

Schedule 'B' Municipal Class Environmental Assessment: Watermain to Service Downtown Brampton

Short Listed Alternative Solutions and Evaluation

Agenda

1. Culture of Caring Moment
2. Introduction and Background
3. Problem and Opportunity Statement
4. Short-List of Viable Alternatives
5. Evaluation of Short-List Alternatives
6. Next Steps

Culture of Caring Moment

Winter driving can be hazardous where ice or snow may be present.

Before the trip:

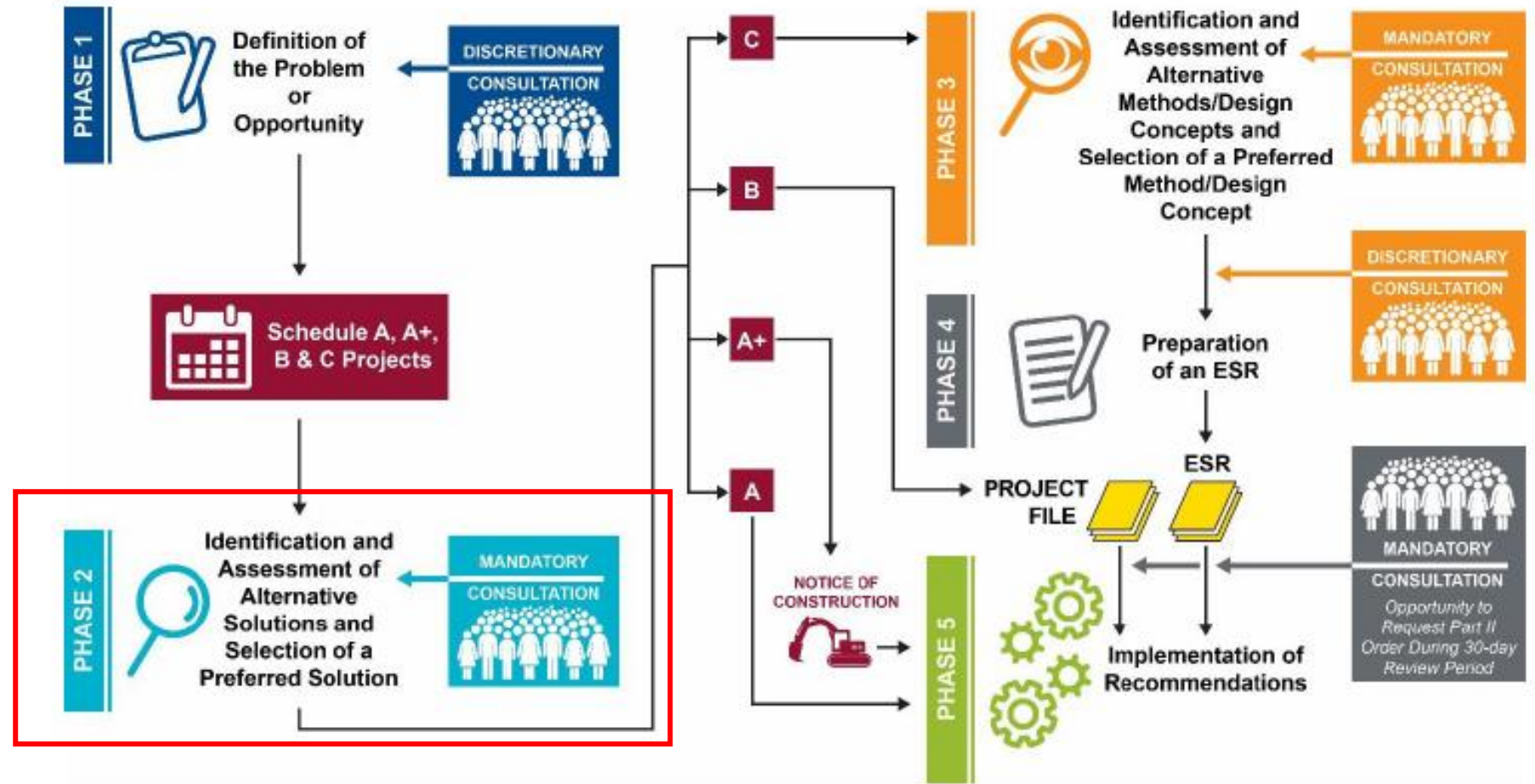
- Consider installing winter tires on your car
- Remove ice and snow off your car
- Fill up windshield washer fluid
- Plan ahead and take the main roads

During the trip, keep a safe distance from other cars whenever possible and adjust driving according to weather conditions. In low visibility situations (winter storms), turn on the car headlight system.

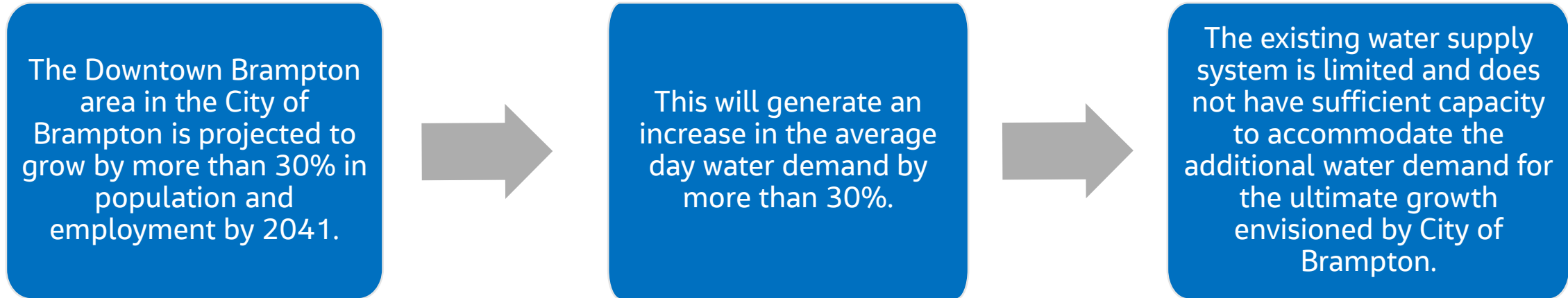


Downtown Brampton Watermain Environmental Assessment (EA)

- Environmental Assessment initiated in 2019
- Phase 1 has been completed
- Currently in phase 2, evaluation of alternatives and recommendation of a preferred solution



Downtown Brampton System Capacity



2020 Master Plan Population and Water Demand		
	2020	2041
Total Equivalent Population	514,745	690,270
Average Day Demand (ML/d)	123	169

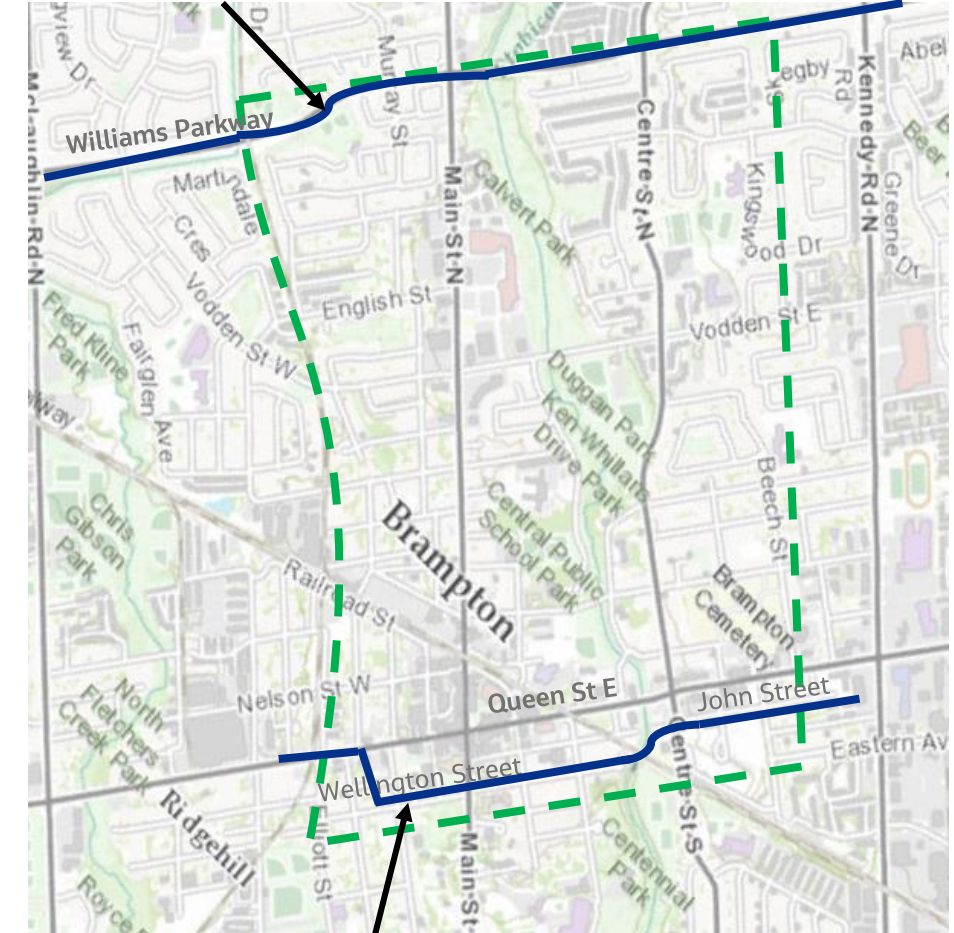
Environmental Assessment- Study Area

Preferred Strategy from Master Plan

(as documented in approved 2013 Master Plan and reconfirmed in 2020 Master Plan update, recently released for public comment)

- Supply Downtown Brampton area from 900 mm transmission main (future) along Williams Parkway and connect to the 600 mm existing watermain along Wellington Street and John Street.
- Provide interconnections to all watermains ≥ 400 mm along the route

900 mm transmission main (future) along Williams Parkway



Existing 600 mm watermain along Wellington Street and John Street

— Existing WM to Connect To - - - Study Area

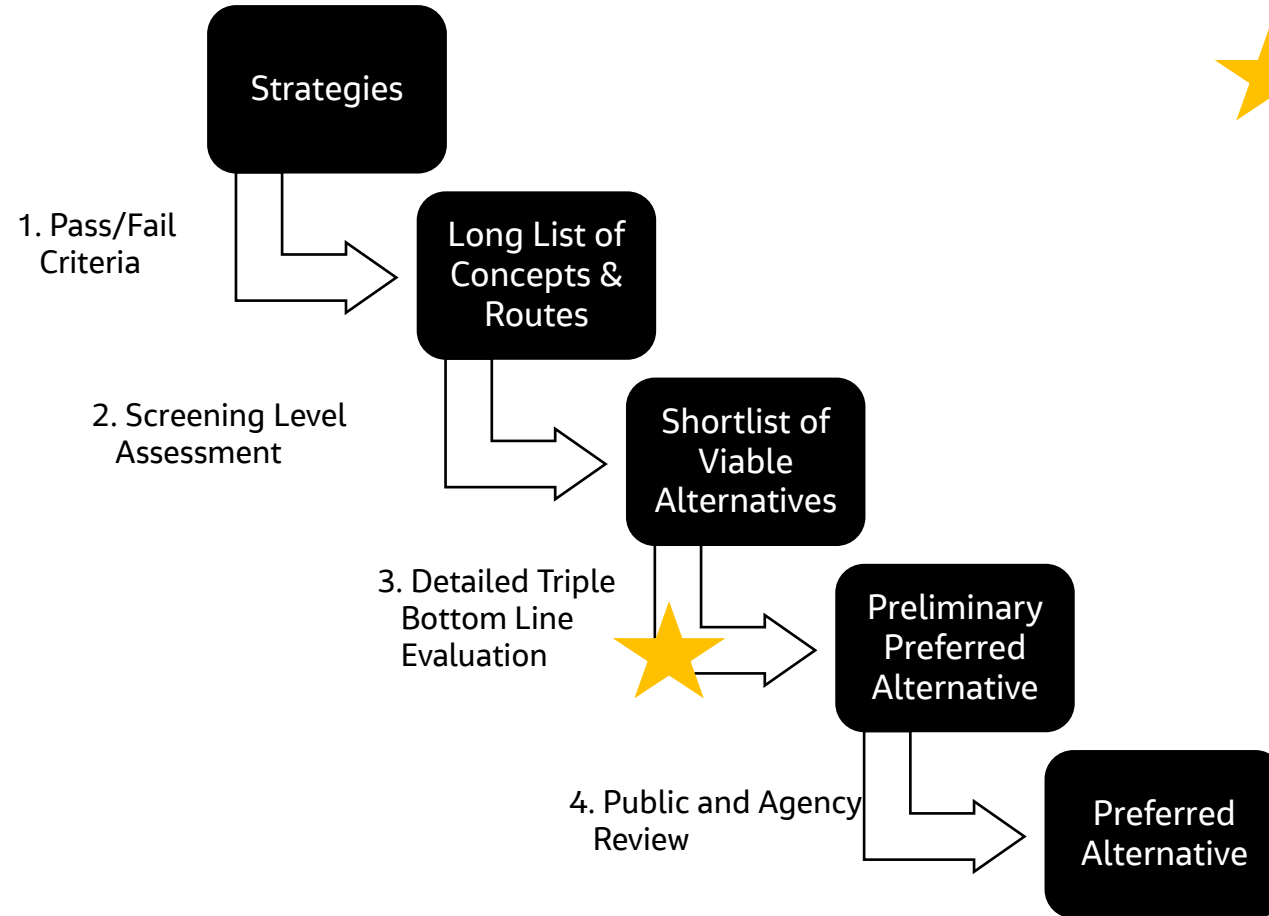
Problem/Opportunity Statement

The purpose of this EA study is therefore to develop and evaluate alternative solutions and recommend a preferred solution for routing of the new 750-mm feeder main.

Objectives

- Design alignment that accommodates required interconnections and provides appropriate solutions to the noted access and operational challenges
- Minimize impacts on key stakeholders, including the City of Brampton, TRCA, and Downtown Brampton BIA
- Where possible, allow for long-term flexibility with managing demand and pressure in the system

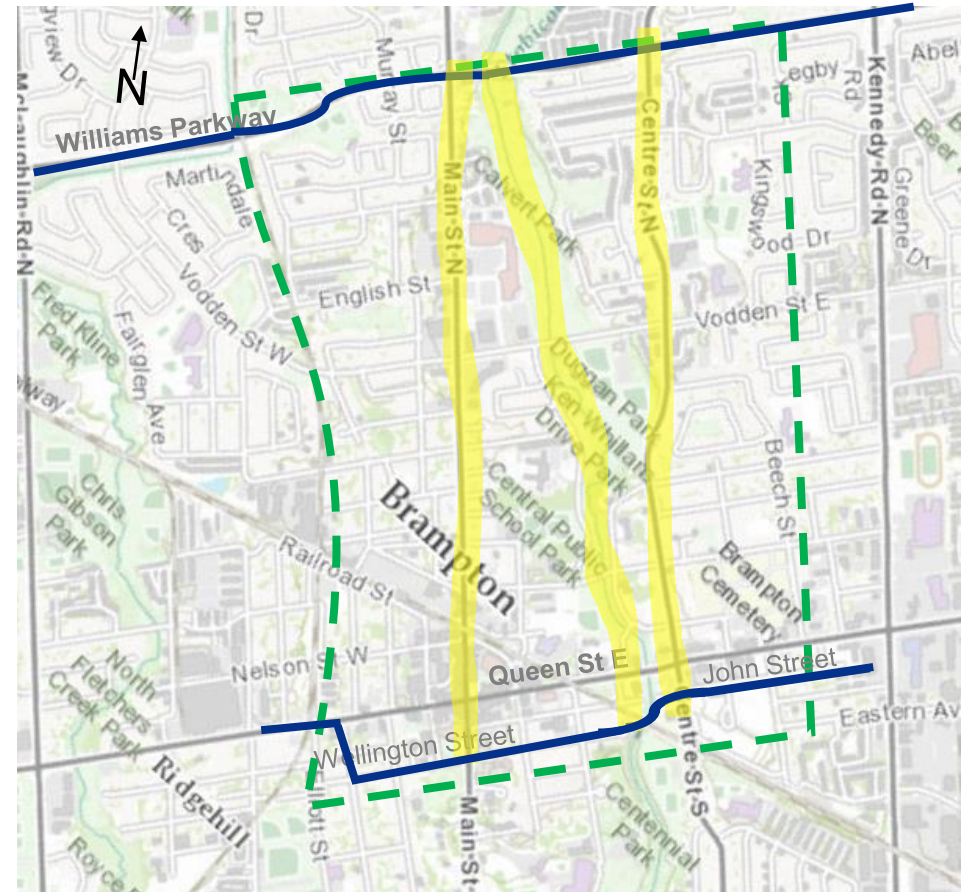
Alternatives Development Process



★ We are here

Long List of Alternatives

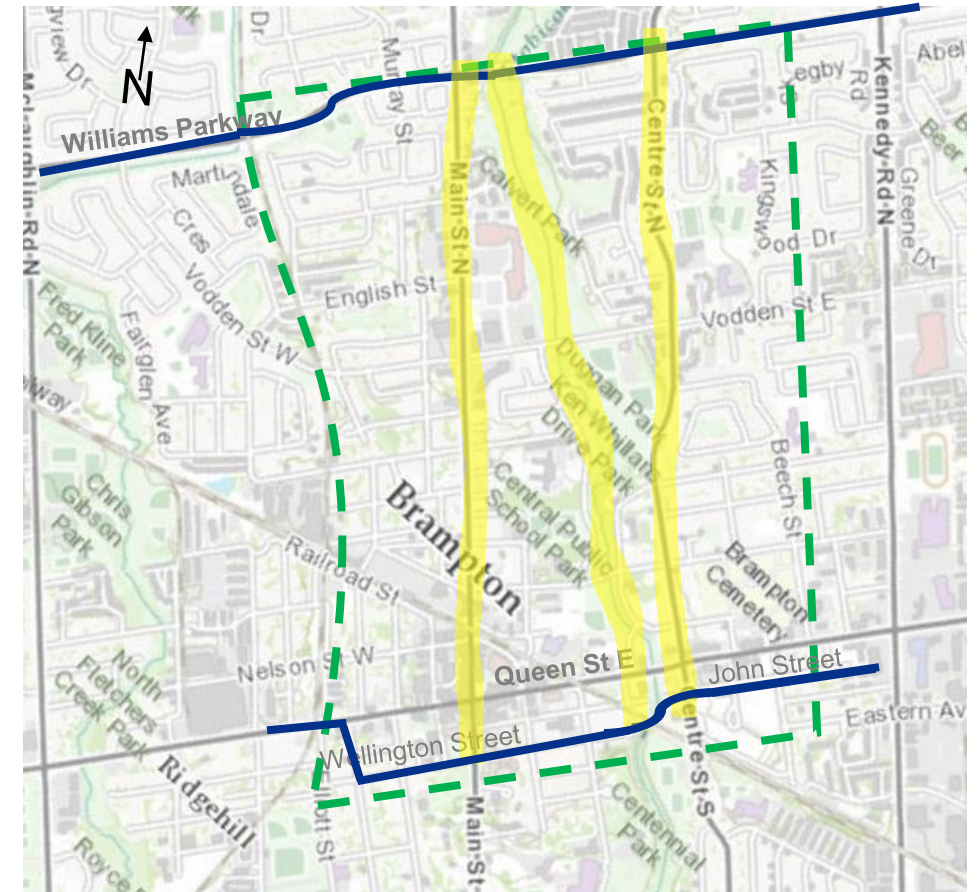
- **Alternative 1: Do Nothing Baseline**
- **Alternative 2: Centre Street**
 - A: Centre Street
 - B: Centre Street and Beech Street
- **Alternative 3: Etobicoke Creek**
 - A: East Side of Creek and Scott Street
 - B: West Side of Creek
- **Alternative 4: Main Street**
 - A: Main Street
 - B: Main Street, Vodden, Centre
 - C: Main Street and Mill Street
 - D: Main Street, Church, Centre
- **Alternative 5: West Neighborhood Route**



- Exist WM to Connect to
- - - Study Area

Background of Short List Alternatives

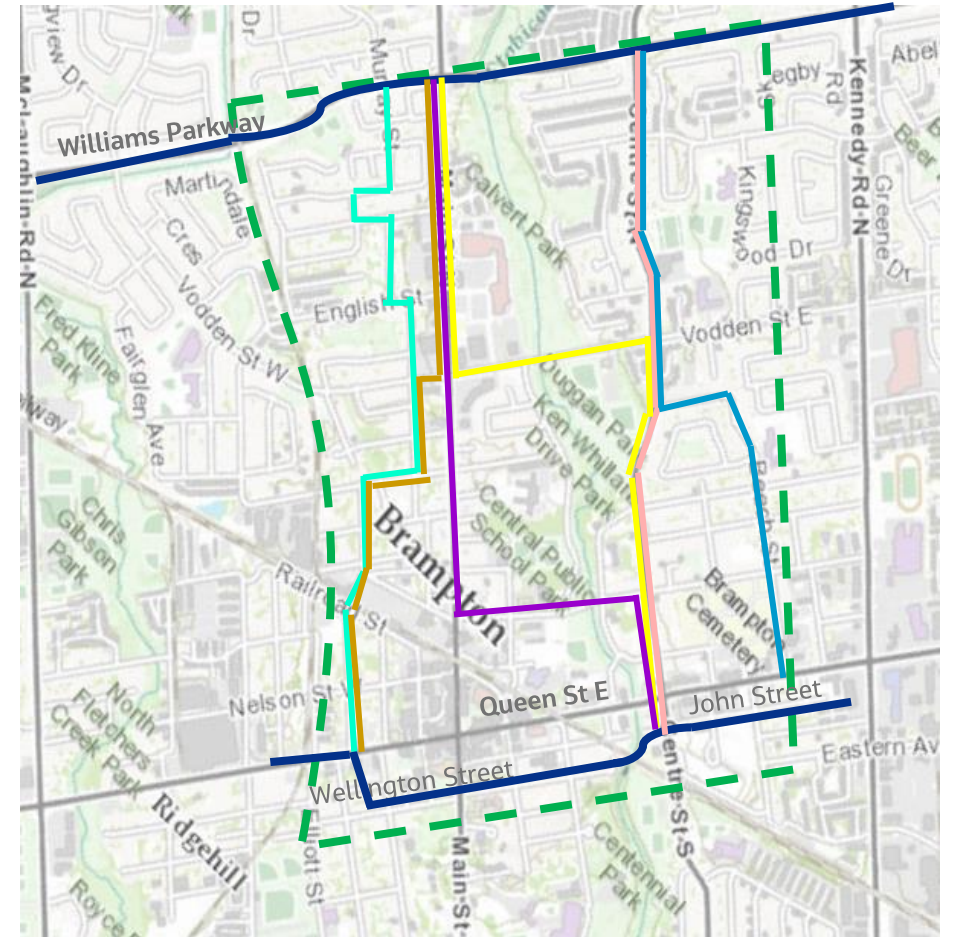
- Three main North/South routes were identified during the long-list evaluation process:
 - Main Street (Major Arterial)
 - Centre Street (Collectors), and
 - Adjacent to Etobicoke Creek
- Routes on local roads were also examined
- Routes that had significant impacts to natural environment, traffic, Major Capital projects in the area or did not meet the Master Plan requirements were screened out during the long-list evaluation process



- Exist WM to Connect to
- - - Study Area

Short List Alternatives

- Alternative 2a – Centre Street
- Alternative 2b – Centre Street and Beech Street
- Alternative 4b – Main, Vodden and Centre Street
- Alternative 4c – Main Street and Mill Street
- Alternative 4d – Main, Church and Centre Street
- Alternative 5 – West Neighbourhood Route



— Exist WM to Connect to
- - - Study Area

Evaluation Criteria

TECHNICAL CONSIDERATIONS

- Implementation Feasibility and Constraints
- Compatibility with Existing/Proposed Infrastructure
- Future Maintenance and Operational Access
- Effectiveness and Flexibility
- Permits and Approvals



NATURAL ENVIRONMENT

- Terrestrial Systems
- Aquatic Systems
- Hydrogeology, Surface and Groundwater
- Soil, Bedrock and Geology
- Contamination



SOCIO-CULTURAL ENVIRONMENT

- Recreational Land Uses and Visual Landscape
- Future Planning Policies/Initiatives
- Disruption During Construction
- Archeological and Cultural Resources



ECONOMIC EVALUATION

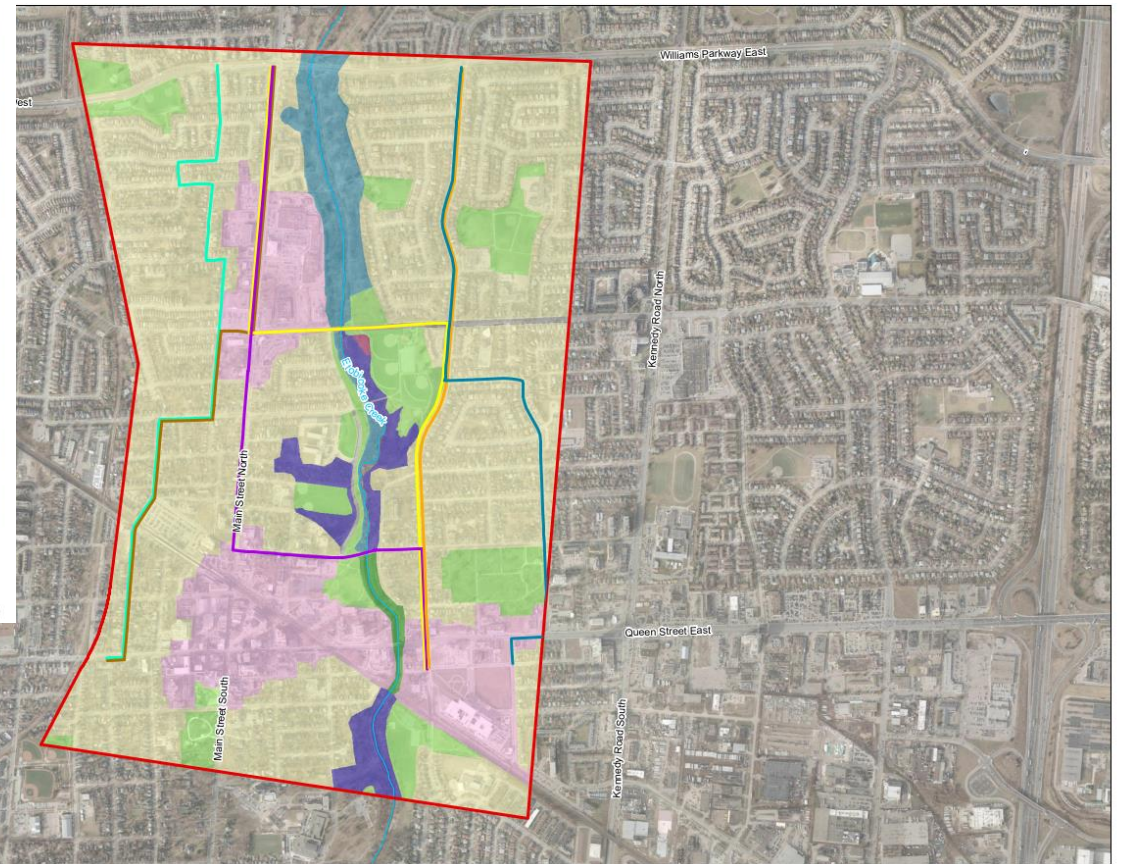
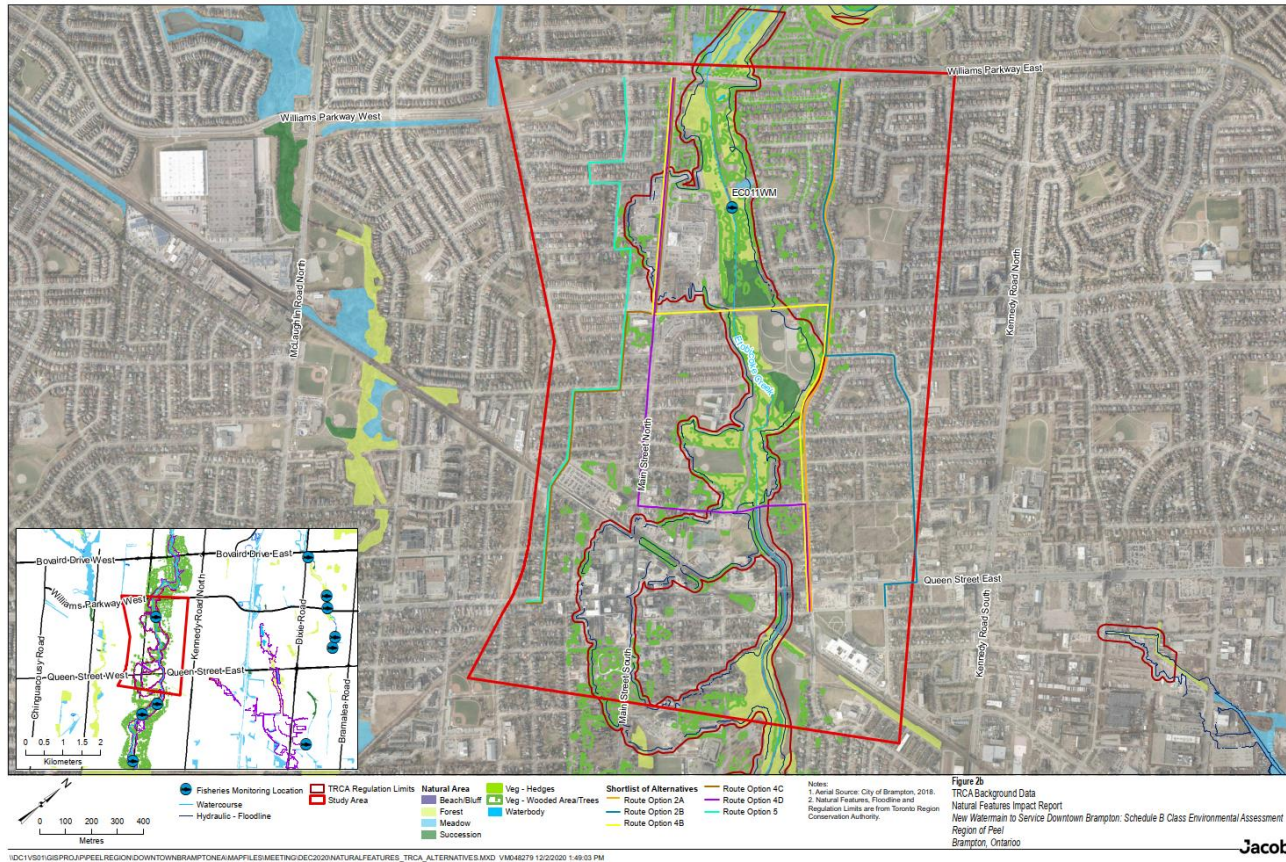
- Capital Cost
- Operation and Maintenance Cost



Archaeology Assessment



Natural Environment Impact Assessment



Alternative 2a – Centre Street

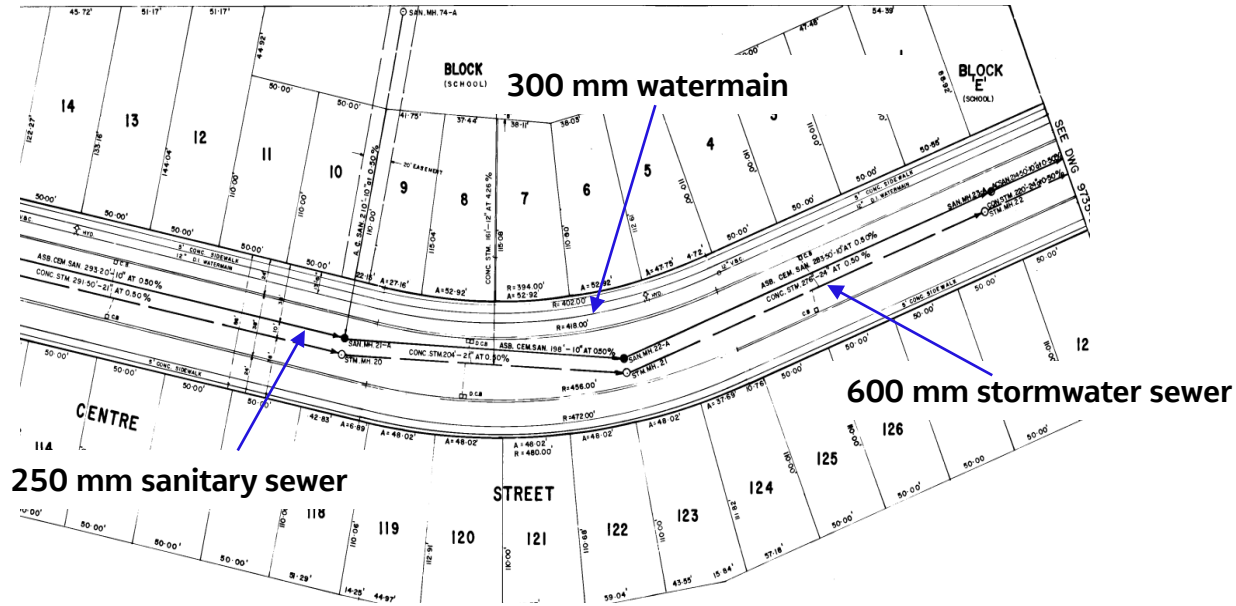


Description

- Approximately 2100 linear meters with route alignment along Centre St. right of way
- Connection points at Williams Parkway and John St.
- Interconnection at 600 mm watermain on Vodden St., proposed 600 mm watermain at Church St., and 600 mm watermain on Queen St.
- Majority of pipe laying proposed as micro-tunnel along existing road right of way due to limited space within road right of way (i.e., existing utilities, limited road width and mature trees)

— Micro-Tunneled ★ Interconnection
— Existing Watermain — Proposed Route

Alternative 2a, 2b, 4b, 4d - Centre Street



Existing utilities along Centre St.



Mature trees along Centre St.

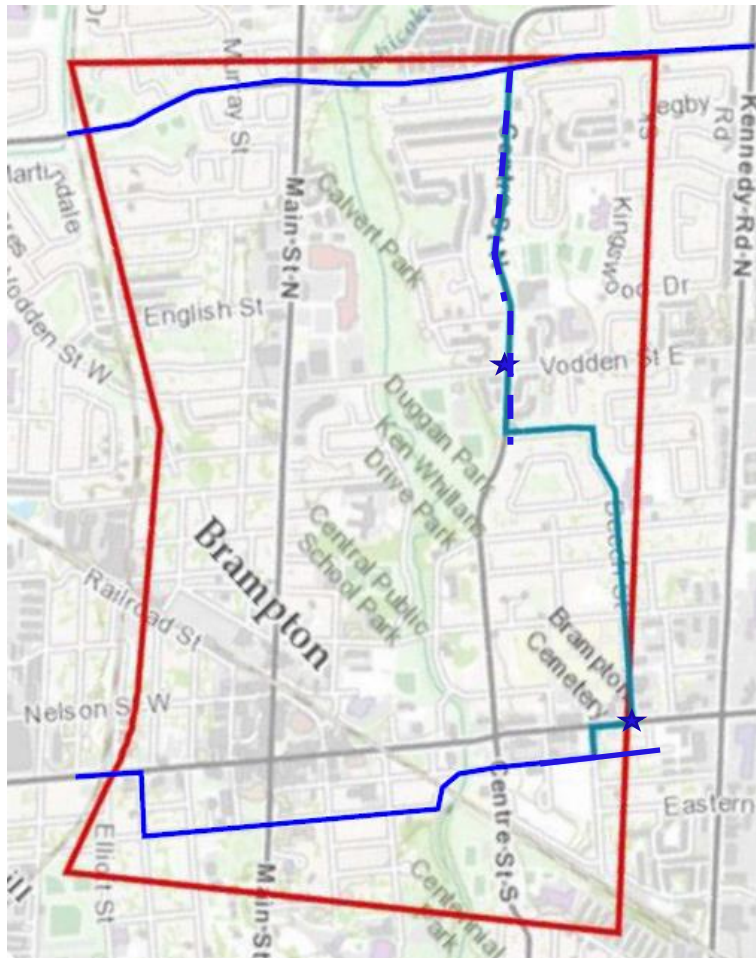
Centre St. proposed to be micro-tunneled (750 mm watermain within 1500 mm casing) based on:

- Collector road 10 m to 12 m width
- Existing utilities include 250 mm sanitary sewer, 600 mm stormwater sewer and 300 mm watermain along the road
- Street trees generally along both sides of the road

Alternative 2a – Centre Street

Evaluation Criteria	Impact Assessment	Score
Technical Considerations	<ul style="list-style-type: none"> • Micro-tunnel (750 mm watermain within 1500 mm casing) for the alignment on Centre St. due to limited space within road right of way • Watermain and chambers within road right of way facilitates access during maintenance and construction • Routing aligns with connections to existing and future watermains • Potential Permits from City of Brampton: Road Closure, Tree Removal (if required for shaft construction), TRCA permit (if shafts are in boulevard). 	Green
Socio-Cultural Environment	<ul style="list-style-type: none"> • Less impact due to traffic diversion, transit and driveways as the watermain is proposed to be laid by micro-tunneling on Centre St. • Detailed design decisions on shaft compounds may impact residential property access and/or require short term road closure • Small section of watermain across Queen St. may be affected by Queen Street BRT project 	Green
Natural Environment	<ul style="list-style-type: none"> • Possible challenges to tunneling expected due to higher number of boulders in ground and bedrock variability • 6 Areas of Potential Environmental Concern may require mitigation during construction (Micro-tunneling may reduce mitigation requirements) • Likelihood of street and parkland mature tree injury/harm due to removals required at shaft locations 	Green
Economic Evaluation	<ul style="list-style-type: none"> • Capital cost of \$40M as a result of tunneling • Average operations and maintenance costs 	Red
Overall Score		Green

Alternative 2b – Centre Street and Beech Street



Description

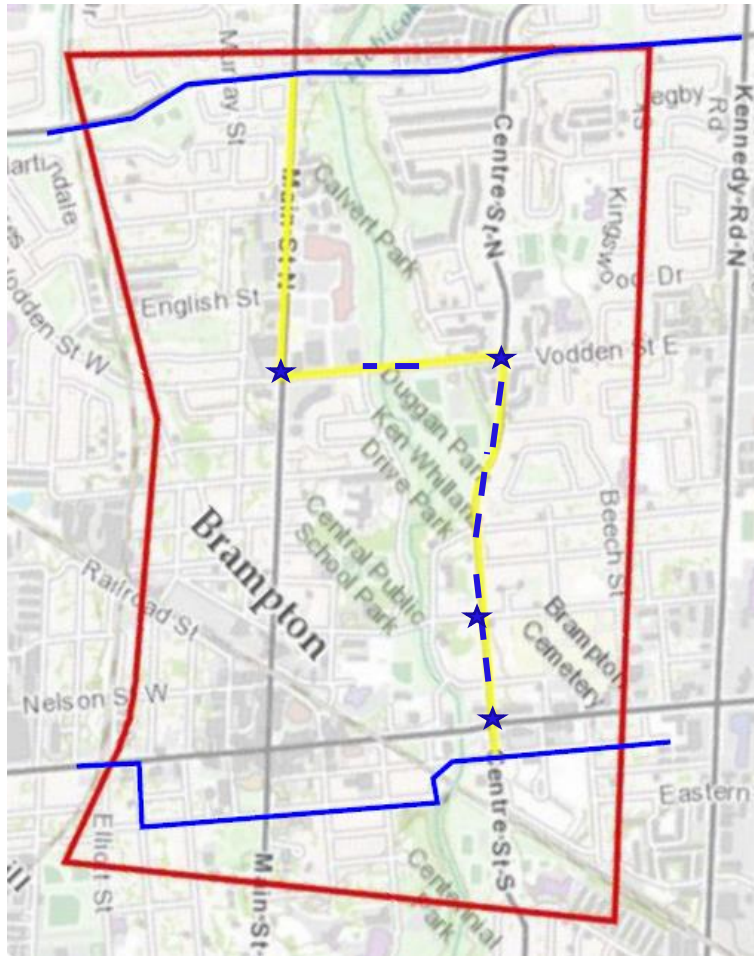
- Approximately 2400 linear meters with route alignment along Centre St. and Beech St. right of way
- Connection points at Williams Parkway and John St.
- Interconnection at 600 mm watermain on Voddan and 600 mm watermain on Queen St.
- Open-cut construction feasible on Beech St. and reduces length of micro-tunnel on Centre St. (required due to limited space within road right of way)

— Micro-Tunneled ★ Interconnection
— Existing Watermain — Proposed Route

Alternative 2b – Centre Street and Beech Street

Evaluation Criteria	Impact Assessment	Score
Technical Considerations	<ul style="list-style-type: none"> • Micro-tunnel (750 mm watermain within 1500 mm casing) for the alignment on Centre St. due to limited space within road right of way • Watermain and chambers within road right of way facilitates access during maintenance and construction • Routing aligns with connections to existing and future watermains, with less opportunity for interconnections than Alternative 2a • Potential Permits from City of Brampton: Road Closure, Tree Removal and TRCA permit (if shafts are in boulevard). 	Yellow
Socio-Cultural Environment	<ul style="list-style-type: none"> • Traffic impact anticipated on Beech Street due to open-cut construction, while traffic impact on Centre Street to be reduced through micro-tunneling • Small section of watermain across Queen St. may be affected by Queen Street BRT project 	Yellow
Natural Environment	<ul style="list-style-type: none"> • Possible challenges to tunneling expected due to bedrock variability • 5 Areas of Potential Environmental Concern may require mitigation during construction (Micro-tunneling may reduce mitigation requirements) • Likelihood of street and parkland tree injury/harm due to removals required at shaft locations 	Green
Economic Evaluation	<ul style="list-style-type: none"> • Capital cost of \$30M as a result of tunneling on Centre St. • Average operations and maintenance costs 	Yellow
Overall Score		Yellow

Alternative 4b – Main, Vodden and Centre Street



- — Micro-Tunneled
- ★ Interconnection
- Existing Watermain
- Proposed Route

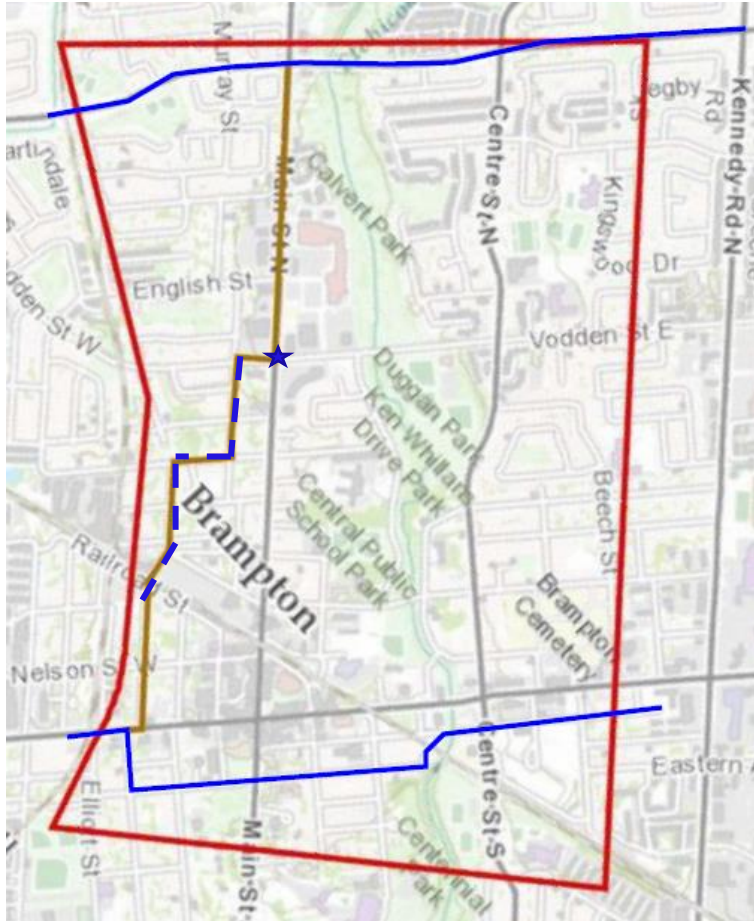
Description

- Approximately 2780 linear meters with route alignment along Main St., Vodden St. and Centre St. right of way
- Connection points at Williams Parkway and John St.
- Interconnection to 600 mm watermain on Vodden St., 600 mm watermain on Queen St and proposed 600 mm watermain on Church St.
- Wider right of way allows for open cut on Main St. and Vodden St. with Centre St. micro-tunneled due to limited space within road right of way and an 80 m creek crossing micro-tunneled to limit environmental impacts

Alternative 4b – Main, Vodden and Centre Street

Evaluation Criteria	Impact Assessment	Score
Technical Considerations	<ul style="list-style-type: none"> • Micro-tunnel (750 mm watermain within 1500 mm casing) for the alignment on Centre St. due to limited space within road right of way and for the Etobicoke Creek crossing on Vodden St. • Potential for chambers at Etobicoke crossing to be located on TRCA land • Potential Permits for Creek Crossing: TRCA, MECP (potential impact to habitats) and DFO (micro-tunneling to avoid the impacts) • Potential Permits from City of Brampton: Road Closure and Tree Removal 	Yellow
Socio-Cultural Environment	<ul style="list-style-type: none"> • Significant impact due to traffic diversion on Main street, a Major Arterial Road, as watermain laid by open cut and partial lane closures required • Shaft compound proposed on TRCA land • Shaft location on Vodden St. Creek Crossing requires stage 2 archaeological assessment 	Red
Natural Environment	<ul style="list-style-type: none"> • Likelihood of street, ravine, woodland and parkland tree injury/harm due to removals required at shaft locations • Potential direct and indirect adverse effects to fish and fish habitat during construction at shaft locations • Potential impacts on surface water quality during construction as shaft compound close to Creek crossing, may require sedimentation control • 9 Areas of Potential Environmental Concern may require mitigation during construction 	Red
Economic Evaluation	<ul style="list-style-type: none"> • Capital Cost of \$33M as a result of tunneling at Creek crossing and Centre St. • Average operations and maintenance costs 	Yellow
Overall Score		Yellow

Alternative 4c – Main Street and Mill Street

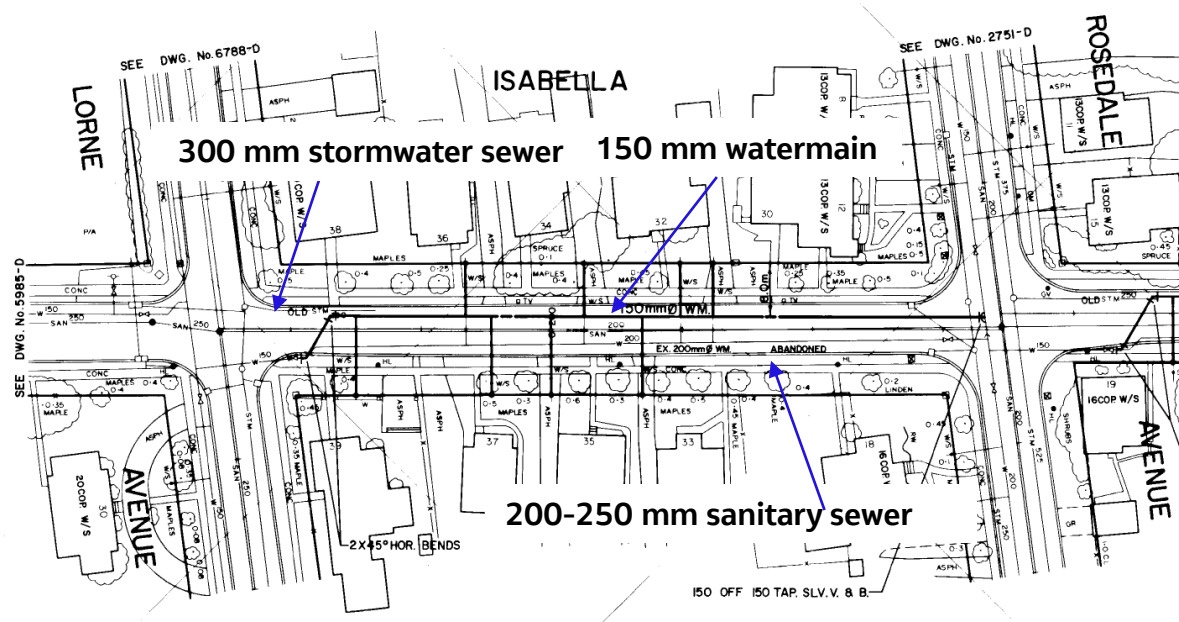


- Micro-Tunneled
- Existing Watermain
- ★ Interconnection
- Proposed Route

Description

- Approximately 2380 linear meters with route alignment to be along Main St., Vodden St., Isabella St., Rosedale St., and Mill St. right of way
- Connection points at Williams Parkway and Queen St.
- Interconnection to 600 mm watermain at Vodden St.
- Proposed as open cut with 80 m rail crossing using micro-tunnel to limit socio-cultural impacts and 860 m micro-tunnel on Isabella St., Rosedale St. and Mill St. N. due to limited space within road right of way (i.e., existing utilities, limited road width and mature trees)

Alternative 4c, 5 - Isabella Street



Existing utilities along Isabella St.

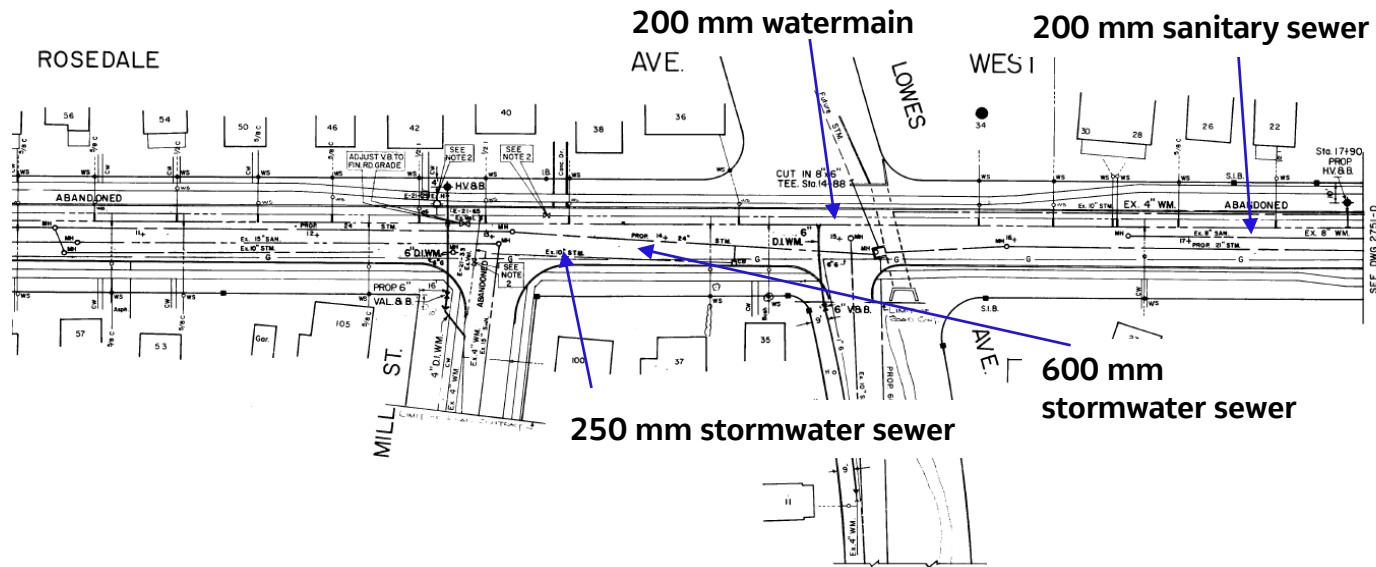


Mature trees along Isabella St.

Isabella St proposed to be micro-tunneled (750 mm watermain within 1500 mm casing) based on:

- Local road 7.5 m to 10 m width
- Existing utilities include 150 mm watermain, 200-250 mm sanitary sewer and 300 mm stormwater sewer
- Abandoned utilities include 200 mm watermain
- Street trees generally along both sides of the road

Alternative 4c, 5 - Rosedale Street



Existing Utilities along Rosedale St.

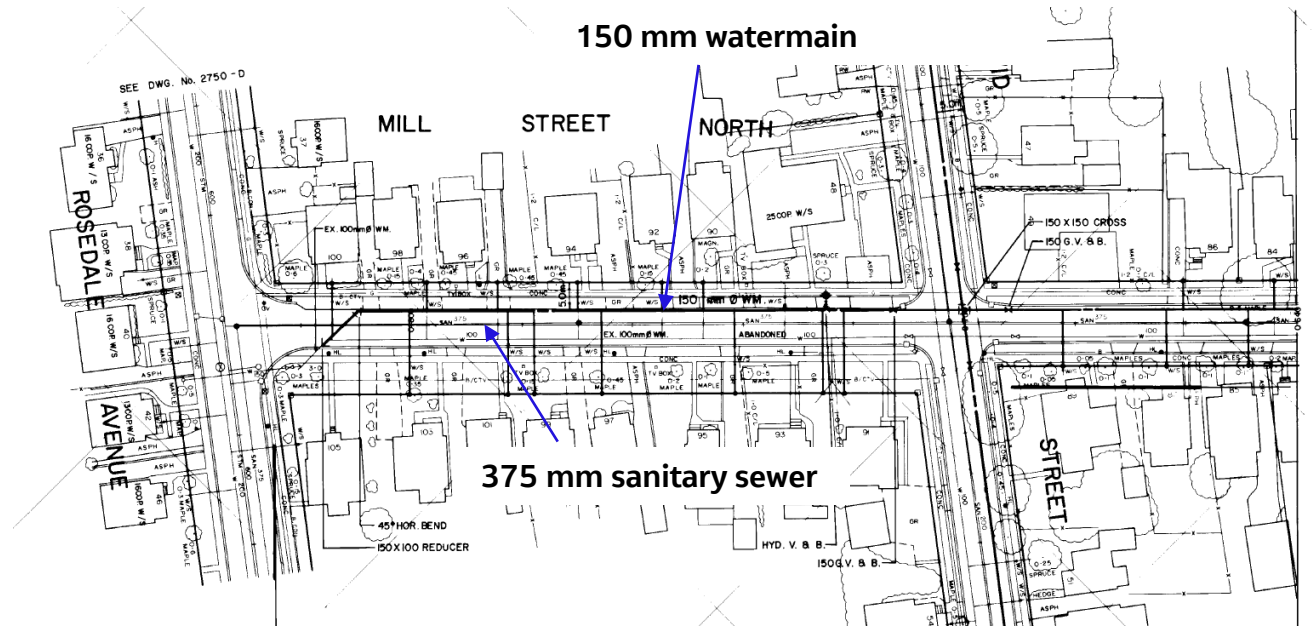


Mature trees along Rosedale St.

Rosedale St proposed to be micro-tunneled (750 mm watermain within 1500 mm casing) based on:

- Local road with 9.5 m width
- Existing utilities 200 mm watermain, 200 mm sanitary sewer and 250 mm and 600 mm stormwater sewer
- Mature street trees generally along both sides of the road

Alternative 4c, 5 - Mill Street North



Existing Utilities along Mill St. N



Mature trees along Mill St. N

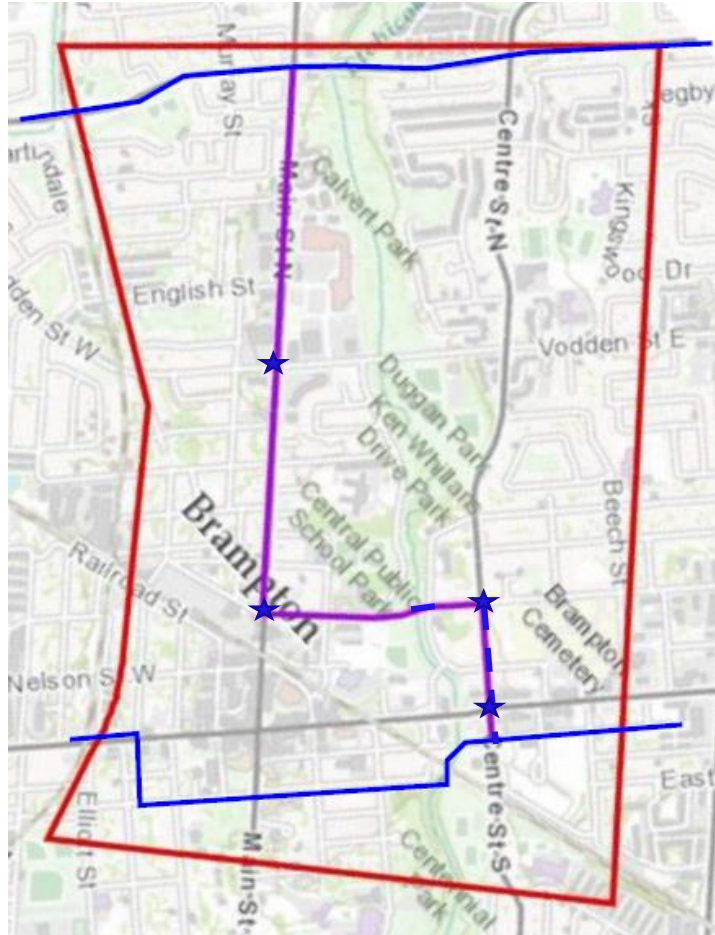
Mill St N proposed to be micro-tunneled (750 mm watermain within 1500 mm casing) based on:

- Collector road (Rosedale Ave to Queen St) with 8 m to 10 m width
- Existing utilities include 375 mm sanitary sewer and 150 mm watermain
- Street trees generally along both sides of the road

Alternative 4c – Main Street and Mill Street

Evaluation Criteria	Impact Assessment	Score
Technical Considerations	<ul style="list-style-type: none"> • Micro-tunnel (750 mm watermain within 1500 mm casing) for the alignment on Isabella St., Rosedale St. and Mill St. North due to limited space within road right of way and micro-tunnel for CN Railway Crossing • Potential for chambers at CN rail crossing to be located on CN Railway parking area • Allows for less interconnection to existing and future watermains than other alternatives • Potential Permits for Railway Crossing: CN Rail Permit • Potential Permits from City of Brampton: Road Closure and Tree Removal 	Red
Socio-Cultural Environment	<ul style="list-style-type: none"> • Shaft compound locations will impact Go Station parking and a mechanics shop parking during construction • The route will be impacted by CN Rail track expansion project and Dennison Avenue Expansion Project • Direct impacts to 1 cultural heritage resource (CNR station) 	Red
Natural Environment	<ul style="list-style-type: none"> • 9 Areas of Potential Environmental Concern may require mitigation during construction • Likelihood of street and parkland tree injury/harm due to removals required at shaft locations 	Yellow
Economic Evaluation	<ul style="list-style-type: none"> • Capital cost of \$32M as a result of tunneling at Isabella St, Rosedale St. Mill St. North and CN Railway crossing • Average operations and maintenance costs 	Yellow
Overall Score		Red

Alternative 4d – Main Street, Church Street, and Centre Street



- Micro-Tunneled
- Existing Watermain
- ★ Interconnection
- Proposed Route

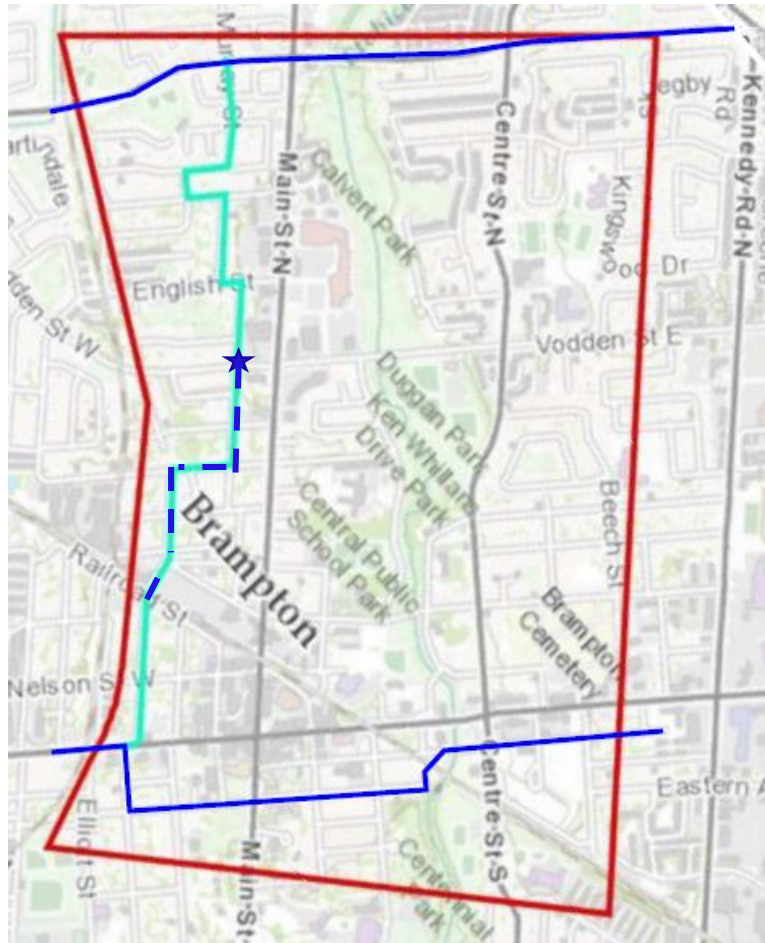
Description

- Approximately 2710 linear meters with route alignment to be along Main St., Church St. and Centre St. right of way
- Connection points at Williams Parkway and John St.
- Interconnection to 600 mm watermain at Vodden St., future 600 mm watermain on Church St. at Main St. and Centre St. intersections and 600 mm watermain at Queen St.
- Proposed as open cut with 80 m creek crossing using micro-tunnel to limit environmental impacts and Centre St. micro-tunnel due to limited space within road right of way (i.e., existing utilities, limited road width and mature trees)

Alternative 4d – Main Street, Church Street, and Centre Street

Evaluation Criteria	Impact Assessment	Score
Technical Considerations	<ul style="list-style-type: none"> • Micro-tunnel (750 mm watermain within 1500 mm casing) for the alignment on Centre St. and Etobicoke Creek crossing • Potential for chambers at Etobicoke crossing to be located on TRCA land • Potential Permits for Creek Crossing: TRCA, MECP and DFO • Potential Permits from City of Brampton: Road Closure and Tree Removal • Hydraulic modelling confirms that this alternative provides highest hydraulic benefit 	Yellow
Socio-Cultural Environment	<ul style="list-style-type: none"> • Significant impact due to traffic diversion on Main St., A Major Arterial Road, as watermain laid by open cut and partial road closures required • Shaft compounds proposed on TRCA land • Church Street shaft compound will temporarily impact walkway to Etobicoke Creek Trail during construction • The route will be impacted by Downtown Brampton Flood Protection Project and Riverwalk Project • Shaft location on Church St. Creek Crossing requires stage 2 archaeological assessment 	Red
Natural Environment	<ul style="list-style-type: none"> • Likelihood of street, ravine, woodland and parkland tree injury/harm due to removals required at shaft locations • Potential direct and indirect adverse effects to fish and fish habitat during construction at shaft locations • Potential impacts on surface water quality during construction as works are undertaken close to Creek crossing • 7 Areas of Potential Environmental Concern may require mitigation during construction 	Red
Economic Evaluation	<ul style="list-style-type: none"> • Capital Cost of \$25M • Average operations and maintenance costs 	Green
Overall Score		Yellow

Alternative 5 – West Neighbourhood Route



- Existing Watermain
- Proposed Route
- - - Micro-Tunneled
- ★ Interconnection

Description

- Approximately 2600 linear meters and follows smaller residential streets west of Main St. (Murray, Garden, Bagshot, Archibald, Murray, English, Isabella, Rosedale, Mill St.)
- Connection points at Williams Parkway and Queen St.
- Connection to 600 mm watermain at Vodden St.
- Proposed as open cut with 80 m rail crossing using micro-tunnel to limit socio-cultural impacts and 860 m micro-tunnel on Isabella St., Rosedale St., Mill St. North due to limited space within road right of way (i.e., existing utilities, limited road width and mature trees)

Alternative 5 – West Neighbourhood Route

Evaluation Criteria	Impact Assessment	Score
Technical Considerations	<ul style="list-style-type: none"> • Micro-tunnel (750 mm watermain within 1500 mm casing) for the alignment on Isabella St., Rosedale St. and Mill St. North and CN Rail crossing • Shaft compounds are located on CN rail parking and road right of way • Potential for chambers at CN rail crossing to be located on CN Railway parking area 	Red
Socio-Cultural Environment	<ul style="list-style-type: none"> • Potential Permits for Railway Crossing: CN Rail Permit • Potential Permits for Road Works: City of Brampton: Road Closure and City of Brampton Tree Removal • Shaft compound locations will impact Go Station parking and a mechanics shop parking during construction • The route will be impacted by CN Rail track expansion project and Dennison Avenue Expansion Project • Direct impacts to 1 cultural heritage resource (CNR station) 	Red
Natural Environment	<ul style="list-style-type: none"> • 7 Areas of Potential Environmental Concern may require mitigation during construction • Likelihood of street and parkland tree injury/harm due to removals required at shaft locations 	Yellow
Economic Evaluation	<ul style="list-style-type: none"> • Capital cost of \$33M as a result of tunneling at Isabella St, Rosedale St. Mill St. North and CN Railway crossing • Average operations and maintenance costs 	Yellow
Overall Score		Red

Comparison of Short List Alternatives

Route Alternative	Technical Considerations	Socio-Cultural Environment	Natural Environment	Economic Evaluation	Total
Alternative 2A – Centre St.	Green	Green	Green	Red	Green
Alternative 2B – Centre + Beech St.	Yellow	Yellow	Green	Yellow	Yellow
Alternative 4B – Main, Vodden Centre	Yellow	Red	Red	Yellow	Yellow
Alternative 4C – Main + Mill St	Red	Red	Yellow	Yellow	Red
Alternative 4D – Main, Church, Centre	Yellow	Red	Red	Green	Yellow
Alternative 5 –W. Neighbourhood	Red	Red	Yellow	Yellow	Red

Alternative 2A is recommended as the preferred alternative

Recommended Preferred Alternatives

- Alternative 2A is recommended as the preferred alternative:
 - No creek or rail crossings which reduce permitting requirements and impacts to the natural environment
 - Trenchless construction reduces impact on tree inventory and existing utilities
 - Only minor impact to Region of Peel and City of Brampton growth initiatives (Queen Street BRT project)
 - Short-term traffic and property impacts may occur at tunnel shaft locations

Next Steps

- Review preliminary alternative with City of Brampton and TRCA
- Confirm preliminary preferred alternative
- Schedule Public Information Centre #1

Questions?

Jacobs

Challenging today.
Reinventing tomorrow.



Additional Information



Evaluation Criteria - Technical Considerations



Comparative Criteria	Description	Main Considerations
Implementation Feasibility and Constraints	<p>Feasibility of implementation in terms of:</p> <ul style="list-style-type: none"> • Constructability (Method of construction) • Construction accessibility • Construction Constraints while working within proximity of critical infrastructure like utility corridors, major roads, employment areas, institutional areas, hydro corridors, railways and watercourse including crossings. • Construction compounds/Corridor • Length of pipe 	<ul style="list-style-type: none"> • Open cut method of construction preferred due to lower capital cost and risk. • Preference is to locate watermain and chambers within road right of way avoid requirement for temporary access road construction (compounds within TRCA lands and Railway lands require permits) • Railway or watercourse crossing less preferred due to delays caused by permits and approvals requirement (Crossing is assumed to be installed by micro-tunnelling method). • Shorter length of watermain preferred to keep the capital cost and potential traffic disruption low.
Compatibility with Existing/Proposed Infrastructure	<p>Potential impacts of existing/proposed infrastructure on functions or performance of proposed watermain.</p>	<ul style="list-style-type: none"> • Preference for maximum opportunities and minimum conflicts with existing/planned infrastructure. • Potential impact of existing/proposed infrastructure on performance or function of proposed watermain
Future Maintenance and Operational Access	<p>Technical viability to maintain operational access and servicing</p>	<ul style="list-style-type: none"> • Access to watermain and associated chambers via right of way preferred to avoid easements.
Effectiveness and Flexibility	<p>Effectiveness and Flexibility in being able to meet current and future demands/variations/expansion requirements; flexibility in future regulatory requirements</p>	<ul style="list-style-type: none"> • Impacts and opportunities associated with future scope of works
Permits and Approvals	<p>Ease of receiving permits and approvals, including the agency approvals necessary</p>	<ul style="list-style-type: none"> • Minimum number of key stakeholders to obtain permits/approvals from preferred. • Minimum extent of infrastructure within lands of concern to each of the key stakeholders preferred.

Evaluation Criteria - Socio-Cultural Environment



Comparative Criteria	Description	Main Considerations
Recreational Land Uses and Visual Landscape	Potential to impact existing parks and open spaces or impact the character of the existing community (i.e., interfere with views)	<ul style="list-style-type: none"> • Potential to impact existing parks and open spaces, land use and TRCA Property not preferable. • Potential to impact character of the existing community, businesses or interfere with views not preferable.
Future Planning Policies/Initiatives	Compatibility with Master Plan and Region of Peel & City of Brampton growth initiatives	<ul style="list-style-type: none"> • Complies with 2020 Water and Wastewater Master Plan for the Lake-based Systems (MP). • Potential to impact Region of Peel and City of Brampton growth initiatives as identified in the Phase 1 report not preferable.
Disruption During Construction	Disruption due to traffic management to existing community during construction.	<ul style="list-style-type: none"> • Traffic impacts are rated based on amount of traffic diversions anticipated from the closure and the amount of capacity remaining on major parallel routes to accommodate these diversions. • Transit impacts are rated based on the number and length of bus routes impacted with higher order transit (e.g. Zum routes) rated as being more severe. Proximity of road closures to GO station accesses also factored in the rating. • Local access and cycling impacts were rated as combined category factoring adjacent land uses (schools, parking, businesses, emergency and medical services, etc.), driveway impacts and required closure of bike routes or impacts to cycling friendly streets.
Archaeological and Cultural Resources	Potential impacts to known archaeological and cultural resources or ongoing operation	<ul style="list-style-type: none"> • Potential impact to archaeological and cultural resources not preferred. • Route within or adjacent to cultural heritage resource not preferred.

Evaluation Criteria – Natural Environment



Comparative Criteria	Description	Main Considerations
Terrestrial Vegetation and Wildlife	<p>Proximity to and potential Impacts due to construction to:</p> <ul style="list-style-type: none"> • Sensitive features and regulated lands • Local wildlife and their habitat • Vegetation and trees 	<ul style="list-style-type: none"> • Presence of terrestrial species potentially affected temporarily and/or permanently not preferred • Area of temporary or permanent loss of sensitive terrestrial feature not preferred
Aquatic Systems	<p>Proximity to and potential impacts due to construction to:</p> <ul style="list-style-type: none"> • Local aquatic species and habitat • Aquatic species at risk 	<ul style="list-style-type: none"> • Presence of aquatic species potentially affected temporarily and/or permanently not preferred • Area of temporary or permanent loss of aquatic feature not preferred
Hydrogeology, Surface and Groundwater	<p>Hydrogeologic setting:</p> <ul style="list-style-type: none"> • Potential impact on the quantity and quality of surface water and groundwater 	<ul style="list-style-type: none"> • Temporarily and/or permanently changes in quantity and quality of surface water bodies, such as creek not preferred • Temporarily and/or permanently changes in groundwater takings quantity and/or location not preferred
Soil, Bedrock and Geology	Geology and geotechnical considerations	<ul style="list-style-type: none"> • Bedrock depth and variability: More variation in the top of bedrock leads to possible challenges in tunneling, tunnel depth also influenced by bedrock depth and variability • Higher number of boulders within soil pose difficulties during tunneling
Contamination	Considerations regarding contaminated areas	<ul style="list-style-type: none"> • The number of areas of potential environmental concerns (APEC) which has the potential for contamination above MECP standard as identified in the Desktop Environmental Site Assessment. Lower number preferred.

Evaluation Criteria – Economic Evaluation



Comparative Criteria	Description	Main Considerations
Capital Cost	Estimated Capital Costs (2020 cost estimate including 30% contingency)	<ul style="list-style-type: none"> • Capital costs includes engineering, construction and commissioning. • Construction cost includes: Tunneling, Shaft construction, CPP pipe, steel liner, shaft preparation and restoration. Also includes open cut excavation, re-instatement, mobilization/ demobilization, traffic management, bonding, dewatering, etc. • Lower capital cost alternative preferred
Operation and Maintenance Cost	Estimated Operational and Maintenance Costs	<ul style="list-style-type: none"> • Operational expenditure incurred throughout the life of the asset, including labour, power and consumables and asset monitoring.