

Chapter 4 – Identification of Alternatives



407 TRANSITWAY - KENNEDY ROAD TO BROCK ROAD

MINISTRY OF TRANSPORTATION - CENTRAL REGION

4. IDENTIFICATION OF ALTERNATIVES AND EVALUATION PROCESS

4.1. Rapid Transit Technology

Rapid Transit Technology evaluation for the entire 407 Transitway was conducted by Parsons (formerly Delcan) as part of the EA of the Central Section (Highway 400 to Kennedy Road), and approved as part of the TPAP EPR filed in February of 2011.

Five candidate technology alternatives were considered in developing a response to the need for inter-regional rapid transit in the ultimate 150 kilometers Highway 407 Corridor.

1. Bus Rapid Transit (BRT);
2. Light Rail Transit (LRT);
3. Automated Guideway Transit (AGT);
4. Heavy Rail Transit (e.g. subway); and,
5. Commuter Rail.

Each of the above candidate technologies was evaluated against four major criteria reflecting the near- and long-term needs and objectives for transit in the Highway 407 Corridor. These included:

- Transit service quality including required capacity, user convenience and comfort, service speed and reliability and network connectivity/interlining;
- Planning considerations addressing infrastructure integration and the system's support of Provincial growth and planning policies;
- Environmental compatibility covering effects on the natural and socio-economic environment and energy consumption; and,
- Implementation considerations including ROW property requirements, cost-effectiveness and implementation staging.

The evaluation of the five candidate technology alternatives was conducted as part of the 407 Transitway Central Section (Highway 400 to Kennedy Road) approved TPAP. Rationale of the evaluation and conclusions are noted below:

- From the evaluation, it is evident that initially, BRT would be the preferred technology for the 407 Transitway but that conversion to LRT technology in the future should be protected to respond to the anticipated growth in ridership volumes beyond the 2031 planning horizon. In addition to significant implementation staging flexibility to transition from operation in mixed traffic on the 407 ETR to higher speed service on a fully exclusive runningway, BRT provides capacity for the projected demand at the desired level of convenience and comfort.
- Like the other line-haul operating technologies, it offers the same benefits of network connectivity with three GO Transit Rail lines and two subway line extensions to the corridor; and as well, being bus-based, it does not need feeder services at all stations as the vehicles are able to interline by operating on city streets or highways to reach key off-line destinations such as Pearson Airport or the 400-series highways.
- Similar to the other technologies, BRT provides a vehicle technology that is becoming increasingly more energy efficient with improved emission control. Another important advantage of the BRT system is

implementation staging flexibility, allowing the opportunity to build specific segments of runningway at a time, maintaining the Transitway operation on the 407 ETR along un-built or under construction segments. BRT's capital and operating costs are compatible with the size of the market for rapid transit service in the corridor compared to the other high capital investment technologies. Lastly, the runningway and station infrastructure can be shared by other transit operators providing compatible local services.

- LRT technology is recommended as a candidate technology for potential later conversion of the busway to meet the potential future increase in service demand. Unlike the DMU's and Heavy Rail, the BRT alignment geometric standards do not limit alignment planning options and LRT can be implemented with adequate measures to mitigate most natural and socio-economic impacts. Conversion to automatic train operation is also feasible if east-west trip volumes in the corridor ever justified higher capacity (over 15,000 passengers per hour per direction) in the distant future.

4.2. Corridor Assessment

In 1998, an EA from Markham Road to Brock Road Transitway Alignment was submitted and approved. The EA included the complete 60m alignment swath on the south side of the Highway. An updated assessment conducted in the initial stage of this project, confirmed that the south side of the Highway was the feasible option for the Transitway, based on the following:

- Most of the lots adjacent to the Highway on the north side have already been developed or the land is planned to be developed; especially at potential station nodes; and,
- Maintaining the alignment on one side of the Highway would avoid long and very costly skewed bridges crossing the Highway.

Preliminary horizontal and vertical alignment alternatives were identified based on station potential viable sites, environmental considerations, optimum travel time, passenger comfort, costs and others, and developed following the *407 Transitway Design Standards*.

4.3. Identification and Evaluation of Station Alternatives

The identification of potential station sites and subsequent evaluation of alternatives was carried out following a two-step screening process.

- Evaluation and screening of station locations.
- Evaluation of potential station sites.

4.3.1. Assessment and Screening of Station Nodes

To provide an efficient transit operation, stations should be located close to the 407 ETR Interchanges for the following essential reasons:

- Initial stage of the 407 Transitway implementation would likely involve construction of key station sites, with the Transitway buses still operating on 407 ETR; consequently proximity of on and off 407 ETR ramps to the stations sites will reduce travel time and operating costs of the Transitway;
- Close proximity of the station sites to the local bus stops at the crossing arterial roads would reduce

- walking distance for transferring transit passengers and for local pedestrians and cyclists; and,
- Close proximity of the station sites to the arterial roads would reduce travel time and operational costs for park and ride and pick-up/drop-off users.

As an initial step, all crossings of 407 ETR with existing and future north-south main arterial roads, were considered potential station locations. The site located east of Reesor Road, west of the CP track was also assessed as a potential future expansion of the Donald Cousens Station, in the event that GO Transit considers rehabilitating the CP line in the future to provide passenger service from the City of Peterborough, North Pickering and a potential future Pickering Airport to Union Station.

Each potential station node, was individually assessed based on the following criteria:

- **Physical and Environmental Constraints:** Presence of environmental features of provincial significance being affected by the facility within potential sites.
- **Ridership Effects:** Planned land development in catchment area; forecast ridership (boardings/alightings); transit integration; interlining opportunities; distance to adjacent stations.

An initial evaluation was conducted following a qualitative rationale by the Project Team based on the outcome of the various indicators used in the criteria. The results were discussed with the MTO Senior Management, and informed to stakeholders and public prior to confirmation or revision of the conclusions.

Table 4.1 outlines the station node assessment.

4.3.2. Evaluation of Station Sites

For all nodes selected through the previous screening stage, sites that could provide sufficient feasible land to accommodate a station layout, were identified and evaluated according to the criteria indicators illustrated in Figure 4.1.

An initial evaluation was conducted following a qualitative rationale by the Project Team based on the outcome of the various indicators used in the criteria. The results were discussed with the MTO Senior Management. Stakeholders and the public were informed prior to finalization and revision of the conclusions.

Figures 4.2 to 4.8 outline the evaluation of station sites and conclusions. This evaluation was reviewed based on the results of the detailed environmental field investigations and traffic analysis.

TABLE 4.1: ASSESSMENT OF STATION NODES

Potential station nodes	McCowan Road	Markham Road	Ninth Line	Donald Cousens Parkway	York Durham Line	Whites Road	Rossland Road	Brock Road
Physical and operational considerations:								
Presence of environmental features of provincial significance	None	None	None	Heritage grounds that need to be avoided by infrastructure for both potential sites.	Rouge Provincial Park and wetlands in the area	None	Station sites may include presence of redbird dace habitat in creek west of Rossland (Ganatsekigan Creek); butternut trees and archeological (Carl Murphy) site; potential aboriginal burial ground in the area.	Brougham Creek runs adjacent to Brock Road. Site layout will need to avoid affects to species at risk
Ridership Effects:								
Estimated (2031) AM peak boardings (P&R, walk, cycle, transit)	630	680	600	440	30	560	150	710
Transit Integration	2 current YRT & TTC routes that could service station. Potential future expansion of route network. Potential to be terminus for routes running on Highway 7.	3 current YRT & TTC routes that could service station. Potential future expansion of route network. Potential to be terminus for routes running on Highway 7.	3 current YRT routes that could service station. Potential future expansion of route network.	3 current YRT routes that could service station. Potential future expansion of route network. Potential to be terminus for routes running on Highway 7.	No current routes. No planned routes.	No current routes. Future planned DRT routes.	No current DRT routes. No planned DRT routes.	Planned GO Transit commuter lot and bus loop No current DRT routes. Future planned DRT routes.
Transfers with Municipal Services and Inter-lining opportunity (demand and accessibility)	Problematic accessibility to potential sites and problematic pedestrian access from street stops.	Feasible transfer and interlining opportunities	Feasible transfer and interlining opportunities	Feasible transfer and interlining opportunities	No local routes and no planned developments in the area;	Interlining opportunity to potential Pickering Airport.	No local bus routes planned along Rossland Road;	Feasible transfer and interlining opportunities
Distance to adjacent station (westerly)	2.2 km (to Kennedy Station)	2.0 km	2.1 km	1.6 km	3.0 km	2.2 km	2.4 km	2.5 km
Selection of Station Locations	Selected Station selected at this node and carried forward to Evaluation of Station Sites.	Selected Station selected at this node and carried forward to Evaluation of Station Sites.	Selected Station selected at this node and carried forward to Evaluation of Station Sites.	Selected Station selected at this node and carried forward to Evaluation of Station Sites.	Not-selected for Station Several reasons made this location unfeasible for a station, including: <ul style="list-style-type: none"> Land availability restricted due to presence of Rouge Valley land to the west of York/Durham Line and private property to the east; Insignificant forecast ridership; No transit connectivity opportunities as there is no current or proposed transit service on York/Durham Line. 	Selected Station selected at this node and carried forward to Evaluation of Station Sites.	Conditionally selected. Subject to further detailed environmental field investigations. Questionable justification for a station at this node due to potential presence of significant environmental issues and poor forecast ridership. It was decided to carry this node forward to evaluate the feasibility of the sites based on existing conditions, before finalizing a station selection decision.	Selected Station selected at this node and carried forward to Evaluation of Station Sites.

Notes: * Extracted from 407 Transitway East Ridership Forecasting Report, December 2014

FIGURE 4.1: STATION SITES EVALUATION CRITERIA



FIGURE 4.2: MCCOWAN STATION EVALUATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SE ALTERNATIVE 1	SE ALTERNATIVE 1A
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
A. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems	Vegetation removals: -Cultural Meadow (CUM1-1) – 3.92 ha -Hedge – 0.42 ha Total – 4.34 ha Distance from nearest watercourse – 208.3 metres	Vegetation removals: -Cultural Meadow (CUM1-1) – 3.92 ha -Hedge – 0.42 ha Total – 4.34 ha Distance from nearest watercourse – 208.3 metres
	Potential Effects on Environmentally Significant Landform/Features	No identified impacts	
	Potential Effects on Geology and Hydrogeology	No effects identified, To be confirmed for preferred alternative through detailed field investigations.	
	Potential Effects on Hydrology		
Potential Species /Habitat at Risk			
B. Social Environment	Potential effects on property.	Station site and access road affects hydro lands. Potential impact to hydro expansion plans. Station access location restricts access to Cemetery and Golf Course west of McCowan to Right-In /Right-Out only. Access road and parking lot would be situated inside the hydro corridor.	Station site affects hydro lands. Potential impact to hydro expansion. Access Road impacts hydro lands, impact to CN Rail and planned commercial development. Impacts to future development, 1 ha of employment lands north of 14 th Avenue. Access road and parking lot would be situated inside the hydro corridor.
	Potential effects on adjacent Noise Sensitive Areas.	No impacts.	Impact to planned commercial development.

OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SE ALTERNATIVE 1	SE ALTERNATIVE 1A
	Land Use Compatibility with provincial and municipal plans and policies.	Station Site, alignment and access road located within lands identified as transportation and utilities in official plan. Within the Parkway Belt West Plan area.	Station Site and alignment located within lands identified as transportation and utilities in official plan. Access road affects planned commercial development and rail line. Within the Parkway Belt West Plan area – Access road footprint is within the City of Markham’s Business Park Employment and Service Employment land use area.
C. Cultural Environment	Potential effects to known presence of archeological potential. Potential Impacts to known First Nations Lands	No identified impacts.	
PREFERRED OPTION		Not Preferred	Not Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION)			
A. Transitway Operation	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time)	The station surface facilities would be located within the 500 KV Hydro corridor, precluding the possibility of including a bus loop on the station site, as Hydro One does not consent to bus layby facility under these lines. In an interim scenario where the Transitway is operating on 407 ETR, the Transitway buses would be unable to access the station site; consequently, this station could only function when the Transitway operates on its exclusive runningway. The station itself cannot have a facility for local and regional buses. Runningway profile must cross over McCowan Road due to presence of municipal trunk sewer precluding underpass. Transitway platform would be elevated, two levels above parking facility.	Same as SE Alternative 1.
	Suitability for staged implementation	Constrained. Station can only be implemented if and when the runingway is built, due to Hydro One restrictions for bus operations under high voltage lines.	Same as SE Alternative 1.
B. Accessibility	Pedestrian accessibility and connectivity	Local pedestrian access and transit transfer connection would require an at-grade crossing at the signal and free flow S-E ramp. This is undesirable due to major safety concerns. Alternatively, if acceptable to 407 ETR, a vertical connection structure could be considered within the interchange area to access the Transitway platforms; however, it would represent significant impact to 407 ETR, complex construction staging implications.	Local pedestrian access and transit transfer connection would require an at-grade crossing at the signal and free flow S-E ramp. This is undesirable due to major safety concerns. Alternatively, if acceptable to 407 ETR, a vertical connection structure could be considered within the interchange area to access the Transitway platforms; however, it would represent significant impact to 407 ETR, complex construction staging implications.
	Vehicular accessibility	Access from McCowan Road. (due to signal spacing standards on arterial roads) would need to be built adjacent to the railway bridge, resulting in poor driver sight line. Driver sight lines turning left into the site would be restricted by the center bridge pier, requiring the left turn movement to operate under protected phasing only; this would be most problematic given limited storage and intersection capacity constraints.	700m long access road off 14 th Avenue. Grade separation required at crossing with rail corridor.
	Transit connectivity	Bus facility within site precluded due to Hydro One restrictions under high voltage lines.	Same as Alternative 1.
C. Site Area (size and shape)	Ability to optimize station facility layout and functionality	Sufficient space available for park and ride only. No feasible land available for bus facility.	Same as SE Alternative 1.
	Additional area for surface expansion		
D. Constructability and Cost	Ease of Implementation (disruption to traffic, major utilities relocation, etc)	Complicated and high construction due to proximity of railroad and presence of hydro corridor.	Same constructability issues as SE Alternative 1.
	Cost range (comparing to average)	High cost compared to other stations.	High cost compared to other stations (costly access).
PREFERRED OPTION		Not Preferred	Not Preferred
OVERALL PREFERRED OPTION		Not Preferred	Not Preferred

FIGURE 4.3: MARKHAM STATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
D. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems	Vegetation removals: -Agricultural – 3.74 -Cultural Meadow (CUM1-1) – 1.38 ha -Hedge – 0.05 ha Total – 5.17 ha Distance from nearest watercourse – 120 metres	Vegetation removals: -Cultural Meadow (CUM1-1) – 2.58 ha -Manicured Lawn – 0.42 ha Total – 3.00 ha Distance from nearest watercourse – 125 metres
	Potential Effects on Environmentally Significant Landform/Features	No impacts.	
	Potential Effects on Geology and Hydrogeology	No effects identified. To be confirmed for preferred alternative through detailed field investigations.	
	Potential Effects on Hydrology		
	Potential Species /Habitat at Risk		
E. Social Environment	Potential effects on property.	Runningway and station site within protected corridor. Minor land may need to be purchased from Markham Hydro.	Site adjacent to large residential subdivision.
	Potential effects on adjacent Noise Sensitive Areas.	No impacts.	Potential noise impacts to residential neighborhood south of station site.
	Land Use Compatibility with provincial and municipal plans and policies.	Station located within lands designated as Transportation and Utilities. Alignment impacts 407 ETR S-E Ramp.	Station located within lands designated as Transportation and Utilities. Alignment impacts 407 ETR S-E Ramp and intersection of W-N/S ramp.

OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
F. Cultural Environment	Known presence of archeological potential.	Site affects area of potential archaeological finding. Field investigations will confirm preliminary assessment. If required, preliminary design shall avoid impact.	No identified impacts.
	Potential Impacts to First Nations Lands.	No impacts	
PREFERRED OPTION		Preferred	Not Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION;)			
E. Transitway Operation	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time)	Meets design standards; no major issues.	Meets design standards; no major issues.
	Suitability for staged implementation	Viable staged implementation of Transitway with buses operating on 407 ETR.	Viable staged implementation of Transitway with buses operating on 407 ETR.
F. Accessibility	Pedestrian accessibility and connectivity	Station platform is located within 150m of Markham Road. Pedestrians will cross Markham Road at a traffic signal.	Station platform is located within 200m of Markham Road Pedestrians would cross Markham Road at a traffic signal.
	Vehicular accessibility	Desirable signalized intersection spacing. Site would be served by new signalized intersection located midway between 14 th Avenue and the 407 ETR ramp. Markham Hydro transformer station access would be combined with station access.	Access will require a new signalized intersection located 200m south of 407 ETR interchange. Access to the site through local residential streets.
	Transit connectivity	A bus loop can be accommodated on site. Viable transit stops along Markham Road and pedestrian connection, from the stops.	Limited land availability would impede potential bus loop. Transit stops along Markham Road and pedestrian connection from the stops would be provided.
G. Site Area (size and shape)	Ability to optimize station facility layout and functionality	Sufficient space available for required parking (5.0 ha).	Site area is significantly constrained by residential development to the south and the Rouge River to the east (2.2 ha available).
	Additional area for surface expansion	Additional (expansion) parking could be provided within the hydro corridor.	Space available is insufficient to accommodate required parking, bus loop. No possibility of any future expansion.
H. Constructability and Cost	Ease of construction (disruption to traffic, major utilities relocation, etc.)	Markham Road and 407 ETR S-E ramp will be affected during construction. Construction staging plan would be developed to minimize effects.	Markham Road and 407 ETR S-E ramp would be affected during construction. Construction noise and traffic would affect adjacent residential neighbourhood.
	Cost range (comparing to average)	Average station cost.	Average station cost.
PREFERRED OPTION		Preferred	Not Preferred
OVERALL STATION RATING:		Preferred	Not Preferred

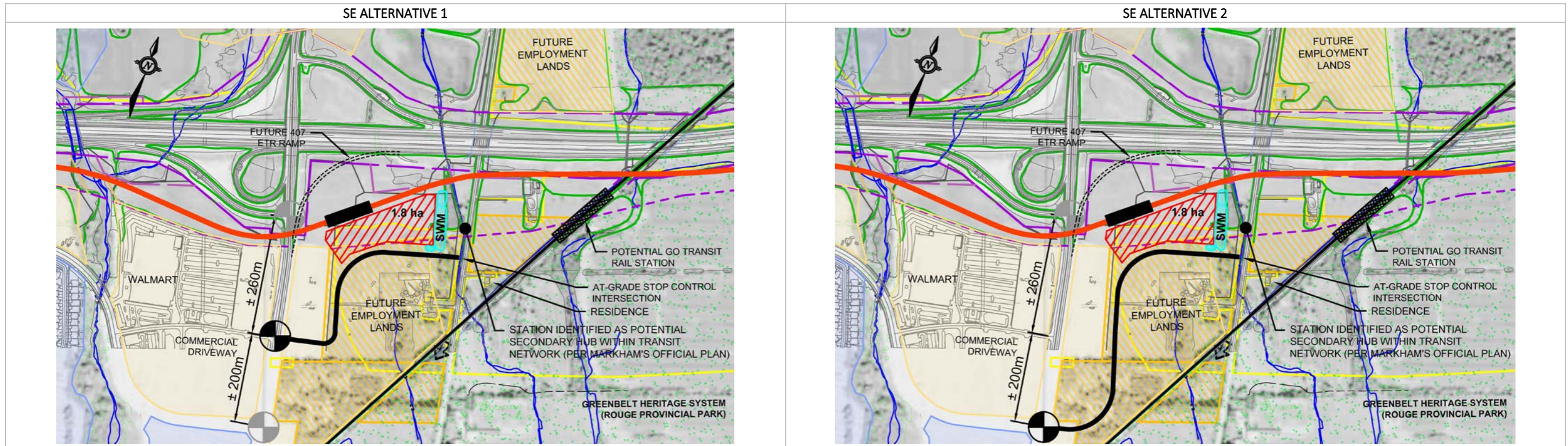
FIGURE 4.4: NINTH LINE STATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
G. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems	Vegetation removals: -Cultural Meadow (CUM1-1) – 5.23 ha Total 5.23 ha Distance from nearest watercourse – 91.9 metres	Vegetation removals: -Cultural Meadow (CUM1-1) – 3.33 ha -Cultural Woodland (CUW1) – 0.54 ha Total – 3.86 ha One watercourse runs through the station footprint (Tributary of Rouge River anticipated coolwater watercourse).
	Potential Effects on Environmentally Significant Landform/Features.	No identified impacts.	
	Potential Effects on Geology and Hydrogeology.	No effects identified. To be confirmed for preferred alternative through detailed field investigations.	
	Potential Effects on Hydrology . Potential Species /Habitat at Risk.		
H. Social Environment	Potential effects on property.	None.	Easement through commercial development required. Station driveway would need to be combined with existing driveway of the Boxgrove Medical Arts Centre. Removes approximately 0.4 ha of developable land.

OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
	Potential effects on adjacent Noise Sensitive Areas	Adjacent to residential neighborhood. Noise detailed assessment (if site is recommended as preferred alternative) will determine noise effects and mitigation measures if warranted. Residential neighborhoods will bound station limits as City of Markham plans to convert any unused land to residential.	Adjacent to planned commercial plaza, medical center and old age home EMI/EMC and noise/vibration concerns for the Boxgrove Medical Arts Centre.
	Land Use Compatibility with provincial and municipal plans and policies.	Station site on land protected for the transitway station. In keeping with current Official Plan Land Use designation, however, reduces future development opportunity. Within the City of Markham’s Residential Low Rise land use area.	Station site located in transportation and utilities corridor. Access road may affect planned institutional / commercial development. Will not reduce residential development opportunity west of Ninth Line. Removes approximately 0.4 ha of commercial/industrial developable land to accommodate access. Within the highway and transitway ROW – Access road footprint is within the City of Markham’s Commercial and Business Park Employment land use area.
I. Cultural Environment	Known presence of archeological potential. Potential Impacts to First Nations Lands.	No identified impacts.	
PREFERRED OPTION		Preferred	Not Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION)			
I. Transitway Alignment	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time).	Meets design standards, underpass alignment minimizes grade separation at station.	Meets design standards; however, overpass alignment likely required due to creek located to the east of the station platform. Overpass alignment would significantly increase alignment complexity and cost.
	Suitability for staged implementation.	Feasible staged implementation with the Transitway operating on 407 ETR for westbound service. For eastbound service, feasible if and when 407 ETR S-E ramp is constructed.	Same as SW Alternative.
J. Accessibility	Pedestrian accessibility and connectivity.	Short walking distance from Ninth Line to station platform (i.e. 100m). Pedestrians would be required to cross Ninth Line at traffic signals. Potential for a walkway from residential neighbourhood to be discussed with the City and the community in further design phase of the project.	Pedestrian access from Ninth Line to station platform (i.e. 200m) would conflict with future 407 ETR S-E Ramp requiring a level, free flow crossing of the ramp.
	Vehicular accessibility.	Site access would be provided using the Old Ninth Line corridor which has been protected for station access; travel distance from Ninth Line = 700 metres. Traffic signals are required at the intersection of Old Ninth Line and Copper Creek Drive.	Site access would be provided via Copper Creek Drive (approximately 380m east of Ninth Line).
	Transit connectivity.	Transit stops along Ninth Line, and pedestrian connection from the stops would be provided. Bus loop also feasible if required.	Limited land availability would restrict potential bus loop. Transit stops along Ninth Line, and pedestrian connection from the stops would be provided.
K. Site Area (size and shape)	Ability to optimize station facility layout and functionality.	Sufficient space available for parking lot (5.5 ha).	Site area is significantly constrained by commercial development to the south and the Rouge River tributary to the east (2.6 ha available). Space available would be insufficient to accommodate required parking and associated facilities.
	Additional area for surface expansion.	Additional area for parking available to the west of the site, if required.	No available land for expansion opportunities.
L. Constructability and Cost	Ease of construction (disruption to traffic, major utilities relocation, etc.).	No major constructability issues.	Constructability impact subject to timing of 407 ETR S-E Ramp is built.
	Cost range (comparing to average).	Average station cost.	Average station cost.
PREFERRED OPTION		Preferred	Not Preferred
OVERALL STATION RATING:		Preferred	Not Preferred

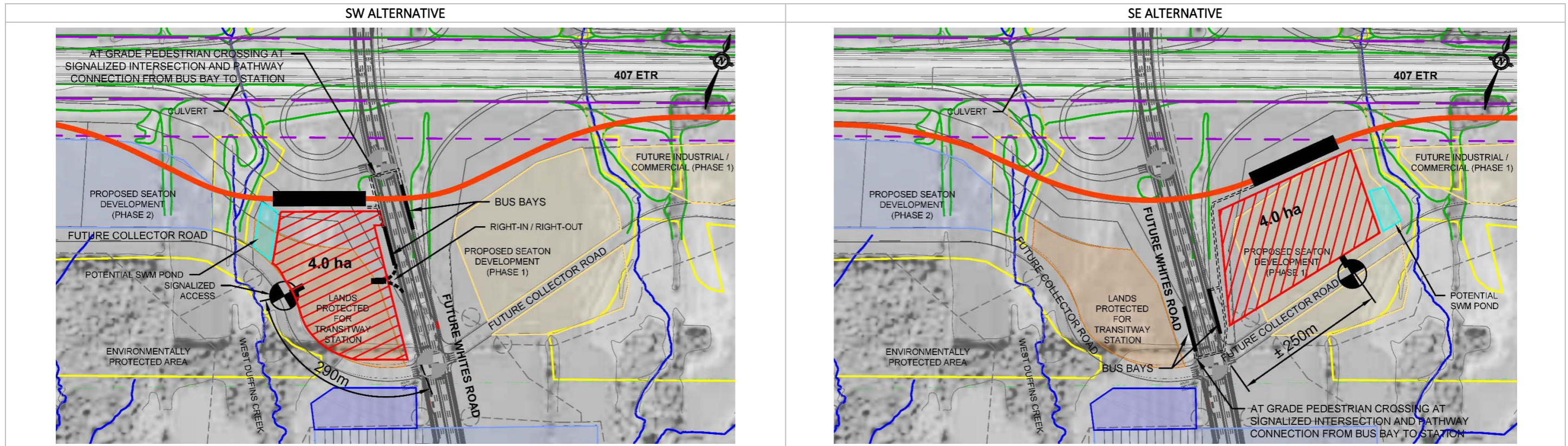
FIGURE 4.5: DONALD COUSENS STATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SE ALTERNATIVE 1	SE ALTERNATIVE 2
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
J. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems.	Vegetation removals: -Agricultural – 3.12 ha -Cultural Meadow (CUM1-1) – 4.83 ha -Deciduous Forest – 0.04 ha -Manicured lawn – 0.4 ha Total – 8.39 ha Distance from nearest watercourse – 17.63 metres	Vegetation removals: -Agricultural – 3.12 ha -Cultural Meadow (CUM1-1) – 4.83 ha -Deciduous Forest – 0.04 ha -Manicured lawn – 0.4 ha Total – 8.39 ha Distance from nearest watercourse – 17.63 metres
	Potential Effects on Environmentally Significant Landform/Features.	No identified impacts	
	Potential Effects on Geology and Hydrogeology.	No effects identified. To be confirmed for preferred alternative through field investigations.	
	Potential Effects on Hydrology.		
Potential Species /Habitat at Risk.			
K. Social Environment	Potential effects on property.	Two properties need to be expropriated for station site. Removal of residential home/ property buy-out (8119 Reesor Road).	Same as Alternative 1.
	Potential effects on adjacent Noise Sensitive Areas.	No impact.	Same as Alternative 1.

OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SE ALTERNATIVE 1	SE ALTERNATIVE 2
	Land Use Compatibility with provincial and municipal plans and policies.	Donald Cousens Pkwy area identified as a future station hub Alignment and station located within lands identified as transportation and utilities in official plan. Heritage site south of station site to be avoided in preliminary design. Within the highway ROW, the Greenbelt Natural Heritage System and Protected Countryside (City of Markham’s Official Plan).	Same as Alternative 1.
L. Cultural Environment	Known presence of archeological potential.	Cultural Heritage feature (CHR6 and CHR7) just south of site.	Potential effects to cultural heritage by access Rd. opposite to Cooper Creek Drive.
	Potential Impacts to First Nations Lands.	No identified impacts.	
PREFERRED OPTION		Preferred	Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION)			
M. Transitway Alignment	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time).	Meets design standards. No major issues.	Same as Alternative 1.
	Suitability for staged implementation.	Viable staged implementation with Transitway buses operating on 407 ETR	Same as Alternative 1.
N. Accessibility	Pedestrian accessibility and connectivity.	About 200m from Donald Cousens Pkwy. If 407 ETR S-E ramp is built in the future, pedestrian walkway from Donald Cousens Pkwy will require re-alignment.	Same as Alternative 1.
	Vehicular accessibility.	Site access from Donald Cousens Pkwy would be provided by new road directly opposite Walmart access and integrated with the road network of the proposed business park / employment lands between Donald Cousens Pkwy and Reesor Road. Traffic signal spacing complies with standards.	Site access from Donald Cousens Pkwy would be provided by new road directly opposite to Cooper Creek Drive through current private property. Long and costly access.
	Transit connectivity.	A bus loop can be accommodated on site. Viable transit stops along Donald Cousens Pkwy and pedestrian connection, from the stops.	Same as Alternative 1.
O. Site Area (size and shape)	Ability to optimize station facility layout and functionality.	Constrained area between west of Reesor Road. Potential expansion east of Reesor Road if GO Transit implements future service on CP Havelock rail line will need to avoid impact to heritage buildings.	Same as Alternative 1.
	Additional area for surface expansion.	Limited land available east of Reesor Road.	Same as Alternative 1.
P. Constructability and Cost	Ease of Implementation (disruption to traffic, major utilities relocation, etc).	No major issues.	Same as Alternative 1.
	Cost range (comparing to average).	Average station cost.	Higher cost of access road.
PREFERRED OPTION		Preferred	Not Preferred
OVERALL STATION RATING:		Preferred	Not Preferred

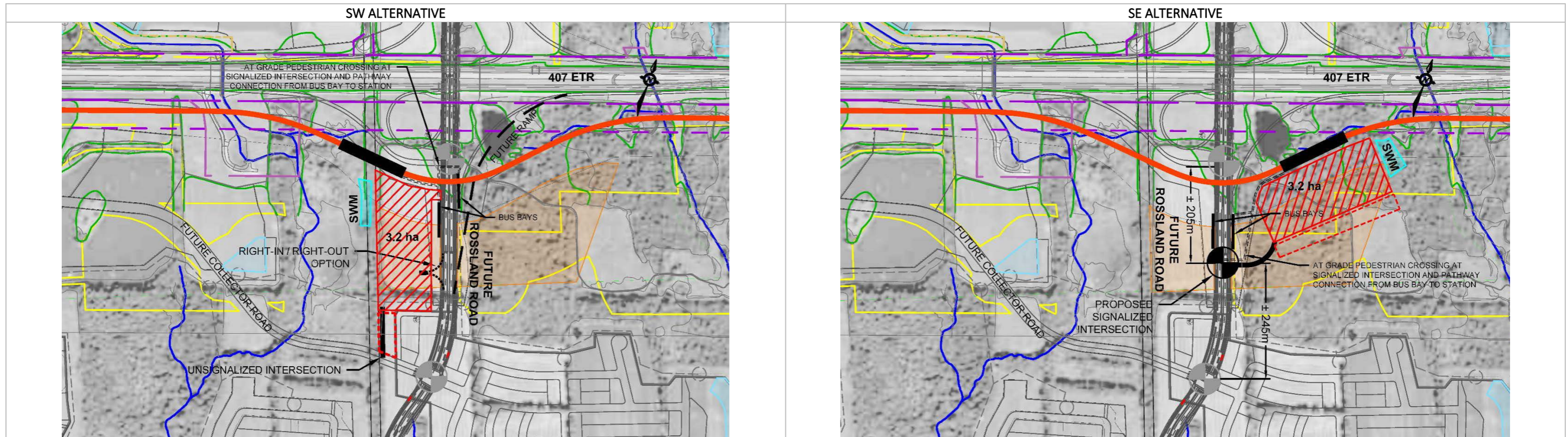
FIGURE 4.6: WHITES ROAD STATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
M. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems	Vegetation Removals: - Agricultural – 3.89 ha - Deciduous Forest (FOD) – 0.09 ha - Hedgerow – 0.08 ha Total – 4.06 ha Distance from nearest watercourse – 24.19 metres (Tributary of West Duffins Creek)	Vegetation Removals: -Agricultural – 4.14 ha Total – 4.14 ha Distance from nearest watercourse – 68.41 metres (Tributary of West Duffins Creek)
	Potential Effects on Environmentally Significant Landform/Features.	No identified impacts.	
	Potential Effects on Geology and Hydrogeology. Potential Effects on Hydrology.	No effects identified. To be confirmed for preferred alternative through field investigations.	
	Potential Species /Habitat at Risk.	Potential impacts to bobolink/eastern meadowlark habitat (to be confirm during field studies) can be avoided. If the species is found to be present, avoidance of their habitat will not be feasible based on the current proposal. Subsequently, an authorization under the ESA (2007) would be required.	Potential impacts to bobolink/eastern meadowlark habitat (to be confirmed during field studies).
N. Social Environment	Potential effects on property.	Station site located on land protected for transitway. Property for station already protected as part of the Seaton Development Plan.	Potential impact to planned Seaton development.

	Potential effects on adjacent Noise Sensitive Areas.	Potential impact to planned Seaton development to be further assessed for the preferred alternative.	Potential impact to planned Seaton development to be further assessed for the preferred alternative.
	Land Use Compatibility with provincial and municipal plans and policies.	Station site on land protected for Transitway station by Seaton development Station compatible with Phase 1 of Seaton Development Plan. Within the Prestige Employment Lands and lands protected for the transitway as per the Central Pickering Development Plan).	Station on land protected for future Seaton development. Identified as phase one employment area. Not compatible with Seaton Development Plan. Land swap would be required with Phase 1 lands west of Whites Road (currently designated for transit station). Within the Prestige Employment Lands area.
O. Cultural Environment	Known presence of archeological potential. Potential Impacts to First Nations Lands.	No identified impacts	
PREFERRED OPTION		Preferred	Not Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION)			
Q. Transitway Alignment	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time). Suitability for staged implementation.	Meets design standards. Constrained by creek to west of station site. Staged implementation with Transitway buses operating on 407 ETR would be feasible, once the Interchange is constructed.	Meets design standards. Staged implementation with Transitway buses operating on 407 ETR would be feasible, once the Interchange is constructed.
R. Accessibility	Pedestrian accessibility and connectivity. Vehicular accessibility. Transit connectivity.	Short walking distance from Whites Road (i.e.100m). Pedestrian crossing would be accommodated at signalized intersection. Site access would be provided via a signalized access on the South Employment Collector Road (approximately 290 m west of Whites Road). Street stops provided. Bus loop provided on site. This station may also be suitable for interlining where local transit vehicles can enter/exit the Transitway corridor. Right-in/right-out to be provided along Whites Road Road for bus only use.	Direct access from Whites Road would require crossing the 407 ETR S-E Ramp. Site access via a signalized access on the South Employment Collector Road (approximately 250 m east of Whites Road). Future 407 ETR S-E Ramp precludes opportunity for second access (right-in /right-out) to/from Whites Road. Street stops provided. Bus loop provided on site. This station may also be suitable for interlining, where local transit vehicles can enter/exit the runningway where feasible. Right-in/right-out access from Whites Road for bus only use not available due to presence of future 407 ETR S-E ramp.
S. Site Area (size and shape)	Ability to optimize station facility layout and functionality. Additional area for surface expansion.	Sufficient area available for parking lot (4.0 ha). No further expansion potential due to presence of West Duffins Creek.	Land within the Seaton Development Phase 1 Plan. No further expansion potential without affecting Seaton Development's Prestige Employment Lands.
T. Constructability and Cost	Ease of construction (disruption to traffic, major utilities relocation, etc.). Cost range (comparing to average).	Construction could be coordinated with construction of Whites Road and South Employment Collector. Average station cost.	Construction can be coordinated with construction of Whites Road and South Employment Collector Road. Average station cost.
PREFERRED OPTION		Cost range (comparing to average).	Not Preferred
OVERALL STATION RATING:		Preferred	Not Preferred

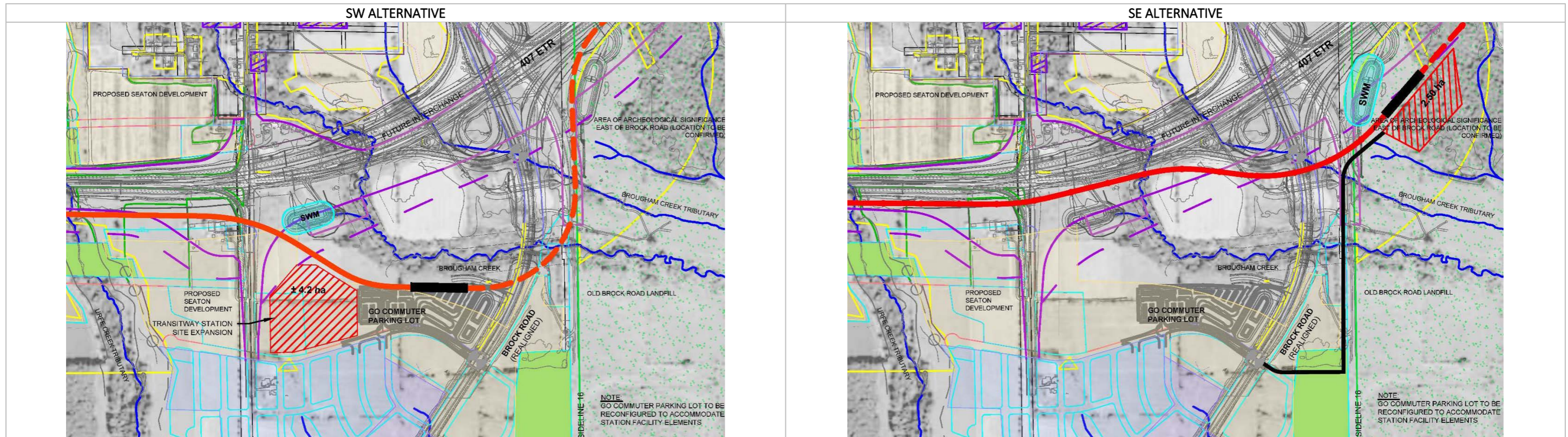
FIGURE 4.7: ROSSLAND ROAD STATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
P. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems.	Vegetation removals: -Agricultural – 2.74 ha -Hedgerow – 0.53 ha Total – 3.27 ha Distance from nearest watercourse – 126.55 metres (Ganatsekiagon Creek)	Vegetation Removals: -Coniferous forest (FOC) – 0.81 ha -Deciduous forest (FOD) – 2.38 ha -Open Aquatic – 0.05 ha Total – 3.25 ha One watercourse runs through the station footprint (Tributary of Urfe Creek anticipated coolwater watercourse).
	Potential Effects on Environmentally Significant Landform/Features.	No identified impacts.	
	Potential Effects on Geology and Hydrogeology.	To be determined for preferred alternative.	
	Potential Effects on Hydrology.	To be determined for preferred alternative.	
	Potential Species /Habitat at Risk.	Potential impacts to bobolink/eastern meadowlark habitat (to be confirm during field studies).	No significant impacts.
Q. Social Environment	Potential effects on property.	No identified impacts.	No identified impacts.
	Potential effects on adjacent Noise Sensitive Areas.	Adjacent to planned Seaton employment corridor.	Adjacent to planned Seaton low rise residential.

OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
	Land Use Compatibility with provincial and municipal plans and policies.	Station located on land protected for transitway station. Station location generally in compliance with the Seaton Development Plan. Within Central Pickering Development Plan's lands protected for Transitway and Natural Heritage System.	Station located on land protected for transitway station. Station location generally in compliance with the Seaton Development Plan. Within Central Pickering Development Plan's lands protected for Transitway and Natural Heritage System.
R. Cultural Environment	Known presence of archeological potential.	No identified impacts.	Impact to area of archaeological potential – 0.008 ha.
	Potential Impacts to First Nations Lands.	No identified impacts.	
PREFERRED OPTION		Preferred	Not Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION)			
U. Transitway Operation	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time).	Alignment constrained by creek west of station site.	Alignment meets design standards.
	Suitability for staged implementation.	Timing uncertainty for construction of Rossland Extension and ETR Interchange does not allow implementation plans.	Timing uncertainty for construction of Rossland Extension and ETR Interchange does not allow implementation plans.
V. Accessibility	Pedestrian accessibility and connectivity.	Short walking distance from Rossland Road (i.e.100m). Pedestrian crossing would be accommodated at signalized intersection.	Direct access from Rossland Road would require crossing the 407 ETR S-E Ramp.
	Vehicular accessibility.	Site access would be provided via a signalized access on the South Employment Collector Road (approximately 290 m west of Rossland Road). Potential for second access (right-in /right-out) to/from Rossland Road.	Site access via a signalized access on the South Employment Collector Road (approximately 250 m east of Rossland Road). Future 407 ETR S-E Ramp precludes opportunity for second access (right-in /right-out) to/from Rossland Road.
	Transit connectivity.	DT does not have service plans that would connect to this station.	DT does not have service plans that would connect to this station.
W. Site Area (size and shape)	Ability to optimize station facility layout and functionality.	Area constrained by West Duffins Creek flood plain.	Area constrained by potential archaeological land.
	Additional area for surface expansion.	No further expansion potential due to presence of West Duffins Creek.	No further expansion potential without affecting Seaton Development's Prestige Employment Lands.
X. Constructability and Cost	Ease of construction (disruption to traffic, major utilities relocation, etc.).	Construction could be coordinated with construction of Rossland Road and South Employment Collector.	Construction can be coordinated with construction of Rossland Road and South Employment Collector Road.
	Cost range (comparing to average).	Average station cost.	Average station cost.
PREFERRED OPTION		Not Preferred	Not Preferred
OVERALL STATION RATING:		Not Preferred for a station. Site protected for other potential uses.	Not Preferred

FIGURE 4.8: BROCK ROAD STATION



OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
EFFECTS TO THE ENVIRONMENT (OBJECTIVE: MINIMIZE ADVERSE EFFECTS ON THE NATURAL ENVIRONMENT)			
S. Natural Environment	Potential Effects on Terrestrial and Aquatic Ecosystems.	Vegetation Removals – -Agricultural – 2.81 ha -Cultural Meadow (CUM1-1) – 0.24 ha -Hedgerow – 0.17 ha Total – 3.22 ha Distance from the nearest watercourse- 118.7 metres	Vegetation Removals – -Cultural Meadow (CUM1-1) – 0.30 ha -Coniferous Swamp (SWC) – 2.24 ha Total – 2.53 ha Distance from the nearest watercourse - 29.7 metres
	Potential Effects on Environmentally Significant Landform/Features.	No identified impacts	Impacts to swamp and forested area – high ecological sensitivity, potential for winter deer habitat.
	Potential Effects on Geology and Hydrogeology.	No effects as site was already investigated through the EA of the GO Transit Commuter lot to be promptly built.	Area includes permanently inundated sections and groundwater seepage (Highway 407 East document).
	Potential Effects on Hydrology. Potential Species /Habitat at Risk.		Drainage impacts – permanently inundated area. To be determined if selected as preferred alternative.
T. Social Environment	Potential effects on property.	Land swap between IO lands and MTO may be required for potential station expansion in the future. Combine station site with planned GO Transit commuter lot.	In Rural Lands. Potential private property acquisition required.
	Potential effects on adjacent Noise Sensitive Areas.	Adjacent to planned Seaton residential development. Further assessment to be performed during detailed field investigations.	Minimal impact.

OBJECTIVES/ CRITERIA/ INDICATORS		POTENTIAL STATION LOCATIONS	
CRITERIA	INDICATORS	SW ALTERNATIVE 1	SE ALTERNATIVE 1
	Land Use Compatibility with provincial and municipal plans and policies.	Adjacent to planned GO Transit commuter lot and partially within land protected for by the transitway station. Near the Central Pickering Development Plan’s Prestige Employment Lands.	In greenbelt lands not compatible with land use plans. Removed from residential and employment lands on west side of Brock Station would be located outside the Seaton Development area. Within the Greenbelt Area – Protected Countryside/Natural Heritage System.
U. Cultural Environment	Known presence of archeological potential.	No identified impacts.	Impacts to archaeological area – 2.53 ha.
	Potential Impacts to First Nations Lands.	No identified impacts.	No identified impacts.
PREFERRED OPTION		Preferred	Not Preferred
SERVICE QUALITY AND INFRASTRUCTURE NEEDS (OBJECTIVE: MAXIMIZE SERVICE QUALITY AND MINIMIZE DISRUPTION)			
Y. Transitway Operation	Runningway Alignment (Safety, Ride comfort, Optimim Travel Time).	Feasible at grade alignment while Brock Road Station acts as the east terminus 407 Transitway facility.	Very long and high viaduct structure required to cross Brougham Creek, Brock Road and Sideline 16.
	Suitability for staged implementation.	This site will allow adequate staged implementation with buses operating on 407 ETR.	This station is not suited for staged implementation, as travel distance to the interchange would be very long.
Z. Accessibility	Pedestrian accessibility and connectivity.	Walking distance from Brock Road is approximately 100 m.	Walking distance from Brock Road is approximately 300 m.
	Vehicular accessibility.	Station access off proposed Seaton Collector Road.	Site access would be provided at a planned signalized intersection on Brock Road and the existing alignment of Sideline 16 (length of access road approximately 1.2 km).
	Transit connectivity.	The GO Transit car-pool would be reconfigured to accommodate a transit station concept. A Transitway turnaround will be integrated to the site, as Brock Road represents the eastern terminus of this section of the Transitway. This station may also be suitable for interlining, where DT vehicles could enter/exit the runningway.	A bus loop would be provided adjacent to the station; however, it would reduce the parking capacity of a restricted area. The station may be suitable for interlining, where local transit vehicles could enter/exit the runningway.
AA. Site Area (size and shape)	Ability to optimize station facility layout and functionality.	Sufficient area is available to accommodate parking, transit and active transportation needs.	The station area (2.5 ha) is insufficient for a complete facility.
	Additional area for surface expansion.	No additional area available. Constrained by Brougham Creek and Seaton Development Employment Lands.	No opportunity for expansion.
BB. Constructability and Cost	Ease of Implementation (disruption to traffic, major utilities relocation, etc).	Construction could be coordinated with construction of Seaton’s collector roadway. Station construction just south of an environmentally sensitive area.	Station site is located in environmentally and culturally sensitive area, requiring extensive mitigation measures. Construction of an additional Transitway grade separation across Brock Road would be required.
	Cost range (comparing to average).	Lower than average as the existing commuter lot will be retrofitted.	Cost much higher than average.
PREFERRED OPTION		Preferred	Not Preferred
OVERALL STATION RATING:		Preferred	Not Preferred

4.3.3. Conclusions and Recommendations of Station Sites Evaluation

The evaluation of station site locations selected in the initial screening of nodes described in **Section 4.3.2** was conducted based on detailed environmental field investigations, traffic studies, ridership sensitivity assessments, adequate vehicular and pedestrian accessibility, transit connectivity, implementation strategy, constructability, future considerations, and discussions with stakeholders and the public. Conclusions and recommendations are described in **Chapter 5** of the EPR.

4.4. Alignment Alternatives

The Corridor Protection Study previously undertaken by MTO, protected property along a 60m wide strip, on the south side of the 407 ETR Highway, based on a conceptual alignment. Wherever technically and environmentally feasible, the updated alignment was defined within the protected corridor, linking the potential alternative station sites that were carried through the first screening of station alternatives. Only in locations where the protected corridor presented technical and/or environmental issues, alignment alternatives were assessed. Alignments were identified based on the following criteria:

- Use as much land as possible that is identified in the 1998 Corridor Protection Study, or land that is Provincially owned or not considered developable;
- Meet with the established MTO Transitway design standards;
- Avoid impacts on private property, environmental features, current and planned infrastructure including active transportation and recreational trails;
- Locate the station platforms as close as possible to surface transportation facilities to allow optimum passenger accessibility;
- Maintain the runningway profile as close to existing ground as practical to reduce earthwork volumes and structure costs;
- Not exceed desirable geometric horizontal and vertical alignment components such as curvature, and grades to maximize passenger comfort, to maximize sight distances and safety, and to reduce future vehicle operation and maintenance costs;
- Minimize adverse effects on adjacent communities and general traffic during construction;
- Minimize effects on municipal services and utilities during construction to reduce costs; and,
- Comply with lateral and vertical provincial and municipal technical and environmental clearance standards.

The alignment options (where applicable) were developed concurrently with the station site alternatives to optimize feasibility and functionality. The alignment alternatives were evaluated as part of the overall site assessments (**Figures 4.2 to 4.8**).

Areas that presented specific physical, infrastructural or environmental constraints that affected the alignment alternative identification and/or definition are discussed below:

McCowan Road Crossing

The McCowan Road Crossing presents several challenges. The presence of a large trunk sewer running under McCowan Road eliminates the possibility of an underpass crossing option. Horizontally, it was confirmed that

Hydro One is planning to add a high voltage 500 KV line north of their existing facilities forcing the Transitway alignment further north. This northern shift involves a long flyover all 407 ETR on and off ramps. Due to the presence of the Hydro Corridor on the south side and the Highway 407 ETR on the north side, no other alignments are feasible through this Interchange.

Donald Cousens Parkway / Reesor Road Crossing

The Donald Cousens Parkway/ Reesor Road area presented some significant challenges. The only viable station site locates the station platform on the southeast quadrant of the interchange. To optimize the use of the limited land available for the station facility, the alignment needed to be located as far north as possible. The grade difference between Donald Cousens Parkway and Reesor Road is significant, requiring either a viaduct structure running above both roadways or an underpass structure at Donald Cousens Parkway and an overpass structure at Reesor Road with a steep grade between the two. With the presence of the CP Havelock rail line just east of Reesor Road, the most suitable profile includes an underpass across the Donald Cousens Interchange, and a bridge over Reesor Road and the rail line.

Seaton Development Area

The future and approved Seaton Development Plans are located south of the Highway 407 ETR along a 7km stretch. There is only a limited corridor between the ETR Highway and the Seaton Development Plans. Alignments were assessed the available corridor, and due to the presence of environmental features such as the West and East Duffins Creeks and tributaries, only one feasible option was identified. At the future Rossland ETR Interchange, profiles crossing the future Interchange over or under were assessed. Due to the presence of a potential sensitive archaeological site east of the future interchange, the underpass option was eliminated.

Brock Road Crossing

In this area, the alignment options were also restricted by several constraints: i) There is only one viable station site and the alignment needs to fit adequately; ii) within the vicinity of Brock Road there is a significant coldwater creek system which runs through the Brock Road Interchange area; and the alignment needs to maintain required regulated offsets from the creek; iii) a cultural heritage site is located in the southeast quadrant of the Interchange forcing a sharp northward bend in the alignment; iv) the creek system precluded any possibility of an underpass alignment at this location; v) natural environmental features east of Brock Road needed to be considered to ensure sufficient flexibility for the Transitway alignment east of Brock Road (not part of this Study). Due to the described constraints, there is only one feasible corridor alignment.

The remaining segments did not present environmental, technical or property issues; consequently, the alignment follows the protected corridor previously identified in the Corridor Protection Study.