Technical Memorandum:
Review Alternative
Trucking Routes for
Site 5 / Stanley Park

Ottawa Combined Sewer
Storage Tunnel (CSST)

City of Ottawa Contract No.
ISD14-2036

Prepared for:
City of Ottawa

Prepared by:

Stantec Consulting Ltd.

February 3, 2017

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Sign-off Sheet

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TECHNICAL MEMORANDUM: REVIEW ALTERNATIVE TRUCKING ROUTES FOR SITE 5 / STANLEY PARK

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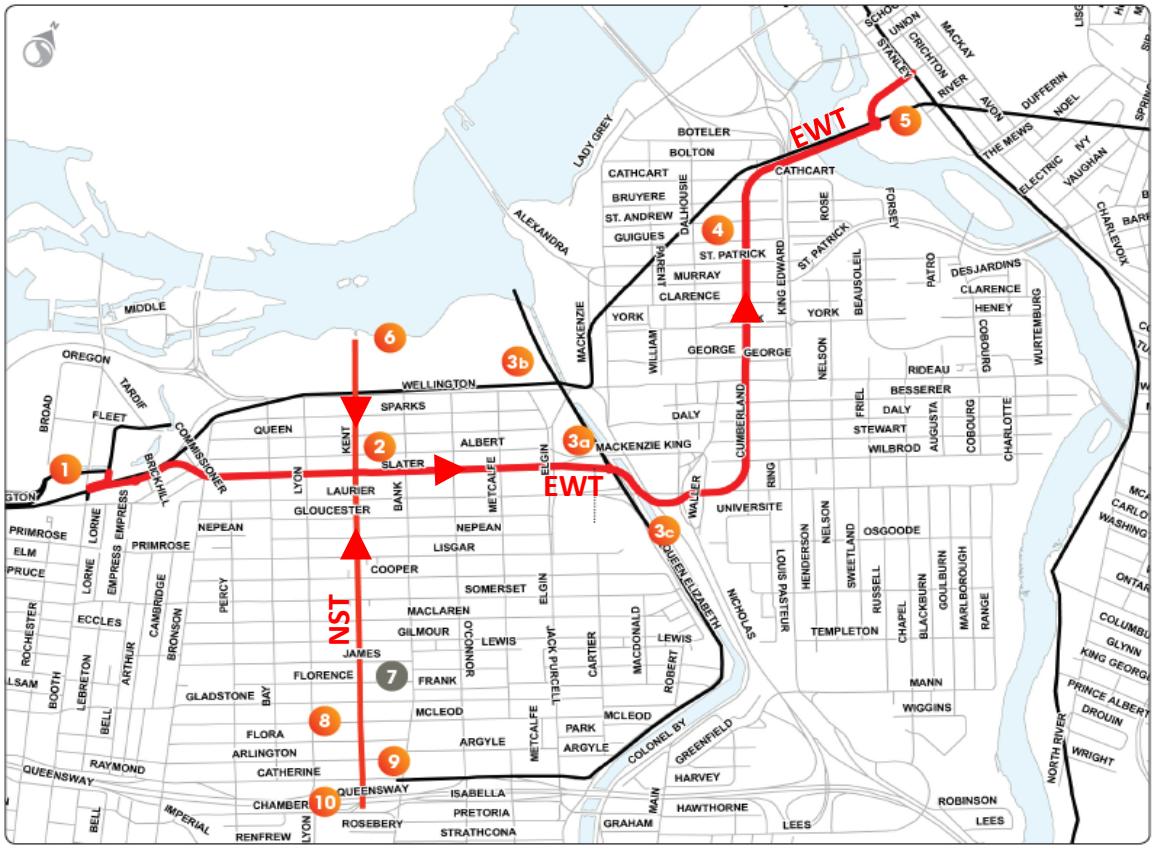
1.0 Introduction

The purpose of this technical memorandum is to review and evaluate the potential routes for construction vehicle access to Site 5 of the Ottawa Combined Sewer Storage Tunnel (CSST), which is located at Stanley Park in the New Edinburgh neighborhood. **Exhibit 1** illustrates the location of the CSST and the location of Site 5 at the east termination of the East-West Tunnel (EWT). This technical memorandum will document the review undertaken in assessing the potential trucking routes to and from Site 5, through the New Edinburgh neighborhood.

Exhibit 1: CSST Key Plan



2.0 Site 5 Staging Area

In order to meet the City Council's mandated Combined Sewer Overflow (CSO) control objectives, as well as meet Provincial policy objectives, the Combined Sewage Storage Tunnel (CSST) is designed to reduce the volume and frequency of combined sewer overflows at four existing combined sewer outfall locations within the urban core. This includes the control of CSO's from the Rideau River Collector (RRC) to the John Street outfall located on the east side of the Rideau River and within the New Edinburgh community.

The CSST project was tendered and awarded in 2016. Site 5 of the CSST project is the downstream end of the East-West Tunnel (EWT) and the location where combined sewer flows stored in the CSST during a storm event will flow back into the Interceptor Outfall Sewer (IOS), which conveys sewer flows to the Robert O. Pickard Environmental Centre (ROPEC). The IOS Connection Chamber at Site 5 is located within Stanley Park on the northeast shore of the Rideau River. In addition to the IOS Connection Chamber, Site 5 also includes the EWT Outlet Chamber (a surge attenuation tank), the Rideau River Collector Overflow Diversion Chamber (at Queen Victoria and River Lane), and the related diversion sewer (i.e. directing combined sewage from the RRC/John Street overflow pipe to the CSST). **Exhibit 2** presents an illustration of the new infrastructure and construction staging area at Site 5 within Stanley Park, along Queen Victoria, and at the intersection of Queen Victoria and River Lane.

Exhibit 2: Site 5 Staging Area

As tendered, and in accordance with the contractor's preliminary proposed construction sequencing, Site 5 is the launch site for the tunnel boring machine (TBM) that will excavate the EWT. The excavation shaft required to launch the TBM will be repurposed to form the EWT Outlet Chamber (surge attenuation tank) and IOS connection once the tunneling of the EWT is completed. A tunnel launch site is also the location from where the excavated material (tunnel spoils) is extracted. The material excavated at the face of the TBM comes out the back of the unit and is conveyed down the excavated tunnel in rail carts to the launch pit.

The CSST construction Contract was awarded in August 2016 and the contractor's schedule indicates a launch shaft construction at Site 5 commencing in March 2017 in preparation for a TBM launch in February 2018. The contractor reports that it will take the better part of a year to prepare the shaft, tail-tunnel, TBM assembly and supporting rail system in preparation for the launch.

After several months of agency consultations and negotiations throughout the design period (2013-2015), and preliminary land-owner approval during the Environmental Assessment (EA – 2009-2013), all approvals are in place for the March 2017 commencement of launch shaft construction at Site 5.

3.0 Infrastructure Required at Site 5

Key Existing Infrastructure

The Rideau River Collector (RRC) is an existing trunk sewer that collects wastewater and some stormwater from local sewers and conveys the combined flows in a northerly direction along the east side of the Rideau River and the Riverside/Vanier corridor. When the RRC was first constructed, it conveyed untreated flows directly to the Ottawa River via an outfall sewer that crosses the New Edinburgh neighborhood along River Lane/John Street. In the mid-1960s, the Interceptor Outfall Sewer (IOS) was constructed in an east-west direction roughly parallel to the Ottawa River. The IOS was designed to intercept all of the wastewater and some of the stormwater from combined outfalls that previously discharged untreated to the river and convey these sewer flows easterly to a new waste water treatment facility – the Robert O. Pickard Environmental Centre (ROPEC) located on Shefford Road, near the Greenbelt. The IOS is a large diameter trunk sewer that intercepts the RRC at the intersection of River Lane/Keefer Street at an underground facility called the Keefer Regulator.

During dry weather flows or modest wet weather flows, the IOS has capacity to intercept all of the flow from the RRC and convey it to the treatment facility at ROPEC. However, during large rain events, the IOS reaches capacity and the Keefer Regulator directs the balance of the flow as a combined sewer overflow (CSO) to the Ottawa River via the old RRC overflow along River Lane/John Street. It acts like a relief valve to mitigate the risk of sewer backups and basement flooding. The overflow is one of the four large CSO outfall locations in the core area of the City where CSOs are to be captured in order to attain the mandated control objectives.

Rationale for CSST Infrastructure Requirement at Site 5

The CSST's primary purpose is to intercept and provide additional storage for combined sewage during wet weather events and thus prevent CSOs from reaching the Ottawa River. It is critical that the four primary CSO locations in the urban core be intercepted by the CSST to achieve the mandate of the project. In addition to three CSO outfall locations west of the Rideau River (i.e. Ottawa River outfalls at LeBreton Flats, and Rideau Canal), this includes the RRC/John St. Overflow (i.e. CSO outfall) on River Lane, north of Keefer Street.

The East-West Tunnel (EWT) of the CSST also roughly parallels the IOS and connects to the IOS at the upper and lower ends of the EWT. The CSST will provide an opportunity for the City to occasionally divert flows from the IOS to the CSST in order to do inspections, repair and maintenance along the IOS – something that has not been possible since the IOS was constructed in the mid-1960s due to the amount of flow in the IOS. Part of the mandate of the CSST project is to provide redundancy to the IOS in the most critical areas, which especially include the watercourse crossings (Rideau Canal and Rideau River). A failure of the IOS under the Rideau River could be catastrophic. Consequently, the City has deemed that providing redundancy to the Rideau River crossing (i.e. extending the CSST across the Rideau River) is a priority to mitigate this risk.

In addition to providing this system reliability, the CSST infrastructure is primarily required in the New Edinburgh area because that is where the existing critical infrastructure is located. This is where the IOS intercepts the RRC and where the RRC/John St. Overflow needs to be intercepted by the CSST. The closest area that has sufficient open space to allow the staging area requirements is Stanley Park.

Infrastructure Required at Site 5

Site 5 is the location where the CSST reconnects to the IOS and also the location where the RRC Overflow needs to be intercepted. Infrastructure required at Site 5 as part of the CSST project include:

- CSST/IOS Connection Chamber in Stanley Park
- CSST Outlet Chamber (surge attenuation tank) in Stanley Park. The purpose of this tank is to attenuate and dissipate the energy from the forward and backward waves of water that can materialize as the tunnel fills and water at this downstream location meets with a closed outlet to the IOS.
- RRC Overflow Chamber at Queen Victoria and River Lane (on the RRC/John St. Overflow Sewer north of Keefer along River Lane).
- New activated-carbon Odour Control Facility to replace the existing biofilter.

4.0 Trucking Route Descriptions

There are a number of potential trucking route options that could be considered. For the purpose of this review, a finite number of reasonable and representative routing options need to be identified, understanding that the list is not exhaustive and that there could be several potential modifications that could be applied to most of these considered options. It should also be noted that these routes could be considered as providing bi-directional access to Stanley Park, or it may be preferable to come in along one route and leave along a different route.

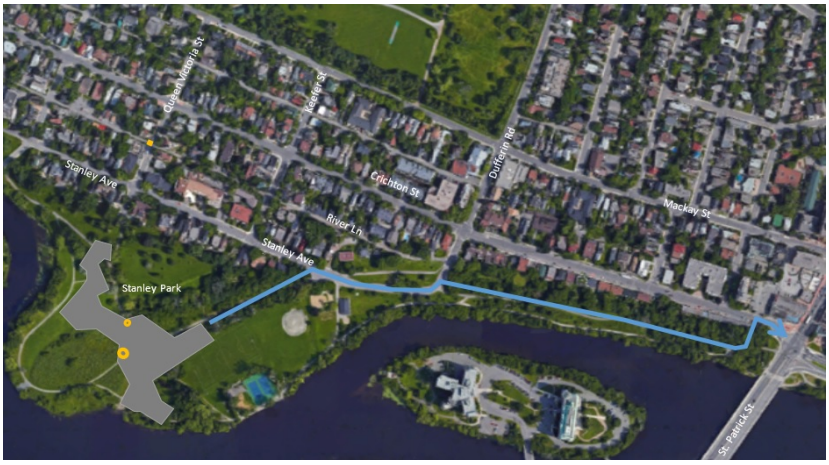
The trucking routes being considered for the purpose of this review are grouped into three categories based on the direction of travel leaving Stanley Park. The three categories are south, north and west. The south routes are directed to the intersection of Vanier Parkway/St. Patrick Street, the north routes to Sussex Drive, while the west routes cross the Rideau River. There are four potential south routes considered in this review, three potential north routes considered, and two potential west routes considered. A description of the routes is provided below and the routes are illustrated on **Exhibit 3**.

Exhibit 3: Considered Potential Trucking Routes

4.1 SOUTH 1

From Stanley Park, the trucking route would head northeast along the Rideau River Pathway, continue east and then north on Stanley Avenue, east onto Crichton Street to the intersection of Vanier Parkway/St. Patrick Street. The route extends over approximately 650 m of roadway within the neighborhood and in front of approximately 60 properties, including some institutional and commercial properties. A 170 m section of the multi-use pathway would be temporarily eliminated and reconstructed into a trucking road. At the St. Patrick/Vanier/Beechwood intersection, the only route out of the neighborhood would be turn right on St. Patrick at Crichton. It should also be noted that left turns from St. Patrick to Crichton are not permitted for access into the site. As such, trucks would need to use Beechwood or the Vanier Parkway (currently not permitted) to enter Site 5 from this location.

4.2 SOUTH 2



From Stanley Park, the trucking route would head northeast along the Rideau River Pathway, turn east onto Stanley Avenue for a short distance before continuing east along the Rideau River Pathway to the intersection of Vanier Parkway/St. Patrick Street. The route extends over approximately 130 m of roadway within the neighborhood but does not front any private properties. Subject to NCC approval, an additional 460 m (total of 630 m) of the multi-use pathway would be temporarily eliminated and reconstructed into a trucking road. At the St. Patrick/Vanier/Beechwood intersection, the only route out of the neighborhood would be turn right on St. Patrick at Crichton. It should also be noted that left turns from St. Patrick to Crichton are not permitted for access into the site. As such, trucks would need to use Beechwood or the Vanier Parkway (currently not permitted) to enter Site 5 from this location.

4.3 SOUTH 3

From Stanley Park, the trucking route would head east through the New Edinburgh Park, between the tennis courts and other sports fields, to meet the intersection of Stanley Ave and Dufferin Rd. From there the Route would follow the same alignment as S1 along Dufferin and Crichton. Another possibility could be that the remainder of the S3 route follow the same route as S2 along the multi-use pathway adjacent to the river, but this would be subject to the same constraints as S2. Once at Crichton, the only route out of the neighborhood would be turn right on St. Patrick at Crichton. It should also be noted that left turns from St. Patrick to Crichton are not permitted for access into the site. As such, trucks would need to use Beechwood or the Vanier Parkway (currently not permitted) to enter Site 5 from this location.

4.4 SOUTH 4

From Stanley Park, the route would head north along Queen Victoria Street, east onto Stanley Avenue, north on Keefer Street, and east along Crichton Street to the intersection of Vanier Parkway/St. Patrick Street. The route extends over approximately 1000 m of roadway within the neighborhood and in front of approximately 150 properties, including a few institutional and retirement properties, and some commercial properties. There would be no impact to pathways other than the modifications already required at the end of Queen Victoria for construction movements between Sites 5b and 5c. Once at Crichton, the only route out of the neighborhood would be turn right on St. Patrick at Crichton. It should also be noted that left turns from St. Patrick to Crichton are not permitted for access into the site. As such, trucks would need to use Beechwood or the Vanier Parkway (currently not permitted) to enter Site 5 from this location.

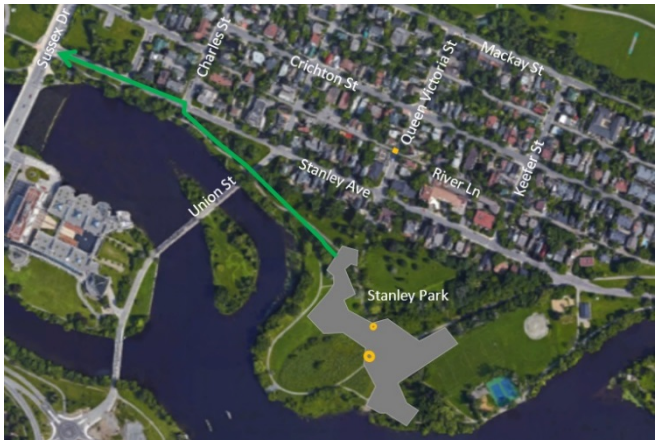
4.5 NORTH 1

From Stanley Park, the route would head north along Queen Victoria Street, and west onto Stanley Avenue to Sussex Drive. This route (N1) would also provide a viable means to enter the site. The route extends over approximately 500 m of roadway within the neighborhood and in front of approximately 35 properties, including at least one embassy. There would be no impact to pathways other than the modifications already required at the end of Queen Victoria for construction movements between Sites 5b and 5c. At the Sussex intersection, it is expected that trucks would be turning left to leave the neighborhood. For use as an exit route, the City may consider vehicle-actuated signalization due to the heavy traffic along Sussex during peak hours. Such a decision would be subject to an intersection performance analysis and review with the City's traffic group.

4.6 NORTH 2

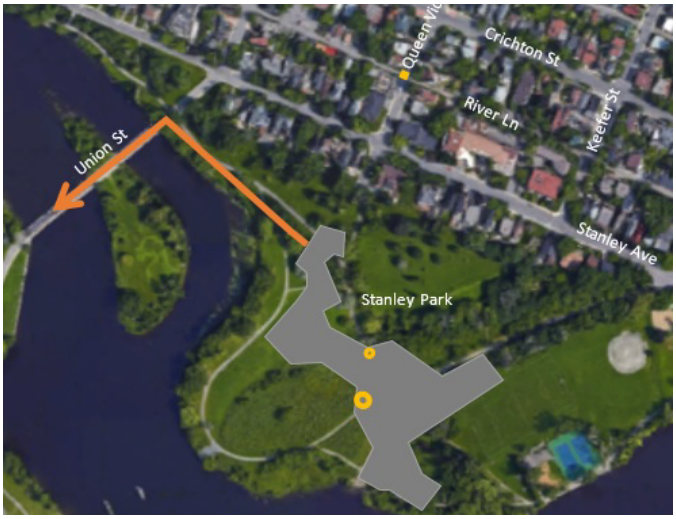
From Stanley Park, the route would head west along the reconstructed Rideau River Pathway, north onto Union Street, and west onto Stanley Avenue to Sussex Drive. This route (N2) would also provide a viable means to enter the site. The route extends over approximately 380 m of roadway within the neighborhood and in front of approximately 10 properties, including at least one embassy. Subject to NCC approval, a 170 m section of the multi-use pathway would be temporarily eliminated and reconstructed into a trucking road. A temporary pathway would be configured between Queen Victoria and Union. At the Sussex intersection, it is expected that trucks would be turning left to leave the neighborhood. For use as an exit route, the City may consider vehicle-actuated signalization due to the heavy traffic along Sussex during peak hours. Such a decision would be subject to an intersection performance analysis and review with the City's traffic group.

4.7 NORTH 3



From Stanley Park, the route would head west along the reconstructed Rideau River Pathway, to form a fourth leg to the intersection of Stanley Avenue/Charles Street. From this intersection, the route would continue west along Stanley Avenue to Sussex Drive. This route (N3) would also provide a viable means to enter the site. The route extends over approximately 180 m of roadway within the neighborhood and in front of approximately 5 properties. Subject to NCC approval, a 300 m section of the multi-use pathway would be temporarily eliminated and reconstructed into a trucking road. A temporary pathway could be configured between Queen Victoria and Union. At the Sussex intersection, it is expected that trucks would be turning left to leave the neighborhood. For use as an exit route, the City may consider vehicle-actuated signalization due to the heavy traffic along Sussex during peak hours. Such a decision would be subject to an intersection performance analysis and review with the City's traffic group.

4.8 WEST 1



From Stanley Park, the route would head west along the reconstructed Rideau River Pathway, south onto Union Street to cross the Minto Bridges to reach King Edward. The route would avoid passing in front of houses on the neighborhood streets. Subject to NCC approval, a 170 m section of the multi-use pathway would be temporarily eliminated and reconstructed into a trucking road. A temporary pathway could be configured between Queen Victoria and Union.

4.9 WEST 2

From Stanley Park, a temporary bridge would be constructed near the abandoned piers from the former railway bridge crossing to convey construction traffic to King Edward. The bridge could either be constructed to support truck traffic or a conveyor system to transfer excavated materials across the river. This second option, however, would not be as effective as it would require multiple handlings of the material. In addition to NCC approvals, the trucking route for this option would require a significant number of additional approvals in order to avoid the neighborhood streets within New Edinburgh. Trucking roadways would be required to be built across Stanley Park and Bordeleau Park to reach the temporary bridge along with the approvals and permits for constructing a bridge across the Rideau River within limited windows of opportunity.

5.0 Peak Construction Trucking Volumes in Context of Existing Traffic Conditions

For the purpose of this analysis, it is considered that the primary access and egress routes in/out of the neighborhood from Stanley Park would be via the intersections of Stanley/Sussex to the north and Crichton/Beechwood/St.Patrick/Vanier to the south. In accordance with City of Ottawa traffic counts, the existing background traffic is as follows:

Stanley at Sussex

- Daily AM Peak Hour: 176 vehicles (87 leaving / 89 incoming)
- Daily Midday Hour: 104 vehicles (60 leaving / 44 incoming)
- Daily PM Peak Hour: 217 vehicles (134 leaving / 83 incoming)

Crichton at Beechwood/St.Patrick/Vanier

- Daily AM Peak Hour: 412 vehicles (244 leaving / 168 incoming)
- Daily Midday Hour: 318 vehicles (148 leaving / 170 incoming)
- Daily PM Peak Hour: 492 vehicles (261 leaving / 231 incoming)

There is a bus route traversing the neighborhood along Crichton. At the north end of Crichton, the bus accesses and egresses the neighborhood via John and Alexander respectfully. At the south end, the bus accesses/egresses via the Vanier Parkway. The bus frequency along Crichton is as follows.

- AM Peak Hour: 9-12 buses (intervals of 15-20 minutes northbound and 8-10 minutes southbound)
- Midday Hour: 6-7 buses (intervals of 20 minutes northbound and 15-20 minutes southbound)
- PM Peak Hour: 9-10 buses (intervals of 10 minutes northbound and 15-20 minutes southbound)

The largest volume of construction related trucking will occur during the 10-month period that the EWT will be constructed and tunnel spoils (muck) will be removed from Stanley Park. During this 10-month tunnel construction and mucking period, it is estimated that 2 to 4 triaxles (dump trucks) per hour will be required to support the tunneling operations. For the remaining 20 months (11 months before tunneling and 9 months after tunneling), the trucking volumes will generally be much lower and will be highly variable; from long periods with no noticeable trucking, to short duration peaks of 3-4 trucks per hour while hauling soil and granular material or concrete deliveries. These peaks will be of short duration due to the modest amount of soil to haul. These are non-coinciding activities and thus non-coinciding trip generations.

During tunnel construction activities, the variation in trucking (2-4 trucks per hour) reflects the variable tunneling production to be expected. As such, the site-generated hauling trips during tunneling are estimated to peak at approximately 4 to 8 trips per hour (half of the trips are empty trucks incoming/half of the trips are full trucks leaving).

If the worst case scenario is considered and that 8 trips (in or out) are generated by the construction within an hour and that all 8 trips use the same route in & out of the neighborhood, it would be no greater than the existing bus volume on Crichton, and it would represent an impact as follows on background traffic:

Stanley at Sussex

- AM Peak: 4.5% increase over existing conditions
- Midday: 7.7% increase over existing conditions
- PM Peak: 3.7% increase over existing conditions

Crichton at Beechwood/St. Patrick/Vanier

- AM Peak: 2% increase over existing conditions
- Midday: 2.5% increase over existing conditions
- PM Peak: 1.6% increase over exiting conditions

If the access and egress to/from the neighborhood are from different routes (for example, come in from Sussex and leave via St. Patrick), this impact would be divided by two.

6.0 Analysis of the Potential Routes

As described in the previous section, nine (9) potential trucking route options are being considered for the purpose of this review. They are as follows:

- North 1 [Queen Vic/Stanley]
- North 2 [Pathway/Union/Stanley]
- North 3 [Pathway/Stanley]
- West 1 [Pathway/Union/Minto Bridges]
- West 2 [Temp Bridge/Bordeleau Park]
- South 1 [Stanley/Crichton]
- South 2 [Stanley/Pathway]
- South 3 [Park/Pathway]
- South 4 [Queen Vic/Stanley/Keefer/Crichton]

Prior to subjecting all of the above options to a review, a verification is made to assess whether some of these are not feasible or acceptable.

Option West 1 (W1)

Option West 1 would see hauling trucks passing over the Minto Bridges. Two independent cursory reviews of the feasibility of this option were conducted by structural engineers at CH2M and Parsons. In theory, the load limit of the bridge would permit an empty dump truck to pass, but not a full one. Both structural engineers recommended against the use of the bridges as a haul route. The CH2M engineer provided the following reasons:

1. The geometry of the structure is not conducive for safe passage of large vehicles.
2. There is a risk of load strike on the knee brace on the portal frame
3. High pedestrian use: report indicates deflection/vibration limit marginal under existing conditions
4. Marginal capacity: 20 tonne limit. Even if specified that only empty trucks take this route there is a risk of driver error once the route has been implemented (i.e. a driver could mistakenly go over with a partial or full load).
5. The design criteria for the rehab assumed 75% of CL3 loading (CL3 loading is for urban buses, milk trucks and single-unit trucks). The volume of trucks that would need to cross the bridge could also subject this historic and recently renovated structure to fatigue and early distress.

Option West 1 is not carried forward to the analysis.

Option West 2 (W2)

Option West 2 would see a temporary bridge being constructed across the Rideau River in order to direct hauling trucks to King Edward Avenue. As previously discussed, the bridge could be either designed to support truck traffic or a conveyor system that would require handling the materials at each end of the river. Structural engineers at CH2M were consulted and prepared a feasibility review for this option of constructing and removing a temporary bridge. Two options for accommodating the bridge across the river were considered:

- Reusing the existing/abandoned piers and abutments from the former rail bridge
- Installing new temporary piers and abutments by the existing/abandoned ones

Given that the existing piers have been abandoned for over 40 years, it is very likely that the construction of new temporary bridge piers will be required. Either way, in-river construction work requiring a number of approvals would be required before this option could be implemented.

Required Approvals for Temporary Bridge

The following outline some of the approvals that are anticipated to be required prior to securing permission to install a temporary bridge across the Rideau River.

- Municipal Budget Approval
- Environmental Assessment (EA) Amendment, complete with consultation with the communities on both sides of the Rideau River
- National Capital Commission (NCC)
    - Approval for impact on a second NCC park (Bordeleau) and an increase in the impact to Stanley Park (additional trees, dog park, pathways, and shoreline impacts)
    - Environmental Effect Evaluation (EEE) Report
    - Federal Land Use Design and Transactions Approval (FLUDTA)
    - Easements Agreements
- Transport Canada – Navigation Protection
- Department of Fisheries and Oceans (DFO)
- Rideau Valley Conservation Authority (RVCA)
- Ministry of Natural Resources and Forestry (MNRF)
- Aboriginal consultation (Rideau River has Aboriginal heritage significance)
- Ministry of Tourism, Culture and Sports (Heritage Considerations)

Negotiation and approval periods for some of the above can be highly variable. Although most can proceed in parallel, it is expected that the whole process would likely extend over a period greater than a year. It has taken close to two years to finalize the agreement with the NCC for the current sites, and this followed years of monthly discussions and negotiations. It is improbable that these approvals would be secured prior to early spring 2018, at which point the design and construction of the bridge would need to commence. In-water works could not commence before July due to fisheries restrictions. It is highly improbable that the bridge could be constructed and ready for use before mid/late fall 2018. In accordance with the contractor's submitted schedule, mobilization to Stanley Park for pre-tunneling

activities and preparations is planned for March 2017, and the tunnel mucking operation for the East-West tunnel is planned between February-December 2018.

With these approval requirements, there is insufficient time for Option West 2 to be implemented in a manner (with bridge for trucks or conveyor system) that would provide an opportunity to significantly reduce the duration of the trucking related to tunnel construction along the preferred route(s) within New Edinburgh. As a result, Option West 2 is not carried forward to the analysis.

Option South 2 (S2)

Option South 2 presents some functional/operational challenges at the Beechwood/Vanier/St. Patrick intersection. As trucks approach St. Patrick from within the park, there are three turning options that were considered:

1. *Turning right onto St. Patrick:* Representing a very sharp turn with limited visibility within the Vanier/Crichton/St. Patrick intersection. This would require making changes to signalization to accommodate a fifth leg to the intersection to allow truck movements. This change could not be done in a safe enough manner to consider this option as being feasible.
2. *Trucking through intersection to Vanier Parkway (currently not permitted)*: Even if trucking were permitted along the Vanier Parkway, making changes to signalization to accommodate a fifth leg to the intersection to allow truck movements between Route S2 and the Vanier Parkway. This change could not be done in a safe enough manner to consider this option as being feasible.
3. *Routing temporary road to Crichton at St. Patrick:* The temporary access road would turn to the east as it approaches St. Patrick and connect to Crichton immediately north of the intersection. Additional mature trees adjacent to the intersection would need to be removed in order to accommodate this route. While this turn onto Crichton is deemed feasible, it will require the use of both the through-right hand and the left turn lanes to make the manoeuver onto Crichton. This may create delays for traffic exiting Crichton. Furthermore, the contractor may be required to flag the truck exits on to Crichton due to poor sight distance and utilization of both lanes to make the manoeuver.

Option South 2 is thus carried forward for evaluation under the configuration of routing temporary road to Crichton at St. Patrick

Other Options

Upon initial screening of, the other six options, there do not appear to be critical constraints that would impact their feasibility. As such, they appear to warrant additional consideration and are therefore carried for further analysis into the evaluation matrix on Exhibit 5. All of these other options feature routes along existing roadways and/or along pathways and through parks. The Environmental Assessment (EA) has established that the works and hauling from the site are acceptable activities, this evaluation considers various hauling routing options. Considerations, advantages, disadvantages and impacts of each options are presented in Exhibit 5.

The criteria were selected to be consistent with that used in the original CSST Environmental Assessment Report, with some modifications to remove those criteria that are not relevant to this trucking route review.

As presented in the following exhibits, the criteria include:

Technical
T1 – Traffic Management
T2 – Geometry
T3 – Infrastructure
T4 – Safety
T5 – Operation
T6 – Schedule

Socio-Cultural
S1 – Urban Green Space / Open Space
S2 – Cultural Heritage Values and Features
S3 – Disruption to Community
S4 – Consistency with Planning Policies
S5 – Property Issues

Economy
E1 – Impact on Businesses / Land Owners
E2 – Affordability

Natural Environment
N1 – Significant Natural Features

The evaluation consists of the following two exhibits. Exhibit 4 is the Pairwise Comparison of the criteria. Each criterion is compared to each other criterion in an attempt to assign relative importance or criticality in order to create a weighting of criteria (i.e. make some criterion more important than others in the evaluation). Further details and explanations are included below the exhibit table. Exhibit 5 consists of the evaluation matrix. Each option is assigned a High/Medium/Low impact rating for each criterion. There is a scoring system associated with these High/Medium/Low ratings. These scores are then multiplied by the weighting developed in Exhibit 4 in order to reflect the variable criticality of the various criteria.

Exhibit 4: Pairwise Comparison of Evaluation Criteria

CRITERIA	T1 - Traffic Management	T2 - Geometry	T3 - Infrastructure	T4 - Safety	T5 - Operation	T6 - Schedule	N1 - Impact on Significant Natural Features	S1 - Impact on Green Space/Open Space	S2 - Cultural Heritage Values or Features	S3 - Disruption to Community	S4 - Consistency with Planning Policies	S5 - Property Issues	E1 - Impact on Businesses and/or Land Owners	E2 - Affordability	Sum	Weighted
T1 - Traffic Management		4	4	0	4	3	4	4	3	1	4	4	3	2	40	7.3%
T2 - Geometry	2		4	0	3	2	2	2	2	1	4	4	2	2	30	5.5%
T3 - Infrastructure	2	2		0	3	2	2	2	2	1	3	3	1	1	24	4.4%
T4 - Safety	6	6	6		6	5	6	6	6	6	6	6	6	5	76	13.9%
T5 - Operation	2	3	3	0		2	2	2	1	1	3	2	2	1	24	4.4%
T6 - Schedule	3	4	4	1	4		3	3	2	2	5	5	3	3	42	7.7%
N1 - Impact on Significant Natural Features	2	4	4	0	4	3		3	2	2	4	4	2	2	36	6.6%
S1 - Effects on Green Space/Open Space	2	4	4	0	4	3	3		2	2	4	4	2	2	36	6.6%
S2 - Cultural Heritage Values or Features	3	4	4	0	5	4	4	4		3	4	4	3	3	45	8.2%
S3 - Disruption to Community	5	5	5	0	5	4	4	4	3		5	5	3	3	51	9.3%
S4 - Consistency with Planning Policies	2	2	3	0	3	1	2	2	2	1		2	1	1	22	4.0%
S5 - Property Issues	2	2	3	0	4	1	2	2	2	1	4		1	1	25	4.6%
E1 - Impact on Businesses and/or Land Owners	3	4	5	0	4	3	4	4	3	3	5	5		3	46	8.4%
E2 - Affordability	4	4	5	1	5	3	4	4	3	3	5	5	3		49	9.0%
								TOTALS							546	100.0%

Prioritized Ranking of Criteria and Weightings

CRITERIA	WT
T4 - Safety	13.9%
S3 - Disruption to Community	9.3%
E2 - Affordability	9.0%
E1 - Impact on Businesses and/or Land Owners	8.4%
S2 - Cultural Heritage Values or Features	8.2%
T6 - Schedule	7.7%
T1 - Traffic Management	7.3%
S1 - Effects on Green Space/Open Space	6.6%
N1 - Impact on Significant Natural Features	6.6%
T2 - Geometry	5.5%
S5 - Property Issues	4.6%
T3 - Infrastructure	4.4%
T5 - Operation	4.4%
S4 - Consistency with Planning Policies	4.0%

Table Notes:

1) In the "pairwise comparison", each criterion is compared to each other criterion in an attempt to assign relative importance or criticality. For each comparison, there are 6 points available. If two criteria are deemed to have comparable criticality, they will each be assigned 3 points (out of six available points). If one is deemed more critical than the other, the more critical criterion may get 4 or 5 of the six available points, with the less critical criterion getting 2 or 1 point. The criteria (or rows) with the higher percentage of overall points are assigned a higher weighting, which will be applied to the evaluation matrix.
   For example, the comparison between criteria T1 and T2 resulted in a 4-2 split in favor of T1, implying that T1 is deemed to be somewhat more critical than T2.

Exhibit 5 - Evaluation Matrix

		SOUTH ROUTES				NORTH ROUTES		
Criteria		**S1**	**S2**	**S3**	**S4**	**N1**	**N2**	**N3**
Technical								
T1	Traffic management	Medium	Medium	Medium	Medium	Medium	Medium	Medium
		- Level of Service of Intersection of St. Patrick/Vanier/Beechwood is at LOS F (very poor) and D (heavy) for AM peak and PM peak hours respectively, but is LOS B (good) & C (decent) off-peak. - The additional 3-4 trucks per hour will typically occur during off peak hours. This represents one truck every 15 min (or one every 8 or 9 signal cycles). - Eastbound Left turn from St. Patrick to Crichton is not permitted. - additional traffic along Stanley & passing in front of New Edinburgh Park access (play structure, field house, sports field, bus stop, etc)	- same comments as for S1 except that impact on Crichton will be at the intersection St. Patrick/Vanier/Beechwood - turn onto Crichton will require use of both the through-right hand and the left turn lane to make the manoeuver onto Crichton. - May create delays for traffic exiting Crichton. - Contractor may be required to flag the truck exits on to Crichton due to poor sight distance and utilization of both lanes to make the manoeuver.	- same comments as for S1 except that it avoids passing in front of New Edinburgh Park north-east access (play structure, field house, sports field, bus stop, etc), however, could impact on access to tennis courts	- Same comments as for S1 except that - avoids passing in front of New Edinburgh Park north-east access (play structure, field house, sports field, bus stop, etc) - would also impact considerably more streets and driveways than S1.	- Intersection of Stanley at Sussex is unsignalized (currently has pedestrian signals only). - intersection operates at LOS F (very poor) during AM and PM peak hours and LOS C or better (good/decent) off-peak. Right turns from Sussex significantly easier than left turns from Stanley. - the additional 3-4 trucks per hour will typically occur during off peak hours. - introduction of vehicle signals at this location is not recommended as it would encourage new cut through traffic during peak hours and additional traffic on Stanley Ave.	- comments for N1 also apply here. - passage of truck along pathway would reduce truck traffic on Stanley but force cycle traffic to relocate to Stanley from the pathway.	- comments for N1 and N2 also apply here. - shorter section of Stanley would be impacted by truck traffic, but would result in longer impact on the pathway and relocation of cyclists.
		5	5	5	5	5	5	5
		7.3%	7.3%	7.3%	7.3%	7.3%	7.3%	7.3%
		0.37	0.37	0.37	0.37	0.37	0.37	0.37
T2	Geometry	Medium	High	Medium	Medium	Low	High	Medium
		- appear to be no issues with turning movements, no tight corners - some pathway modifcations required - modification likely required where pathway connects to Stanley (3-way stop) to enhance safety	- geometry at Crichton and St. Patrick's / Beachwood / Vanier intersection is functional but more complicated - Contractor may be required to flag the truck exits on to Crichton due to poor sight distance and utilization of both lanes to make the manoeuver. - most extensive pathway modications required - modification likely required where pathway connects to Stanley (3-way stop) to enhance safety	- modification likely required where pathway connects to Stanley (3-way stop) to enhance safety	- some potentially tight corners along local streets; potential to conflict with oncoming traffic and parked vehicles for turning movements	- appear to be no issues with turning movements, no tight corners - the fewest turning movements	- Stanley/Union turn is sharper than 90° - likely too tight for hauling trucks turning right - Will require pathway modifications and some tree removal	- special attention required at Stanley/Charles intersection to create third leg - Will require pathway modifications and some tree removal
		5	0	5	5	10	0	5
		5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%
		0.27	0.00	0.27	0.27	0.55	0.00	0.27
T3	Infrastructure	Low	High	Medium	Low	Low	Medium	Medium
		- predominantly along existing roads - access road construction to replace pathway required to support truck traffic; followed by reconstruction of pathway	- extensive pathway modifcations required to support truck traffic	- pathway modifcations required to support truck traffic around the sports field - tennis courts impacted, and potential other recreational spaces	- along existing roads, no modifications required (other than minor pathway modification for trucks)	- along existing roads, no modifications required (other than minor pathway modification for trucks)	- access road construction to replace pathway required to support truck traffic; followed by reconstruction of pathway and reinstatement of park - requires replacement pathway during construction	- significant access road construction to replace pathway required to support truck traffic; followed by reconstruction of pathway and reinstatement of park - requires replacement pathway during construction
		10	0	5	10	10	5	5
		4.4%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%
		0.44	0.00	0.22	0.44	0.44	0.22	0.22
T4	Safety	Medium	Medium	Low	Low	Low	Low	Medium

		SOUTH ROUTES				NORTH ROUTES		
Criteria		**S1**	**S2**	**S3**	**S4**	**N1**	**N2**	**N3**
		- portion of pathway closed during construction for safety - truck access connects with Stanley at location busy with pedestrian crossings, bus stop, and close to play structure	- significant pathway closure - Visibility may be an issue for truck turns onto Crichton, contractor may be required to flag the truck exits on to Crichton due to poor sight distance and utilization of both lanes to make the manoeuver.	- portion of pathway closed during construction for safety - avoids passing in front of New Edinburgh Park north-east access (play structure, field house, sports field, bus stop, etc), however, could impact on access to tennis courts	- along narrower local streets with pedestrian traffic and parked cars - need to create ped crossing location at Queen Vic extension - avoids play structure proximity	- need to create ped crossing location at Queen Vic extension	- will require parallel temp pathway between Queen Victoria and Union and ped crossing for dog park access	- will require parallel temp pathway between Queen Victoria and Union and ped crossing for dog park access - north of Union, no space for temp path (cyclists on Stanley Ave)
		5	5	10	10	10	10	5
		13.9%	13.9%	13.9%	13.9%	13.9%	13.9%	13.9%
		0.70	0.70	1.39	1.39	1.39	1.39	0.70
T5	Operation	Low	Medium	Medium	Low	Low	Medium	Medium
		- high-maintenance granular route is short - Stanley is a local residential, Crichton is a local collector	- high-maintenance granular route is the longest of all the options - regular dust control along the temporary granular trucking route may be required to mitigate excessive dust	- high-maintenance granular route is long - Stanley is a local residential, Crichton is a local collector - regular dust control along the temporary granular trucking route may be required to mitigate excessive dust	- high-maintenance granular route is short - Stanley, Queen Victoria & Keefer are local residential, Crichton is a local collector	- shortest path to access truck route - Stanley is a local residential road	- shortest path to access truck route - Stanley is a local residential road - high-maintenance granular route is relatively short - regular dust control along the temporary granular trucking route may be required to mitigate excessive dust	- high-maintenance granular route is longer - Stanley is a local residential road - regular dust control along the temporary granular trucking route may be required to mitigate excessive dust
		10	5	5	10	10	5	5
		4.4%	4.4%	4.4%	4.4%	4.4%	4.4%	4.4%
		0.44	0.22	0.22	0.44	0.44	0.22	0.22
T6	Schedule	Low	High	Medium	Low	Low	Medium	Medium
		- pathway modification approved - on roadways for most part	- Additional NCC negotiations and approvals likely required (significant mpacts to pathways and more tree cutting) - Longer to construct and to reinstate post-construction	- NCC negotiation and approval for connection to Stanley may be required - Considerable length of temporary road to construct and to reinstate post-construction	- pathway modification approved - on roadways for most part	- pathway modification approved - on roadways for most part	- NCC negotiation and approval required, some tree cutting - Longer to construct and to reinstate post-construction	- NCC negotiation and approval required, some tree cutting - Longer to construct and to reinstate post-construction
		10	0	5	10	10	5	5
		7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
		0.77	0.00	0.38	0.77	0.77	0.38	0.38
Natural Environment								
N1	Impact on Significant Natural Features (Terrestrial/Aquatic)	Low	High	Medium	Low	Low	Medium	Medium
		tree branch trimming required	- most extensive tree removals required - proximity to river or riparian area	- more extensive tree removals required - proximity to river or riparian area	- no additional vegetation impact on top of what's already required to access Site 5c from 5b	- no additional vegetation impact on top of what's already required to access Site 5c	- one or two additional tree removals required - proximity to river or riparian area	- four or five additional tree removals required - proximity to river or riparian area
		10	0	5	10	10	5	5
		6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%
		0.66	0.00	0.33	0.66	0.66	0.33	0.33
Socio-Cultural								
S1	Effect on urban green space/open space (impact on park users)	Low	High	Medium	Low	Low	Medium	Medium
		- marginal fragmentation of park space when compared to other options	- loss of waterfront access to properties along Crichton - most extensive tree removals	- impact on park space / bisecting park - tree removals	- no additional park space or tree impact on top of what's already required to access Site 5c from Site 5b	- no additional park space or tree impact on top of what's already required to access Site 5c from Site 5b	- loss of waterfront access to properties along Stanley - one or two additional tree removals required - impacts on residents' use of park	- marginally more extensive loss of waterfront access along Stanley - four or five additional tree removals required - impacts on residents' use of park
		10	0	5	10	10	5	5
		6.6%	6.6%	6.6%	6.6%	6.6%	6.6%	6.6%
		0.66	0.00	0.33	0.66	0.66	0.33	0.33
S2	Cultural heritage values or features	Medium	Low	Medium	High	High	Medium	Medium
		Runs through New Edinburgh HCD. Four contributing properties along route.	Not part of New Edinburgh HCD. No Part IV designated properties along route.	Similar impact as S1	Runs through New Edinburgh HCD. Thirty-seven contributing properties along route. Three buildings were Part IV designations prior to HCD designation.	Runs through New Edinburgh HCD. Twenty-seven contributing properties along route. Two buildings were Part IV designations prior to HCD designation.	Runs through New Edinburgh HCD. Nine contributing properties along route. One building was a Part IV designation prior to HCD designation.	Runs through New Edinburgh HCD. Two contributing properties along route.
		5	10	5	0	0	5	5
		8.2%	8.2%	8.2%	8.2%	8.2%	8.2%	8.2%

		SOUTH ROUTES				NORTH ROUTES		
Criteria		**S1**	**S2**	**S3**	**S4**	**N1**	**N2**	**N3**
		0.41	0.82	0.41	0.00	0.00	0.41	0.41
S3	Disruption to community (impact on local residents)	Medium	Low	Medium	Medium	Medium	Low	Low
		- route adjacent to recreational area access with some potential conflicting movements requiring mitigation - along residential properties on Crichton and by church and school - dust generation from granular route	- route adjacent to recreational area access with some potential conflicting movements requiring mitigation - not passing in front of private properties - higher potential for dust generation with longer granular road	- route adjacent to recreational area access with some potential conflicting movements requiring mitigation (avoids north-east entrance to park) - along residential properties on Crichton and by church and school - dust generation from longer granular route	- route avoids proximity to recreational area but highest number of residential and institutional properties impacted, including retirement home, school of dance, in addition ot other school and church on Crichton	- route avoids proximity to recreational area, but high number of residential properties along route, including embassies	- route avoids proximity to recreational area, but still impacts some residential properties along route - dust generation from granular route	- minimal proximity to private properties - higher potential for dust generation with longer granular road
		5	10	5	5	5	10	10
		9.3%	9.3%	9.3%	9.3%	9.3%	9.3%	9.3%
		0.47	0.93	0.47	0.47	0.47	0.93	0.93
S4	Consistency with planning policies/processes	Low	High	Medium	Low	Low	Medium	High
		- moderately long access to City streets - having vehicles on streets is most compatible with zoning and other regulatory practices and policies	- very long access to City streets - not having vehicles on streets is not compatible with zoning and other regulatory practices and policies	- longer access to City streets - having vehicles on streets is most compatible with zoning and other regulatory practices and policies	- shortest access to City streets - having vehicles on streets is most compatible with zoning and other regulatory practices and policies	- shortest access to City streets - having vehicles on streets is most compatible with zoning and other regulatory practices and policies	- longer access to City streets - having vehicles on streets is most compatible with zoning and other regulatory practices and policies	- very long access to City streets - not having vehicles on streets is not compatible with zoning and other regulatory practices and policies
		10	0	5	10	10	5	0
		4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
		0.40	0.00	0.20	0.40	0.40	0.20	0.00
S5	Property Issues	Low	High	Medium	Low	Low	High	High
		- partially on NCC property - but already approved	- NCC property for extensive length and within floodplain; no negotiations or approvals commenced	- Additional NCC property may be required at connection at Stanley - additional approavals for work within floodplain; - no negotiations or approvals commenced	- smallest impact on NCC property	- smallest impact on NCC property	- NCC property for extensive length and within floodplain; discussions with NCC initiated, but no approvals reached	- NCC property for extensive length and within floodplain; discussions with NCC initiated, but no approvals reached
		10	0	5	10	10	0	0
		4.6%	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%
		0.46	0.00	0.23	0.46	0.46	0.00	0.00
Economy								
E1	Impact on businesses and/or land owners	Medium	Low	Medium	Medium	Medium	Medium	Low
		- trucking could be on same routes as trips generated by businesses	- trucking would not interfere with trips generated by local community businesses	- trucking could be on same routes as trips generated by businesses	- trucking could be on same routes as trips generated by businesses	- trucking could be on same routes as trips generated by businesses	- trucking could be on same routes as trips generated by businesses	- trucking could be on same route as trips generated by businesses, but only short distance
		5	10	5	5	5	5	10
		8.4%	8.4%	8.4%	8.4%	8.4%	8.4%	8.4%
		0.42	0.84	0.42	0.42	0.42	0.42	0.84
E2	Affordability	Low	High	Medium	Low	Low	Low	Medium
		- no additional cost	- considerable and highest additional cost	- additional cost for longer temporary Road	- no additional cost	- no additional cost	- marginal additional cost	- considerable additional cost
		10	0	5	10	10	10	5
		9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
		0.90	0.00	0.45	0.90	0.90	0.90	0.45

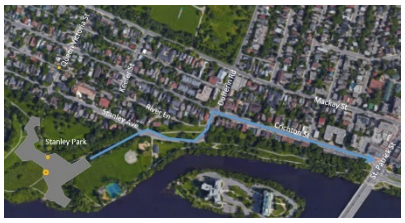
0	High	Highest Impact - least Desirable
5	Medium	Medium Impact - Neutral
10	Low	Lowest Impact - Most Desirable

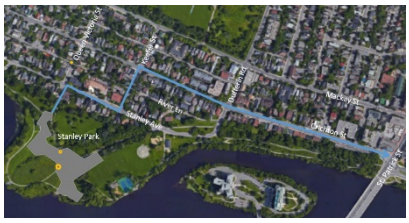
SOUTH ROUTE				NORTH ROUTE		
S1	**S2**	**S3**	**S4**	**N1**	**N2**	**N3**
7.36	**3.88**	**5.70**	**7.65**	**7.92**	**6.11**	**5.46**
✓	☒		✓	✓		

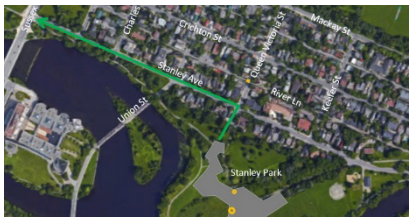
Summary of the Evaluation Matrix

The above evaluation matrix shows that three potential routes (S1, S4, N1) score considerably higher than the others based on the criteria. These three routes are deemed to be "most preferred" options. Their scores are relatively similar and, based on this initial assessment, they would be deemed by the evaluation to be equally acceptable.

The three options that scored the highest (S1, S4, N1) are illustrated below (refer to section 4 for larger images).







These options happen to be routes that make the best use of existing infrastructure, roadways, properties and approvals/permitting. The project team recognizes that directing trucks through the neighborhood results in disruptions to the community. It should be kept in perspective that in the worst case scenario (all trucks utilizing the same route for in & out), the trucking would result in an increase of 5 to 7% to existing traffic on Stanley Avenue at Sussex Drive, or an increase of 2% to existing traffic on Crichton Street approaching the intersection of Crichton/Beechwood/Vanier/St. Patrick. These increases would be halved if separate routes are adopted for access & egress.

One of the potential routes (S2) scored considerably lower with several criteria being red (high impact – least desirable). In addition to greater impacts on the park space and trees, there are some significant challenges with functionality and safety at the intersection of St. Patrick/Vanier/Beechwood. The connection to Crichton immediately north of the intersection would likely result in the removal of mature trees adjacent to the intersection and will require the use of both the through-right hand and the left turn lanes to make the manoeuver onto Crichton. This may create delays for traffic exiting Crichton. Furthermore, the contractor may be required to flag the truck exits on to Crichton due to poor sight distance and utilization of both lanes to make the manoeuver. The other three potential routes (S3, N2, N3) score somewhat in between the preferred options and this least desirable option (S2).

Amongst the remaining South egress/access routes, Option S3 did not score as high as the above three, but also did not score as low the least desirable one (S2). Similarly, Route options N2 and N3 that would see the construction of a trucking route along the Eastern River Pathway north of Stanley Park did not score as high as the above three, but also did not score as low the least desirable one (S2). **These options will not be discounted prior to further consultation with the community.**

TECHNICAL MEMORANDUM: REVIEW ALTERNATIVE TRUCKING ROUTES FOR SITE 5 / STANLEY PARK

February 3, 2017

It is recommended that the findings of this analysis be reviewed with the New Edinburgh community to confirm, from their perspective, which of the preferred routes are most desirable / palatable. This will include the community's perspective on potentially using a different route for access vs egress in order to mitigate the impact on the most affected properties. Based on factoring in the community's perspectives, the evaluation will be updated and a recommended preferred alternative will be presented to the broader community.