Materials
- Protocol for Wildlife Protection During Construction
- Spills Response and Reporting Plan
- Traffic Management, Access and Pedestrian Control Plan
- Unexpected Discovery of Archaeological Resources
- Wildlife Protocol for Road Construction/Rehabilitation Projects
- Site Specific Mitigation Measures

After potential effects are predicted and built-in mitigation applied, site specific mitigation measures are identified to reduce specific potential negative environmental effects. These site-specific mitigation measures include specific design features, commitment to future studies and permitting processes triggered by the proposed works, and outlining appropriate approvals required prior to the start of construction.

Monitoring is important to verify the accuracy of the prediction of environmental effects. Monitoring measures may be recommended to determine what effects may actually occur with project implementation and may result in the modification of mitigation measures to improve their effectiveness. Identified monitoring measures include inspection and surveillance, and compliance monitoring. Should the description of the project be changed, additional site-specific mitigation and monitoring may need to be considered.

Geotechnical

Potential Project Interaction: Construction of new infrastructure where the subsurface conditions generally consist of fill overlying a thick deposit of firm to very stiff silty clay. The groundwater level varies from about 1.3 to 2.9 m below ground surface with seasonal fluctuations.

Potential Environmental Effect: The silty clay beneath this site has a limited capacity to support additional stresses caused by foundation loads and/or grade raises.

Proposed Mitigation Measures: Lightweight fill (LWF) materials could be considered for any infilling or embankment exceeding 2.5 m in height, thereby reducing the stress increase on the compressible clay and mitigating the anticipated settlement. Conventional cast-in-place concrete retaining walls and bridges need to be supported on deep foundations driven to bedrock, as shallow foundations would not provide sufficient bearing resistances or acceptable settlement performance for the structure.

Embankment / Excavation Stability

Potential Project Interaction: Embankments will be required at various locations throughout the study area, including at the agricultural / MUP underpass crossing at the Bus Rapid Transitway (BRT).

Potential Environmental Effect: The clay deposit is relatively weak within the study areas and therefore the potential for deep-seated rotational shear failure (i.e., bearing capacity failure) of the embankment subgrades exists.

Proposed Mitigation Measures: Detailed design to confirm lightweight fill material requirements, to avoid excessive settlements and provide an adequate factor of safety against instability. Embankments as high as 2.5 m (such as agricultural / MUP underpass crossing at BRT) constructed with select subgrade material should have adequate factors of safety against static and seismic global instability with side slopes no steeper than 2 horizontal to 1 vertical (2H:1V).

The embankment stability for any embankments higher than 2.5 m, such as the 10 m high embankment west of Navan Road where the use of lightweight fill has been recommended, should be assessed during detailed design once the embankment materials and construction details have been selected.

Groundwater

Potential Project Interaction: Various construction activities, including those requiring foundations for structures, and associated with the Innes Road BRT tunnel may require dewatering during construction.

Potential Environmental Effect: In general, lowering of the groundwater level may increase the effective stress in the overlying soil, resulting in consolidation and settlement of overlying structures, utilities and surface features. That increase in stress can lead to consolidation of sensitive silty clay soil.

Proposed Mitigation Measures: The impact of groundwater lowering should be assessed during detail design for any potential impacts to utilities, roadway and surface features in the area. Further hydrogeological assessment may be required to determine the dewatering radius of influence during detailed design for the proposed excavations near the Innes Road / BRT tunnel and excavations for the Mud Creek realignment.

Unstable Slopes and Ravines

Potential Project Interaction: The proposed road widening and BRT will likely require some encroachment into ravines associated with Green's Creek and Mud Creek. The stability of the Mud Creek slopes has been documented and certain segments are known to be at risk of slope failures, largely connected to active erosion undercutting the toe of slopes within the creek.

Potential Environmental Effect: Encroachment in ravines associated with the watercourses poses potential fluvial geomorphological risks / impacts to Green's Creek and Mud Creek.

Proposed Mitigation Measures: An Erosion Allowance of 8 m will need to be included in the determination of the Limit of Hazard Lands given the active erosion observed along many portions of the Mud Creek bank. This value can be reduced in areas that have an existing flood plain width or where erosion control measures are being considered.

Significant filling of the table land areas could have a negative impact on the stability of the Mud Creek slopes and should therefore be avoided. Erosion allowances will be confirmed during detailed design. Erosion protection is required west of the Renaud Road intersection, where the Mud Creek realignment is proposed and where the recommended set-back may not be achievable.

Detailed and site-specific erosion control measures are considered feasible along Mud Creek and will be developed during detailed design. Erosion protection measures may include but will not be limited to erosion protection rip-rap, placed on a maximum 2 horizontal to 1 vertical front slope up to the 100 year flood level and underlain by a non-woven geotextile, channelling of tributary flows with open "half-pipe" culverts along steep grades and partial infilling and live crib walls.

The clay soil at this site is susceptible to erosion particularly at the outside bends of the valley slopes. Surface water should not be directed to flow over the creek slopes without erosion protection measures. To the extent possible, limit the magnitude of the foundation stresses since higher stresses will result in increased magnitudes of settlement.

Concrete closed box culverts are considered most feasible since the foundation loads are distributed over a larger area, resulting in lower foundation stress levels, and therefore reduced settlement magnitudes, as opposed to a rigid frame open box culvert. However, open box culverts with piled foundations to bedrock could also be considered. Modifications within the Mud Creek Channel should be designed and constructed with oversight and input from a fluvial geomorphologist or other channel design experts.

The Rideau Valley Conservation Authority (RVCA) has raised concerns about slope stability and the risk of landslides at locations where the recommended alignment is close to Mud Creek. RVCA has recommended that additional geomorphological study, slope stability analysis and landslide hazard assessment be conducted prior to finalizing an alignment. The analysis completed for this study provided Limit of Hazard Lands assessment offsets along Mud Creek within the study area that are considered appropriate at the planning stage. The City will undertake more detailed investigations and assessments to manage and identify appropriate mitigation during the design phases.

Geomorphology – Mud Creek Realignment

Potential Project Interaction: The stability of the Mud Creek slopes has been documented and certain segments are known to be active for slope failures, largely connected to active erosion undercutting the toe of slopes within the creek.

Potential Environmental Effect: Realignment of Mud Creek poses potential fluvial geomorphological risks / impacts to the watercourse.

Proposed Mitigation Measures: More detailed hydraulic modeling should be prepared for Mud Creek during detailed design to ensure that the implementation of the proposed measures do not negatively impact adjacent property. Erosion thresholds, cumulative impacts and changes to peak flow resulting from the project will need further consideration during detailed design.

Where stormwater management alone may not be sufficient, recommendations for in-stream works will be made. Where possible, it is proposed to increase the watercourse length by meandering with micro pools, expand the vegetated buffer and increase the resilience of the creek bed and banks by providing a layer of less erodible materials to protect the underlying finer creek substrate.

Surface Water – Stormwater Management (Interim)

Potential Project Interaction: New roadway, widened roadway, connections, transitway and project components will increase the impervious surfaces within the study area.

Potential Environmental Effect: Increase in impervious surfaces (due to widening) will lead to recurring increases in stormwater runoff peak and volume following rain events with enough rainfall to generate runoff into adjacent watercourses.

Proposed Mitigation Measures: Runoff quality treatment and quantity control (peak flow attenuation) will be achieved through one or more of the following:

- Option 1: New perforated storm sewer systems under the widened sections of Innes Road. These new systems would be connected to the existing storm sewer networks with oil and grit separators providing quality control treatment. The capacity of the existing system should be confirmed during detail design stage.
- Option 2: Median can be converted to a Low Impact Development (LID) feature such as rain garden or infiltration trench with subdrains to capture runoff from the roadway through curb cuts. Subdrains would be connected to the existing storm sewer network and would not need any new storm systems as in Option 1.
- Option 3: Enhanced grass swales with rock check dams installed on the north side of the roadway.

The proposed stormwater management controls will be included within the proposed right-of-way. Detailed design should evaluate enlarging culverts to allow for better distribution of water flow where culvert replacements are necessary to mitigate the effects of flash flooding events within Mud Creek.

Surface Water – Stormwater Management (Ultimate)

Potential Project Interaction: New roadway, widened roadway, connections, transitway and project components will increase the impervious surfaces within the study area.

Potential Environmental Effect: Increase in impervious surfaces (due to widening) will lead to recurring increases in stormwater runoff peak and volume following rain events with enough rainfall to generate runoff into adjacent watercourses.

Proposed Mitigation Measures: Runoff quality treatment and quantity control (peak flow attenuation) will be achieved through enhanced grass swales with rock check dams and vegetated filter strips. This approach is preferred due to the rural landscape and preserving the natural character of the Greenbelt. The proposed stormwater management controls and any mitigation measures will be included within the proposed right-of-way.

Detailed design should evaluate enlarging culverts to allow for better distribution of water flow, where culvert replacements are necessary to mitigate the effects of flash flooding events within Mud Creek. Consider Mud Creek and Green's Creek protection and enhancement during detailed design. Natural channel design such as roots wads/live stakes to be considered for bank stabilization and water quality improvements

Fish and Aquatic Species – Mud Creek Realignment

Potential Project Interaction: Both land-based and in-water activities are anticipated to result from the proposed construction works, including: Excavation, Grading, Vegetation Clearing, Use of Industrial Equipment, Change in timing, duration and frequency of flow, and Wastewater Management. The Mud Creek realignment will alter the naturally occurring watercourse.

Potential Environmental Effect: Short-term, localized sediment release may result from run-off associated with various construction activities. Sedimentation of fish habitat may decrease water quality in the short-term, as well as cause respiratory distress and reduced feeding efficiency in fish. The overall goal of the creek realignment will be to improve or limit potential impacts on both aquatic life and aquatic systems, and wildlife and terrestrial systems (e.g. riparian areas).

Proposed Mitigation Measures: The Mud Creek realignment should be designed and constructed with oversight from a fluvial geomorphologist or other channel design experts. It is recommended that the channel design incorporate natural channel features and meanders as well as fish and aquatic habitat. This may include riffles, pools and breeding areas. The goal is to increase and enhance the riparian vegetation buffer along Mud Creek; re-establish areas where riparian features are absent or inadequate. Ensure culverts and/or water crossings are designed to maintain fish passage and natural channel flow regimes to avoid accelerated erosion and scouring in downstream areas.

Development of a site-specific management and monitoring plan for construction is proposed. This plan should include undertaking fish removals and wildlife sweeps before implementing flow diversions and/or dewatering. The plan will have consideration for all works undertaken below the high-water mark and based on final detail design.

A Department of Fisheries and Oceans (DFO) Request for Review (RFR) would be required under the *Fisheries Act* for the proposed channel re-alignment works along Mud Creek. Potential for a *Fisheries Act* Authorization may be required, which would be dependent upon site specific field investigations and final design. An application to RVCA for permit under Ontario Regulation 174/06 – Development, Interference with Wetlands and Alterations to Shorelines and Watercourses will likely be required.

Wetlands - Unevaluated

Potential Project Interaction: Approximately 0.8 hectares of unevaluated wetlands will be directly impacted by the project. Approximately 8 hectares of unevaluated wetlands

may be indirectly affected by project activities when a 120 m buffer is applied to the Ultimate Recommended Plan.

Proposed Mitigation Measures: Undertake field investigations to confirm wetland boundaries at the time of construction. The Federal Policy on Wetland Conservation requires a No Net Loss of Wetland Functions for wetlands on federal property. A project specific Wetland Mitigation Plan will be developed during detailed design in consultation with the NCC. The Plan will identify a series of measures to limit and where required offset potential effects. In accordance with federal policies, a 4:1 compensation will be required for loss of any wetlands on federal land, though compensation does not need to be strictly area based. The compensation may include natural and/or social enhancements and would be subject to review and approval from Environment and Climate Change Canada. Compensation may include eco-passage road culverts as amphibian crossings and/or invasive species (i.e. buckthorn) mitigation, educational signage or other measures as determined in consultation with appropriate authorities.

Significant Wetlands (Mer Bleue Bog)

Potential Project Interaction: The Recommended Plan does not intersect directly with either the Mer Bleue Bog Wetland of International Importance (Ramsar Convention) boundary or the Provincially Significant Wetland (PSW). Note that the Ramsar Site and PSW boundaries are not exactly the same with the PSW boundary extending a short distance north of the Ramsar Site boundary east of Anderson Road and south of Renaud Road

A 120 m buffer has been applied to the recommended design for the purposes of evaluating the potential indirect project environmental effects on the Mer Bleue Bog. The 120 m buffer extends close to the Ramsar Site boundary south of the existing Renaud Road / Anderson Road intersection and extends into the Ramsar Site boundary (4.9 hectares) along a section of Renaud Road west of Bradley Estates. This latter encroachment results from proposed work in this area to relocate this section of Renaud Road outside of the Ramsar Site boundary and also some minor work associated with a new Multi-Use-Pathway (MUP) connection to the Prescott-Russell Trail.

There are potential impacts within the NCC's Mer Bleue Management Area Sector of the Greenbelt beyond the Ramsar boundary. Potential project interactions, environmental effects and proposed mitigation measures for air quality, stormwater management, vegetation and terrestrial habitat, fish and aquatic species, sensitive and at-risk species, and climate change mitigation and adaptation are discussed elsewhere in this report.

A 120 m buffer beyond the project intersects with approximately 3.4 hectares of adjacent PSW in the area of the project east of Anderson Road and south of existing Renaud Road. However, the project will have no direct impact on the PSW, based on a 2 m buffer beyond the project grading limits, and management of construction activities can serve to manage or eliminate impacts.

Potential Environmental Effect: Construction of the project has the potential for temporary indirect impacts on the Mer Bleue Bog during construction including noise, light pollution, and fugitive dust. Change in land use may affect the quality and quantity of the Mer Bleue Wetland, including an opportunity for introduction of exotic and invasive species.

Proposed Mitigation Measures: A project specific *Wetland Mitigation Plan* will be developed during detailed design in consultation with the NCC. This plan will ensure there is no net loss as required by the Ramsar Convention agreement. It will account for mitigation such as the existing portion of Renaud Road currently within the Ramsar boundary that is proposed to be relocated outside of the boundary. The *Ecological Restoration and Enhancement Plan* will be developed with the NCC and have consideration for restoration and enhancement of the area of relocated roadway. The Plan must have clear criteria and defined outcomes.

Design consideration has been given to reducing proximity and potential impacts to the footprint of the wetland. Field investigations to confirm significant wetland features and boundaries are recommended closer to the time of design and implementation to properly identify wetland conditions at the time of construction. It is proposed that the *Ecological Restoration and Enhancement Plan* address management of invasive species, installation of key habitat features, contingency measures and adaptive management. Consultation is required with the NCC regarding implementation of various recommendations and key actions to achieve objectives as outlined in existing wetland management plans including, but not limited to the *Mer Bleue Wetland Management Plan (NCC, 2007)* and the *Ramsar Handbook for Addressing Change in Wetland Ecological Character*.

On-going collaboration with the NCC in advance of design could be undertaken to implement some of the key actions as identified in the 2007 Mer Bleue Management Plan. Actions to consider may include, but not be limited to:

- Develop effective strategies to ensure the long-term viability of species at risk occurring in the Mer Bleue Management Area.
- Map priority habitats to ensure maintenance of composition and structure of native vegetation communities.
- Identify appropriate prevention and control methods for invasive species that threaten native plant species and communities. Promote public awareness of, support for, and involvement in the control of non-native plants.

Species-at-Risk Vegetation (Butternuts and Black Ash)

Potential Project Interaction: Based on the information gathered during the background review and results of the screening level field investigations undertaken by the Study Team in October 2020, there is potential for Butternut to be found within the project area, based on the confirmed candidate habitat present within wooded areas, and other treed

vegetation communities. The Butternut is listed as an Endangered species both federally and provincially and it is prohibited to harm or remove this species under the Endangered Species Act (ESA). Black Ash are currently considered a Threatened species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are expected to be up-listed federally in January 2022, thereby acquiring the same protection as Butternut.

Potential Environmental Effect: Any vegetation clearing (including tree removals) anticipated to occur within the project area resulting from ultimate construction and staging activities has a high potential to impact existing Butternut and Black Ash.

Proposed Mitigation Measures: During Detail Design, on-site field investigations including tree inventories will be conducted to confirm the presence or absence of Butternut and Black Ash, within the project area. A 50 m buffer from the limits of construction will also be incorporated into the field investigations, to account for suitable areas for Butternut, or other SAR trees that may be indirectly affected by construction.

If Butternut is identified on site during the field investigations, a Butternut Health Assessment will be completed for each specimen to determine whether it is retainable (resistant to the Butternut Canker). The results of this assessment may allow for a conditional exception for the removal of a Butternut under Ontario Regulation 242/08. It is recommended that work, including equipment operation and material storage is not carried out within 50 m of any Butternut tree.

At the time of authoring this report, Black Ash are not yet protected and as a result, protection measures are not fully known until it is officially up-listed, which is expected in January 2022. Species specific mitigations will be reviewed at a later time, following the species up-listing.

The proper installation of tree protection fencing, or sediment fencing will clearly delineate the project boundaries and allow for laydown areas, minimizing any indirect impacts to vegetation located outside of the construction zone. Consideration to trees located outside of but within close proximity to the project area should be given when installing tree protection fencing, to minimize damage to their critical root zones.

To avoid impacts to bat species and breeding birds, tree removal activities must be completed outside the species active seasons (i.e. between October 1 and April 8). Vegetation clearing should not extend past the limits of the new road expansion area.

Impacts to Butternut and Black Ash are possible, but are expected to be minimal as the proposed project impact area is primarily located along grassland, crops and pastureland. It is anticipated that any Butternut or Black Ash which need to be removed as a result of the project can be compensated for through new plantings in the general area.

SAR Insects (Monarch Butterflies)

Potential Project Interaction: Based on the information gathered during the background review and results of the screening level field investigations undertaken by the Study Team in October 2020, there is a high probability of occurrence for Monarch butterflies to be found within the project area, based on the confirmed candidate habitat present within cultural meadows and grassland communities. The Monarch is currently designated as a Special Concern species and is not afforded species or habitat protection under the ESA. However, Monarch habitat is protected under the *Provincial Policy Statement (2020)*.

Potential Environmental Effect: Any vegetation clearing and land stripping anticipated to occur within the project area resulting from ultimate construction and staging activities has a high potential to impact Monarch species and habitat.

Proposed Mitigation Measures: During Detail Design, onsite field investigations must be carried out to confirm the presence of Monarch, a general search of candidate habitat (meadows, grasslands). The findings will help determine appropriate best management practices and mitigation measures to ensure conservation of habitats where possible.

If the presence of SAR insects, including Monarch, are confirmed within the project area, a general survey of Monarch foraging movements and milkweed growth should be carried out to develop an understanding of the potential impacts the project would have on the SAR insect population.

Site restoration activities should include the use of native seed mixes along disturbed areas where appropriate. These seed mixes should include pollinator plants, milkweed and butterfly weed to provide habitat and foraging plants for the Monarch.

To minimize incidental impacts to Monarch, areas requiring vegetation clearing/stripping should be maintained (i.e., mowed) prior to and during construction to prevent the growth of flowers or milkweed attractive to Monarchs.

SAR Amphibians and Reptiles

Potential Project Interaction: Based on the information gathered during the background review and results of the screening level field investigations undertaken by the Study Team in October 2020, there is a moderate to high probability for several SAR amphibians and reptiles (including Blanding's Turtle, Snapping Turtle, Western Chorus Frog and Spotted Turtle) to be found within the project area. This is based on confirmed, or potential candidate habitat present within wooded areas, crop and pasture, settlement, and wetland areas.

Potential Environmental Effect: The vegetation clearing and grubbing anticipated to occur within the project area, encroachment on wetlands, and the installation of

roadway/culvert infrastructure resulting from ultimate construction and staging activities has a high potential to impact or displace SAR amphibians and reptiles.

Proposed Mitigation Measures: During detail design, onsite field investigations to target reptiles and amphibians must be carried out to confirm the presence of SAR and SAR habitat as well as associated Significant Wildlife Habitat within the project area. The findings will help determine appropriate best management practices and mitigation measures to ensure conservation of habitats where possible.

Field investigations targeting Turtle Nesting Areas or Turtle Overwintering Areas should also be completed during the design phase to confirm the presence of potential suitable habitat within the project area. Confirmed nesting and overwintering areas are afforded protection under the Provincial Policy Statement. If a SAR turtle is observed at any of the potential nesting sites, that area is considered habitat for SAR and is protected under the ESA and permits may be required depending on the nature of impact.

Vegetation clearing and work within or adjacent to watercourse or wetland areas should occur outside the peak activity period for reptiles which extends from May 01 - October 31.

Wildlife Exclusion Fencing (WEF) should be considered based on the results of the targeted reptile and amphibian studies. Temporary and/or permanent WEF should be installed following recommendations outlined in *Best Management Practices for Mitigating the Effects of Roads on Amphibians and Reptiles Species at Risk in Ontario* (MRNF, 2016), and the *Wildlife Protocol for Road Construction/Rehabilitation Projects* to protect SAR species as well as exclude SAR from entering construction work areas.

During construction, frequent (i.e., weekly) inspections of WEF should be conducted to ensure mitigation measures are properly maintained throughout the construction phase, minimizing accidental harming of amphibian and turtle species within the construction work areas.

As a result of new infrastructure, there is potential for habitat fragmentation following construction. To mitigate impacts to movement patterns of reptiles and amphibians, the design of culverts must consider wildlife passage with a focus on size and openness to ensure crossings meet species requirements.

SAR Birds

Potential Project Interaction: Based on the information gathered during the background review and results of the screening level field investigations undertaken by the Study Team in October 2020, there is a high probability for several SAR birds (including Bobolink, Eastern Meadowlark and Evening Grosbeak) to be present within the project area. This is based on confirmed, or potential candidate habitat present within wooded areas, crop and pasture, grassland, and wetland areas.

Potential Environmental Effect: Any vegetation clearing (including tree removals) anticipated to occur within the project area from ultimate construction and staging activities has a high potential to impact SAR birds through loss of habitat and nesting areas.

Proposed Mitigation Measures: During detail design, onsite field investigations must be carried out to confirm the presence of SAR birds and associated Significant Wildlife Habitat within the project area. The *Forest Bird Monitoring Program* developed by Environment Canada and the Canadian Wildlife Service, and the *Ontario Breeding Bird Atlas (OBBA) Guide for Participants* outline the methods for conducting breeding bird surveys in Ontario. The results of these studies will determine appropriate mitigation measures required for confirmed species and habitats.

Several provincial and federal legislations protect the destruction of bird species and their habitats, including the *Migratory Birds Convention Act* (MBCA). The MBCA protects breeding migratory birds, their nests and young in Canada. To remain compliant with the MBCA, it is recommended that any vegetation removal take place outside the breeding bird season for this region (April 5 – August 30). If the vegetation communities could be considered ‘simple habitats’ (habitats that contain few likely nesting spots or a small community of migratory birds), a nest search may be completed during the nesting period (April 5 – August 30) by a qualified biologist prior to construction. The biologist needs to confirm that the proposed works would not affect the nest or young of a protected species or wait for the young to fledge.

SAR Mammals

Potential Project Interaction: Based on the information gathered during the background review and results of the field investigations undertaken by the Study Team in October 2020, there is a high probability for SAR bats (including Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis and Tri-colored Bat) to be found within the project area, based on confirmed potential foraging and roosting habitat within wooded areas and man-made structures.

Potential Environmental Effect: The vegetation clearing (including tree removals) anticipated to occur within the project area from ultimate construction and staging activities has a high potential to impact SAR bats.

Proposed Mitigation Measures: Field investigations should be completed prior to construction within appropriate forested communities that may support bat species. These should include a bat cavity tree survey during leaf off season, where potential tree cavities for bats may be observed. Specific criteria will assist in identifying a candidate bat tree, including size, tree species and general location. If necessary, an acoustic monitoring program may be initiated to confirm the presence of SAR bats within the project study area. The results of these studies will determine future steps, and mitigation measures taken to protect SAR bats.

To avoid construction impacts to bats (including SAR), limit construction to daytime hours, and shield lights downward should night works be required. To avoid impacts to individuals, tree clearing activities should be during the species inactive season (September 1 – April 8). Vegetation clearing should not extend past the limits of the new road expansion area.

SAR General

Following verification of presence, should any SAR habitat be determined to be impacted by the project works, appropriate mitigations must be implemented on a species-specific basis to avoid impacts. The SAR legislation (provincial and federal) are updated on a regular basis and should be consulted during the detailed design stage to identify any new species under the protection of the Acts or any new Management Plans. Permits / approvals from the Ontario Ministry of the Environment and Climate Change (MECP) and Environment and Climate Change Canada (ECCC) should be obtained as needed.

Land Use – Greenbelt Core Natural Areas and Natural Link Areas

Potential Project Interaction: New infrastructure, including the roadway and transitway will encroach on Greenbelt designated areas including Core Natural Areas and Natural Linkages.

Potential Environmental Effect: Approximately 1 hectare of Greenbelt Core Natural Area and 10 hectares of Greenbelt Natural Link area may be impacted based on the recommended ultimate project footprint (i.e. limits of grading plus a 2.0 m buffer).

Proposed Mitigation Measures: Overall protection / enhancement of the Greenbelt may include general Best Management Practices (BMPs) during construction. The prevention of introduction of invasive species within the project area is highly important, especially around significant and sensitive natural features. Introduction of invasive species (ex: Wild Parsnip) has the potential to reduce species diversity, encroach on wildlife habitat and out-compete native species. To mitigate this potential, all equipment must arrive onsite clean (construction site should include a wash station for vehicles entering the project area), and any invasive growth within the project area or adjacent lands should be controlled. For example, invasive plants can be pulled by hand and disposed of at a municipal landfill site.

It is recommended to work in partnership with the NCC to develop enhancements to the existing Mer Bleue Sector features such as trail improvements, new signage and/or interpretive resources to improve visitor experience and understanding of ecological impacts.

To reestablish vegetation within Greenbelt Core Natural Areas, install erosion blankets with native seed mix coupled with plantings of trees and shrubs to restore disturbed areas as well as exposed areas along watercourses and wetland areas. Seed mixes for these areas should include species which will thrive in that specific soil type and also

include pollinator plants such as milkweed and butterfly weed to provide habitat for Monarch butterflies.

There is potential for habitat fragmentation following construction. To mitigate impacts to movement patterns of reptiles and amphibians, the design of culverts must consider wildlife passage with a focus on size and openness ratio to ensure crossings meet species requirements.

Visual Aesthetics / Landscape

Potential Project Interaction: New roadway and transitway infrastructure will be built in a primarily agricultural and rural landscape.

Potential Environmental Effect: Grade separations associated with the BCB extension and BRT infrastructure may impact established views and existing landscape character.

Proposed Mitigation Measures Three key impact/mitigation zones have been identified based on existing landscape features, including an Ecological Zone, Agricultural Zone and Residential Zone. Design principles identified for the Landscape Strategy have been recommended to maintain a landscape character rooted in the existing land uses. It is recommended that the design incorporate landscaping elements to enhance existing views and vistas, screen undesirable views, and locate the infrastructure to mitigate impacts on sensitive environments. Creating an identifiable character, providing rest areas and benches along pathways and adopting principles of Crime Prevention through Environmental Design Principles will enhance the user experience. Areas that are proposed to receive particular attention as part of the Landscape Strategy include intersections, grade separations, the Mud Creek realignment and the area of the existing Chapel Hill Park & Ride lot and proposed transit station. Additional planting is proposed along the north edge of the Park & Ride lot to provide visual screening between it and the residences located to the north.

Land Use - Businesses

Potential Project Interaction: The recommended ultimate plan will require severing various agricultural land parcels to accommodate the project footprint.

Potential Environmental Effect: Businesses, including farms and NCC lease agreements, may be fragmented due to reduced / loss of access due to new road / transitway alignment / corridor. Approximately 27 hectares of agricultural land (NCC Greenbelt designated) will be required to accommodate the recommended ultimate project footprint.

Proposed Mitigation Measures: Potential impacts to farm access during operation of the new infrastructure have been mitigated via design. This includes: a grade separation for continued farm equipment access; consideration of farm drainage requirements in

the final design and upgrading (as possible) municipal and farm drainage systems in final design.

Land Use – Community Gardens

Potential Project Interaction: New transportation infrastructure may result in road realignments, closed intersections, and changes to the transportation network configuration.

Potential Environmental Effect: The recommended ultimate plan will result in loss of access to community gardens just north of Weir Road once the BRT is built.

Proposed Mitigation Measures: Opportunities will be explored for the potential relocation of the community gardens during detailed design.

Land Ownership

Potential Project Interaction: The new road and BRT will require property from federal and private landowners.

Potential Environmental Effect: Approximately 43.1 hectares of property will need to be acquired from the NCC. This includes 1 hectare for interim widening along Innes Road. Removal of 2 NCC owned buildings (one residence and one shed) will be required for construction of the Transitway. Up to 3 additional NCC owned residences may be affected along the south side of the new roadway although design modifications will be considered to avoid having to remove these buildings. Discussions will need to occur and be in accordance with the land uses at the time of planned construction. Approximately 1.1 hectares of property will also need to be acquired from one private property owner.

Proposed Mitigation Measures: Acquisition of NCC property will be negotiated by the City by means of land purchase, land exchange or land lease. A Federal Land Use, Design and Transaction Approval (FLUDTA) will be required for NCC lands. A federal environmental impact assessment will also be required. Acquisition of the privately owned property will be negotiated by the City.

Noise and Vibration (Ultimate)

Potential Project Interaction: New roadway and transit infrastructure will result in changes to existing noise levels within the study area. The vibration levels resulting from the ultimate design are not expected to exceed the level commonly considered perceptible by most building occupants.

Potential Environmental Effect: Noise levels at a number of areas are greater than 55 dBA with the future conditions having an increase in noise levels more than 5 dBA. A few areas are also expected to exceed 60 dBA. Therefore, noise sensitive areas may be affected by the operation of the new road and transitway.

Vibration levels as a result of the project are not expected to exceed the level commonly considered perceptible by most building occupants. Future vibration would also be negligible with respect to the risk of structural damages or even cosmetic damages to building finishes.

Proposed Mitigation Measures: Noise control measures in the form of noise attenuating berms, walls, or in combination, will be required as part of the project, and have been incorporated into the design for both the ultimate and interim phases.

Noise levels at 2870 Navan Road, 2253 Maurice Street, 70 Whispering Winds Way, in addition to the lots north of Whispering Winds Way and Percifor Way will require mitigation. Noise levels can be reduced by 6 dBA using a 2.8m tall sound barrier in most cases.

The maximum noise reduction possible for the property located at 2253 Maurice Street is 3 dBA, resulting in a noise level of 59 dBA at the Outdoor Living Area (OLA). Given the setback distance from the road and the OLA, implementation of a noise barrier to achieve a 6 dBA reduction is not technically and administratively feasible. Should a barrier be implemented, it is recommended that a 2.5 m barrier be constructed. It is recommended that the requirement for noise mitigation be confirmed based on detailed design.

Noise and Vibration (Interim)

Potential Project Interaction: New roadway and transit infrastructure will result in changes to existing noise levels within the study area. The vibration levels resulting from the interim design are not expected to exceed the level commonly considered perceptible by most building occupants.

Potential Environmental Effect: Future noise levels under the interim plan scenario, are anticipated to be above 60 dBA for 2354 Pepin Court.

Proposed Mitigation Measures: Noise mitigation including a 3 m barrier will be required to reduce noise levels at 2354 Pepin Court by 6 dBA. It is recommended that the requirement for noise mitigation be confirmed based on detailed design.

Archaeological Resources

Potential Project Interaction: Potential construction activities include the use of excavators, dump trucks and heavy traffic as well as vegetation removal. The project will result in a new roadway, transitway, connections, park and ride lot and widening of existing roads. In addition, there needs to be consideration of the locations of construction staging areas and temporary workspaces which have not yet been determined.

Potential Environmental Effect: Ground disturbance has the potential to destroy/disturb archaeological resources.

Proposed Mitigation Measures: A Stage 2 field investigation is required to confirm the nature and extent of disturbance to the existing landscape. In areas where ploughing is possible, Stage 2 pedestrian survey assessment will be implemented. Where ploughing is not possible, the Stage 2 Assessment should consist of a test pit survey at 5 m intervals.

Cultural Heritage Resources – Prescott-Russel Trail/Greenbelt

Potential Project Interaction: Potential construction activities include the use of excavators, dump trucks and heavy traffic as well as vegetation removal. The project will result in a new roadway, transitway, connections, park and ride lot and widening of existing roads. The exact locations of construction staging areas and temporary workspaces have not yet been determined.

Potential Environmental Effect: It is likely that some vegetation removal will occur in the vicinity of the Prescott-Russell Trail in association with construction and operation. This may result in some potential permanent, site-specific and generally negligible impact to the greater setting of the Greenbelt and its recreational and aesthetic values. Construction activities are not anticipated to isolate any heritage attributes from their surrounding environment, context or significant relationship.

Proposed Mitigation Measures: Although the potential indirect impact is predicted to be negligible, the following are recommended: Document existing conditions prior to construction: Limit vegetation clearing to the extent possible; and develop a Landscape Plan

Sewer Infrastructure

Potential Project Interaction: The Innes Road corridor has a large storm sewer (750 mm to 900 mm diameter) and a large sanitary sewer (525 mm diameter) which fall within the grading limits of the proposed ultimate BRT alignment and the interim/ultimate widening of Innes Road. Adjustments or relocations may be required to accommodate the proposed alignment. The Greens Creek Collector Sanitary Sewer (3000 mm diameter) crosses the corridor just east of Blair Road. An access shaft is located approximately 10 m north of Innes Road. The Greens Creek Collector and access chamber do not fall within the grading limits of the proposed alignment although it may require protection during construction.

A large storm sewer (750 mm diameter) on the south side of Navan Road will be in direct conflict with the proposed Navan Road / BCB extension intersection modification. The storm sewer may be required to be relocated or adjusted.

Potential Environmental Effect: Short-term localized service interruptions may occur for various utility services due to component relocations prior to various construction activities.

Proposed Mitigation Measures: Coordination with various stakeholders will be required to confirm locates, protection requirements and relocations. Anticipated component relocations include but are not limited to the following:

- Sewer and manhole adjustments or relocations for the sanitary sewer on the north side of Innes Road.
- Sewer, manholes and catch basin adjustments or relocations for the storm sewer on the south side of Innes Road.
- Sewer, manholes and catch basin adjustments or relocations for the storm sewer on the south side of Navan Road.

Water Infrastructure

Potential Project Interaction: There is a 400 mm diameter watermain under traffic lanes on the south side of Innes Road that may be disturbed during construction. In addition, existing water infrastructure currently located outside of the Innes Road ROW such as fire hydrants will be required to be relocated to accommodate the widening.

Potential Environmental Effect: Short-term localized service interruptions may occur due to component relocations prior to various construction activities.

Proposed Mitigation Measures: Coordination with the Drinking Water Services and Asset Management Branch is needed to confirm protection requirements and relocations. Hydrants on the south side of Innes Road will need to be relocated.

Water Wells

Potential Project Interaction: New road and BRT infrastructure will be constructed and operated in the vicinity of identified water wells – some of which are used for domestic and agricultural purposes. There is potential impact to domestic water wells within 50 m of the project area.

Potential Environmental Effect: There is potential impacts to quality and quantity of water wells during some construction activities that require dewatering as well as potential impacts to water quality from infrastructure run-off during operation.

Proposed Mitigation Measures: Prior to construction, confirm the presence and use of wells. Identify the water source and usage to develop site specific mitigation measures and proposed monitoring requirements if applicable at the time of construction.

Utilities – Hydro One

Potential Project Interaction: There are existing high voltage Hydro One Transmission Facilities within the project corridor. The proposed alignment crosses the overhead transmission lines just west of Navan Road and reduces the existing line clearances.

Potential Environmental Effect: Construction works within the Hydro One Corridor have the potential to affect the environment of the transmission facility. This may include changes to drainage, vegetation removal and other natural environment components as previously discussed.

Proposed Mitigation Measures: Any changes to lot grading or drainage within, or in proximity to Hydro One transmission corridor lands must be controlled and directed away from the transmission corridor. Any construction activities must maintain the electrical clearance from the transmission line conductors as specified in the Ontario Health and Safety Act for the respective line voltage.

As detail design progresses, formally confirm that Hydro One infrastructure and associated rights-of-way will be completely avoided, or if not possible, allocate appropriate lead-time in the project schedule to collaboratively work through potential conflicts with Hydro One.

Utilities – Enbridge to update

Potential Project Interaction: There are 300 mm and 150 mm diameter gas mains which run along the south side of Innes Road. In addition, there is an NPS 16 (400mm) diameter vital gas main which runs through the corridor on the south side of Anderson Road / Renaud Road from Innes Road to the north-south section of Renaud Road. There are large valve boxes for the vital gas main in the area of the existing Anderson Road / Renaud Road roundabout. The vital gas main has three access points for inspection, two are located in front of 2126 and 2170 Anderson Road and the third is located south of the Innes Road and Anderson Road Intersection. The vital gas main will require relocation to accommodate the proposed BRT tunnel crossing at Innes Road.

Potential Environmental Effect: Short-term localized service interruptions may occur due to component relocations prior to various construction activities. No adverse environmental effects are anticipated if the gas lines are properly located and excavation around the gas line is carried out safely. The vital 400 mm diameter gas main is required to be internally inspected every few years in accordance with the CSA Z662 code. The inspection requires access to the main via the three access points using open cut excavations for a few weeks at a time. It is required that these points are protected and access is maintained. Relocating the vital gas main and the associated valves would require an 18–24-month design lead time from Enbridge. The vital gas main will require relocation to accommodate the proposed BRT tunnel crossing at Innes Road.

Proposed Mitigation Measures: The most effective way to reduce risks of working around gas infrastructure is to plan works in locations where gas infrastructure is not located or where the impact can be minimized. As detail design progresses, formally confirm the protection and relocation requirements with Enbridge. Allocate appropriate lead-time in the project schedule to collaboratively work through potential conflicts with Enbridge.

Utilities – Hydro Ottawa

Potential Project Interaction: There are existing Hydro Ottawa overhead power lines and utility poles on the south side of Innes Road which may be in conflict with the project between Blair Road and the proposed BRT tunnel under Innes Road.

Potential Environmental Effect: Some relocation of Hydro Ottawa infrastructure will be required.

Proposed Mitigation Measures: Developments should not reduce line clearances or limit access to Hydro Ottawa infrastructure at any time. Any construction activities must maintain the electrical clearance from the transmission line conductors as specified in the *Ontario Health and Safety Act* for the respective line voltage. Allocate appropriate lead-time in the project schedule to collaboratively work through anticipated conflicts with Hydro Ottawa infrastructure along Innes Road and develop relocation plans.

Utilities – Telecom

Potential Project Interaction: There is existing shallow buried telecom infrastructure on the south side of Innes Road which may need to be relocated to accommodate road widening.

Potential Environmental Effect: Short-term localized service interruptions may occur due to component relocations prior to various construction activities. No adverse environmental effects are anticipated if telecoms are properly located and excavation around telecoms is carried out safely.

Proposed Mitigation Measures: Coordination with the utility provider to confirm protection requirements and relocations is required.

Areas of Potential Environmental Concern

Potential Project Interaction: Due to the relatively long development history, there is a potential to encounter impacted soil and/or groundwater in / on sites as identified in the Phase 1 ESA. The Phase I ESA identified various contaminants of concern, in various locations throughout the study area.

Potential Environmental Effect: Ground disturbance and/or changes to groundwater in areas of potential environmental concern may cause pollutants to migrate and/or become fugitive dust, thus creating a larger area of impact if left unmanaged.

Proposed Mitigation Measures: Should the proposed works be undertaken on or in close proximity to any of the issues of potential environmental concern as identified in the Phase I ESA, further ESA work may be required, including a Phase II in order to assess the soil and groundwater quality associated with the identified issues of potential environmental concern.

Monitoring should be undertaken as determined / required through future study / survey. Any approach related to the management of materials (soil and/or groundwater) during construction will incorporate the results of the Phase II ESA. The management approach may need to be updated, should new information be discovered during future work.

Climate Change Mitigation and Adaptation

In December 2017, the Ministry of the Environment and Climate Change (MOECC) released guidelines titled “Considering Climate Change in the Environmental Assessment Process” which lay out the Ministry’s expectations for project proponents to consider including the potential effects of a project on climate change, and the potential effects of climate change on a project. The City of Ottawa’s Climate Change Master Plan lays out a framework to reduce greenhouse gas (GHG) emissions in accordance with Council’s reduction targets and respond to the current and future effects of climate change.

This EA considered the project’s potential impact on GHG emissions; assessed the resiliency or vulnerability of the project to changing climate conditions; and, identified potential climate change adaptations and future monitoring requirements based on regional climate and severe weather projections to 2050 and beyond.

Climate change presents both challenges and opportunities, particularly in relation to infrastructure design, implementation and operations/maintenance. There are two categories of response to climate change risk, namely:

- a) Mitigation refers to human interventions to reduce GHG emissions, and,
- b) Adaptation refers to any activity designed to reduce the negative impacts of climate change and/or take advantage of new opportunities.

The Interim and Ultimate designs provide new infrastructure for sustainable modes of active transportation and transit, while encouraging carpooling through HOV lanes, thus reducing greenhouse gas emissions. The landscaping plan will include offsetting of any loss of existing trees and vegetation, which will ensure that study area planting continues to provide a carbon sink.

Some of the potential hazards identified for this project include extreme rain impacts to the roadway / transitway, bridges, and culverts; freezing rain impacts to overhead wires, roadways and walkways; extreme heat impacts to public health; and extreme wind impacts to landscaping and emergency access routes. To mitigate these impacts, adaptation options for the project may include engineering and technological solutions, as well as policy, planning, management and maintenance approaches. For example, more frequent storm events will increase runoff of roadway drainage and may require larger roadside ditches and/or storm sewers. Increased frequency of extreme heat days may require additional shading and rest areas/benches along pathways and/or landscaping protection at the Chapel Hill Park and Ride transit station or at bus stops along Innes Road.

It is recommended that additional climate lens assessment be undertaken and that climate change adaptation measures be considered during detail design including those related to flood design, stormwater management, selection of plant species for landscaping and erosion protection. This will be particularly important in relation to the natural channel design for the realignment of Mud Creek. To account for increases in rainfall intensities due to climate change, the design of culverts should be based on projected future rainfall events and the design of storm sewers should be checked against the 100-year storm plus 20%.

It is also proposed that sustainable design principles be followed including consideration of low carbon material selection and sourcing which should be based on a GHG emissions assessment of the project based on the City's carbon calculator or similar tool.