

5.0 PURPOSE AND RATIONALE FOR THE UNDERTAKING

The purpose of this EA study is to address the following within the study limits:

- The long-term rehabilitation needs of the QEW Credit River Bridge; and,
- The future improvement needs and requirements for the QEW within the study limits and Mississauga Road Interchange.

5.1 PROBLEM BEING ADDRESSED

The QEW is a critical element in the Greater Toronto Area (GTA) transportation network, and is one of Ontario's most important transportation facilities, for trade, commuter and tourism traffic and connects the GTA to Niagara and the US border. Approximately 22,000 commercial vehicles cross the Credit River Bridge daily, making the QEW a major economic corridor for inter-regional and international goods movement. The QEW Credit River Bridge is a critical piece of infrastructure within the QEW network.

The QEW Credit River Bridge is over 75 years old; it was originally constructed as a four lane bridge in 1934; widened to six lanes in 1960; and last rehabilitated over 20 years ago in 1987, as described in **Section 4.4.2**. The existing 1936 bridge deck is in very poor condition; the concrete is delaminated, spalling, and scalling and requires immediate attention. Independent of this Class EA Study, MTO has initiated a Detail Design study, referred to as the Holding Strategy, to address the immediate and short-term rehabilitation needs of the QEW Credit River Bridge and is currently under construction. This immediate rehabilitation is intended to "hold" the bridge until the long-term plan, identified by this Class EA Study, can be implemented.

To address the long-term rehabilitation needs of the QEW Credit River Bridge, the existing bridge deck requires rehabilitation or replacement. The existing bridge deck is approximately 29 m wide; carrying 6 lanes with no median shoulders and very narrow outside shoulders. No roadway elements (i.e., lane width, shoulders, barriers) on the existing bridge deck meet current standards. As a result, there is no additional width on the existing bridge deck to maintain all 6-lanes of traffic staging and a working zone for construction of rehabilitation/replacement. Therefore, it is not possible to maintain the existing six lanes across the Credit River Bridge while rehabilitating/replacing the existing bridge deck.

In considering, construction staging options with long term 1 or 2-lane closures of the QEW, it is noted that the existing QEW experiences significant congestion in the peak periods and reducing the number of lanes for bridge improvements will result in unacceptable delays and significant impacts to this economic corridor and adjacent local roads. Within the study limits there are 175,000 vehicles per day (upwards of 195,000 vehicles in the summer) using the QEW. The segment from Erin Mills Parkway to Mississauga Road is the slowest section of the QEW Mississauga corridor during the morning peak period for eastbound traffic, seeing average speeds of 46 km/h. As well during the weekends, along most of the QEW Mississauga corridor is operating at capacity.

In considering potential traffic impacts during construction to the surrounding local road network, it is noted that any increase in congestion along the QEW (i.e., reduction in the number of lanes) would put a strain on other transportation facilities within Mississauga (i.e., regional and local roadways, GO Lakeshore Line) and would negatively impact neighbouring communities. Lakeshore Road (approximately 2 km to the south) and Dundas Street (approximately 2 km to the north) are the only parallel routes to cross the Credit River within the study area and would provide only minimal relief to the QEW since it is not a desirable alternative due to the substantial out-of-way travel (upwards of 5 km of out-of-way travel).

The section of the QEW within the study area, from west of Mississauga Road to west of Hurontario Street, is an urban cross-section, as described in **Section 4.4.1**. Through the Mississauga Road Interchange and across the Credit River Bridge there is little to no median shoulders, and the outside shoulders are less than 1.5 m wide across the Credit River Bridge.

The existing Mississauga Road Interchange is an unconventional buttonhook configuration and many of the interchange elements do not conform to current MTO geometric design standards. Even though the north side of the interchange was reconfigured in the late-1990's, the ramps on the south side remain unchanged - the length of the two existing eastbound on-ramps is well below current standards due to the close proximity of Mississauga Road and the Credit River Bridge.

Through the QEW Mississauga Road Interchange and Credit River Bridge, the collision rate is slightly higher than the provincial average for a freeway. Rear-end, sideswipe, and secondary collisions account for the majority of collisions (approximately 70% of total collisions within the study area), which is symptomatic of a congested facility with limited shoulder space and the constraints imposed on the Mississauga Road Interchange eastbound on-ramps by the Credit River Bridge. A review of the existing collision data is provided in **Section 4.4.3**.

Therefore, as part of addressing the long term needs of the QEW Credit River Bridge, there is an opportunity to address the existing geometric deficiencies and local operational issues on the QEW mainline and Mississauga Road Interchange.

Underscoring the importance of addressing the long term needs of the QEW Credit River Bridge and the long term operational needs of the QEW within the study limits, the Province's Growth Plan for the Greater Golden Horseshoe (GGH) recognizes the QEW as a key corridor to connect economic centres and international gateways. The Province's *Growth Plan* has established policies and plans that support managing growth and development within the GGH over the next 30 years by establishing an integrated, multi-modal transportation network.

Recognizing the priority for provincial highways to facilitate the efficient movement of people and goods, MTO is addressing the Credit River Bridge structural needs and QEW operational issues through this Class EA Study.

Additionally, building on one of the guiding principles for the *Growth Plan*, "optimize the use of existing and new infrastructure to support growth in a compact efficient form", MTO has

established an HOV network plan for 400-series highways within the GGH to optimize network capacity by encouraging carpooling and transit use. This plan includes the QEW corridor.

In summary, an assessment of the existing bridge and roadway conditions within the study area identified the following structural and transportation problems and opportunities:

Problems

- The QEW Credit River Bridge is in poor condition and requires immediate attention to avoid potential significant safety consequences; the last rehabilitation was completed over 20 years ago in 1987
- It is not possible to maintain the existing six lanes across the Credit River Bridge while rehabilitating/replacing the existing bridge deck. Reducing the number of lanes during the day for bridge rehabilitation will result in unacceptable delays and significant impacts to this economic corridor and adjacent local roads.
- The existing QEW though the study limits has a narrow cross-section with almost no shoulders across the Credit River Bridge.
- The existing Mississauga Road Interchange has an unconventional configuration and is in very close proximity to the Credit River Bridge limiting the length of the eastbound on-ramps from Mississauga Road.

Opportunities

- Addressing the long term needs of the QEW Credit River Bridge (i.e., rehabilitation/replacement) also presents opportunities to optimize the use of existing infrastructure by addressing:
 - the long term operational needs of the QEW and the Mississauga Road Interchange within the study limits; and
 - to not preclude the Ministry's future opportunity to optimize the network capacity by encouraging carpooling and transit use through the MTO HOV network plan for 400-series highways within the GGH.

Therefore, the purpose of the study is to address the existing bridge and transportation problems within the study limit, while at the same time not precluding the province's vision to establish an integrated multi-modal network in support of the Growth Plan for the GGH.

6.0 ALTERNATIVES AND EVALUATION

6.1 INTRODUCTION

In accordance with the Class EA process, the assessment and evaluation of planning and preliminary design alternatives in this study are traceable, replicable and understandable. This study has also recognized public and agency input, as well as MTO highway standards and requirements throughout the assessment and evaluation process.

The assessment and evaluation of planning and preliminary design alternatives consisted of the following key steps:

- Identification of the problems and opportunities within the study area (see **Chapter 5.0**);
- Identification of assessment factors and sub-factors to be used in evaluating the alternatives;
- Assessment of alternatives to the undertaking, to establish an approach most appropriate to address the overall problem;
- Develop a long list of alternative methods (bridge and interchange);
- Assessment and evaluation of short-listed alternative methods (bridge / mainline and interchange); and,
- Establishment of an overall preferred alternative.

6.2 ALTERNATIVES TO THE UNDERTAKING

A principal of the Environmental Assessment process is to identify and compare a reasonable range of alternatives to address the stated study problems or opportunities. Alternatives to the Undertaking (commonly called transportation planning alternatives) are *functionally* different ways of addressing transportation problems and opportunities, and for achieving the purpose of the undertaking.

An analysis of the Alternatives to the Undertaking was completed to determine the preferred solution to be carried forward to the Alternative Methods phase. The alternatives were assessed based on their ability to address the purpose of the undertaking, including the previously identified problems and opportunities, and potential positive and negative effects on the natural, social and economic environments.

For this study, the Alternatives to the Undertaking were examined in two parts to address the two primary goals of this Class EA Study:

- The long-term rehabilitation needs of the QEW Credit River Bridge; and
- The future improvement needs and requirements for the QEW and Mississauga Road interchange.

6.2.1 Alternatives to the Undertaking – Bridge Alternatives

To address the long-term rehabilitation needs of the QEW Credit River Bridge, the following bridge “Alternatives to the Undertaking” were considered:

- Do Nothing;
- Rehabilitate; and
- Replace.

Do Nothing

This alternative implies a scenario whereby the QEW Credit River Bridge would remain “as is” after the completion of the 2013 rehabilitation work (see **Section 1.4.1** for more details). Any future work undertaken would be limited to routine maintenance, i.e., concrete patching, snow clearing, etc. Due to the current condition of the structure and expected further deterioration (as discussed in **Section 5.0**), providing only routine maintenance does not address the structural needs and will not allow the bridge to continue to safely carry traffic. Continued deterioration of the bridge would result in bridge failure and would have high potential for significant socio-economic and natural environmental effects given the importance of the QEW as a goods movement corridor within southern Ontario and a commuter route between Hamilton/Burlington/Oakville/Mississauga and Toronto. This alternative was not considered to be an option since there are significant safety issues related with maintaining the bridge in its current condition.

Therefore, this alternative was not considered a viable option and was not carried forward for further consideration.

Rehabilitate

It is anticipated that the long-term rehabilitation strategy for the QEW Credit River Bridge would require a full deck replacement. As described in **Chapter 5 Problems and Opportunities**, it is not feasible to maintain all 6-lanes of traffic for the duration of construction, as the existing bridge deck width is too narrow to safely accommodate 6-lane traffic staging and a working zone for the deck replacement. Construction staging with 4-lane traffic staging (i.e., 1 lane closed in each direction) for a full deck replacement would result in unacceptable extensive traffic delays and congestion along the QEW through Mississauga and adjacent local roads.

In order to maintain the existing 6-lanes of traffic for the duration of construction, rehabilitation options are required to either widen or twin the existing bridge. Widening would require enough width to accommodate 6-lanes, including upgrading the cross-section to current geometric standards, plus additional width to allow for connection of the existing and widened portions. A new twinned bridge could be located to either the north or south side of the existing structure. Although, both options will have direct impacts to the adjacent properties and the surrounding natural environment in the Credit River Valley, as well as minor effects on the cultural heritage value of the existing bridge, opportunities to avoid /

minimize these impacts will be assessed through the consideration of various design alternatives, and it is anticipated that these impacts could be effectively mitigated through design.

Therefore, this alternative was considered a viable option and was carried forward for further consideration.

Replace

This alternative would involve completely replacing the existing bridge with a new bridge. The new bridge would include the sufficient deck width required to safely accommodate construction traffic staging and to improve the cross-section to current geometric standards.

This alternative would result in the demolition of the existing provincially significant Credit River Bridge, originally built in 1934. This alternative would have direct adjacent property impacts and would have temporary and permanent effects on the natural environment; even with a bridge spanning the Credit River new piers would still be required in the Valley. However, it is anticipated that these impacts could be effectively mitigated through design.

Therefore, this alternative was considered a viable option and was carried forward for further consideration.

6.2.2 Alternatives to the Undertaking – Transportation Alternatives

To address the future transportation needs of the QEW and the Mississauga Road Interchange, the following transportation “Alternatives to the Undertaking” were considered:

- Do Nothing;
- Travel Demand Management (TDM);
- Transportation System Management (TSM);
- Improvements To/New Transit and Rail;
- Adjacent Road System Improvements;
- QEW Geometric and Local Operational Improvements; and
- Combinations of the above.

Do Nothing

This alternative implies a scenario whereby the QEW would remain “as is” and no other transportation improvements beyond what are already planned. This alternative would not address the existing transportation problems within the corridor along the QEW and at the Mississauga Road Interchange (as discussed in **Sections 5.0 and 4.4.3**).

Therefore, this alternative was not considered a viable option and was not carried forward for further consideration.

Travel Demand Management (TDM)

TDM strategies include measures aimed at improving the operation of the current transportation system by managing travel demand independent of actually expanding or constructing new infrastructure. The emphasis of TDM strategies is to reduce overall demands on the highway network by shifting demand to time periods outside of the critical congestion periods, and to alternative modes of transportation, principally transit, cycling and walking. Several strategies include:

- Shifting demand to alternative modes of transportation (e.g., transit, cycling, and walking);
- Shifting demand to time periods outside of the critical congestion period (e.g., staggered work hours);
- Minimizing the frequency of travel (e.g., work from home);
- Eliminating any increase in transportation demand (e.g., through caps on development); and
- Ridesharing (i.e. car/van pooling).

As part of The City of Mississauga Official Plan and the *Our Future Mississauga Plan (Strategic and Action Plan (2009))*, the City has begun the implementation of several TDM strategies, in accordance with the Province's *Growth Plan*. Mississauga's plan includes policies that encourage increased development of inter-regional transit services, pedestrian and cycling facilities, and encourage appropriate land uses and transit-supportive development densities along major transit corridors. The Smart Commute Mississauga program was implemented to reduce traffic congestion and to take action on climate change by encouraging the use of sustainable modes of transportation in the City of Mississauga by introducing carpool programs, reduced transit fares and walking and cycling programs. Additionally, the Region of Peel is committed to working with municipalities and other levels of government to promote and support the development and implementation of TDM strategies and programs within the Region.

TDM plays a key role in the province's strategy in dealing with expected growth within Mississauga and the Region of Peel and if fully implemented, could provide considerable benefits to road capacity. However, on their own TDM strategies will not address the existing transportation problems identified within the study area (i.e. geometric and local operational issues at the Mississauga Road Interchange).

As a result, on its own TDM was not a viable alternative; however, the TDM initiatives are on-going, independent of this study, as part of provincial, regional and municipal planning.

Transportation Systems Management (TSM)

The objective of TSM is to improve the efficiency and safety of the transportation system and optimize the use of existing and planned infrastructure through a wide range of technology and policy initiatives. Initiatives include transit priority facilities, intelligent transportation systems (ITS), HOV lanes and reserved bus lanes (RBLs), Park 'n' Ride facilities and localized operational and safety roadway improvements.

The Ministry has a long term HOV network plan, *Ontario's High Occupancy Vehicle Lane Network Plan for the 400-Series Highways in the Greater Golden Horseshoe*. High Occupancy Vehicle Lanes reflect current Provincial policies to encourage carpooling and transit use. These plans are being carried forward independent of this study.

Also, the Ministry has installed an Advanced Traffic Management System (ATMS) along the QEW through Mississauga, known publicly as COMPASS. System elements include in-pavement detector loops, changeable message signs, metered entry ramps and closed circuit television cameras. Both the City of Mississauga and Region of Peel support the implementation of TSM initiatives in their Official Plans, in accordance with the Province's *Growth Plan*.

TSM plays a key role in the province's strategy in dealing with expected growth within Mississauga and the Region of Peel and if implemented, could provide considerable benefits to road capacity, and the implementation of TSM strategies will not result in natural environmental effects on the Credit River Valley. However, on their own TSM strategies will not address the existing transportation problems identified within the study area (i.e., geometric and local operational issues at the Mississauga Road Interchange).

As a result, on its own TSM was not a viable alternative; however, the TSM initiatives are on-going, independent of this study, as part of provincial, regional and municipal planning.

New or Improved Transit / Rail

The Province's Growth Plan incorporates regional transit plans including Metrolinx's Big Move. These plans are being carried forward by the Province, independent of this study.

The GO Transit Lakeshore West commuter rail line runs between Hamilton and Toronto's Union Station. In Mississauga, the line runs parallel to the QEW on the south side of the highway. The GO Transit Lakeshore West line is also at capacity and GO Transit is undertaking a major rail expansion to add a third track to the corridor to increase the number of trains and provide all-day service.

The City of Mississauga has a well-established municipal transit service and is working to optimize their network by expanding services and improve the connectivity with other transit facilities. Currently Mississauga is underway with the Mississauga Bus Rapid Transit (BRT) project and higher order transit along Hurontario/Main Street (Light Rail Transit (LRT)). Both studies will integrate several existing and proposed transit services including Mississauga Transit, Brampton Transit and GO Transit.

The Greater Golden Horseshoe (GGH) Traffic Demand Model used in this study reflects the Province's Growth Plan and is a multi-modal model which takes into consideration various types of transportation such as auto, transit and non-motorized modes (walking and cycling). It is recognized that the proposed transit projects identified in the Growth Plan as noted above, will need to meet the requirements of the applicable environmental assessment process. Expansion of existing and any new infrastructure required to support these transit and rail projects will result in additional social and natural environmental effects and will be identified and assessed in accordance with the EA process. However, these initiatives are being carried out independent of the QEW Class EA Study.

Transit and rail infrastructure plays a key role in the Province's strategy in dealing with expected growth within Mississauga and the Region of Peel and, if implemented, could provide considerable transportation benefits. However, on its own, new/expanded transit and rail infrastructure will not address the existing transportation problems identified within the study area (i.e., geometric and local operational issues at the Mississauga Road Interchange).

As a result, transit and rail alone was not a viable alternative; however, these initiatives are on-going, independent of this study, as part of provincial, regional, and municipal planning.

Adjacent Road System Improvements

The local road network immediately adjacent to the QEW, within the study area, primarily serves the urban residential area with local roads in close proximity. North and South Sheridan Way are located immediately adjacent to the QEW west of the Mississauga Road Interchange. To the east of the Credit River Bridge, the QEW is flanked by residences and a local residential road network. The North and South Service Roads begin again at Hurontario Street and continue east.

The service roads do not extend over the Credit River, and there is a significant gap in the municipal road network between Dundas Street to the north and Lakeshore Road to the south, which results in discontinuities in the adjacent local road network. As a result, it is reasonable to assume that a portion of the existing traffic using the QEW Credit River Bridge is for local trips.

It is recognized that Regional and Municipal road improvements play a key role and if fully implemented could provide considerable transportation benefits, and any proposed roadway expansion projects will be carried out independent of this study and will address the associated social and natural environment impacts. However, improving the adjacent municipal parallel arterial roads, Dundas Street and Lakeshore Road (approximately 2km north and south of the QEW), and the other provincial highways through Mississauga (Highways 403 and 401) would not address the existing transportation problems identified within the study area (i.e., geometric and local operational issues at the Mississauga Road Interchange).

In addition, widening Lakeshore Road is not supported by the local community planning currently underway; the City's Draft Official Plan states that Lakeshore will not be built in excess of four lanes. The Draft Plan identifies Dundas Street as an intensification corridor; which will contain express transit (possibly higher order transit) and active transportation; it is 4/6-lanes today and further widening would result in significant socio-economic impacts.

On their own, improving adjacent roadways will not address the transportation problems identified within the study area and was not considered a viable standalone option.

QEW Geometric and Local Operational Improvements

This alternative would include upgrading the QEW to current standards, and improving the Mississauga Road Interchange in order to improve traffic operations on the QEW and the local roads leading to the interchange.

This alternative will address the transportation problems identified within the study area and was carried forward for further consideration.

6.2.3 Preferred Alternatives to the Undertaking

The carried forward Bridge Alternatives to the Undertaking were Rehabilitate Bridge and Replace Bridge. The carried forward Transportation Alternatives to the Undertaking were QEW Geometric and Local Operational Improvements. These two parts of the Alternatives to the Undertaking were combined to form two alternatives for further consideration:

- Rehabilitate Bridge with QEW Geometric and Local Operational Improvements
- Replace Bridge with QEW Geometric and Local Operational Improvements

These alternatives were carried forward for further consideration because they address the long-term needs of the Credit River Bridge and have the potential to support the transportation needs of the QEW Mississauga corridor. Although these alternatives will have property impacts and will result in some potential effects to natural features in the Credit River Valley, it is anticipated that significant effects can be avoided or mitigated through design.

It should be noted that while the goals of this EA Study do not include the long-term capacity needs of the QEW, the above Alternatives to the Undertaking would present opportunities not to preclude future HOV lane possibilities.

6.3 GENERATION OF ALTERNATIVE METHODS

Upon determination of the Alternatives to the Undertaking recommended to be carried forward for further consideration, the next study phase was to develop and examine alternative methods.

Alternative methods were developed in two stages:

Stage 1 – Bridge Alternatives

Stage 2 – Interchange Alternatives

6.3.1 Generation of Bridge Alternatives

A key consideration in the development of the bridge alternatives was the ability to maintain the existing six lanes of traffic, while carrying out the required deck replacement on the existing bridge. This was required because reducing the number of lanes during the day would result in unacceptable delays and significant impacts to this significant economic corridor.

Additional considerations during the generation of bridge alternatives included:

- Structural needs;
- Structural feasibility;
- Construction staging requirements;
- Cultural heritage significance of the Credit River Bridge;
- Environmental effects
 - Impacts of new pier placement on Credit River flow and channel form and stability
 - Natural environment (Provincially Significant Wetland, Area of Natural and Scientific Interest, Environmentally Sensitive Area)
- Socio-economic effects (such as, property effects and proximity effects on the local community, e.g. noise)
- Utilities

A long-list of ten (10) different bridge alternatives was developed for consideration. Each alternative is described in **Exhibit 6-1**. Exhibits of each of the alternatives are included in **Exhibits 6-3 to 6-12**.

An initial assessment of the ten bridge alternatives was performed to determine whether each bridge alternative was reasonable based on meeting study objectives and key environmental impacts, which included cultural and natural environmental effects. The long-list was reviewed with the Ministry of Tourism, Culture and Sport (MTCS) and the Ministry of Natural Resources (MNR).

EXHIBIT 6-1: LONG LIST OF BRIDGE ALTERNATIVES

Groups	Alternatives	Key Features
South Twinning	ST-1A	Match piers – straight
	ST-1B	Match piers – skewed
	ST-2	No piers in water – segmental
North Twinning	NT-1A	Match piers – straight
	NT-1B	Match piers – skewed
	NT-2A	Less pier impact to creek
	NT-2B	Less pier impact to creek – longer span; overbuild
	NT-3	No pier in water – segmental
Widening	W	Widening
Replacement	R	Replacement

Given the provincial heritage significance of the Credit River Bridge, the preliminary bridge alternatives were reviewed by the Project Team in conjunction with the MTCS Heritage Bridge Guideline Conservation Options. Section 4.0 of the Ontario Heritage Bridge Guidelines (Interim, January 2008) recommends that eight conservation measures be considered.

The results of the review are outlined in **Exhibit 6-2**. As discussed in **Section 4.2.2**, the Project Team met with MTCS and MNR on May 5, 2010 to discuss the reasonableness of the preliminary alternatives as they relate to matters of provincial significance, such as heritage. At the May 5, 2010 meeting, MTCS and MNR agreed with the approach outlined in **Exhibit 6-2**. A number of design alternatives that meet Conservation Options 3, 4 and 8 were subsequently developed and were carried forward for detailed analysis and evaluation.

EXHIBIT 6-2: REVIEW OF MTCS HERITAGE BRIDGE GUIDELINE CONSERVATION OPTIONS AND BRIDGE ALTERNATIVES	
MTCS Heritage Bridge Guideline Conservation Options	How the Conservation Options were Addressed through the Generation of Bridge Alternatives
<i>Option 1:</i> Retention of existing bridge with no major modification undertaken	• This option would leave the existing bridge in the existing condition at the existing location. Any work undertaken would be limited to routine maintenance, i.e., snow clearing. • This option is not considered feasible as it does not address the structural needs (i.e. would result in local failures of the existing bridge) and does not address the long term needs of the QEW.
<i>Option 2:</i> Restoration of missing or deteriorated elements	• This is not a feasible option as a standalone design alternative as it does not address the structural needs nor the long term needs of the QEW.
<i>Option 3:</i> Retention of existing bridge with sympathetic modifications	• This option includes rehabilitation and widening of the existing structure. • This option was carried forward for detailed analysis and evaluation as Alternative W - Widening.
<i>Option 4:</i> Retention of existing bridge with sympathetically designed new structure in proximity	• This option includes rehabilitation of the existing bridge and construction of a new bridge on an offset alignment. • A number of design alternatives were carried forward for detailed analysis and evaluation. These include the Alternatives South Twinning ST-1, North Twinning NT-1A, 1B, 2A, 2B, 3A, and 3B. • Some options are more “sympathetic” than others.
<i>Option 5:</i> Retention of existing bridge no longer in use for vehicular purposes but	• This option would entail construction of a new bridge on an offset alignment and complete realignment of the existing QEW. • This option is not considered reasonable as it would result in unacceptable

EXHIBIT 6-2: REVIEW OF MTCS HERITAGE BRIDGE GUIDELINE CONSERVATION OPTIONS AND BRIDGE ALTERNATIVES	
MTCS Heritage Bridge Guideline Conservation Options	How the Conservation Options were Addressed through the Generation of Bridge Alternatives
adapted for a new use	socioeconomic effects on the surrounding residential community and natural environmental effects on the Credit River Valley (including river channel and wetland impacts).
<i>Option 6:</i> Retention of bridge as a heritage monument for viewing purposes only	• Same rationale as Conservation Option 5.
<i>Option 7:</i> Relocation of bridge to an appropriate new site for continued use or adaptive re-use	• Not technically feasible due to the size and scale of existing bridge.
<i>Option 8:</i> Bridge removal and replacement with a sympathetically design new structure.	• This design option entails complete replacement of the existing bridge on the existing alignment. • This option was carried forward for detailed analysis and evaluation as Alternative R - Replacement.
Conservation Options 3, 4 and 8 were developed and carried forward for detailed analysis and evaluation.	

Given the provincial environmental significance of the Credit River Valley, the preliminary bridge alternatives were also reviewed in conjunction with MNR. Based on input from MTCS, MNR/CVC, and the project team's understanding of the potential impacts on the Credit River, the following four bridge alternatives were eliminated (or, screened out). Exhibits of each of the screened out bridge alternatives are included in **Exhibits 6-3 to 6-6**.

- **South Twinning: ST-1A** – This alternative is not feasible. The location and orientation of the piers in the Credit River are such that they would have significant impacts on Credit River flows resulting in substantial bank and wetland erosion.
- **North Twinning: NT-1A** – This alternative is not feasible. The location and orientation of the piers in the Credit River are such that they would have significant impacts on Credit River flows resulting in substantial bank and wetland erosion.
- **North Twinning: NT-2A** – This alternative does not minimize effects on the Credit River, as there are two piers in the water. It is also less desirable from a cultural heritage perspective as it does not match existing pier placement, thus resulting in high impacts to the aesthetic view of the heritage bridge.
- **Replacement: R** – The Credit River Bridge is listed on the Ontario Heritage Bridge List and is considered provincially significant. Complete demolition is not to be considered unless there are no other feasible and/or reasonable alternatives.

Therefore, the bridge alternatives carried forward for further assessment and evaluation were South Twinning options ST-1B and ST-2, North Twinning options NT-1B, NT-2B and NT-3, and Widening (W). Exhibits of each of the carried forward bridge alternatives are included in **Exhibits 6-7 to 6-12**, along with the associated rationale for their continued inclusion.

EXHIBIT 6-3: SCREENED OUT BRIDGE ALTERNATIVE – ST-1A

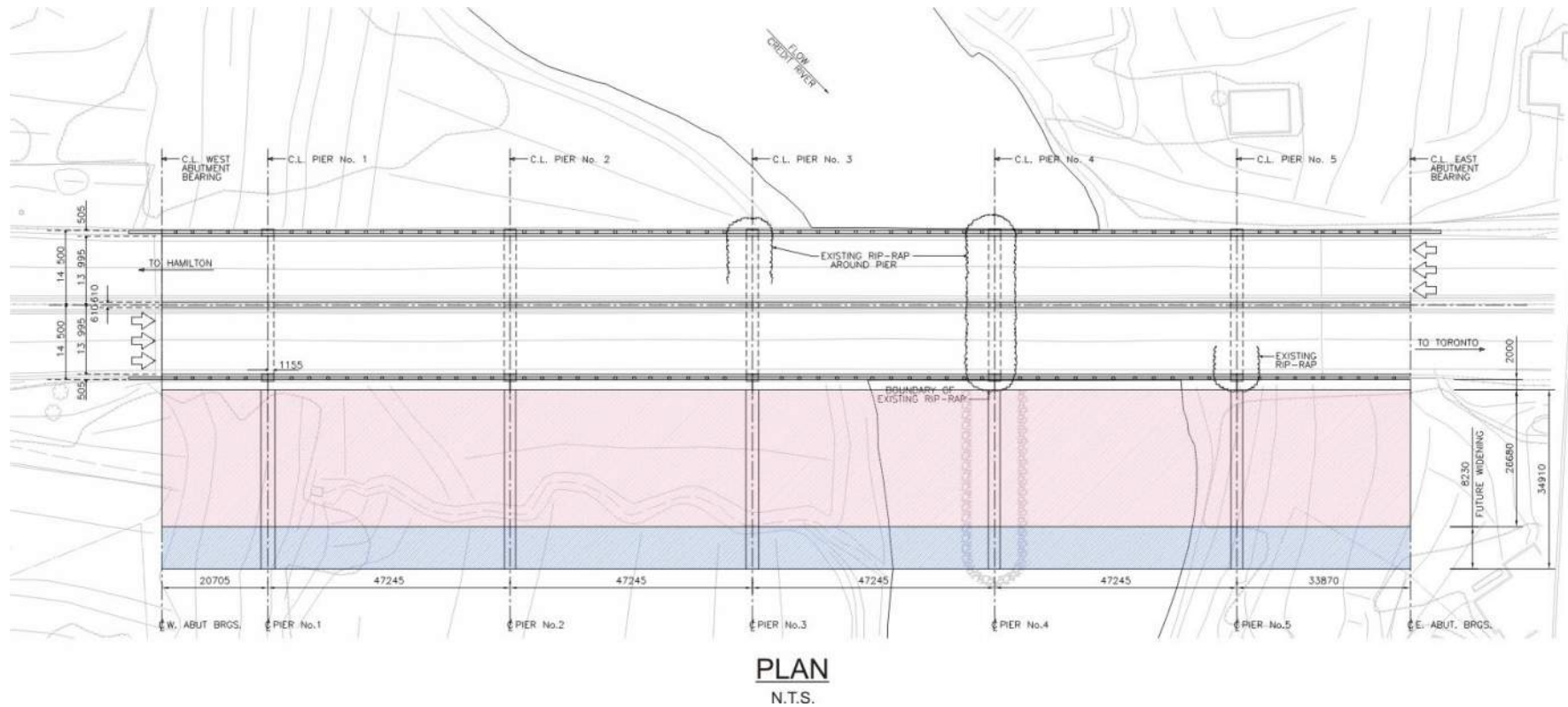


EXHIBIT 6-4: SCREENED OUT BRIDGE ALTERNATIVE – NT-1A

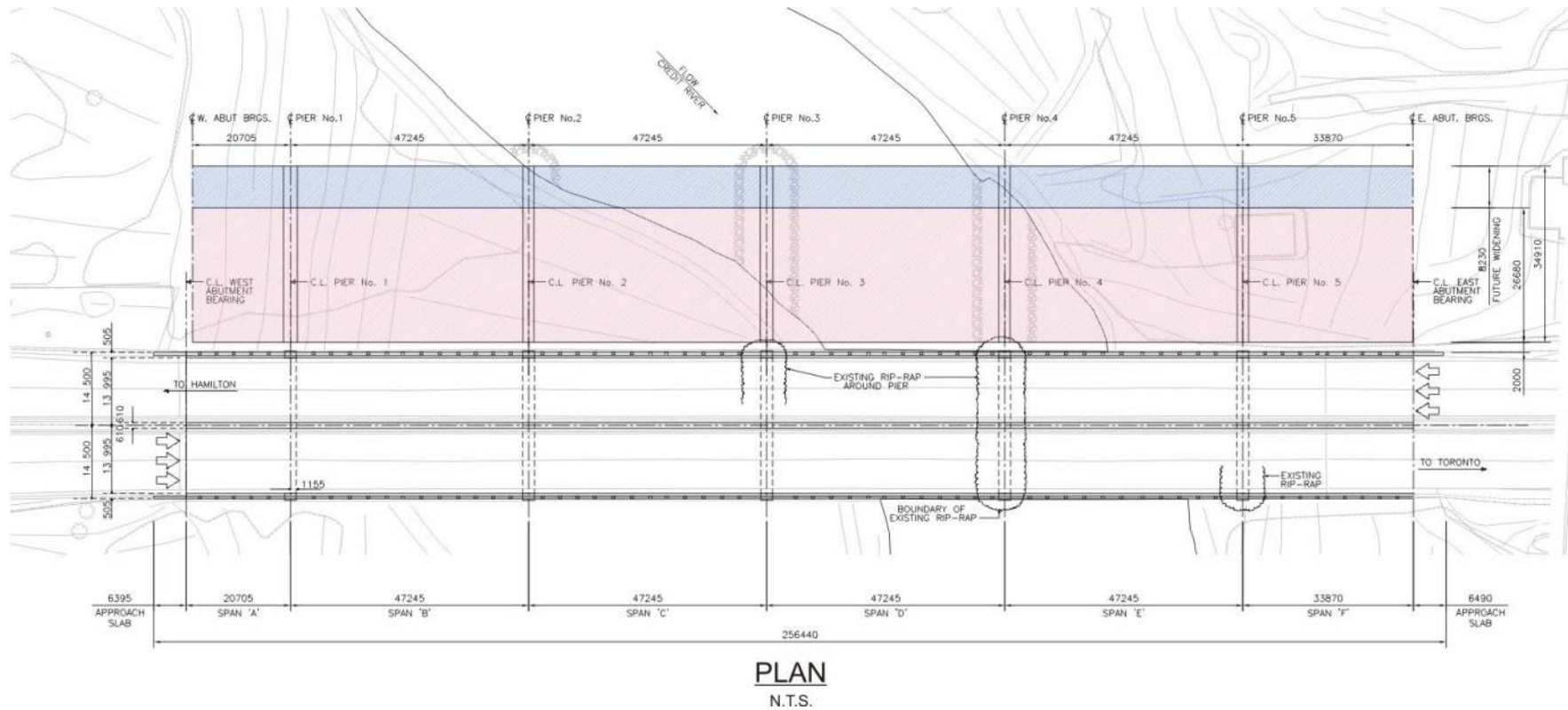


EXHIBIT 6-5: SCREENED OUT BRIDGE ALTERNATIVE – NT-2A

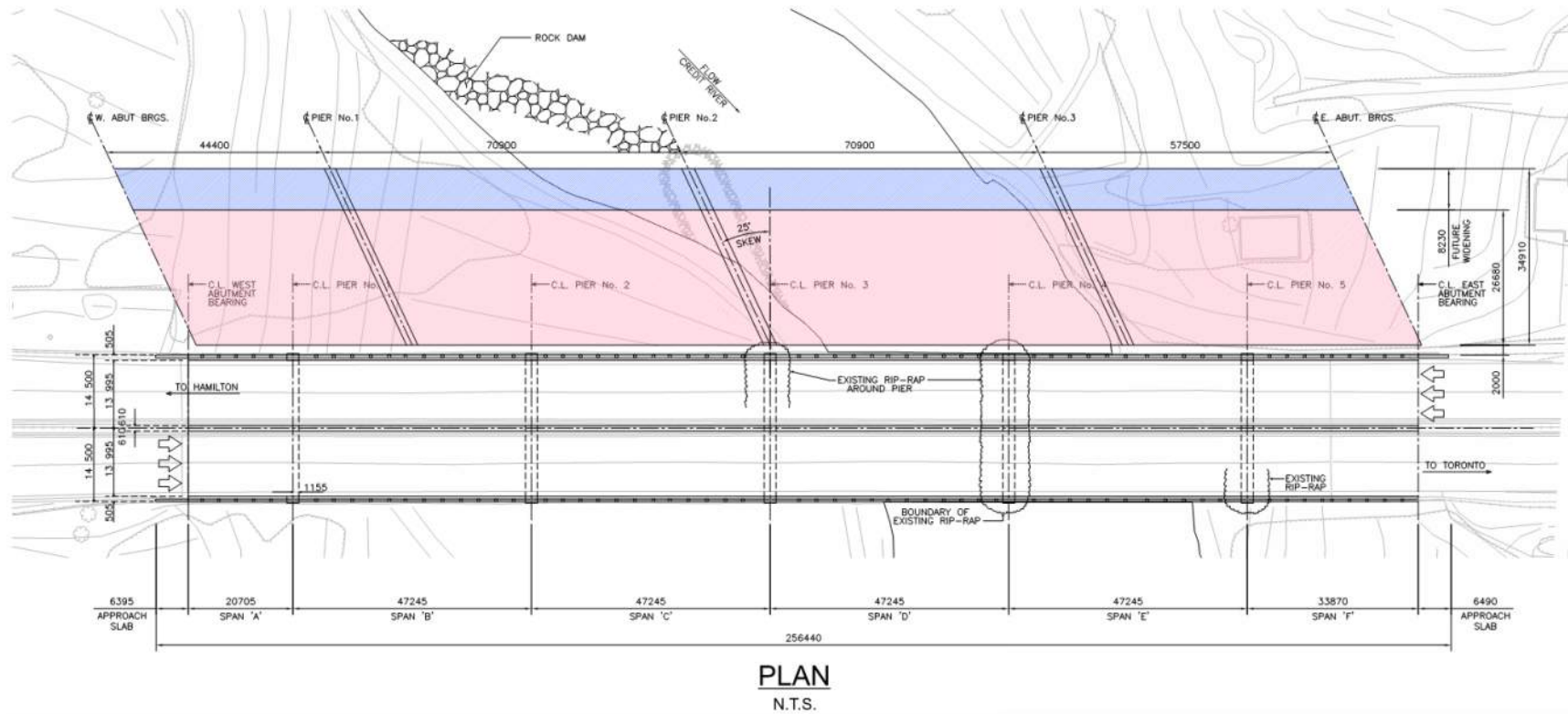


EXHIBIT 6-6: SCREENED OUT BRIDGE ALTERNATIVE – R (REPLACEMENT)

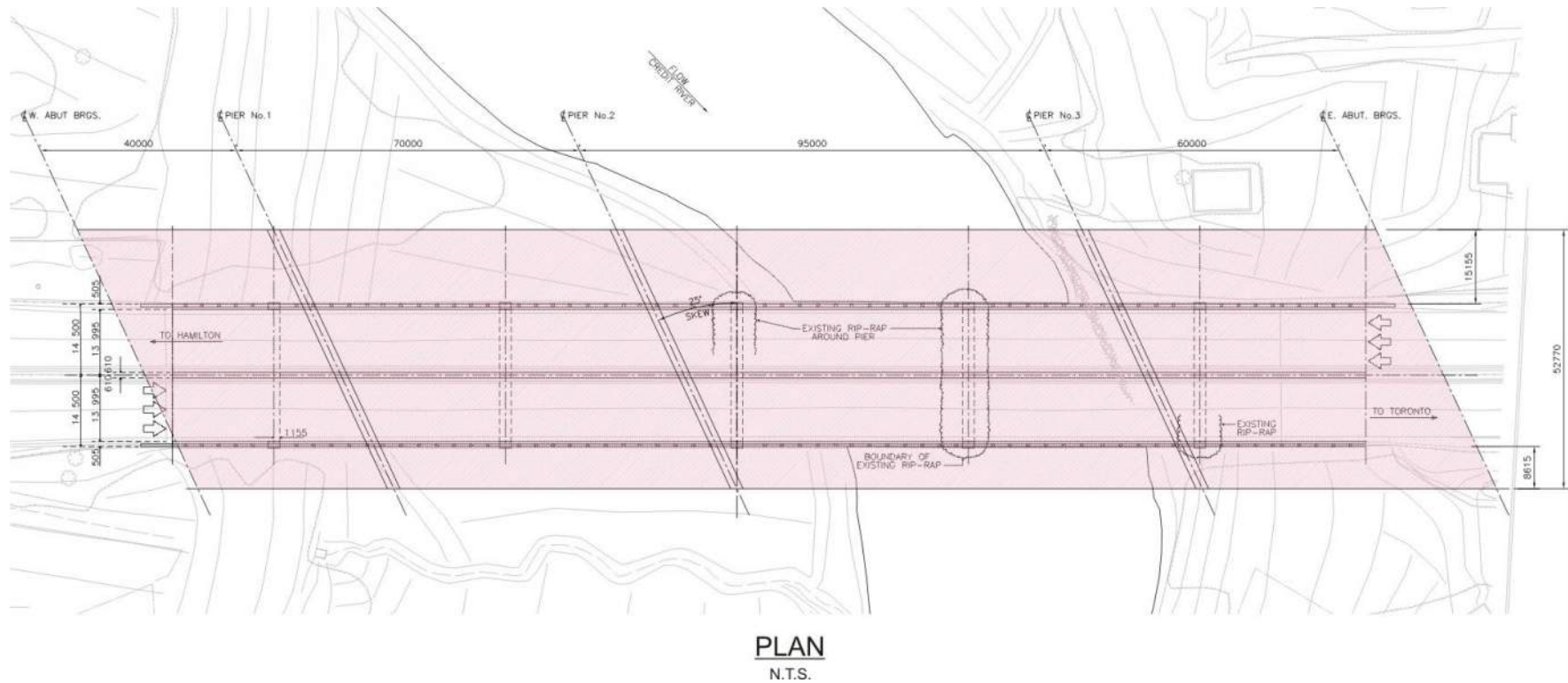


EXHIBIT 6-7: SHORT-LISTED BRIDGE ALTERNATIVE – ST-1B

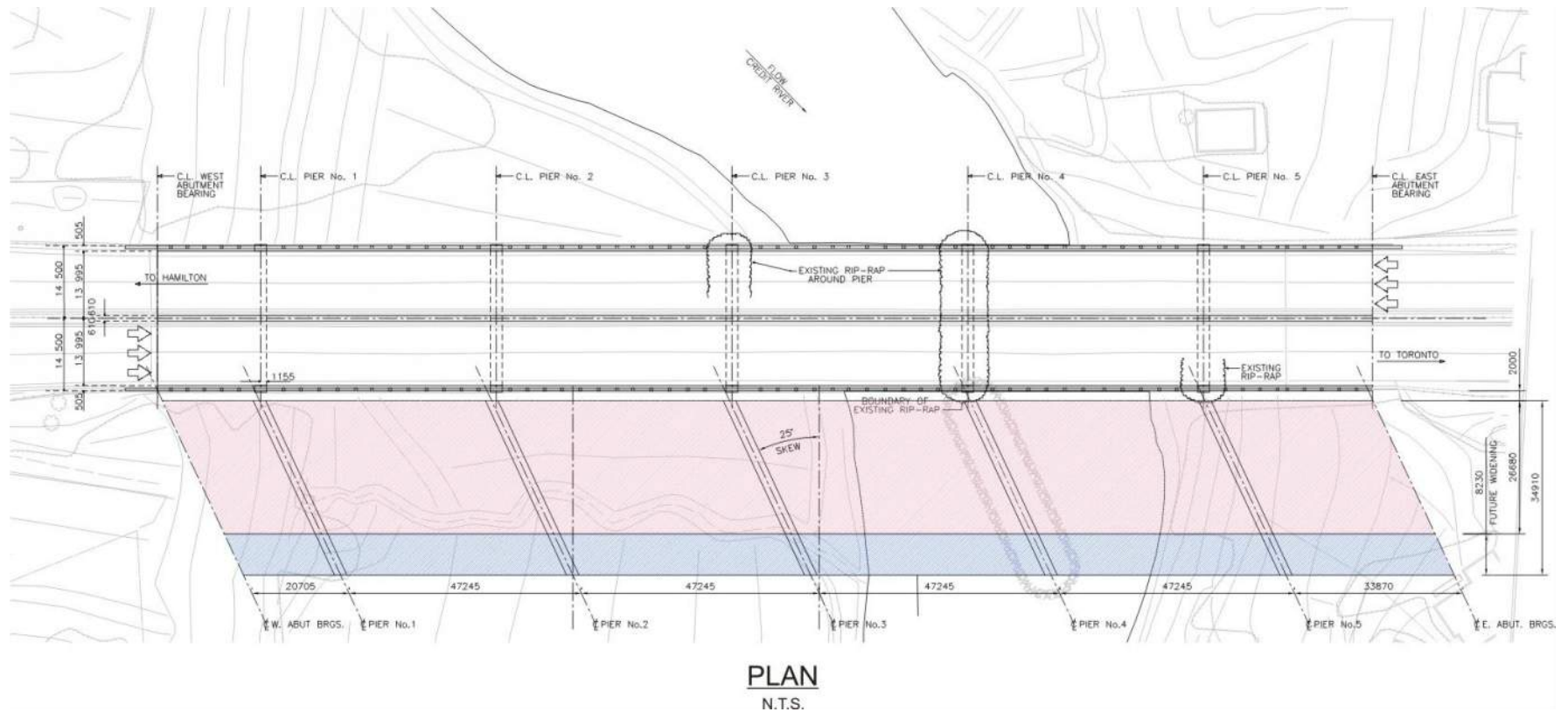


EXHIBIT 6-8: SHORT-LISTED BRIDGE ALTERNATIVE – ST-2

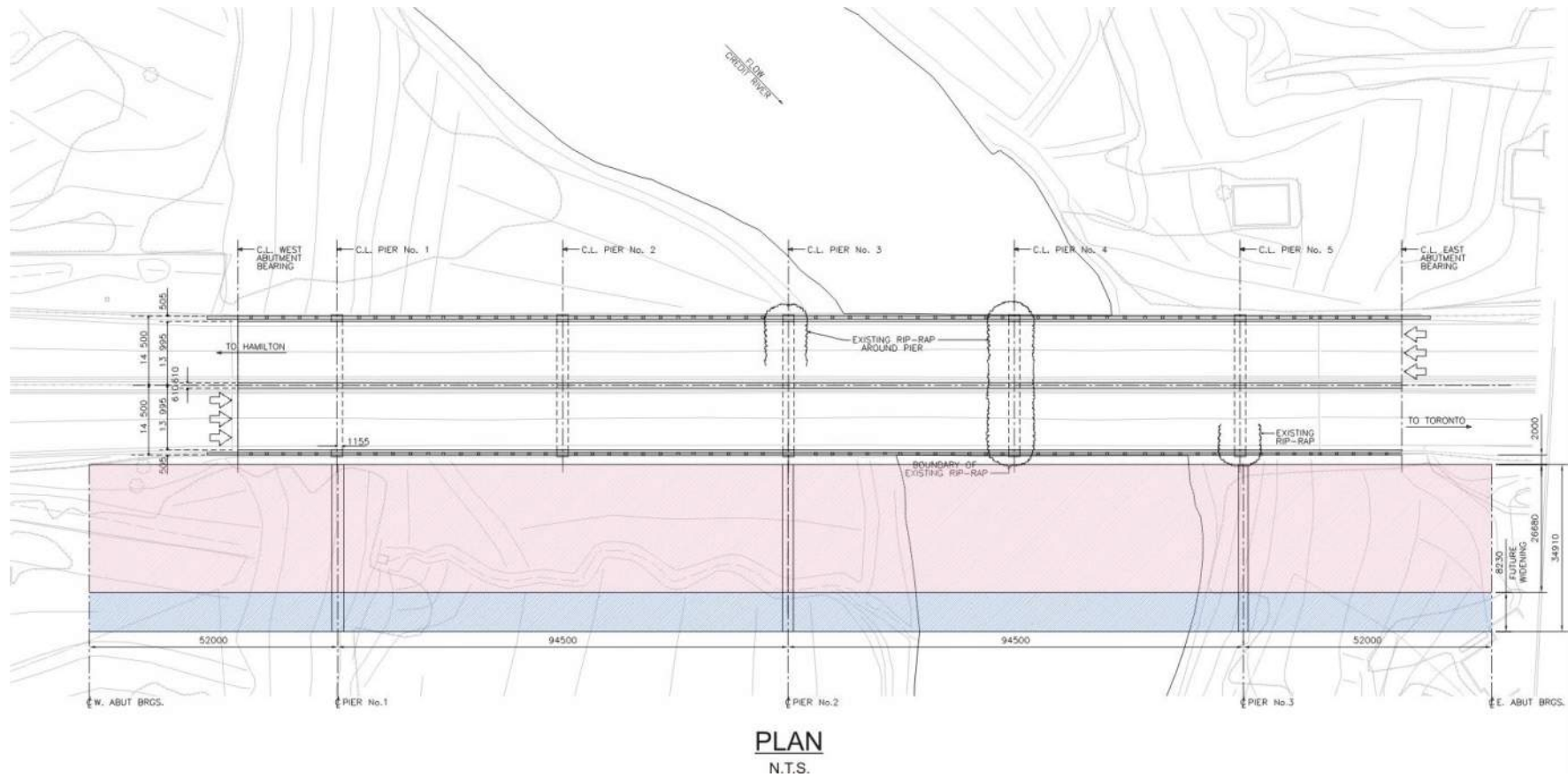


EXHIBIT 6-9: SHORT-LISTED BRIDGE ALTERNATIVE – NT-1B

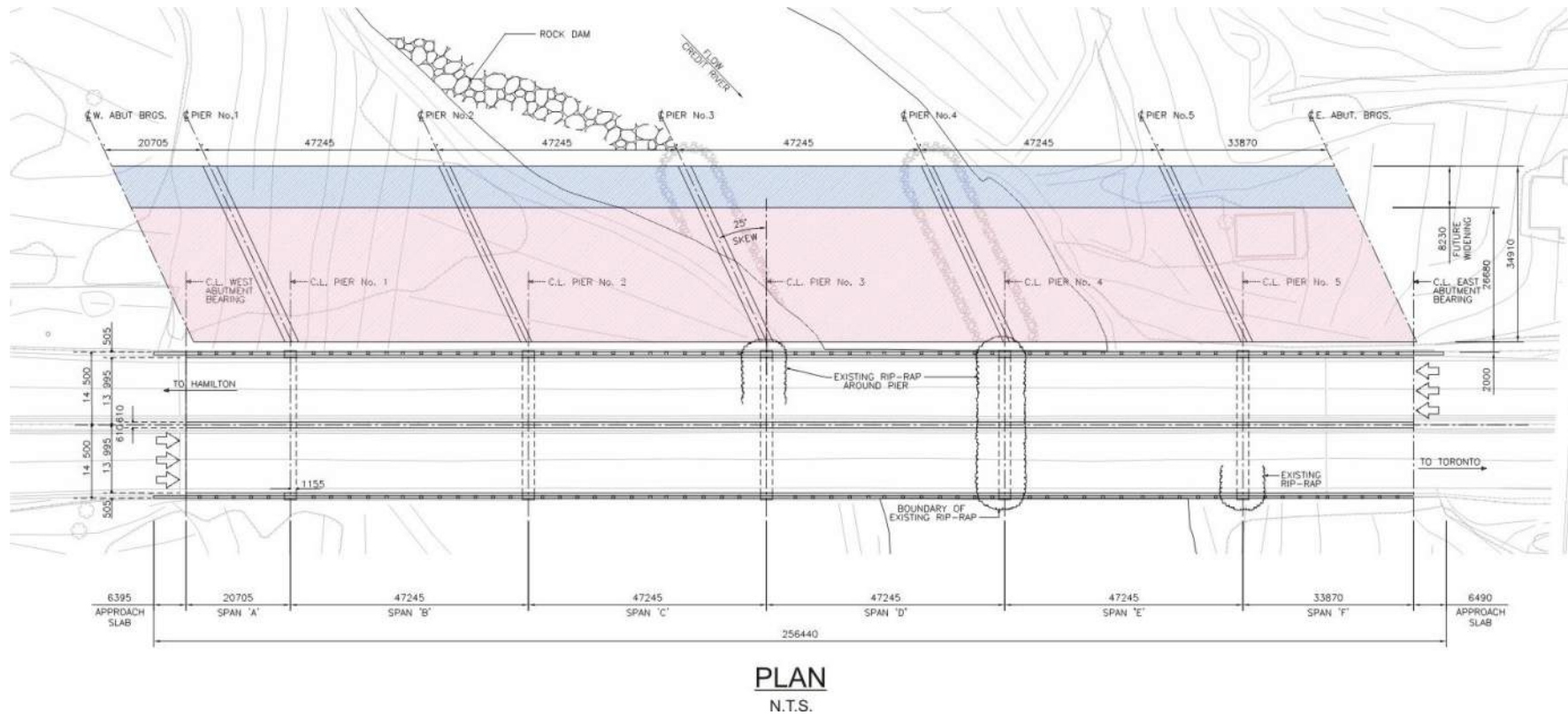


EXHIBIT 6-10: SHORT-LISTED BRIDGE ALTERNATIVE – NT-2B

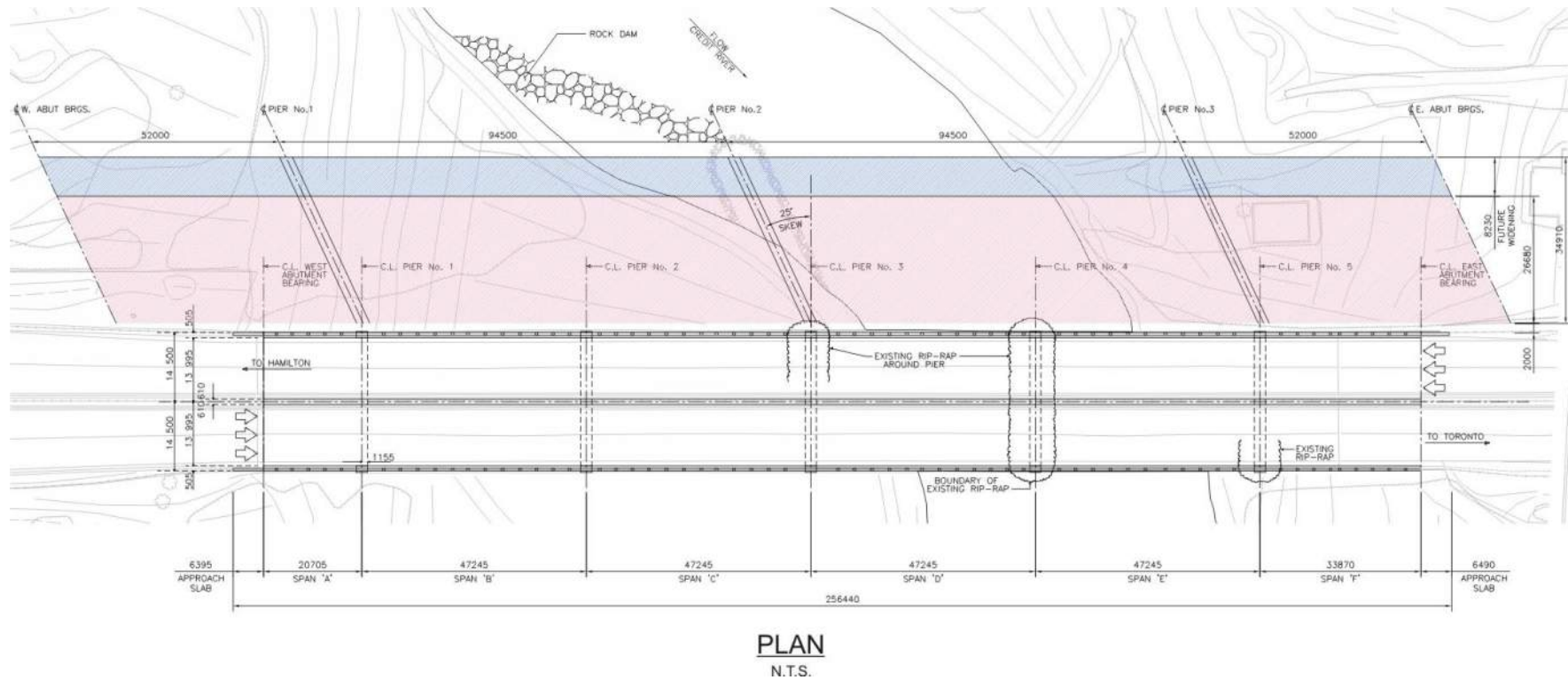


EXHIBIT 6-11: SHORT-LISTED BRIDGE ALTERNATIVE – NT-3

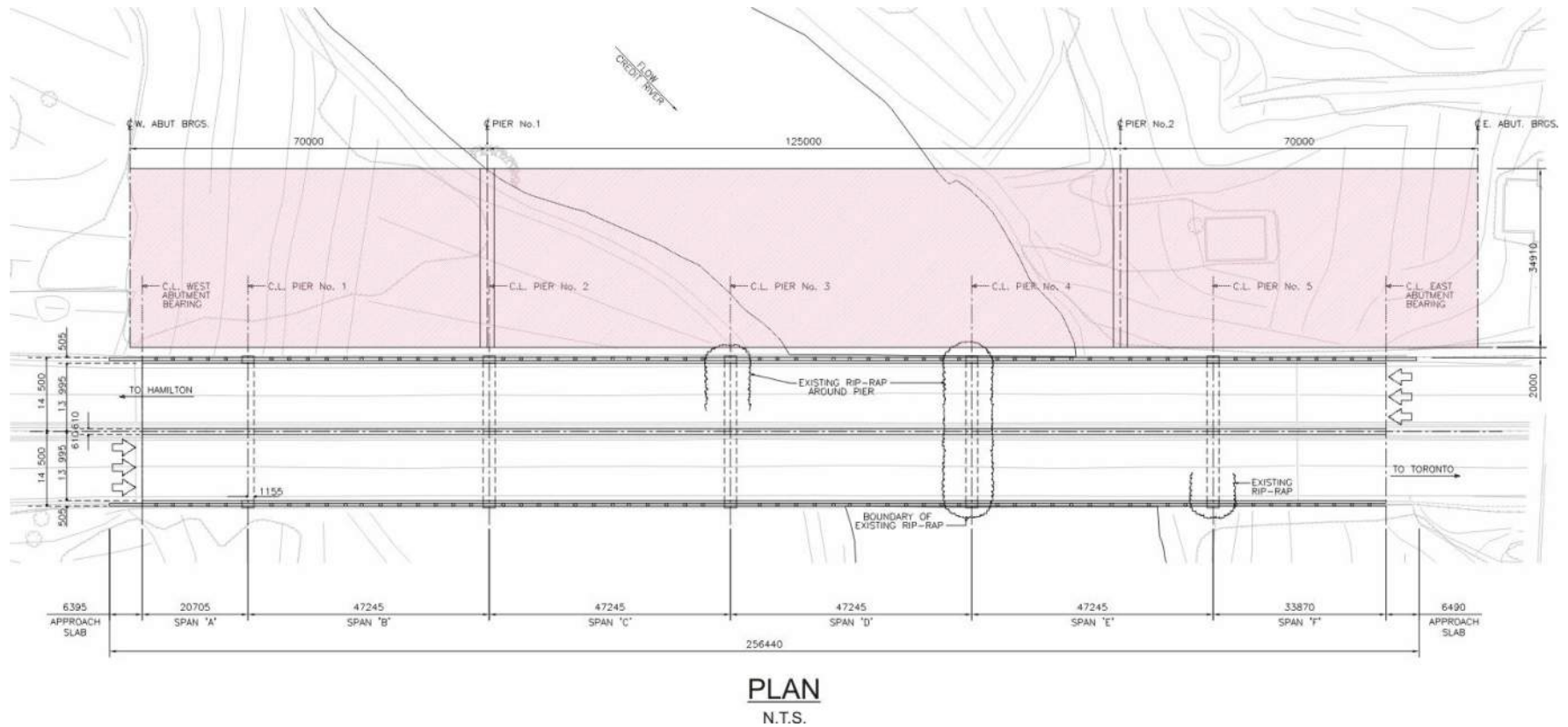
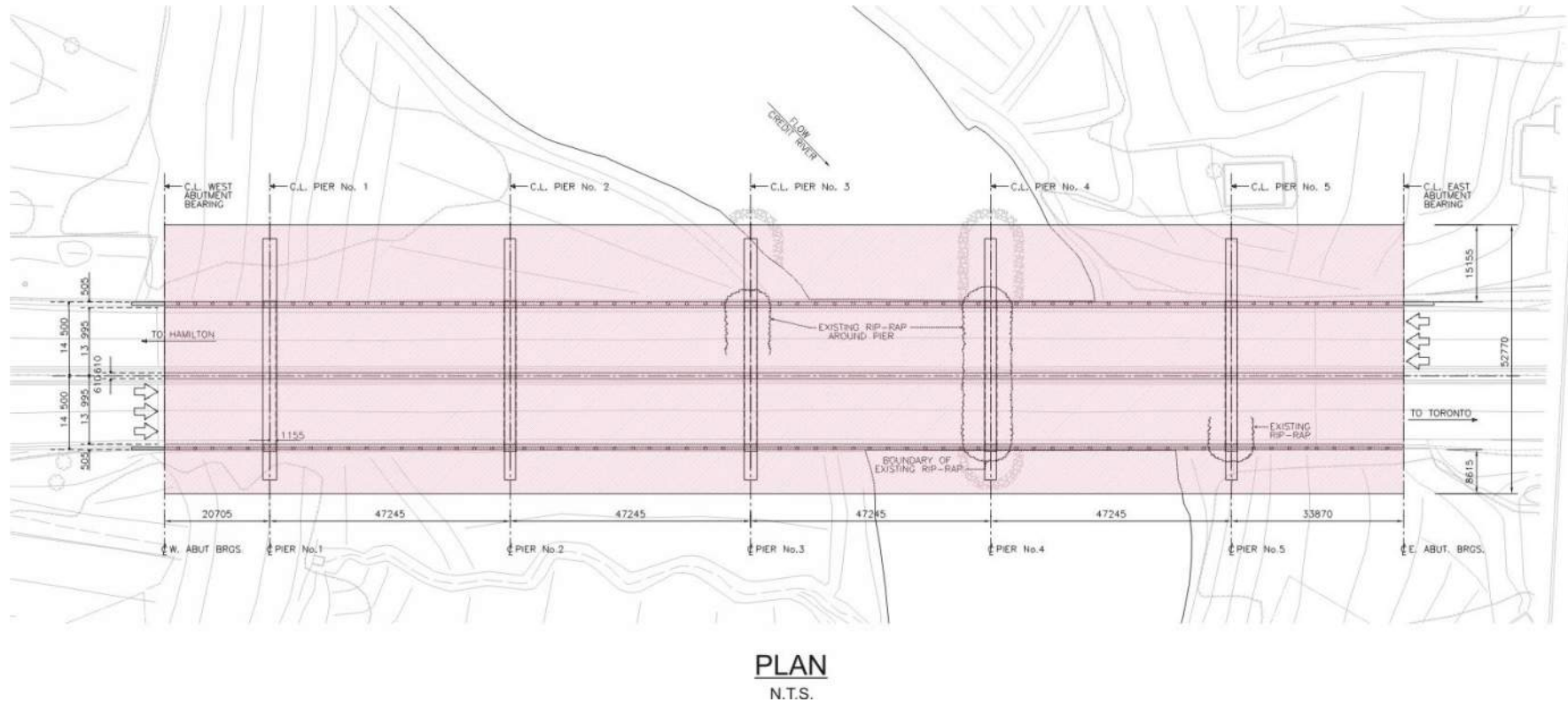


EXHIBIT 6-12: SHORT-LISTED BRIDGE ALTERNATIVE – W (WIDENING)



6.3.1.1 Bridge Construction Staging Requirements and Cross Sections

As indicated in **Section 6.3.1**, all bridge alternatives must maintain the existing six lanes of traffic. This is required because reducing the number of lanes during the day would result in unacceptable delays and substantial impacts to this significant economic corridor. The cross-section that could maintain and stage six lanes of traffic for each of the bridge design alternatives are outlined below.

Twinning Alternatives

For a twinning alternative (i.e., building a new bridge next to the existing bridge), during construction the new bridge would carry the six lane (narrow) cross-section for traffic staging. After construction, the existing bridge will carry one direction of traffic; the new twinned bridge will carry the other direction of traffic. **Exhibit 6-13** shows the cross sections during and after construction for the Twinning Alternative.

Widening Alternatives

For a widening alternative, during construction the widening on the north and south sides of the existing bridge would carry the six lane (narrow) cross-section for traffic staging. After construction, the six lanes of traffic will revert back to the central portion of the bridge deck. **Exhibit 6-14** shows the cross-sections during and after construction of the Widening Alternative.

6.3.2 Generation of Interchange Alternatives

The existing Mississauga Road Interchange has an unconventional configuration and routinely experiences congestion in the morning peak period. The main consideration while developing the interchange design alternatives was to bring the Mississauga Road Interchange to current standards and improve operations.

6.3.3 Review during First Round of Consultation

The Alternatives to the Undertaking, long and short-listed bridge alternatives, and interchange alternatives were presented at the first Public Information Centre (PIC) on June 9, 2010.

No concerns with regards to the short-listed bridge alternatives were voiced. The property impacts of the South Twinning alternatives were of some concern. The majority of comments received were related to noise (including requests for the installation of noise barriers along the Credit River Bridge in the short term), pedestrian / cycling connections (including requests for increased connections across the QEW and Credit River), and the environment (including concerns regarding air quality and property values).

Additional information on the first PIC and how comments were addressed are presented in **Section 3.1.3.1**.

EXHIBIT 6-13: TWINNING ALTERNATIVE CROSS-SECTIONS

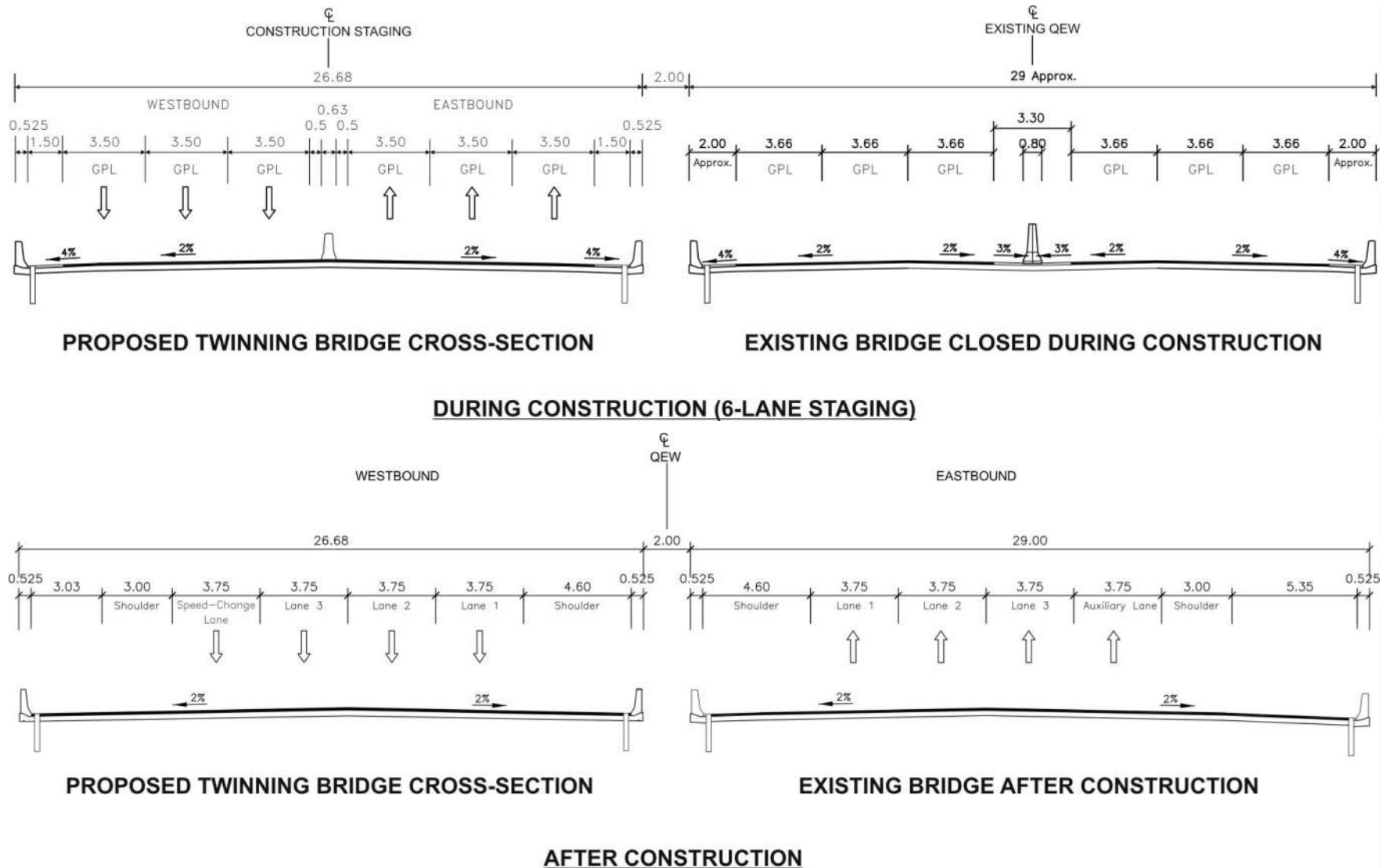
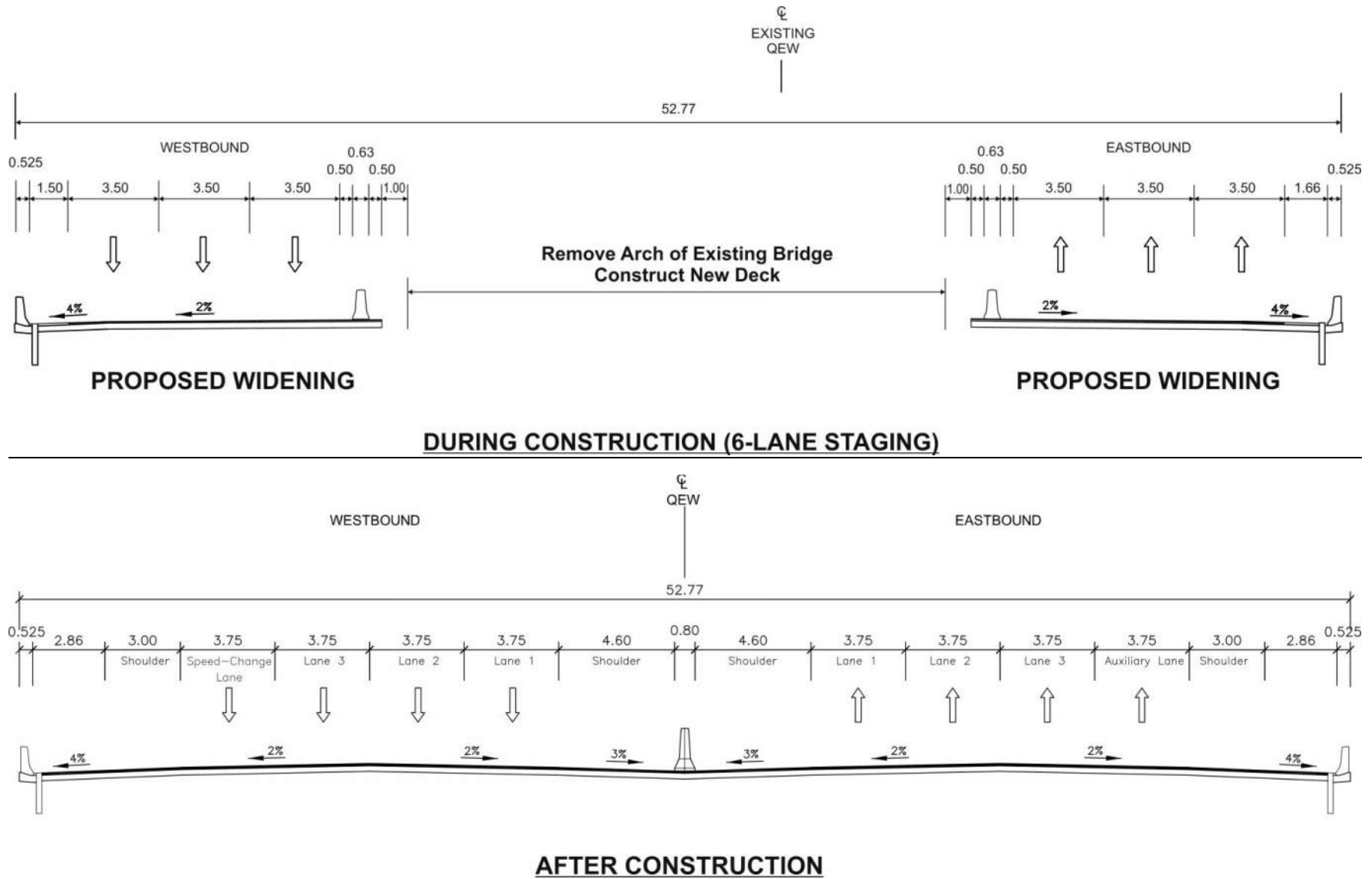


EXHIBIT 6-14: WIDENING ALTERNATIVE CROSS-SECTIONS



6.4 ASSESSMENT AND EVALUATION OF ALTERNATIVE METHODS

Upon generating bridge and interchange alternatives for further consideration, the next study phase was to assess and evaluate them.

The assessment and evaluation of the alternatives was completed in three stages:

Stage 1 – Comparison of Bridge Alternatives

Stage 2 – Comparison of Technically Preferred Bridge Alternatives, with their associated Mainline Alignment Improvements

Stage 3 – Comparison of Interchange Alternatives

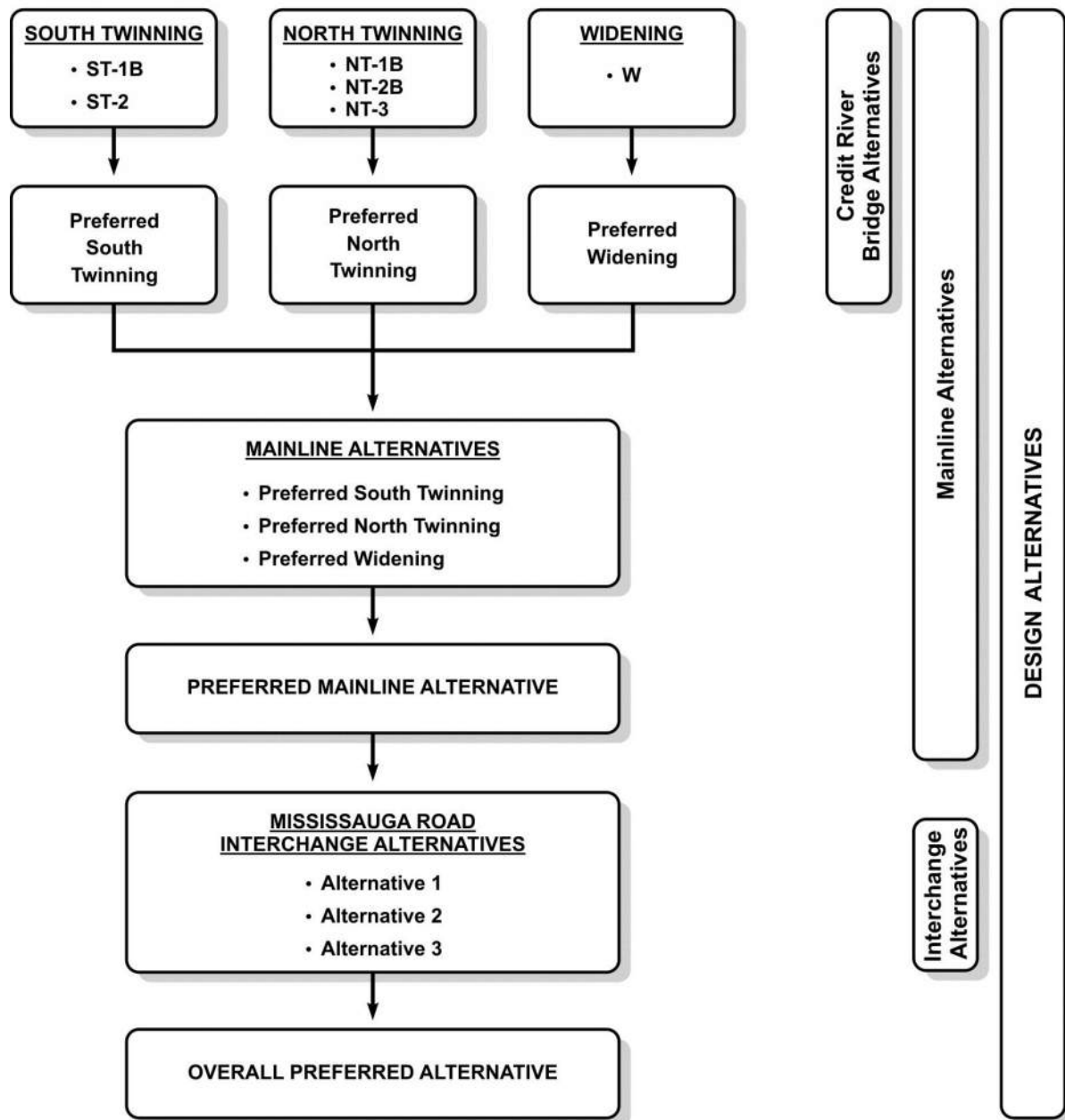
The selection process for each stage contained two steps:

Step 1 – Assessment: Identification of potential advantages and disadvantages of each alternative; and,

Step 2 – Evaluation: Comparative examination of the advantages and disadvantages of the alternatives to identify a preferred alternative.

Exhibit 6-15 illustrates the process used to evaluate the interchange alternatives and short-listed bridge alternatives, in order to determine the Overall Preferred Alternative.

EXHIBIT 6-15: ALTERNATIVES EVALUATION FLOW CHART



The evaluation of alternatives was carried out using the Reasoned Argument method. The Reasoned Argument method compares the differences in net effects and provides a clear rationale for the selection of the Overall Preferred Alternative.

The rationale (“trade-offs”) to favour one alternative over all others was derived using the following:

- Study purpose;
- Government legislation, policies and guidelines;
- Municipal policy (e.g., approved Official Plans);
- Issues and concerns identified during consultation with stakeholders; and,
- The experience and expertise of the Project Team.

Each of the alternatives was evaluated using the factors and criteria outlined in **Exhibit 6-16**.

EXHIBIT 6-16: EVALUATION CRITERIA

Environmental Factor	Criteria
Socio-Economic Environment	
Property and Access	• Impacts to residential areas • Impacts to commercial / industrial areas
Community Effects	• Noise and aesthetic impacts • Impacts to cemeteries, schools, places of worship, unique community features • Impacts to recreational features • Effects on air quality
Cultural Environment	
Archaeology	• Impacts to historic / archaeological sites
Heritage Features	• Impacts to built heritage features and cultural landscape units
Natural Environment	
Surface Water	• Fluvial geomorphology • Hydraulics • Highway drainage
Fish and Fish Habitat	• Effect on fish and fish habitat
Terrestrial Ecosystems	• Effect on wetland vegetation communities • Effect on upland vegetation communities • Effect on wildlife and habitat
Designated Natural Features	• Designated natural features include, for example, Provincially Significant Wetlands (PSWs), Areas of Natural and Scientific Interest (ANSIs), Environmentally Sensitive/Significant Areas (ESAs), and Regional Greenlands Systems. These features are defined by resource agencies, municipalities, the government

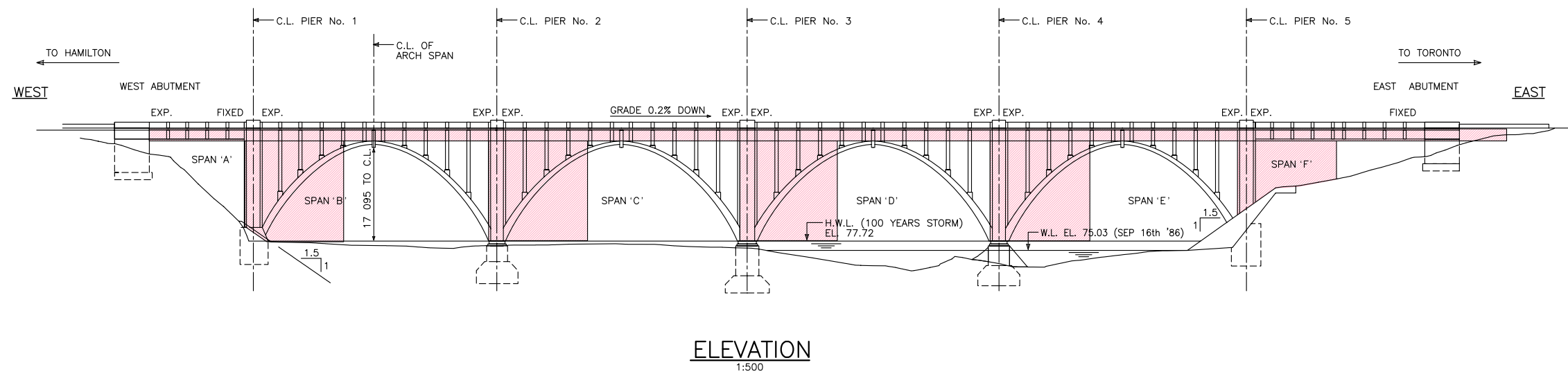
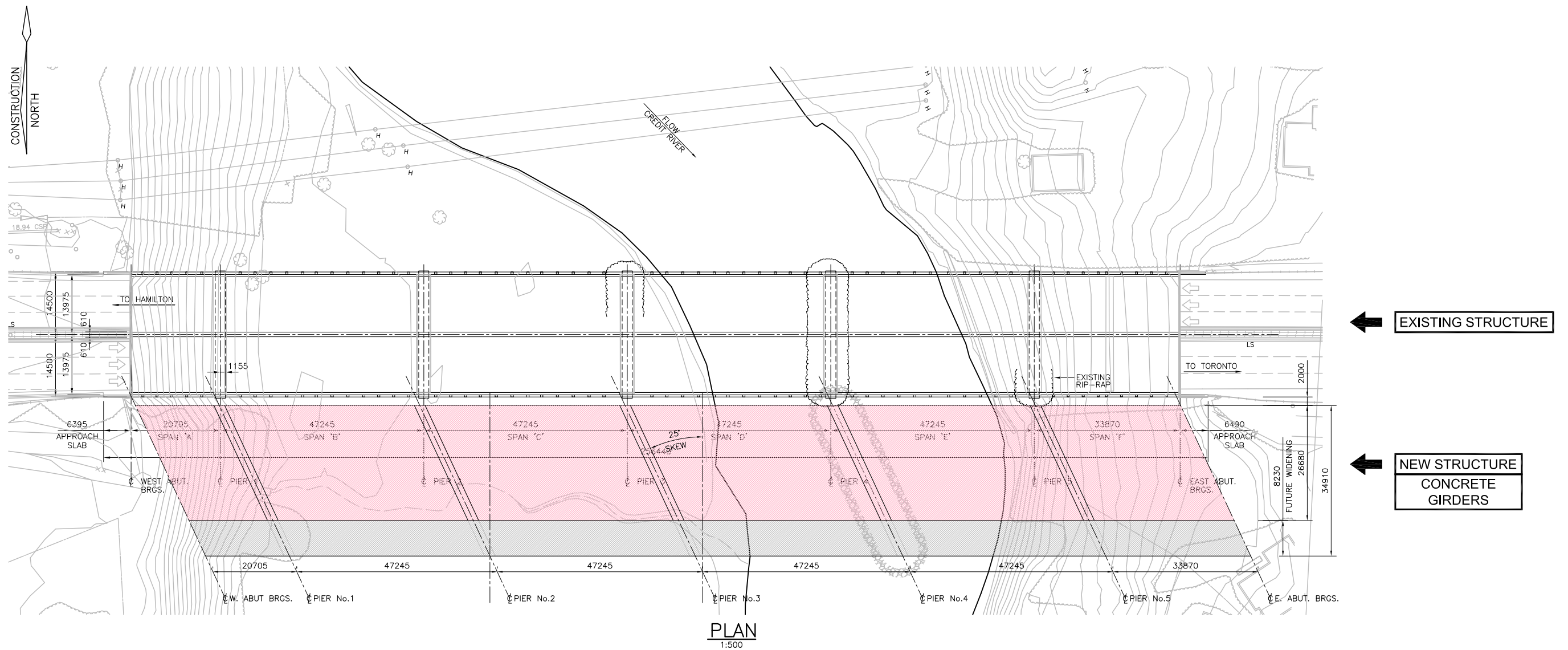
Environmental Factor	Criteria
	and/or the public, through legislation, policies or approved management plans, to have special or unique value
Property Waste & Contamination	• Effect on operating and closed waste disposal sites • Impacts to other known contaminated sites • Impacts to potentially contaminated sites
Technical Considerations	
Transportation	• Flexibility for future needs • Traffic operations • Safety • Compatibility / connectivity with local road network • Emergency access
Engineering	• Structural • Constructability • Compliance with appropriate design criteria • Utilities
Cost	• Cost

6.4.1 South Twinning Bridge Alternatives

The two South Twinning Alternatives, ST-1B and ST-2, were assessed and evaluated to identify the Preferred South Twinning Bridge Alternative to carry forward to the mainline assessment and evaluation. See **Exhibits 6-17** and **6-18** for plans of each of the alternatives.

The alternatives were assessed and evaluated based on the criteria identified in **Exhibit 6-16**. The summary results of the evaluation of the South Twinning Alternatives is provided in **Exhibit 6-19** (the complete assessment and evaluation tables are included in **Appendix E**).

ST-2 was the technically preferred South Twinning bridge alternative. Although ST-1B was slightly preferred from a technical perspective, ST-2 was preferred in all other factor areas as it results in the least overall impacts to the socio-economic, cultural and natural environments.



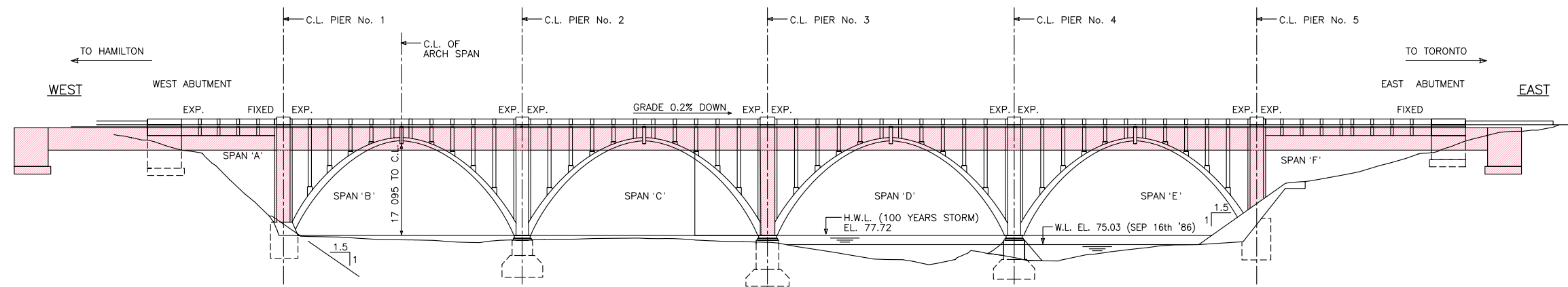
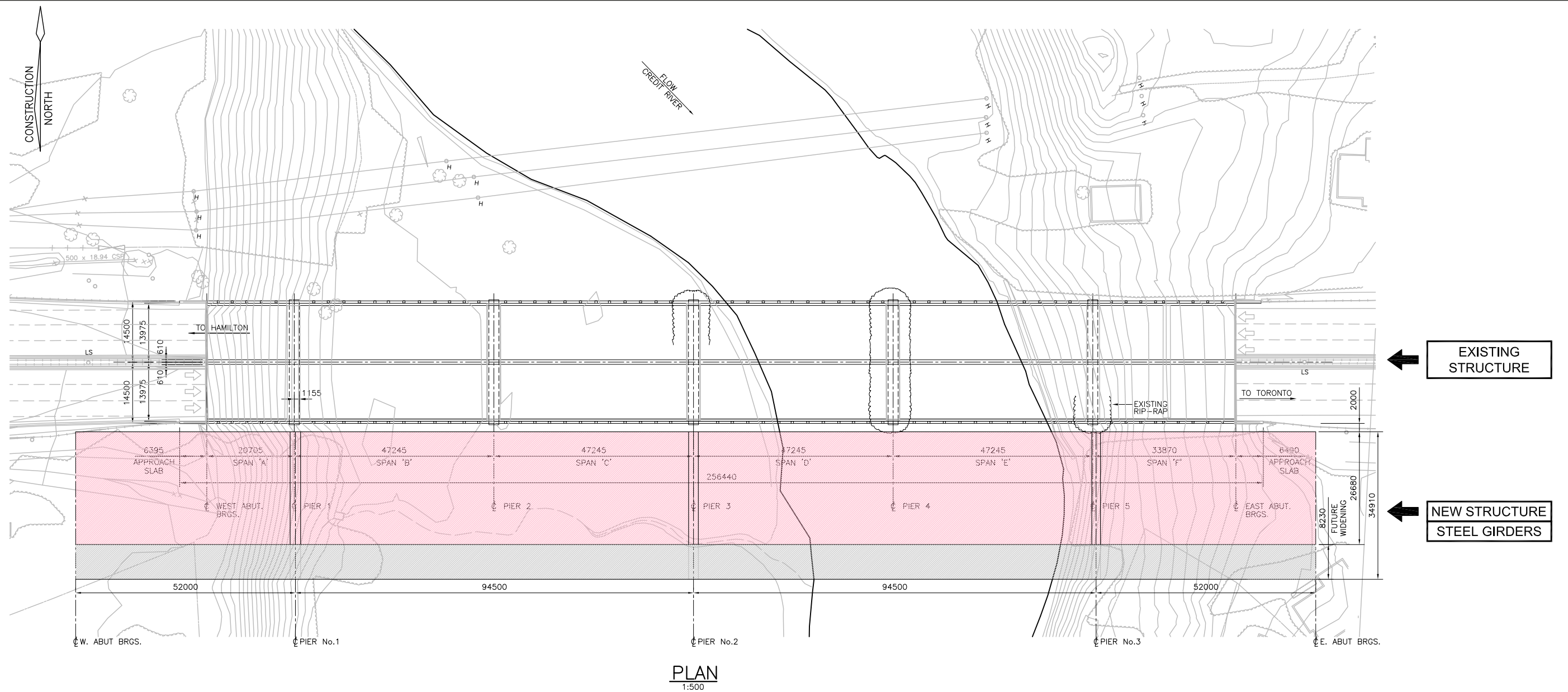
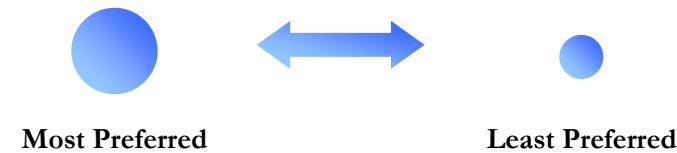


EXHIBIT 6-19: SOUTH TWINNING EVALUATION SUMMARY

FACTOR/CRITERIA/INDICATOR	ST-1B	ST-2	SUMMARY
1.0 SOCIO-ECONOMIC ENVIRONMENT • Property • Community Effects			Both alternatives result in similar impacts to the Socio-Economic Environment. Both alternatives result in similar low impacts to property and access. ST-1B and ST-2 result in higher noise levels to the exposed receivers since the new twinned bridge alternative is in closer proximity to residences to the south which has significantly more residences than to the north. ST-2 results in slightly lower impacts to recreational features, in that it has lower indirect impacts on river aesthetics and user enjoyment of the valley. Therefore, ST-2 is slightly preferred over ST-1B.
2.0 CULTURAL ENVIRONMENT • Archaeological • Heritage Features			None of the alternatives result in direct built heritage impacts on the Credit River Bridge and result in similar low impacts to archaeology. ST-1B results in high cultural heritage landscape impacts due to the number and angle of bridge piers in the river. ST-2 has very low impacts to the riverscape landscape since none of the bridge piers are skewed, hidden or silhouetted behind existing piers or topography. Therefore, ST-2 is preferred.
3.0 NATURAL ENVIRONMENT • Surface Water • Fish and Fish Habitat • Terrestrial Ecosystems • Designated Natural Features • Property Waste and Contamination			ST-2 is preferred over ST-1B because it avoids a permanent water footprint in the Credit River and avoids significant secondary impacts to fish habitat associated with fluvial responses to ST-1B Piers 3 and 4. ST-2 also results in slightly less of a footprint impact to the vegetation communities within the PSW and associated habitat. Therefore ST-2 is preferred.
4.0 TECHNICAL CONSIDERATIONS • Transportation • Engineering • Cost			From a Technical perspective, ST-1B and ST-2 are similar. However, ST-2 requires a longer structure and therefore has a higher new structure cost and maintenance cost. Therefore, ST-1B is preferred.
OVERALL SUMMARY			From a Socio-Economic perspective, ST-2 is slightly more preferred since it results in lower impacts to recreational features. From a Cultural perspective, both alternatives result in similar low archaeological impacts. ST-2 is preferred since it has the least impact to the Credit River cultural heritage landscape. From a Natural Environment perspective, ST-2 is preferred since it avoids permanent water footprint impacts, and has less footprint impact to vegetation communities within the PSW and associated habitats. From a Technical perspective, both alternatives resulted in similar impacts; however ST-1B is preferred since it has a lower cost. Overall, although ST-1B is slightly preferred from a technical perspective, ST-2 is preferred in all other factor areas as it results in the least overall impacts to Socio-Economic, Cultural, and Natural Environments. Therefore, ST-2 is preferred.

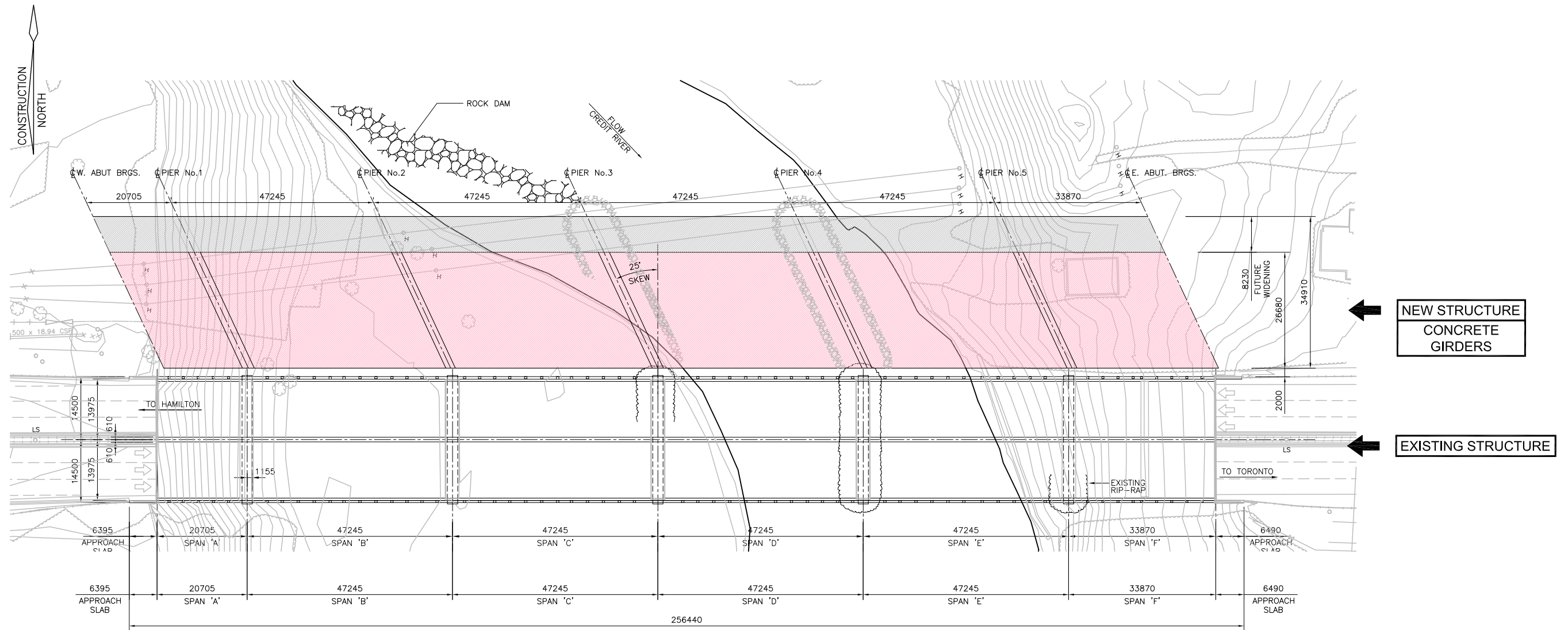


6.4.2 North Twinning Bridge Alternatives

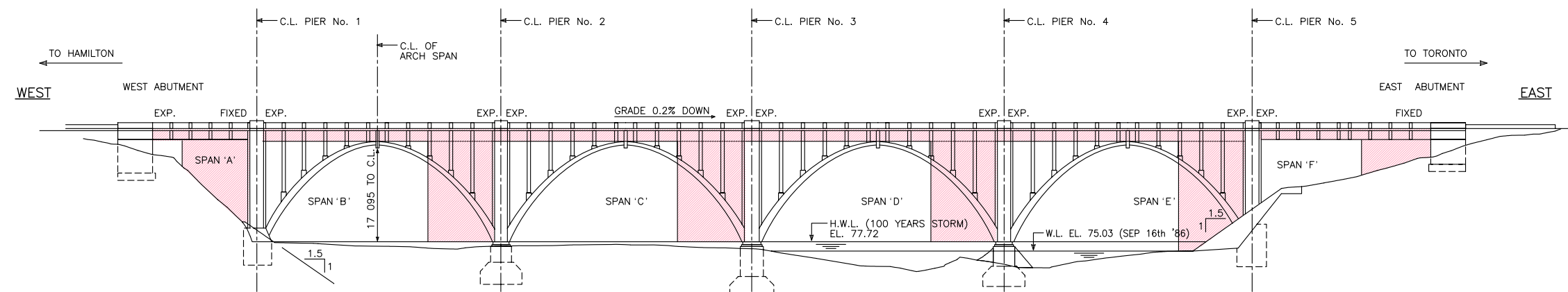
The three North Twinning Alternatives, NT-1B, NT-2B and NT-3, were assessed and evaluated to identify the Preferred North Twinning Bridge Alternative to carry forward to the mainline assessment and evaluation. See **Exhibits 6-20, 6-21 and 6-22** for plans of each of the alternatives.

The alternatives were assessed and evaluated based on the criteria identified in **Exhibit 6-16**. The summary results of the evaluation of the North Twinning Alternatives is provided in **Exhibit 6-23** (the complete assessment and evaluation tables are included in **Appendix E**).

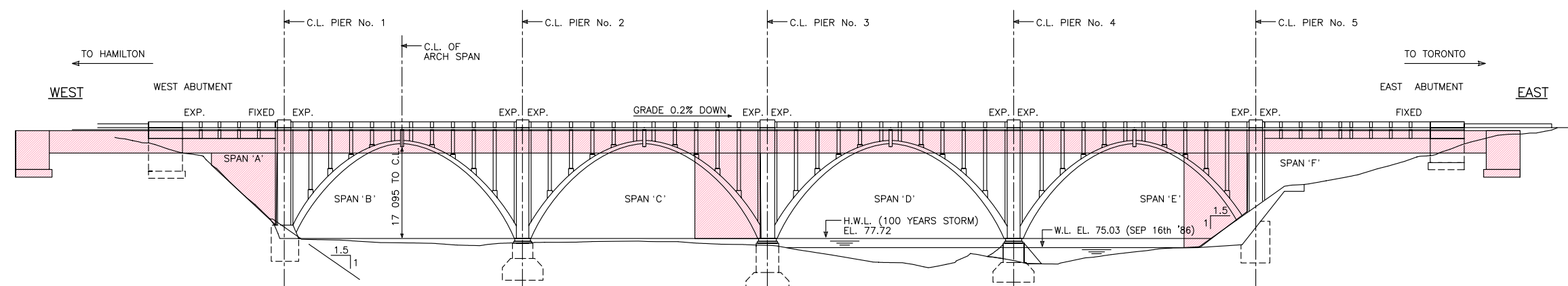
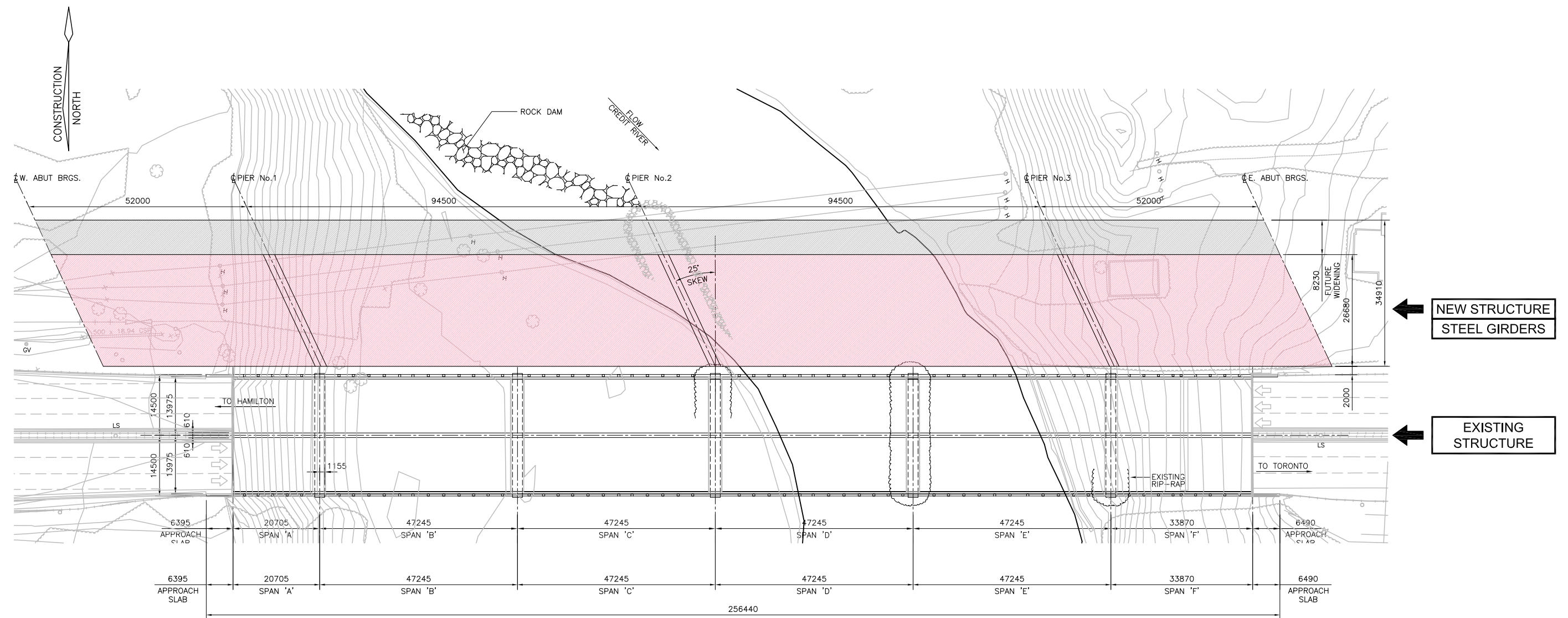
Although it costs more than the other alternatives, **NT-3 was the technically preferred North Twinning bridge alternative** because it minimizes impacts to provincially significant environmental and heritage features. While NT-1B was slightly preferred from a technical perspective, NT-3 was preferred in all other factor areas as it results in the least overall impacts to the socio-economic, cultural and natural environments.



PLAN
1:500



ELEVATION
1:500



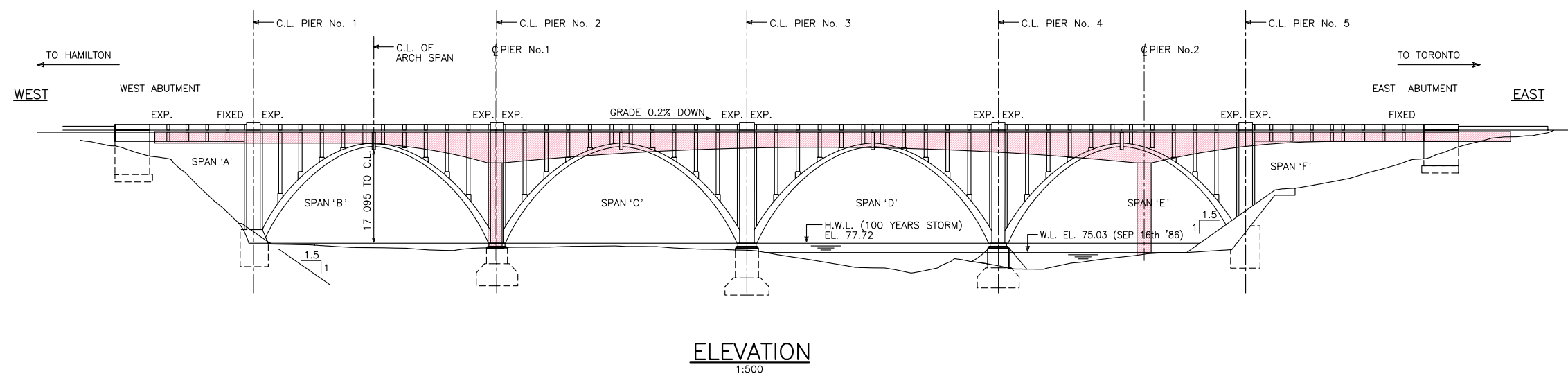
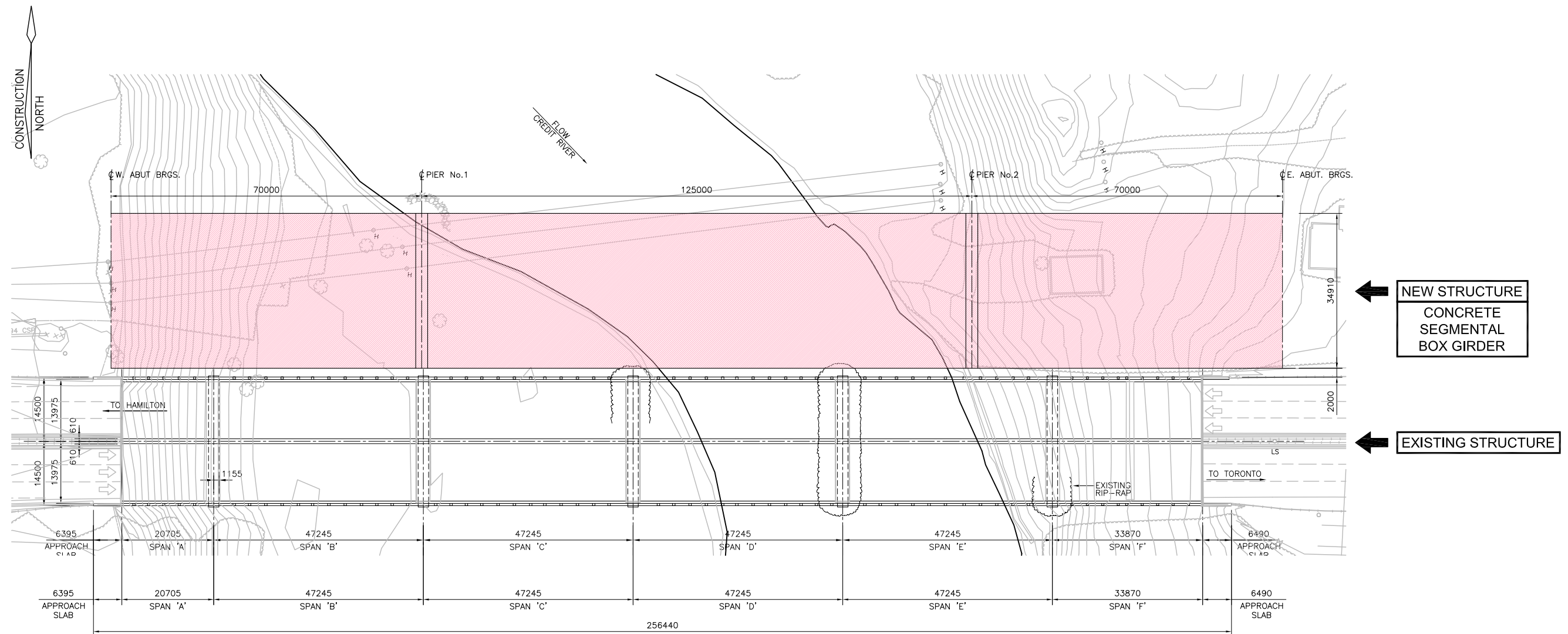
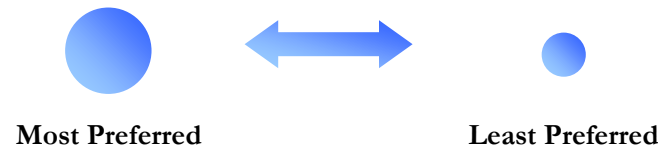


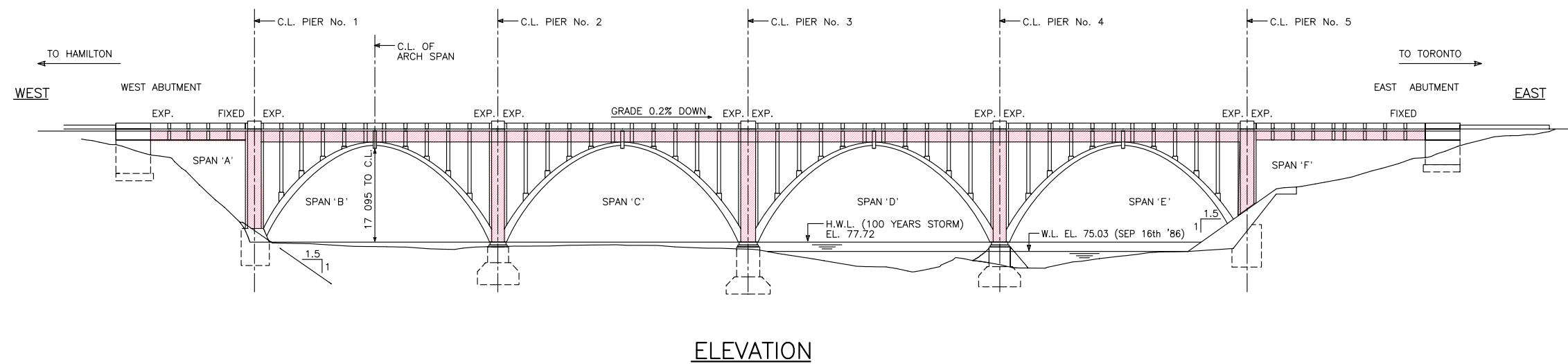
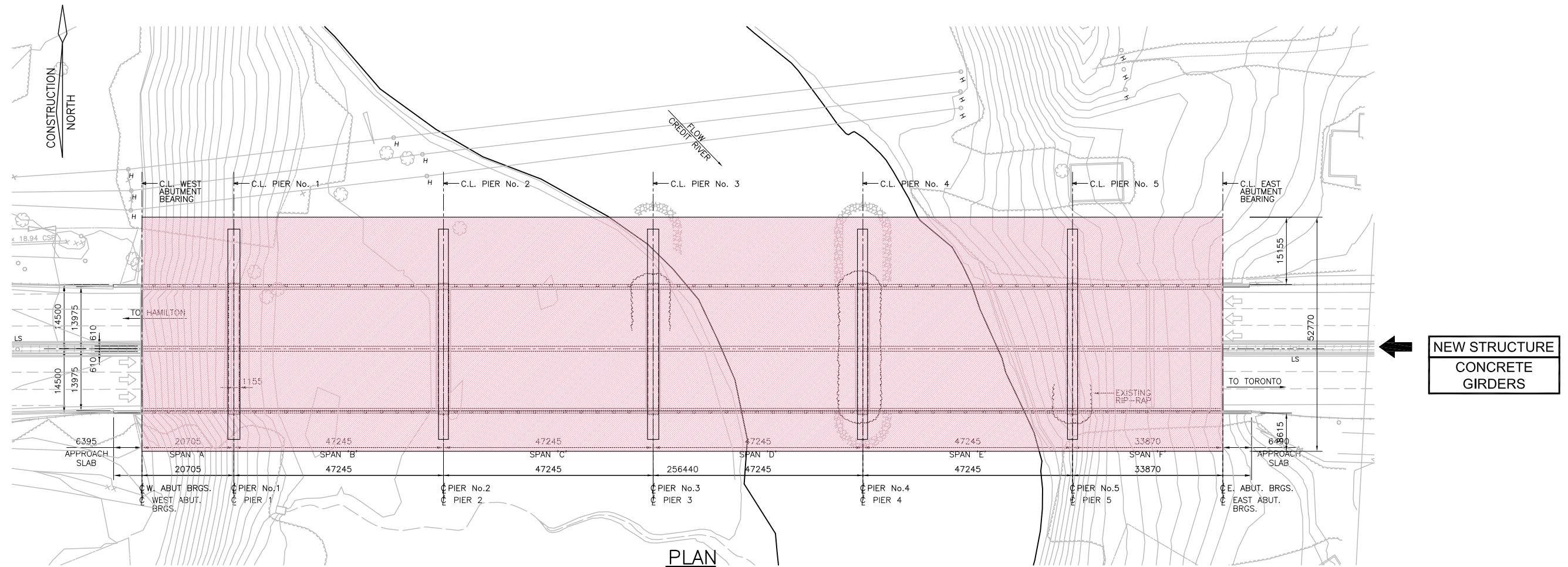
EXHIBIT 6-23: NORTH TWINNING EVALUATION SUMMARY

FACTOR/CRITERIA/INDICATOR	NT-1B	NT-2B	NT-3	SUMMARY
1.0 SOCIO-ECONOMIC ENVIRONMENT • Property • Community Effects				All alternatives result in similar low impacts to the Socio-Economic Environment, except NT-3 is slightly preferred as it minimizes effects on recreational features. Therefore, NT-3 is slightly preferred.
2.0 CULTURAL ENVIRONMENT • Archaeological • Heritage Features				All of the alternatives result in similar low impacts to archaeology and none of the alternatives result in direct built heritage impacts on the Credit River Bridge. NT-1B and NT-2B result in high to moderate cultural heritage landscape impacts due to the number and angle of bridge piers in the river. NT-3 has very low impacts to the riverscape landscape since none of the bridge piers are skewed, hidden or silhouetted behind existing piers or topography. Therefore, NT-3 is preferred.
3.0 NATURAL ENVIRONMENT • Surface Water • Fish and Fish Habitat • Terrestrial Ecosystems • Designated Natural Features • Property Waste and Contamination				NT-3 is substantially better than and highly preferred over NT-1B and NT-2B because: 1) It has no permanent footprint impact to fish and fish habitat in the Credit River; 2) It does not require substantial rock protection (and associated footprint impacts to relatively more sensitive nearshore fish habitat) to mitigate fluvial responses; 3) It avoids removing the only shallow marsh community within the study area that is considered a relatively more sensitive/higher quality wetland community, dominated by a regionally rare plant species. Further, in comparing NT-1B and NT-2B, NT-2B is slightly preferred over NT-1B as it results in slightly less impact to the Credit River in fluvial, hydraulic capacity, and potential to increase upstream flood elevations. Therefore, NT3 is highly preferred.
4.0 TECHNICAL CONSIDERATIONS • Transportation • Engineering • Cost				NT-1B and NT-2B are preferred over NT-3, since they have a lower overall cost and provide flexibility for future needs. However, NT-2B requires a longer structure and therefore has a higher new structure cost and maintenance cost. Therefore, NT-1B is preferred.
OVERALL SUMMARY				From a Socio-Economic perspective, NT-3 is slightly preferred since it minimizes effects on recreational features. From a Cultural perspective, NT-3 is preferred since it results in the least impacts to the Credit River Valley cultural heritage landscape. From a Natural Environment perspective, NT-3 is highly preferred as there is no permanent footprint impact to the fish habitat, does not require substantial rock protection to mitigate fluvial responses, and avoids removal of sensitive terrestrial features. From a Technical perspective, NT-1B and NT-2B are slightly preferred over NT-3 since they have a lower overall cost and provide flexibility for future needs. However, NT-2B requires a longer structure and therefore has a higher new structure cost and maintenance cost. Overall, although NT-1B is slightly preferred from a technical perspective, NT-3 is preferred in all other factor areas as it results in the least overall impacts to Socio-Economic, Cultural, and Natural Environments. Therefore, NT-3 is preferred.



6.4.3 Widening Bridge Alternative

The one Widening Alternative (W) was assessed and carried forward to the mainline assessment and evaluation, as it was the only widening alternative. See **Exhibit 6-24** for a plan of the alternative. The assessment of the widening alternative is included in **Appendix E**.



6.4.4 Technically Preferred Bridge Alternatives with Mainline Alignment Improvements

The technically preferred South Twinning (ST-2), North Twinning (NT-3), and Widening (W) bridge alternatives were combined with the required QEW mainline alignment adjustments and were compared to each other in order to identify an overall technically preferred bridge / mainline alternative. Each of the selected bridge / mainline alternatives are illustrated in **Exhibit 6-25**.

The QEW mainline alignment adjustments and improvements include the realignments of the QEW that are needed to connect both ends of the Credit River Bridge and the upgrading of the QEW cross-sectional elements to current standards.

The bridge / mainline alternatives were assessed and evaluated based on the criteria identified in **Exhibit 6-16**. The results of the summary evaluation for the bridge / mainline alternatives is provided in **Exhibit 6-26** (the detailed assessment and evaluation tables are included in **Appendix E**).

Based on the assessment and evaluation, **North Twinning (NT-3) was the technically preferred bridge / mainline alternative** because:

- From a Socio-Economic perspective, North Twinning (NT-3) is preferred because it results in the least direct and indirect impacts to properties.
- From a Cultural perspective, North Twinning (NT-3) is preferred since it results in the least direct impacts to built heritage and aesthetics.
- From a Natural Environment perspective, North Twinning (NT-3) is preferred since it does not have piers in the Credit River and has low impacts to less sensitive/lower quality vegetation communities.
- From a Technical perspective, South Twinning (ST-2) is preferred over North Twinning (NT-3) and Widening (W) since it provides the most flexibility for future needs, and has the least impact on utilities.

Although South Twinning (ST-2) was slightly preferred in the technical considerations factor group, North Twinning (NT-3) was preferred in all other factor areas as it minimizes impacts to adjacent properties, the natural environment and the cultural environment. Therefore, **North Twinning (NT-3) was preferred overall.**

EXHIBIT 6-25: SELECTED BRIDGE ALTERNATIVES WITH MAINLINE ALIGNMENT IMPROVEMENTS

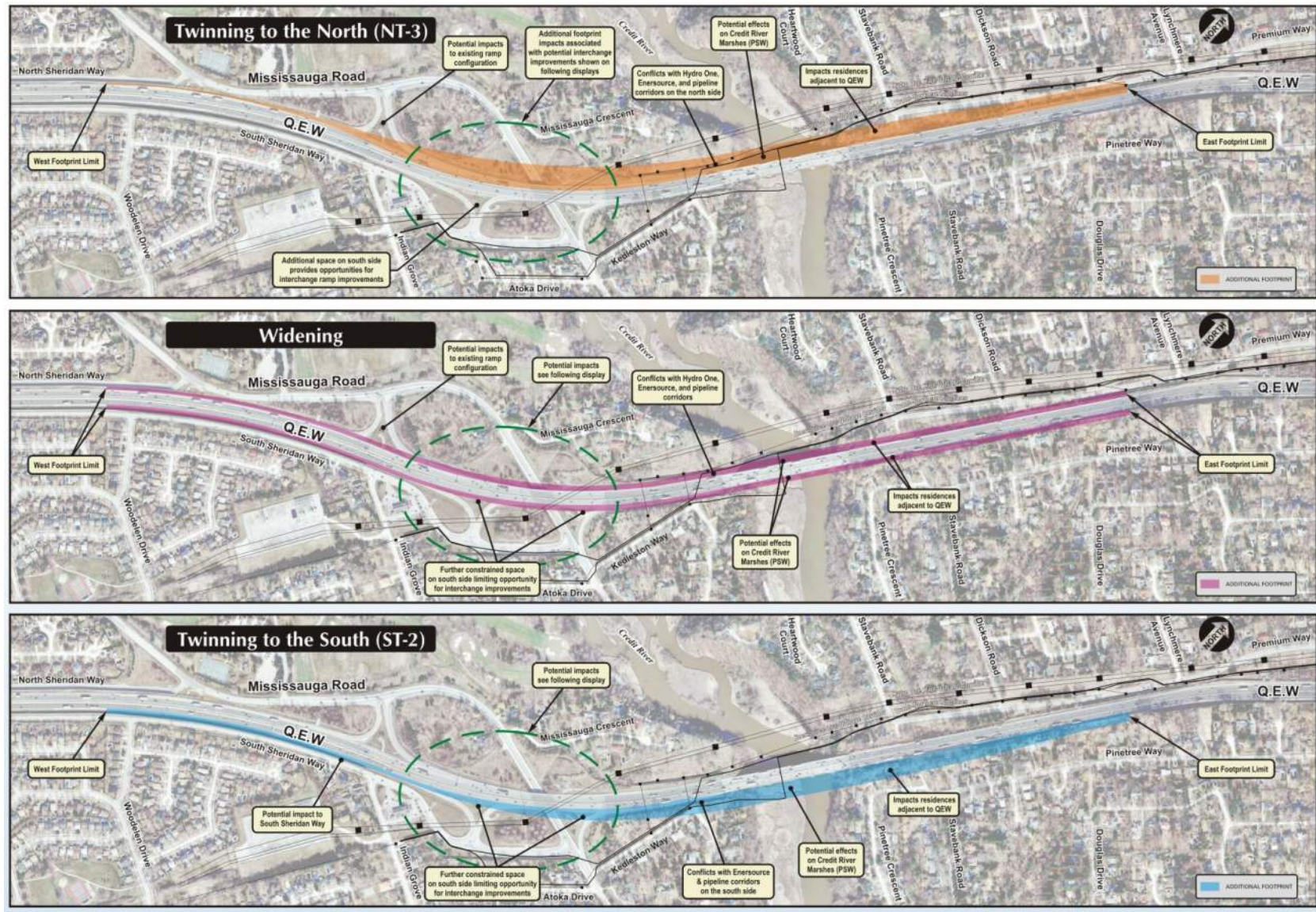
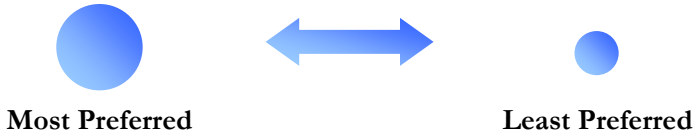


EXHIBIT 6-26: BRIDGE / MAINLINE EVALUATION SUMMARY

FACTOR/CRITERIA/INDICATOR	NT (NT-3)	ST (ST-2)	W	SUMMARY
1.0 SOCIO-ECONOMIC ENVIRONMENT • Property • Community Effects				From a Socio-Economic perspective, NT is preferred in all criteria. W is similar to NT but is less preferred because it results in more impacts to properties on both the north and south sides of the bridge. ST is least preferred and results in high to moderate direct and indirect effects to properties on the south side of the bridge. Therefore, NT is preferred.
2.0 CULTURAL ENVIRONMENT • Archaeological • Heritage Features				All alternatives result in impacts to heritage features. W results in very high impacts given that it impacts the existing bridge. NT and ST result in similar impacts, however overall NT results in the least impacts to the Credit River cultural heritage landscape. Therefore, NT is preferred.
3.0 NATURAL ENVIRONMENT • Surface Water • Fish and Fish Habitat • Terrestrial Ecosystems • Designated Natural Features • Property Waste and Contamination				NT is preferred because it results in low impacts to less sensitive/lower quality vegetation communities (upland and wetland) and does not have a permanent footprint impact in the Credit River. Although W results in lower impacts to relatively higher quality vegetation (upland and wetland), ST is slightly more preferred because it has no permanent footprint in the Credit River. Therefore, NT is preferred.
4.0 TECHNICAL CONSIDERATIONS • Transportation • Engineering • Cost				All alternatives have similar abilities to provide improved transportation features. However, NT is slightly more preferred than ST and W since it has the least impact on the local road network. The costs for W are slightly lower than ST< and NT results in the highest costs. However, ST is slightly preferred over NT and highly preferred over W when evaluating engineering factors because it provides the most flexibility for future needs and is has the least impact on utilities. Therefore, ST is slightly preferred over NT and W.
OVERALL SUMMARY				From a Socio-Economic perspective, NT is preferred because it results in the least direct and indirect impacts to properties. From a Cultural perspective, NT is preferred since results in the least direct impacts to built heritage and aesthetics impacts. From a Natural Environment perspective, NT is preferred since it does not have a permanent footprint impact on the Credit River and has low impacts to less sensitive/lower quality vegetation communities. From a Technical perspective, ST is slightly preferred over NT and W. Although ST is slightly preferred Technically, NT is preferred in all other factor areas. Therefore, NT is preferred overall.



6.4.5 Interchange Alternatives

Three (3) QEW / Mississauga Road Interchange Alternatives were assessed and evaluated to identify the Preferred Interchange Alternative to carry forward for combination with the preferred bridge / mainline alternative (North Twinning, NT-3). The three Interchange Alternatives involved various improvements on the south side of the interchange; all were common on the north side:

- **Alternative 1 – Operational Improvements:** This alternative would maintain the existing physical configuration of the ramps but would include improvements to lane geometry and intersection signals.
- **Alternative 2 – Partial Parclo:** This alternative would replace the existing ‘south-to-east’ move with a loop ramp directly from southbound Mississauga Road.
- **Alternative 3 – Roundabout:** This alternative would replace the existing signalized intersection at Mississauga Road and South Sheridan Way with a roundabout.

The alternatives, including descriptions of the alternatives and the associated benefits, are presented in **Exhibit 6-27**.

The alternatives were assessed and evaluated based on the criteria identified in **Exhibit 6-16**. The results of the evaluation of the Interchange Alternatives is summarized in **Exhibit 6-28** (the detailed assessment and evaluation tables are included in **Appendix E**).

Alternative 2 does not provide any significant benefit to traffic operation compared to Alternative 1 but requires property along the south side of South Sheridan Way and construction of new (loop) ramp. Hence, Alternative 2 was not carried forward for detailed analysis.

Alternative 3 results in high demand on a single on-ramp (all three on-ramp traffic movements approach the roundabout and use the direct eastbound on-ramp) and with the ramp meter, it was observed during simulation that significant traffic backs up and results in grid-lock in roundabout. In addition, the provision of a roundabout also requires property along the south side of South Sheridan Way. Hence, this option was set aside and not considered for further analysis.

Alternative 1 was the technically preferred Interchange Alternative because it minimizes impacts to the natural, cultural and social environments, and could improve traffic operations at the lowest cost.

EXHIBIT 6-27: MISSISSAUGA ROAD INTERCHANGE ALTERNATIVES

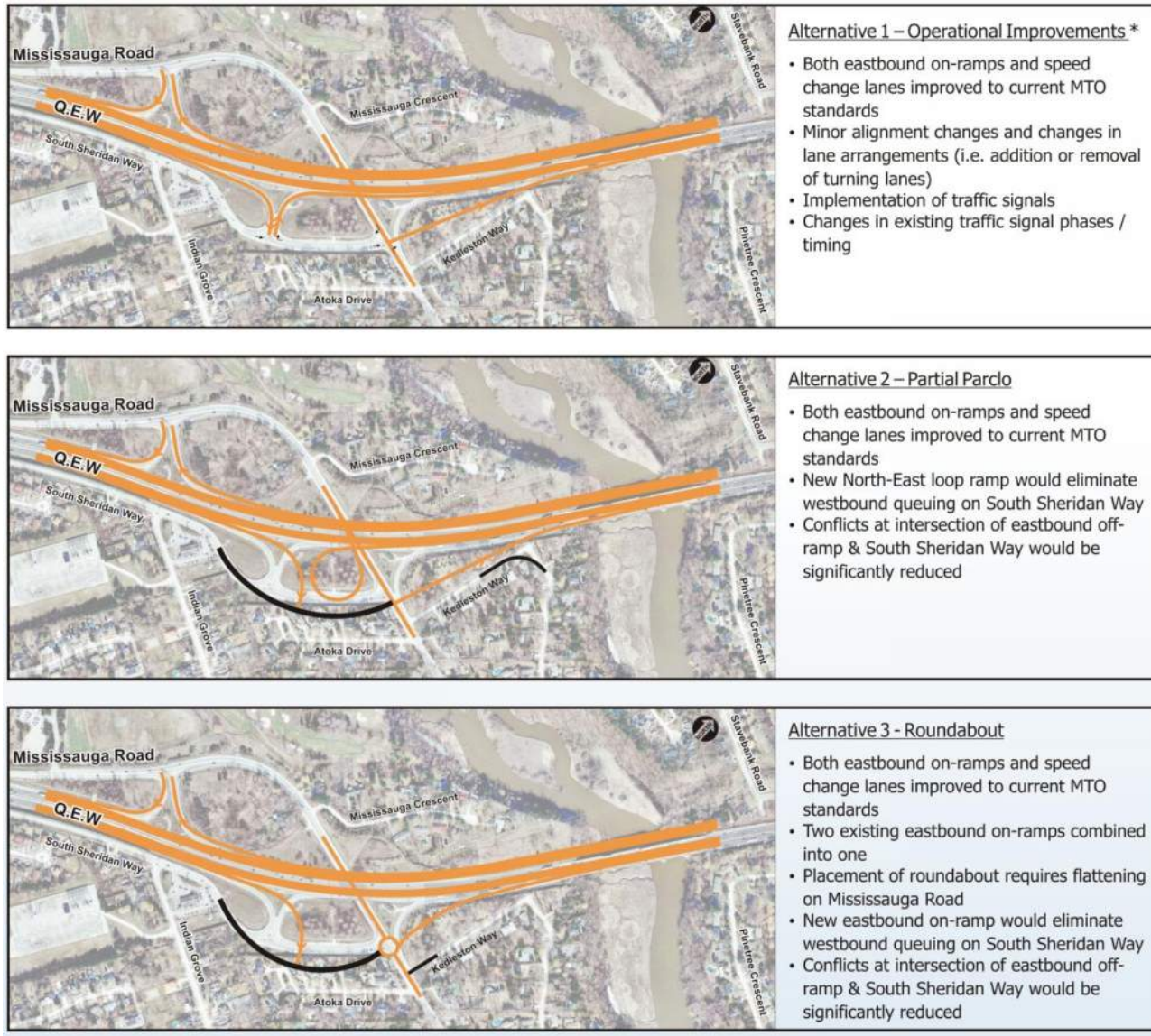
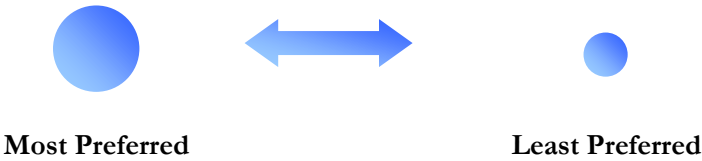


EXHIBIT 6-28: MISSISSAUGA ROAD INTERCHANGE EVALUATION SUMMARY

FACTOR/CRITERIA/INDICATOR	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	SUMMARY
1.0 SOCIO-ECONOMIC ENVIRONMENT • Property • Community Effects				All alternatives result in similar low impacts to the Socio-Economic Environment. However, Alternative 1 does not impact residential property or result in any residents becoming newly exposed to noise. Therefore, Alternative 1 is highly preferred over the other alternatives.
2.0 CULTURAL ENVIRONMENT • Archaeological • Heritage Features				All alternatives result in similar low impacts to the Cultural Environment. Therefore, all alternatives are equally preferred.
3.0 NATURAL ENVIRONMENT • Surface Water • Fish and Fish Habitat • Terrestrial Ecosystems • Designated Natural Features • Property Waste and Contamination				All alternatives result in similar low effects to culturally derived vegetation and associated habitat. Alternative 1 is slightly preferred since it has moderate impacts to potentially contaminated sites and has the least impact on existing storm sewer system. Therefore, Alternative 1 is slightly preferred.
4.0 TECHNICAL CONSIDERATIONS • Transportation • Engineering • Cost				Alternative 1 is preferred because it will improve the operations and safety of the interchange by providing longer speed change lanes, and reduce the conflict at the QEW EB off-ramp. Additionally, there will be no impact to properties and utilities, results in the lowest cost. Therefore, Alternative 1 is preferred.
OVERALL SUMMARY				From a Socio-Economic perspective, Alternative 1 is preferred because it results in no direct and indirect impacts to properties. From a Cultural perspective, all alternatives result in similar low impacts. From a Natural Environment perspective, all alternatives result in similar low effects. From a Technical perspective, Alternative 1 is preferred since it will improve the operations of the interchange at the lowest cost. Therefore, Alternative 1 is preferred or equally preferred in all categories.



QEW Credit River Bridge

Preliminary Design and Class Environmental Assessment Study

Transportation Environmental Study Report

Following the selection of Alternative 1 as the Preferred Interchange Alternative, six sub-alternatives (1A, 1B, 1C, 1D, 1E and 1F) with different traffic movement configurations, ramp meter timings and the option of an auxiliary lane were developed and analyzed for the 2031 traffic demand. The 2031 planning horizon assumes 6 GPL + 2 HOV lane configuration on the QEW network through Mississauga. As noted in previous discussion, the goals of this EA Study do not include the long-term capacity needs of the QEW. This EA study is not seeking an approval for QEW widening or HOV lanes, but does not preclude the Ministry's future HOV network plans for the QEW through Mississauga.

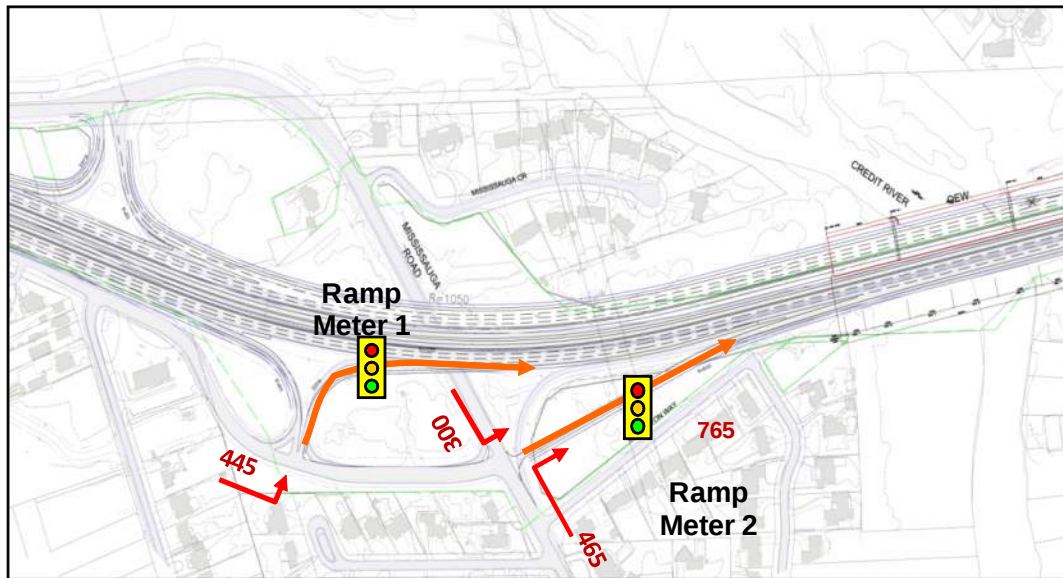
The traffic movement configurations, on-ramp meter timings and presence/absence of the auxiliary lane (in the eastbound direction between Mississauga Road Interchange and Hurontario Street Interchange) for each of the sub-alternatives are presented in **Exhibit 6-29**.

EXHIBIT 6-29: SUB-ALTERNATIVES – TRAFFIC MOVEMENT CONFIGURATIONS

Sub-Alternative	Traffic Accommodated by		Ramp Meter 1	Ramp Meter 2	EB Auxiliary Lane
	Ramp 1	Ramp 2			
Do-Nothing (base case)	- EB South Sheridan Way - SB Mississauga Road	- NB Mississauga Road	7 sec	7 sec	✗
1A	- EB South Sheridan Way	- NB Mississauga Road - SB Mississauga Road	5 sec	5 sec	✗
1B	- EB South Sheridan Way	- NB Mississauga Road - SB Mississauga Road	5 sec	0 sec	✗
1C	- EB South Sheridan Way	- NB Mississauga Road - SB Mississauga Road	5 sec	0 sec	✓
1D	- EB South Sheridan Way	- NB Mississauga Road - SB Mississauga Road	5 sec	5 sec (double ramp)	✓
1E	- SB Mississauga Road	- EB South Sheridan Way - NB Mississauga Road	5 sec	5 sec (double ramp)	✓
1F	- EB South Sheridan Way - SB Mississauga Road	- NB Mississauga Road	5 sec	5 sec (double ramp)	✓

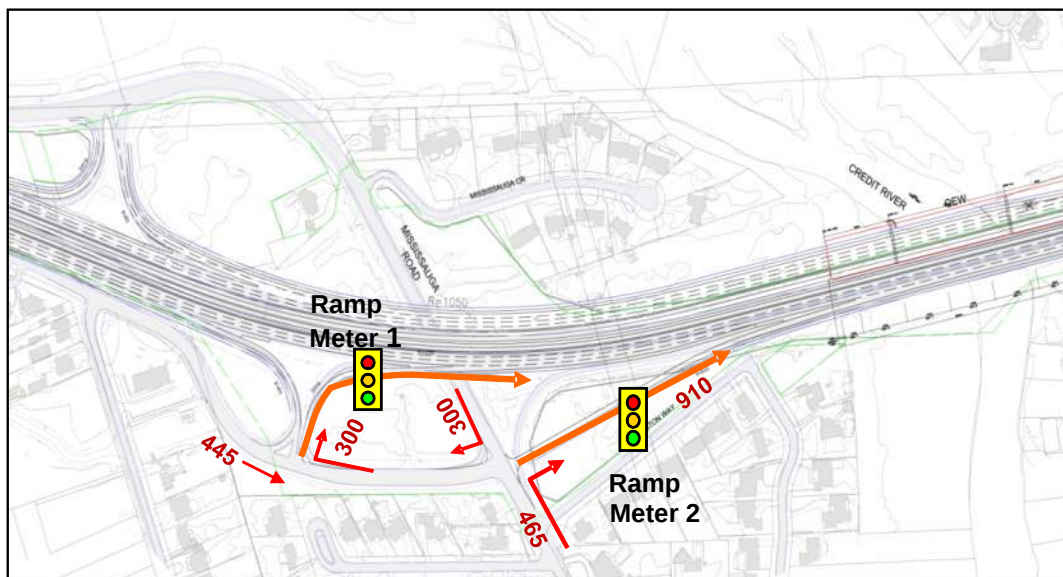
The traffic movement configurations for Alternative 1A, 1B, 1C and 1D are presented in **Exhibit 6-30**.

**EXHIBIT 6-30: TRAFFIC MOVEMENT CONFIGURATIONS FOR
ALTERNATIVES 1A, 1B, 1C AND 1D (EB ON-RAMPS)**



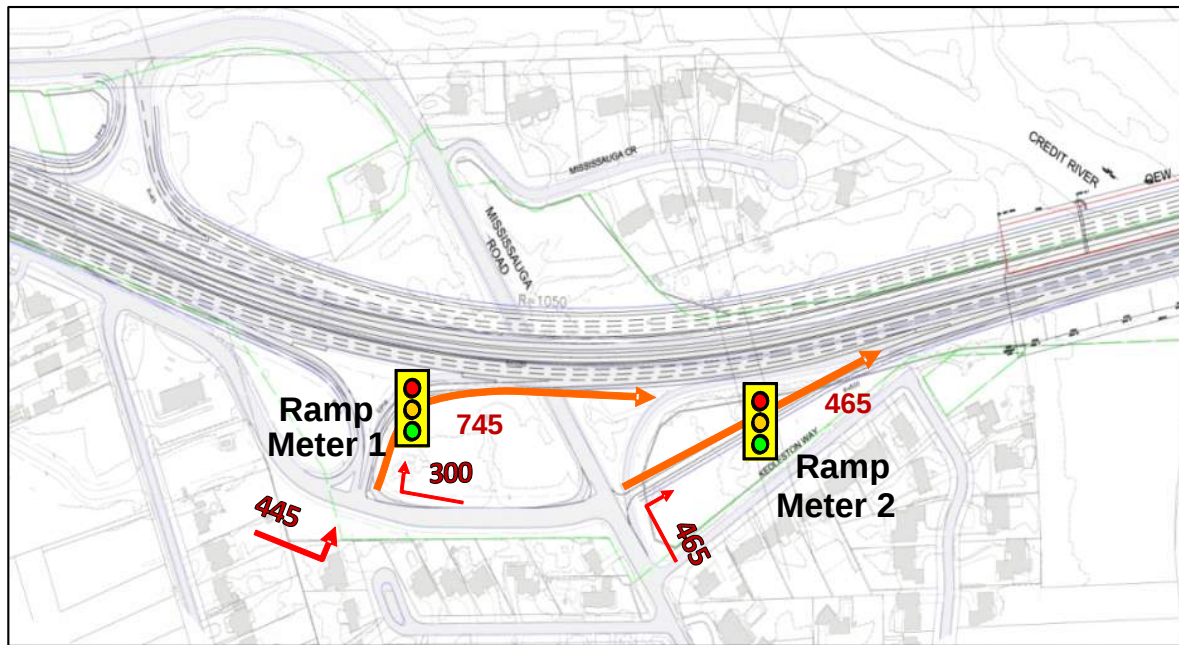
The traffic movement configuration for the Alternative 1E is presented in **Exhibit 6-31**.

**EXHIBIT 6-31: TRAFFIC MOVEMENT CONFIGURATIONS FOR
ALTERNATIVES 1E (EB ON-RAMPS)**



The traffic movement configuration for Alternative 1F, which is same as the existing configuration, is presented in Exhibit 6-32.

**EXHIBIT 6-32: TRAFFIC MOVEMENT CONFIGURATIONS FOR
ALTERNATIVES 1F (EB ON-RAMPS)**



Summary Assessment of Interchange Alternatives

Alternatives 1A-1F were analyzed using VISSIM micro-simulation model which models traffic operations under the conditions defined for each Alternative (presented in Exhibit 6-29).

The comparison of simulated (VISSIM) travel times and speeds for 2031 a.m. eastbound direction are presented in **Exhibit 6-33A**. The comparison of travel delay and Level of Service are presented in **Exhibit 6-33B**.

**EXHIBIT 6-33A: COMPARISON OF TRAVEL TIME AND SPEED ON
MAINLINE (EB)****Travel Time (Sec) from Erin Mills to Hurontario St Interchange:**

Time/Alternative	1A	1B	1C	1D	1E	1F
6.30 to 7.30	264	260	245	252	247	254
7.30 to 8.30	376	363	316	325	289	296
8.30 to 9.30	383	398	351	315	350	359
Average	341	340	304	297	296	303

Travel Time (Min) from Erin Mills to Hurontario St Interchange:

Time/Alternative	1A	1B	1C	1D	1E	1F
6.30 to 7.30	4.4	4.3	4.1	4.2	4.1	4.2
7.30 to 8.30	6.3	6.0	5.3	5.4	4.8	4.9
8.30 to 9.30	6.4	6.6	5.9	5.2	5.8	6.0
Average	5.7	5.7	5.1	5.0	4.9	5.0

Avg. Speed (km/h) from Erin Mills to Hurontario St Interchange:

Time/Alternative	1A	1B	1C	1D	1E	1F
6.30 to 7.30	84.5	86.1	91.1	88.5	90.3	88.1
7.30 to 8.30	59.4	61.6	70.7	68.8	77.3	75.5
8.30 to 9.30	58.4	56.1	63.6	70.9	63.7	62.3
Average	67.4	67.9	75.1	76.1	77.1	75.3

EXHIBIT 6-33B: COMPARISON OF AVERAGE DELAY AND LEVEL OF SERVICE AT RAMP TERMINALS

Ramp	Delay/ LOS	1A	1B	1C	1D	1E	1F
On-Ramp 1	Delay (Sec.)	52.1	56.0	42.1	42.8	7.2	143.1
	LOS	D	E	D	D	A	F
On-Ramp 2	Delay (Sec.)	130.0	17.3	17.5	19.4	17.8	7.2
	LOS	F	B	C	B	B	A

Alternative 1D and Alternative 1E result in good traffic performance for both QEW mainline and ramp terminal. However, Alternative 1E provides fewer disturbances and higher speed for mainline traffic. Alternative 1E also provides better LOS at both eastbound ramp terminal intersections than Alternative 1D.

The other interchange alternative configurations result in lower speed on mainline and higher delay (i.e., poor level of service) at the eastbound ramp terminals. Alternative 1A results in poor LOS at ramp terminals and also increases travel time. Alternative 1B and Alternative 1C are not carried forward since '0' sec of ramp meter timing is not acceptable to ATMS (MTO). Alternative 1F would not only worsen the mainline operation (than Alternative 1E), but also result in poor level of service at Ramp Terminal 1.

Therefore, Alternative 1E was preferred over the other alternatives in terms of traffic movement configuration.

The lane configuration for Alternative 1E is presented in **Exhibit 6-34**.

EXHIBIT 6-34: LANE ARRANGEMENTS FOR ALTERNATIVE 1E

One potential issue identified with Alternative 1E, was the queue length for the eastbound through movement approaching the South Sheridan Way and Mississauga Road intersection. The queue length for the eastbound through movement was 163 m, which is close to the available storage length of 200 m (on South Sheridan Way between Mississauga Road and EB on/off-ramp). This queue could potentially extend back to Ramp Terminal 1 blocking the off-ramp traffic (QEW eastbound off-ramp traffic), and that off-ramp traffic queue could lead back onto mainline.

To assess the opportunity to reduce the queue length for eastbound through approach at Ramp Terminal 2 (Mississauga Road/South Sheridan Way intersection), a modified Alternative 1E with a provision of dedicated eastbound right turn lane (instead of a short storage lane for this movement) at Ramp Terminal 2 was assessed. The comparison of Level of Service and travel delay for traffic movement configuration Alternatives 1E and 1E Modified are presented in **Exhibit 6-35**.

EXHIBIT 6-35: COMPARISON OF AVERAGE DELAY AND LEVEL OF SERVICE AT RAMP TERMINALS

Ramp	Delay/ LOS	1E	1E-Modified
On-Ramp 1	Delay (Sec.)	7.2	8.7
	LOS	A	A
On-Ramp 2	Delay (Sec.)	17.8	13.8
	LOS	B	B

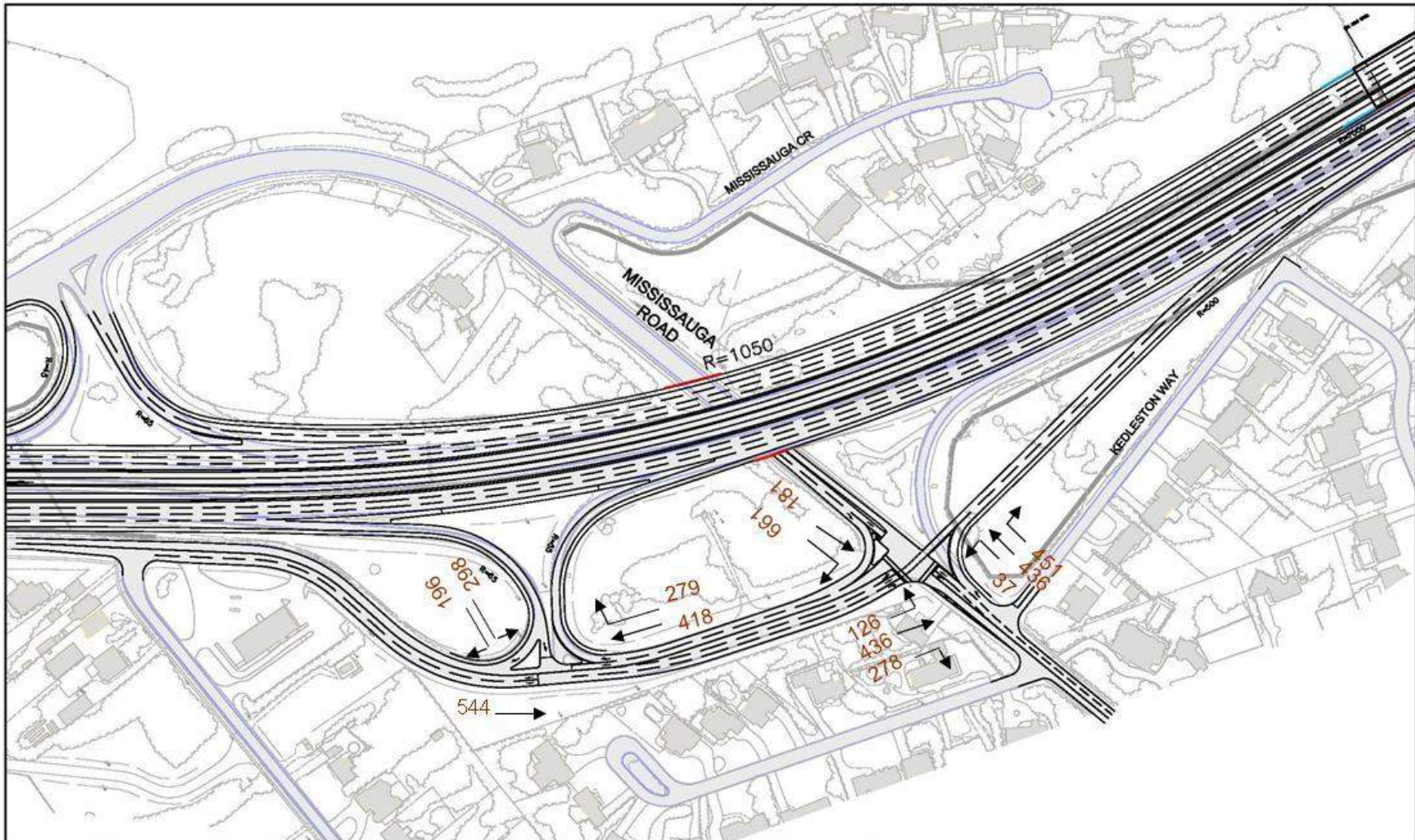
Alternatives 1E and 1E Modified both provide good level of service at both ramp terminals. Due to provision of dedicated eastbound right turn lane at the South Sheridan Way and Mississauga Road intersection, this alternative configuration reduces the queue length and delay for the eastbound through movement.

Thus, Alternative 1E Modified was selected as the preferred alternative. The proposed lane arrangement for this alternative is presented in **Exhibit 6-36**, and includes the following improvements:

- Provision of longer speed change lanes between two successive eastbound on-ramps at Mississauga Road Interchange.
- Provision of an eastbound auxiliary lane extending from the second eastbound on-ramp at Mississauga Road Interchange to the eastbound off-ramp at Hurontario Street Interchange.
- Implementation of traffic signals at QEW eastbound on/off-ramp at South Sheridan Way Intersection. The signal warrant analysis undertaken as part of existing conditions analysis suggests that the traffic signal control justification criteria are nearly satisfied on the basis of Justification 2: Delay to Cross Traffic. Additionally, the eastbound off-ramp is operating with the stop-control. The delays and corresponding queue formation at the off-ramp may result in queues extending on to the mainline. The installation of traffic signal would alleviate the potential chances of queuing to the mainline.

Prohibiting eastbound left-turn movement at the intersection of QEW eastbound off-ramp at South Sheridan Way and providing a double on-ramp at the second eastbound on-ramp. The trips originating at South Sheridan Way between Erin Mills Parkway and Mississauga Road, and destined eastbound on QEW will travel using second eastbound on-ramp at Mississauga Road interchange. This second eastbound on-ramp with two lanes (tapered to one lane before the merge with QEW) will operate with staggered ramp meter signal control in the morning peak period.

EXHIBIT 6-36: LANE ARRANGEMENTS FOR ALTERNATIVE 1E MODIFIED



6.5 RATIONALE FOR THE OVERALL PREFERRED ALTERNATIVE

The Overall Preferred Alternative is bridge / mainline alternative **North Twinning (NT-3) and Interchange Alternative 1E**. See **Exhibit 6-37** for a plan of the Overall Preferred Alternative.

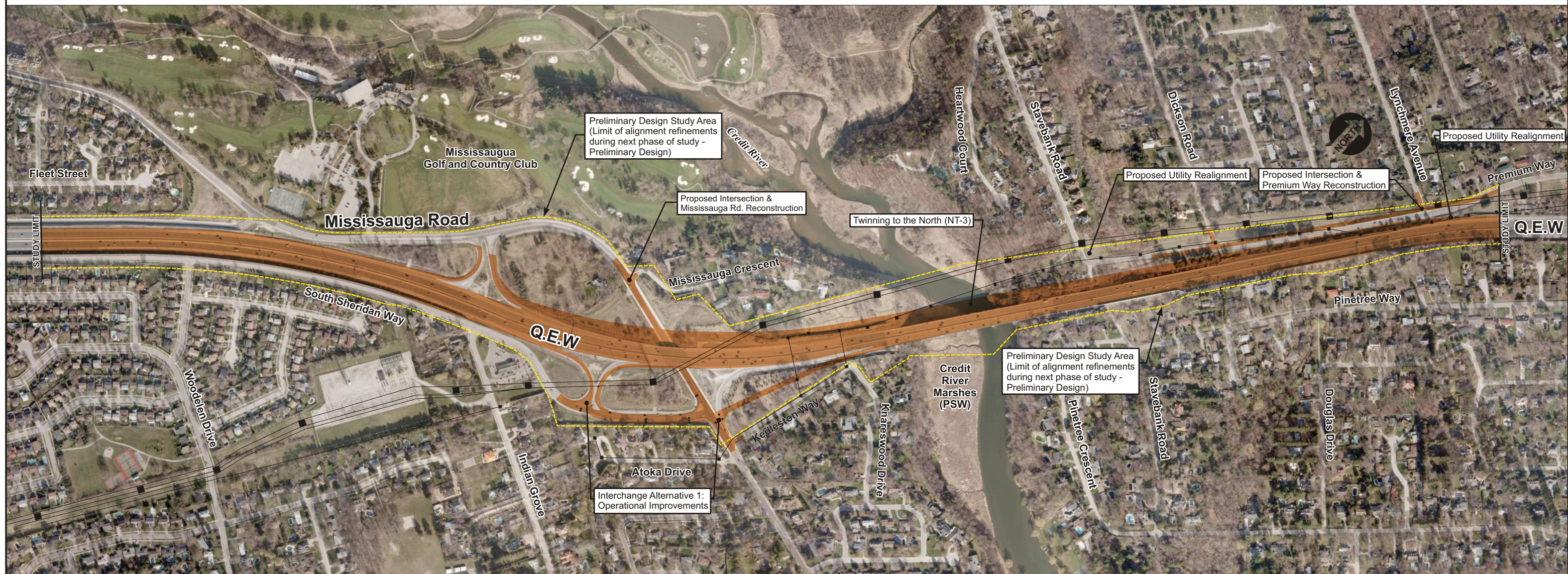
The Overall Preferred Alternative was identified through a staged approach. The preferred bridge alternatives were combined with the required QEW mainline alignment improvements and were compared to each other in order to identify an overall technically preferred bridge / mainline alternative.

Based on the assessment and evaluation, **North Twinning (NT-3)** is the technically preferred bridge / mainline alternative because:

- From a Socio-Economic perspective, North Twinning (NT-3) is preferred because the mainline results in the least direct and indirect impacts to properties.
- From a Cultural perspective, North Twinning (NT-3) is preferred since the bridge results in the least direct impacts to built heritage and aesthetics.
- From a Natural Environment perspective, North Twinning (NT-3) is preferred since the bridge does not have piers in the Credit River and has low impacts to less sensitive/lower quality vegetation communities.

Interchange Alternative 1E is the technically preferred interchange alternative because:

- It minimizes impacts to the natural, cultural and social environments; and,
- It improves operations at the lowest cost.



6.6 VE & RISK ASSESSMENT WORKSHOP

A combined Value Engineering & Risk Assessment Workshop was held to review the Overall Preferred Alternative in early December 2010.

Value Engineering (VE), also known as Value Analysis, is a systematic and function-based approach to improving the value of a project. VE involves an independent team of specialists following a structured process. On highway projects, improvements to value might include reducing the life cycle cost of an interchange, enhancing safety in a design, or reducing impacts to the public by shortening the duration of a construction project. Risk Assessment (RA), is a systemic analysis of the scope, schedule and cost estimates of a project to evaluate the anticipated risk and uncertainty in the projected cost and schedule.

The goal of the workshop was to:

- Ensure that the project is accomplishing necessary functions
- Identified the risks to cost and schedule
- Identify areas of unnecessary or excess cost
- Challenge how the problem is being solved
- Develop a wide-range of technically viable design alternatives
- Develop risk management and mitigation strategies

Key outcomes from the workshop included:

1. Agreement that the Overall Preferred Alternative is a viable option to be carried forward to the Preliminary Design.
2. Development of more than 30 design suggestions for the Project Team to consider during as part of this study, as well as subsequent design phase.

6.7 REVIEW DURING SECOND ROUND OF CONSULTATION

The Overall Preferred Alternative was reviewed at the second Public Information Centre (PIC) on March 31, 2011. There was overwhelming agreement that the North Twinning option was the technically preferred alternative, and it was noted that maintaining views of the existing heritage bridge were important.

The majority of comments received were related to noise (including requests for the installation of noise barriers along the Credit River Bridge as soon as possible), pedestrian / cycling connections (including requests for increased connections across the QEW and Credit River, and review of opportunities on the new bridge), and the environment (including concerns regarding impacts to the river valley). Concerns regarding the proximity of the new QEW Eastbound Ramp to Kedelston Way were voiced, as well as inquiries on what the long-term plans for HOV lanes on the QEW through Mississauga are.

Additional information on the second PIC and how comments were addressed are presented in **Section 3.1.3.4**.