County of Brant

Grand River Street North Corridor Improvements

Class Environmental Assessment

Preliminary Evaluation of Paris Links Road Connection Alternatives

April 9, 2018

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1.0 Study Introduction

1.1 Preface

The County of Brant has initiated this Class Environmental Assessment (Class EA) for the planning of operational improvements along Grand River Street North from Watts Pond Road to William Street. These improvements will address traffic operation and safety concerns, associated with increased traffic demand through the Community of Paris, and will take into consideration the adjacent institutional, commercial and residential land uses.

This Class EA study will complete all required phases of the Municipal Class EA. The study will: establish the need and justification for the improvements; complete environmental inventories; establish a baseline to compare alternatives; consider all reasonable alternatives; and proactively involve the public in defining a recommended plan for improvements.

The County of Brant is the proponent of this undertaking and is actively engaging the public throughout the project. As an initial step in the engagement of the community a Community Café event was undertaken in January 2017 as a discretionary activity of Stage 1 of the Class EA. Several suggestions were received from the public at this event. Three of these suggestions were:

1) Extension of the Class EA to the south to consider the traffic operations and safety of traffic growth where the current street cross section narrows;
2) Consider an extension of the study area to the east of Silver Street and Paris Links Road to allow alternatives which provide a direct connection to Silver Street beyond the residential community; and
3) Consider the connections to the future Eastern Bypass as part of the EA as they may have an outcome on the choice of connection.

The initial draft Study Design is being amended to reflect an amended work program to address these comments received from the public.

The coarse screening analysis described in this report will be presented to the public at the first Public Information Centre (PIC) for public review and comment. This report will also be available for a scheduled OMB Hearing scheduled to occur between May 14 and June 26, 2018.

1.2 Background

Grand River Street North represents the northern gateway to the Community of Paris, providing access to existing commercial and residential developments. Increased area traffic congestion has been forecast as a result of a mix of proposed residential and employment growth. Safety concerns have been noted to exist along the corridor for pedestrians and cyclists.

The need for improvements to the Grand River Street North corridor, south of Bradbury Crescent, was identified in the Transportation Master Plan (TMP) Update, specifically with the planned Paris Grand Subdivision. Future development, north of Scott Avenue, that will include the Northwest Paris

Area, the Cordon lands and the Vicano site will further increase traffic along the corridor. This study will consider the roadway requirements to meet existing and future travel demands, so that these improvements can potentially be coordinated with the roadway construction that will be required to service those developments.

The County of Brant initiated this Class Environmental Assessment (Class EA) in August of 2017 for operational improvements to Grand River Street North. The 2016 Transportation Master Plan update recommends the long-term solution of an Eastern Bypass to divert traffic. This Class EA Study is a separate and distinct project that will address existing and short-term traffic operational constraints and current safety concerns, and accommodate all road users along the corridor.

In 2017, IBI completed the Grand River Street North Corridor Transportation Study which evaluated existing and long term traffic impacts resulting from future expansion along the corridor, primarily large residential and commercial developments. Grand River Street North is a north-south arterial road providing access to downtown Paris and Highway 403 to the south, as well as surrounding communities including Brantford and Cambridge.

This 2017 Traffic Study recommended the widening of the corridor to 4 lanes, with a multi-use trail on one side of the street and a sidewalk along the other side of the street. The use of signalized intersections or roundabouts at key intersections was recommended to improve traffic flow.

2.0 Study Area

The study area is illustrated in **Figure 1**.

The study area encompasses Grand River Street North as it turns into Pinehurst Road. It is bounded by: Watt’s Pond Road to the north; William Street to the south; and West River Road to the east. Many local, two lane roads connect to Grand River Street North. These local roads provide access to residential areas and existing/planned subdivisions.

Figure 1 reflects two Study Area extensions with one to the south and one to the east that were added following the initial round of public consultation. The easterly study area extension is the focus of this preliminary coarse screening analysis report.

3.0 Land Development

The northwest and northeast quadrants of the study area are currently undeveloped, but are planned for future commercial and residential developments. Along the east Study Area extension, there is a proposed four stage development of the previous Paris Grand Golf Club lands. This proposed development is being planned for an initial Stage 1 residential development of approximately 200 homes and this will be followed by the development of an additional 600 houses.

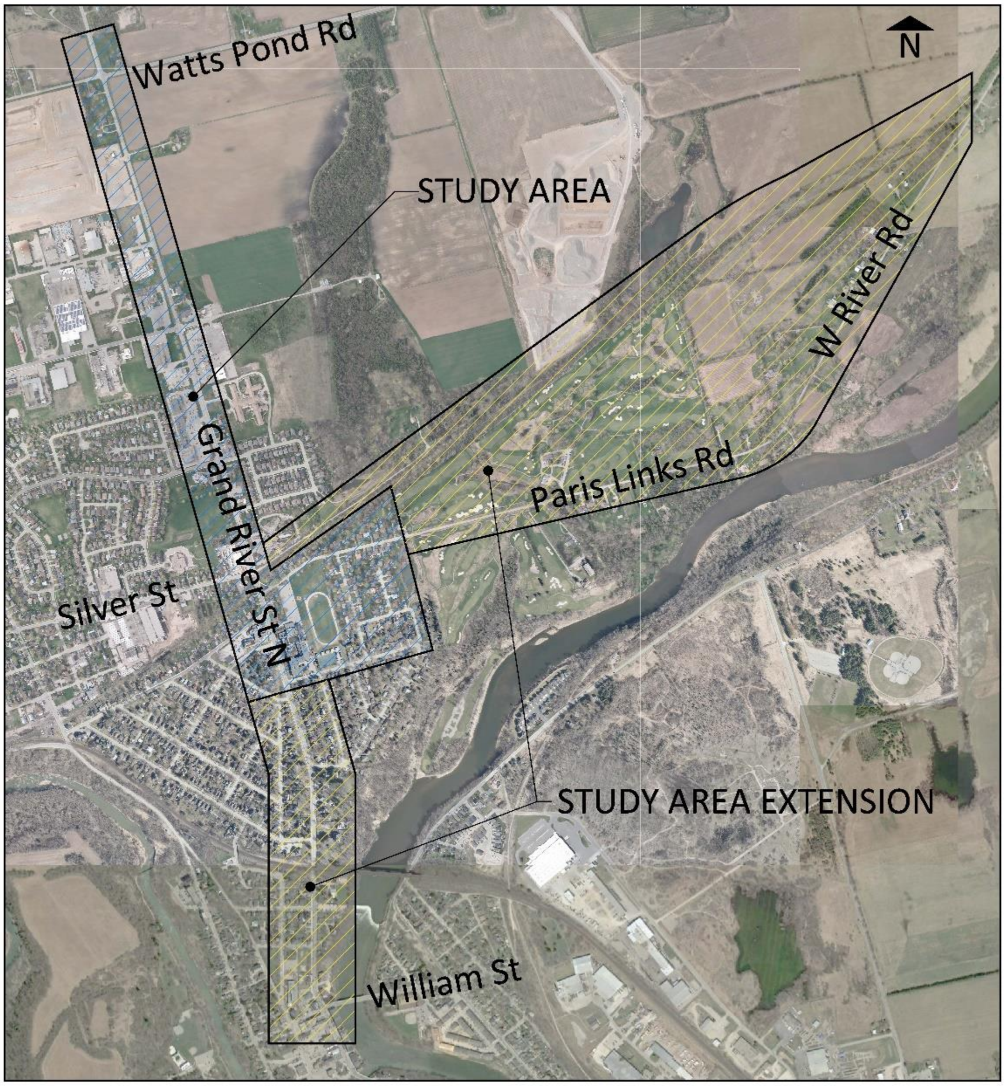

Figure 1: Study Area

An illustration of the draft Paris Grand Estates site plan is provided in **Figure 2**.

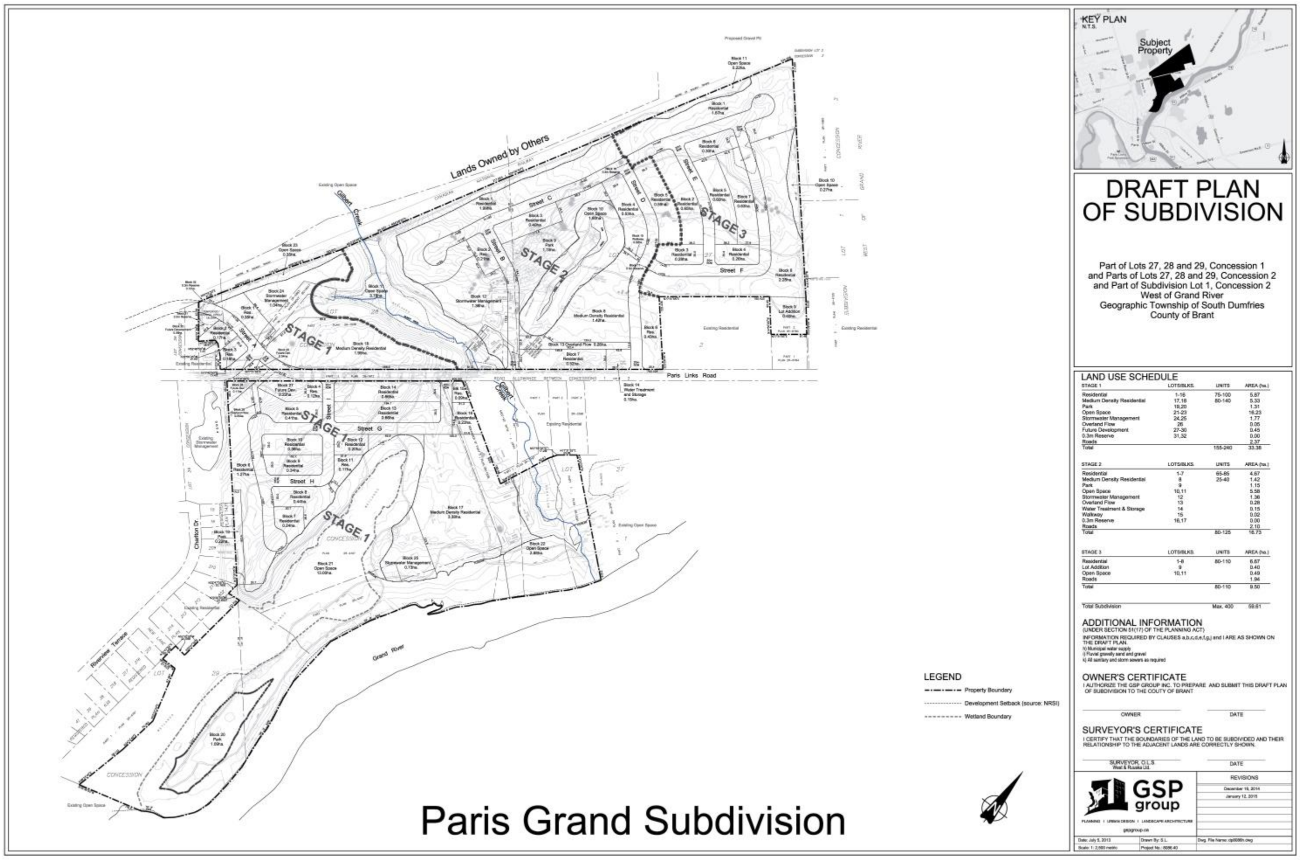

Figure 2: Proposed Paris Grand Subdivision

4.0 Future Eastern Bypass

Construction of a new corridor or bypass of Paris was considered as part of the 2010 and 2016 Transportation Master Plans (TMP) completed by the County. The 2010 TMP presented the potential for an eastern bypass, by recommending protection of a corridor as a potential longer term improvement (see **Figure 3**). Timing of a future bypass would be beyond the planning horizon of the Transportation Master Plan. As a result, this alternative will not reduce traffic demands on Grand River Street North to accommodate existing and planned development within the current Official Plan horizon but will be protected by the County. The current EA and development plans consider this to be longer term infrastructure. Planning for the proposed Paris Grand Estates development on Paris Links Road identified Stage 2 to Stage 4 of the development could not be accommodated until the bypass is in place.

Figure 3: Paris East Side Bypass Concept

5.0 Generation of Paris Links Road Alignment Alternatives

5.1 Existing Silver Street/Grand River Street North/Paris Links Road Geometry

The need for an improved roadway link connecting to Grand River Street North from Paris Links Road is to augment the existing road network that exists today entering Paris from the east (West River Road South) and accommodate possible future development of the former Paris Grand Golf Club (Paris Grand Estates development). This local area is characterized as a residential area with Paris Links Road (collector street) providing a link to Grand River Street North (arterial street). In this area, the Paris District High School is a major traffic generator with trips to/from the school as well as pedestrians and cycling.

An operational issue is that the Paris Links Road intersection with Grand River Street North is in close proximity to Silver Street that is another collector street to the west of Grand River Street North. The intersections are 77 m apart. The use of offset tee intersections is undesirable but at low volumes, as was the case when they were originally constructed, these intersections can function. Originally they were divided by the historic Great Western Railway (GWR) which had crossed Grand River Street

North between these intersections. Today the railway is abandoned and the lands are in private ownership.

With higher volumes on Grand River Street North today and the forecast of significantly higher volumes on each of the 3 streets in the future, operational problems are anticipated with the continued use of the offset tee configuration.

Offset tee intersections break down due to several reasons. One reason is that the section between the intersections typically carries higher traffic demand than on any of the three individual legs. In this section the link will carry both through trips of the east-west road and the north-south roadway. To explain this, consider a simplified example where there are no turning movements and that the east-west road carries volume A traffic and the north-south street carries volume B. In this example the shared link road must carry volume A+B.

Now consider adding turning movements. When turning movements are added and the through roads have high traffic demand, the available time to accommodate left turns is reduced. Queuing develops and these critical left turns begin to have extended queues that back into the other offset tee intersection. At this point the intersections fail. Because of this issue, the desirable standard for intersection spacing is being recommended as 400 m on Grand River Street North (with a 250 m minimum).

Figure 4: Existing Streets and Land Uses within the Eastern Study Area

5.2 Intersection Alternatives

As part of the EA study all reasonable intersection alternatives have been considered. These include the use of a single signalized intersection, a single roundabout (combined location of Silver Street and Paris Links Road), and also an elongated roundabout maintaining the two offset roadways. The use of 2 closely spaced signalized intersections is recommended to be screened out as part of the course screening analysis. The initial elongated roundabout from the IBI planning study is illustrated in **Figure 5**.

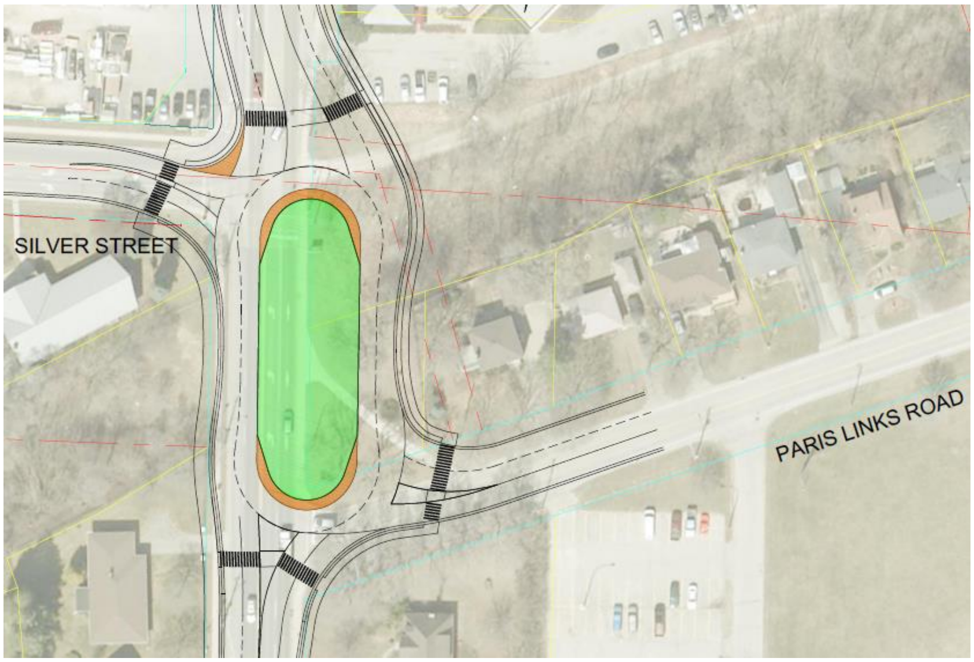

Figure 5: Intersection Alternative – Elongated Roundabout

The intersection alternatives have been further developed to include:

- Alternative ER - Elongated Roundabout
- Alternative TR - Teardrop Elongated Roundabout
- Alternative S - Single Signalized Intersection (realigning Paris Links Road or Silver Street to create a 4th leg utilizing the abandoned rail right-of-way); and
- Alternative R - Single Roundabout Intersection (realigning Paris Links Road or Silver Street to create a 4th leg utilizing the abandoned rail right-of-way).

These alternatives are presented in **Figure 6** to **Figure 9.**

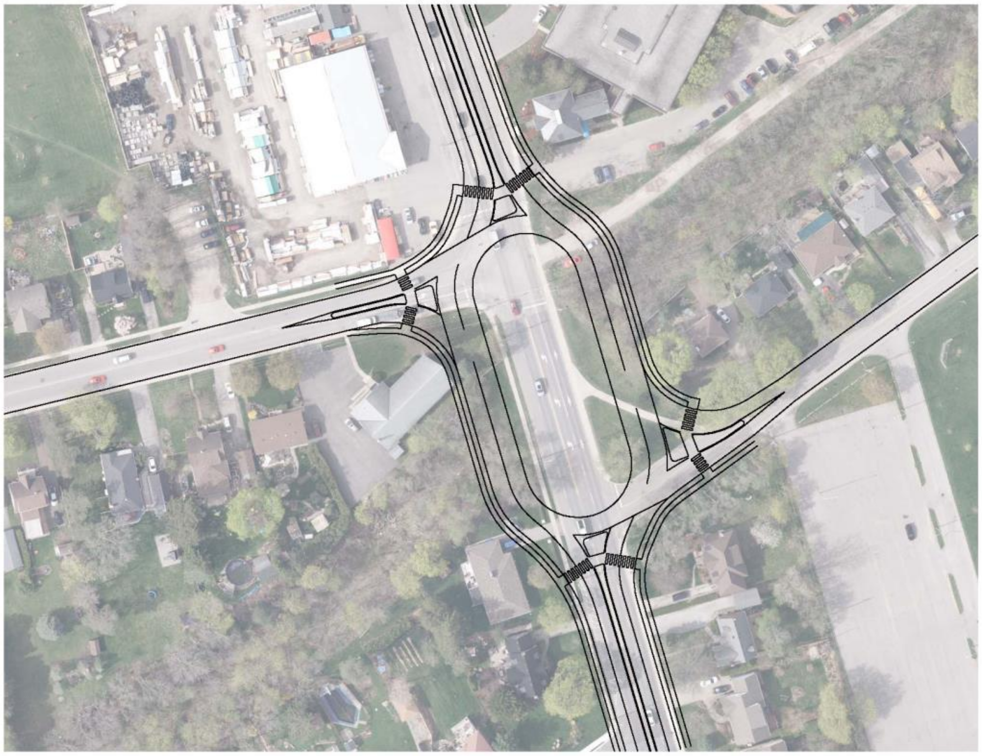

Figure 6: Alternative ER - Elongated Roundabout

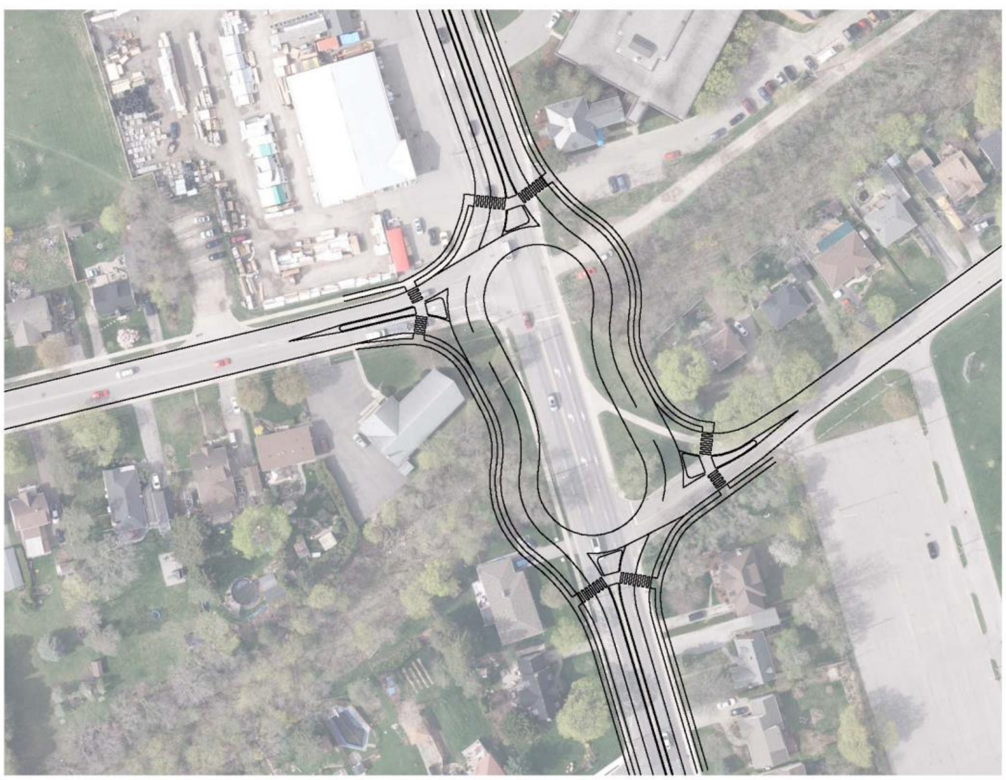

Figure 7: Alternative TR - Teardrop Elongated Roundabout

Figure 8: Alternative S - Single Signalized Intersection

Figure 9: Alternative R - Single Roundabout Intersection

The differences among these alternatives from a traffic operation and safety perspective include:

- Roundabout designs are considered safer for vehicular traffic
- Signalized intersections are generally safer for pedestrian movements
- Roundabouts are considered better for traffic operations (less delays)
- Single intersections are better for traffic operations than offset intersections.

5.3 Alignment Alternatives

Several alignment alternatives were developed and initially presented in the draft Study Design Report as illustrated in **Figure 10**. This initial long list considered either tight realignments of Paris Links Road or Silver Street to make a common intersection location, or realignments of Paris Links Road to create a common intersection location. This initial list was further developed into the short list of alternatives presented in **Figure 11** to **Figure 16**.

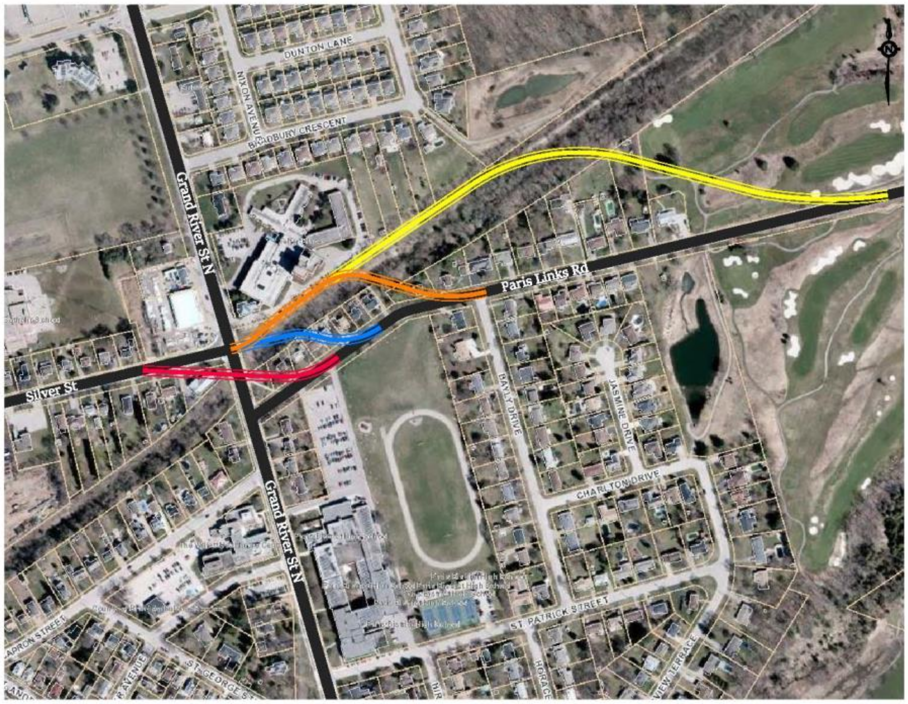

Figure 10: Potential Alignments for a Conventional Signalized Intersection

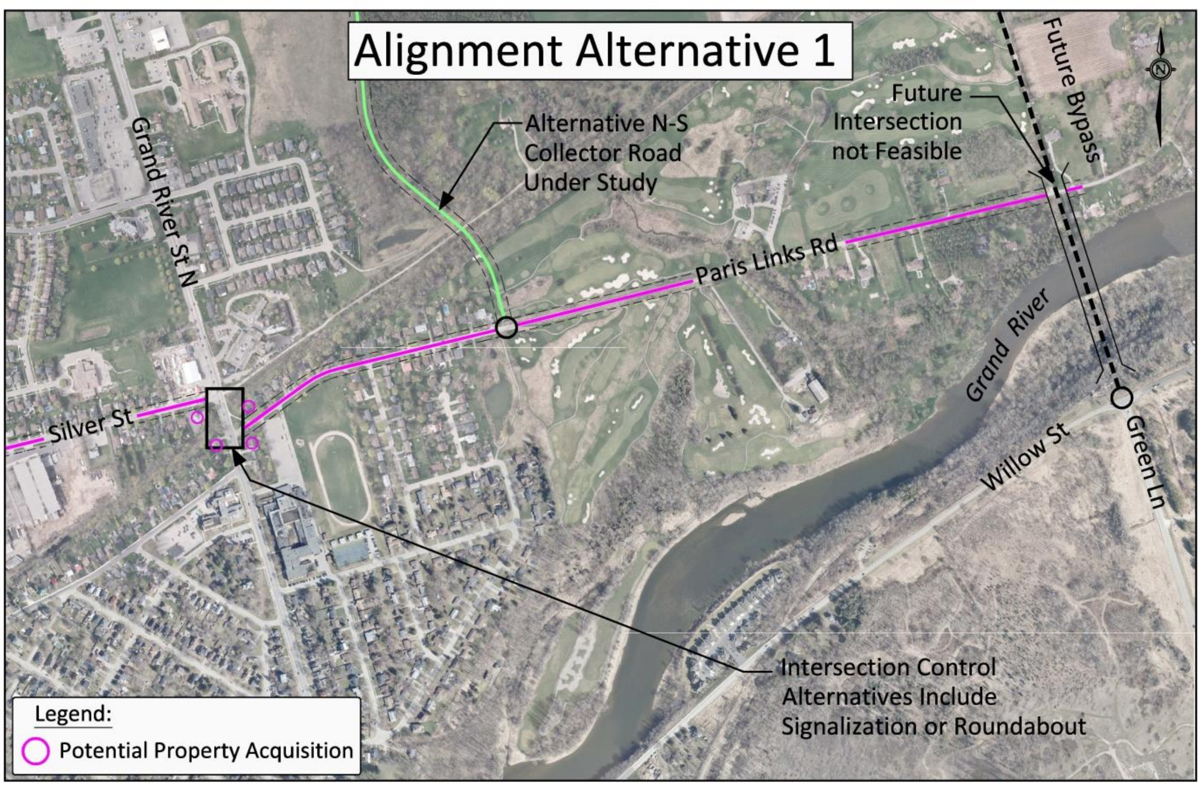

Figure 11: Alignment Alternative 1

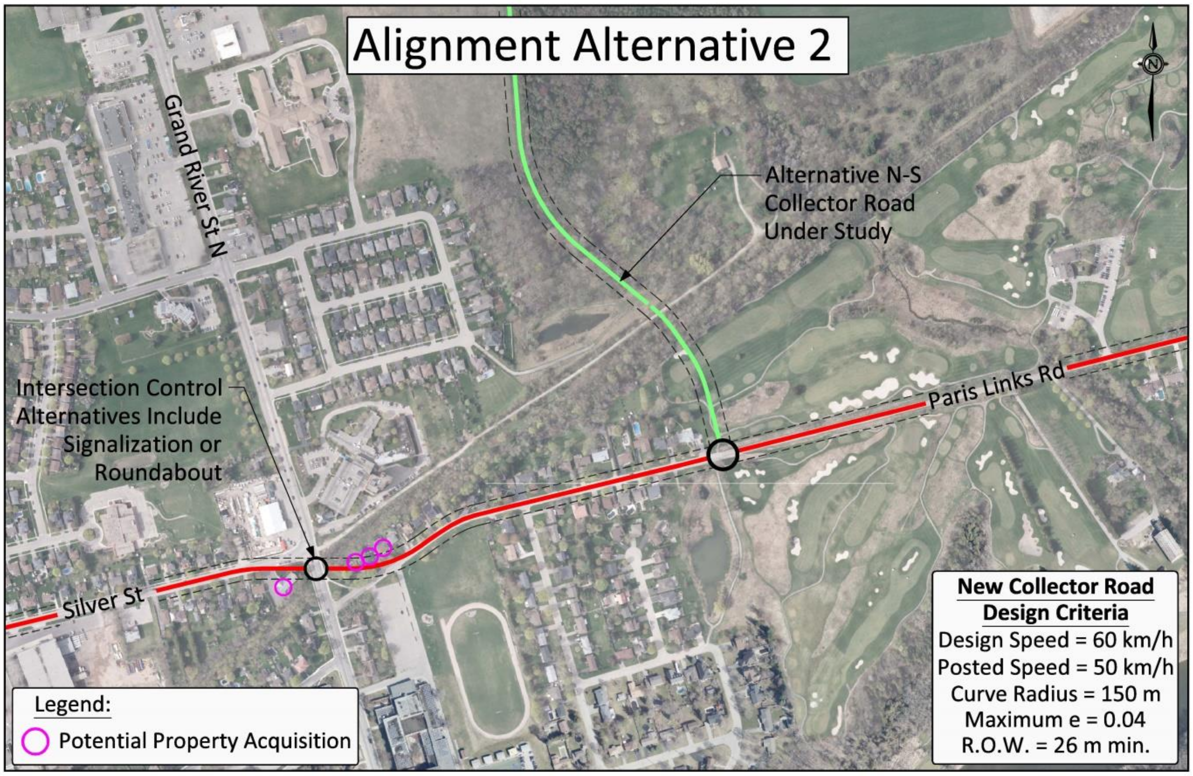

Figure 12: Alignment Alternative 2

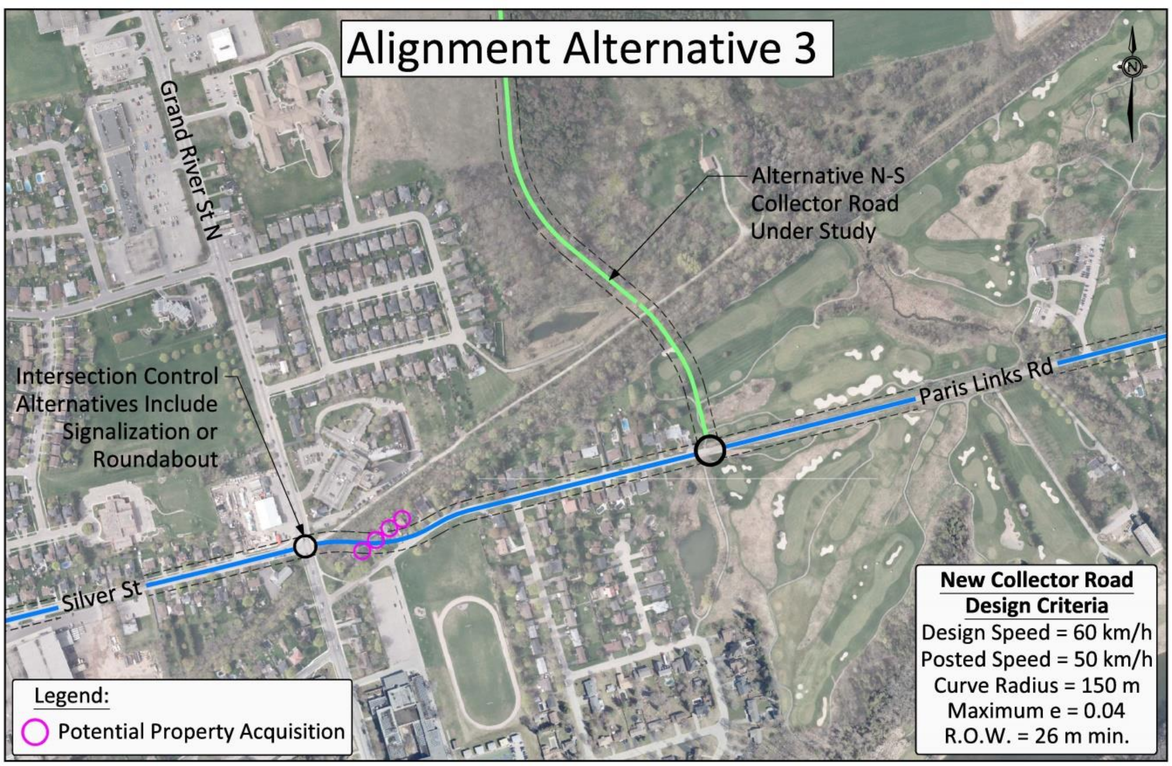

Figure 13: Alignment Alternative 3

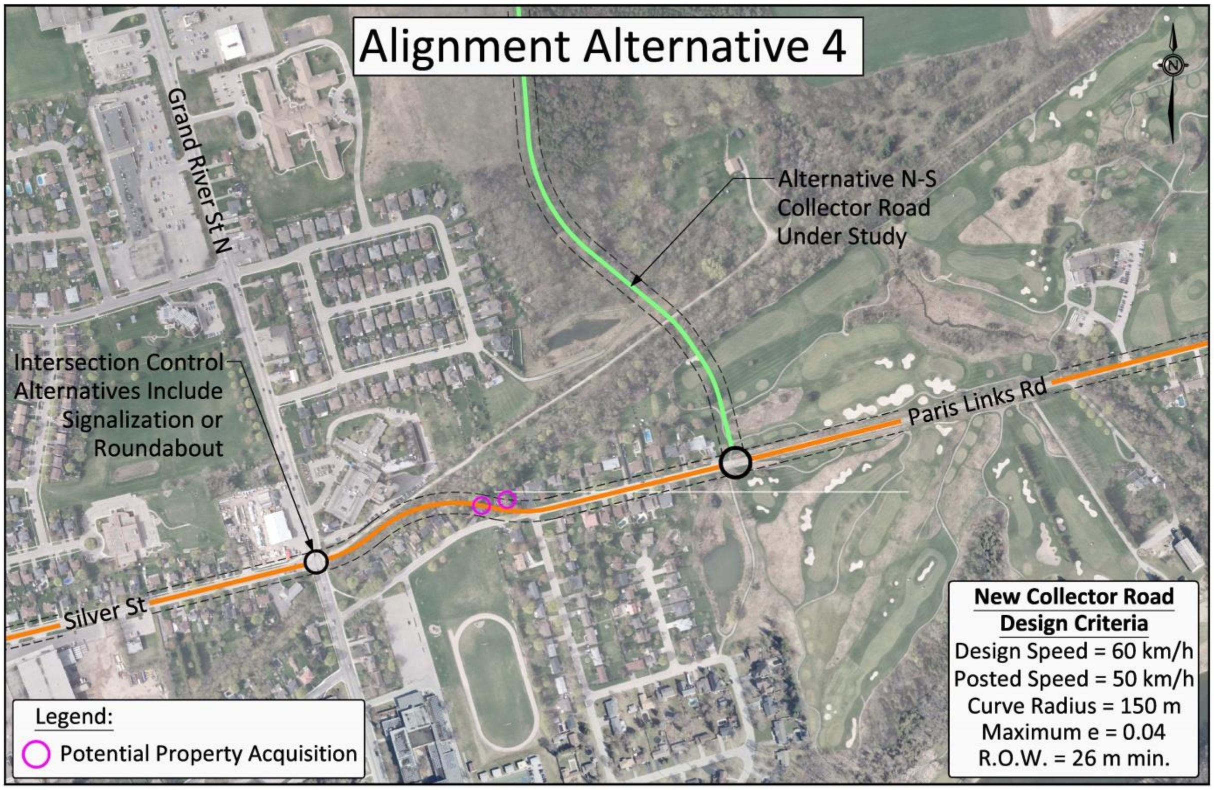

Figure 14: Alignment Alternative 4

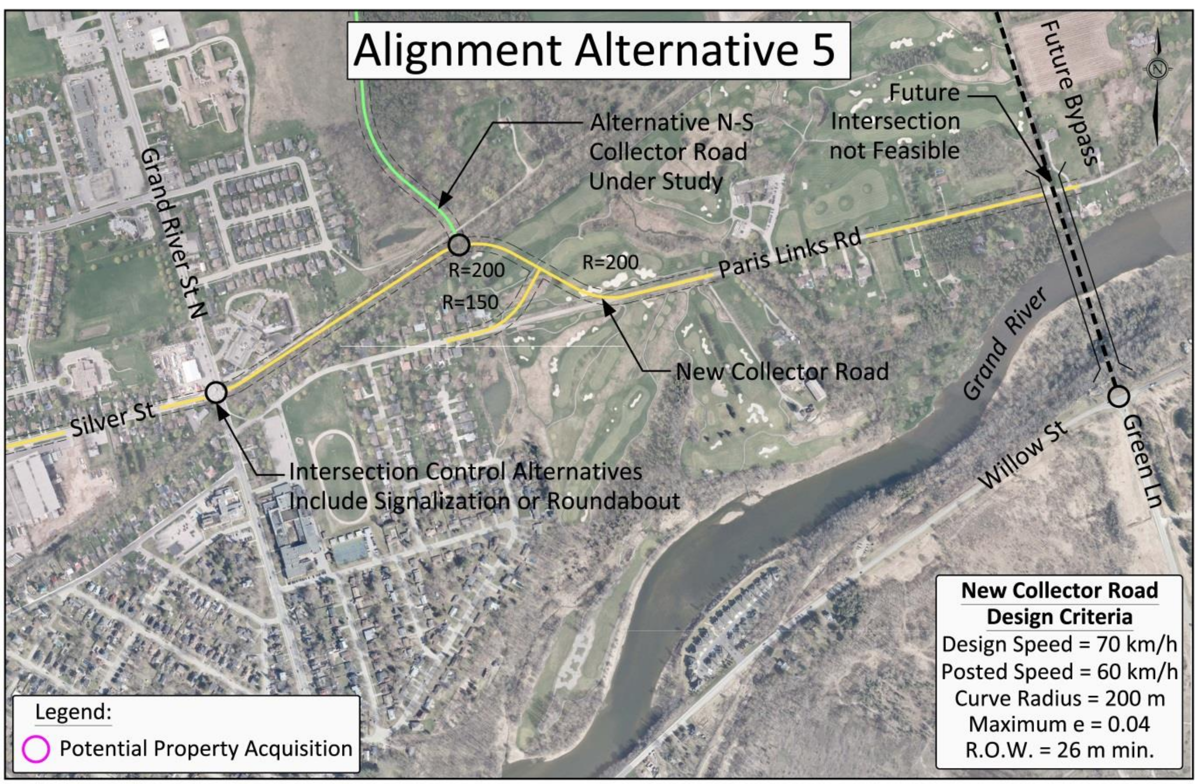

Figure 15: Alignment Alternative 5

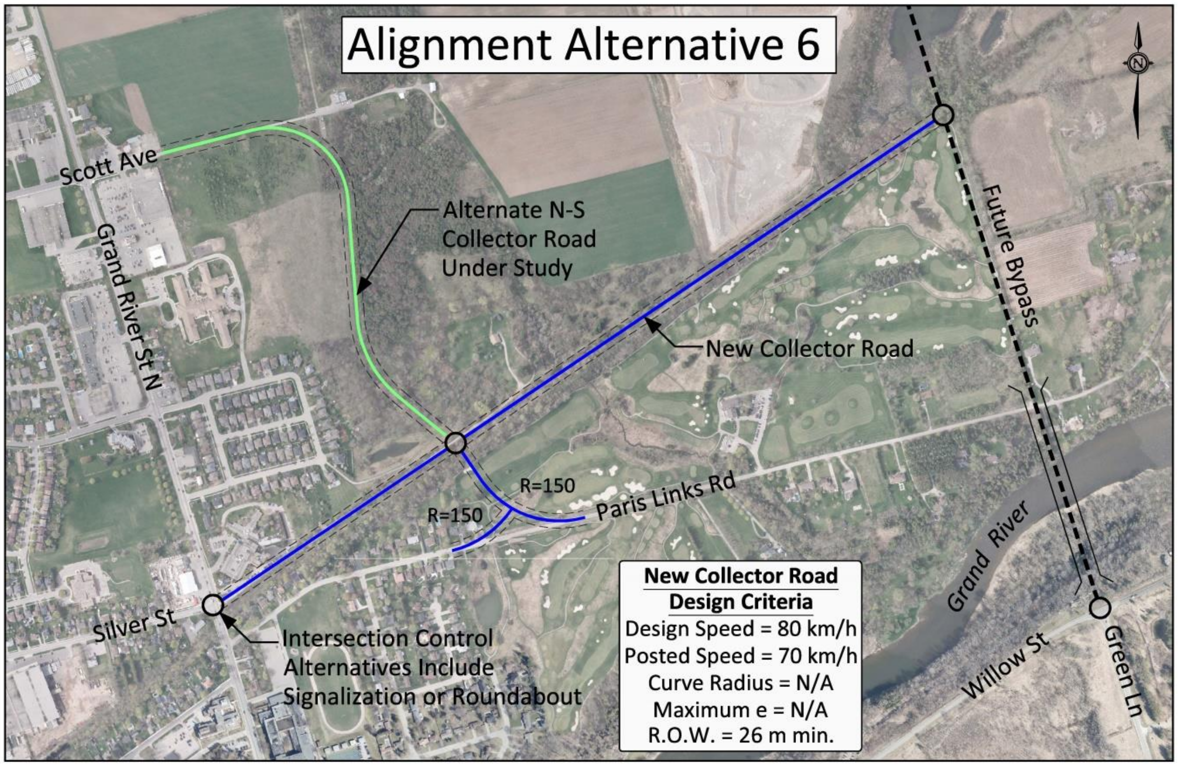

Figure 16: Alignment Alternative 6

5.4 Eastern Bypass Connection Alternatives

A third component of the decision on the preferred configuration of the intersection of Grand River Street and the alignment of Paris Links Road is how should the longer term connection be made to the Eastern Bypass. This longer term connection may dictate the choice of intersection design and road alignment of Paris Links Road.

Four (4) alternative approaches considered on a long list include:

Alternative I1a: Utilize the existing Paris Links Road with an intersection to the future bypass (these alignments meet horizontally but are separated by approximately 17m vertically).

Alternative I1b: Utilize a realigned Paris Links Road from Silver Street to connect to Paris Links Road with an intersection to the future bypass (these alignments meet horizontally but are separated by approximately 17m vertically).

Alternative I2: Utilize a connection from Silver Street using the abandoned railway corridor with an intersection to the future bypass and close the intersection of Paris Links Road and Grand River Street North (or convert to right-in/right-out).

Alternative I3: Utilize a link from Paris Links Road from Grand River Street North to the abandoned railway corridor with an intersection to the future bypass and then realign Silver Street to Paris Links

Road. This alternative was not carried forward as it was recognized that Silver Street is the more prominent of the two cross streets.

The network connection alternatives carried forward are illustrated on **Figure 17.**

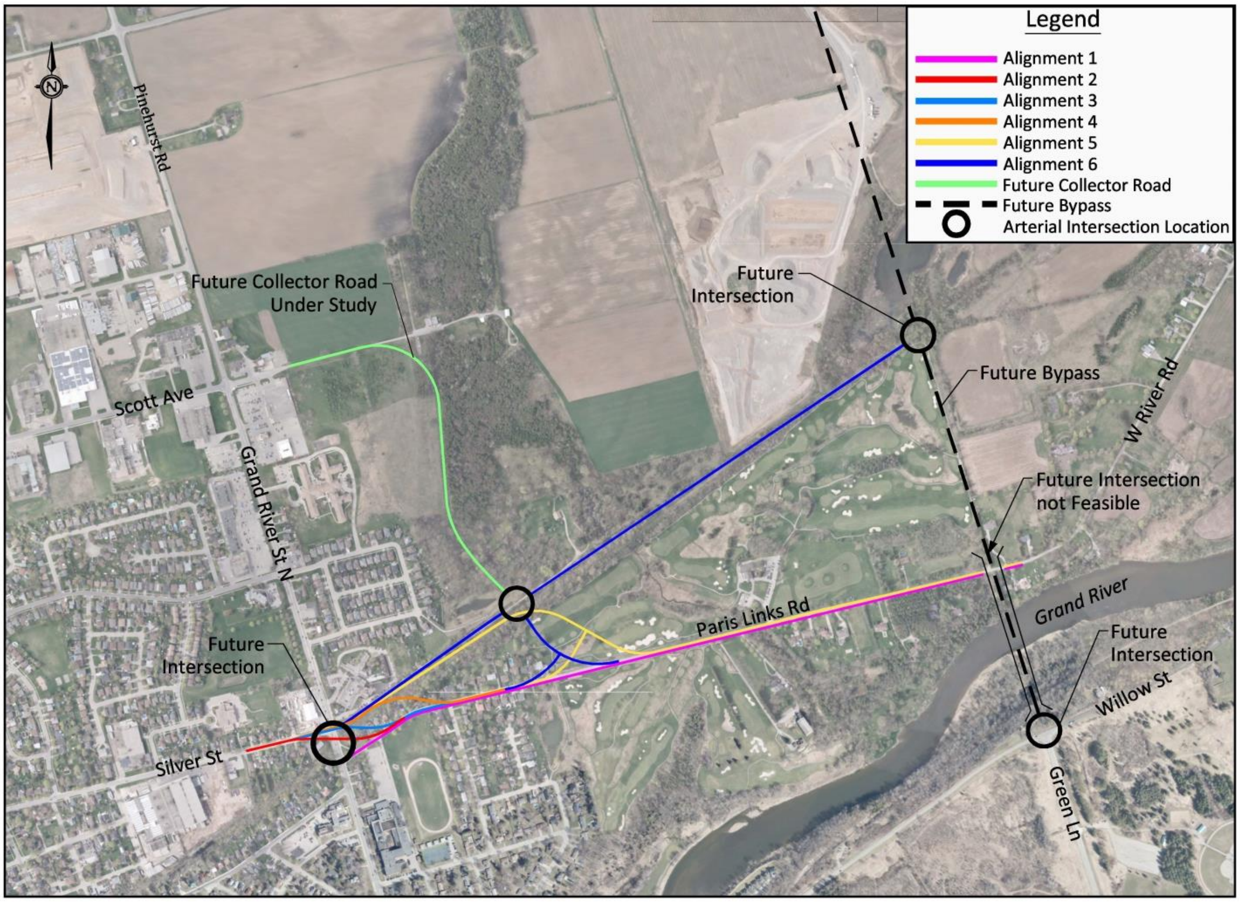

Figure 17: Network Connection Alternatives from Grand River Street North to the Eastern Bypass

5.5 Eastern Collector Road

With each of these three network alternatives there has been an identification of a possible additional north-south collector road (shown with a green solid line on **Figure 17**). This concept of a parallel collector road (parallel to Grand River Street North) was identified by the public and is being carried forward in the EA. This street has been used as a possible intersection location along the abandoned rail corridor.

5.6 Paris Links Road Preliminary Alternatives

The preliminary alternatives for Paris Links Road were developed by combining the groups of alternatives identified in **Section 5**. The combination of alternatives is illustrated in **Figure 18.**

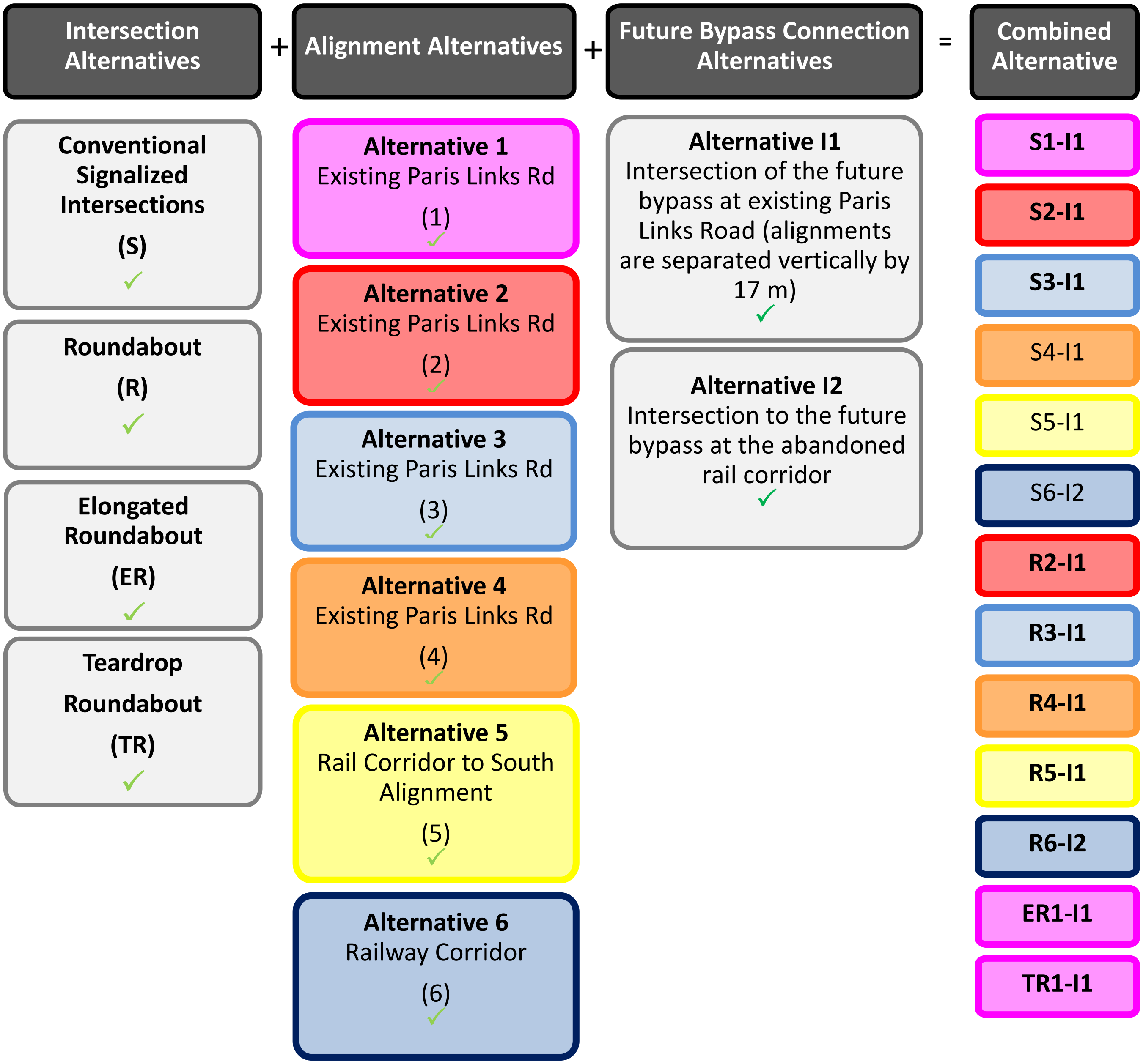

Figure 18: Combination of Alternatives for Paris Links Road

6.0 Preliminary Evaluation of Alternatives

6.1 Long List of Evaluation Criteria

The alternatives were evaluated using a quantitative methodology known as the Multi-Attribute Trade-off System (MATS). This evaluation approach is based on the "Weighted Additive Method" which focuses on the differences between the alternatives, addresses the complexity of the base data collected, and provides a traceable decision-making process. See **Appendix A** for the Evaluation Methodology Report.

A long list of evaluation criteria was developed to determine the preferred alternative to be carried forward for preliminary design. The long list is illustrated in **Table 1.**

Table 1: Long List of Evaluation Criteria

Factors and Sub-Factors	Unit of Measure	Carried Forward Y - Yes N - No	Remarks
Transportation			
Traffic Operations and Queuing	Poor to Best	Y	
Safety – Collision Potential	High/Medium/Low	Y	
Safety – Pedestrians	High/Medium/Low	Y	
Network Connectivity – Access to bypass	Yes/No	Y	
Support of environmentally sustainable (active) transportation	Yes/No	N	All considered equal
Accessibility requirements	Yes/No	N	All considered equal
Access to transit service	Yes/No	N	All considered equal
Ability to Stage Future Bypass	Yes/No	Y	
Natural Environment			
Natural area(s) avoidance	m^2	Y	
Air quality/Climate change	High/Medium/Low	N	All considered equal
Aquatic/Terrestrial SAR	No. SAR	N	None identified
Water quality – stormwater runoff	m^2	N	All considered equal
Migratory bird nesting	m^2	N	All considered equal
Significant wildlife habitat	m^2	N	None identified
ESAs/ANSIs/PSWs	Yes/No	N	None identified
Non-native trees removed	No.	N	All considered equal
Climate change	High/Medium/Low	N	Carbon emissions measured under air quality (negligible change)
Unclassified wetlands	m^2	N	Not within Study Area
Groundwater source protection	Yes/No	N	All considered equal
Social and Cultural Environment			
Community cohesion	High/Medium/Low	Y	
Cultural heritage potential	m^2	N	All considered equal
Archaeological potential	m^2	N	All considered equal
Noise impacts	dBA	N	All considered equal
Green spaces impacted	Yes/No	N	All considered equal

Factors and Sub-Factors	Unit of Measure	Carried Forward Y - Yes N - No	Remarks
Lighting and visual impacts	High/Medium/Low	N	All considered equal
Intrusion for neighbours	High/Medium/Low	N	All considered equal
Excess materials management	Yes/No	N	All considered equal
Land Use and Property			
Property required (residential buyouts)	No.	Y	
Property required (industrial buyouts)	No.	N	
Property required (commercial buyouts)	No.	N	
Property required (institutional impact)	No.	Y	
Area of property required	m^2	N	See Property Required
Support of Paris Grand Estates Development	Yes/No	Y	
Impact on Developable Lands	m	Y	
Cost			
Capital cost	$	N	See Life Cycle Cost
Life Cycle Cost	$	Y	
Utility impacts	$	N	All alternatives considered equal
Future maintenance and operation cost	$	N	See Life Cycle Cost

6.2 Short List of Evaluation Criteria

The performance of the alternatives has been compared using the following sub-factors:

Transportation

- **Traffic Operations and Queuing**: This criterion provides an assessment of traffic operations on the Grand River Street North (GRSN) corridor. Roadway alignment Alternative 6 will have the least impact on GRSN since much of the development-generated traffic could access a future bypass directly. The use of roundabouts is preferred as they provide an opportunity for continuous flow of traffic through the intersection (minimizing queuing and delay) while signalized intersections stop traffic (increased queuing and delay). The provision of 2 closely spaced traffic signals should be avoided since it would result in traffic queuing through an adjacent signal, adversely impacting traffic operations and safety. Those alternatives minimizing delays and avoiding queuing between intersections are preferred.
- **Safety – Collision Potential:** This criterion reflects the potential collision severity. Those alternatives with roundabouts are judged to provide the greatest level of safety. Among the roundabout alternatives, those that do not allow fastest path travel with speed differentials greater than 15 km/h are preferred.
- **Safety – Pedestrians:** This criterion provides a measure of the safety for pedestrians crossing at intersections along Grand River Street North. Alternatives with signalized intersections are preferred.

- **Network Connectivity – Access to the Bypass:** This criterion assesses the ability to provide a connection to the Eastern Bypass. Based on the 17 m elevation differential between the south side of the river (connection to Green Line) and the elevation of West River Road / Paris Links Road, it is not considered feasible to provide an at-grade intersection or an interchange (generally feasible for a 5-7 m differential in grades).
- **Ability to Stage Future Bypass:** This sub-factor measures the ability of the alternative to support a staged implementation of the bypass by providing an arterial link from Grand River Street North to the future bypass. The entire bypass cannot be built until the Dufferin Quarry is closed (30 year horizon), therefore it is desirable if an interim stage can cross the Grand River. Those alternatives which can allow an interim stage linking Grand River Street North to the bypass are desirable.

Natural Environment

- **Natural Environment:** This criterion considers the magnitude of disturbance to the existing natural areas along the abandoned railway. Those alternatives avoiding the use of this naturalized area are preferred.

Social Environment

- **Community Cohesion:** This criterion measures the protection and compatibility with the existing residential area and Paris District High School. Alternatives that enhance the existing community are preferred; alternatives disrupting the existing community by creating increased traffic through an existing residential area are not preferred.

Land Use and Property

- **Property Required:** This criterion measures if the alternative requires the buyout of private properties. Alternatives that do not require property buyouts, or result in the minimum number of buyouts/impacts, are preferred.
- **Support of Paris Grand Estates Development:** This criterion measures support of the interim and long term development of the Paris Grand Estates (subdivision development) of up to 800 units. Alternatives supporting the full development are preferred.
- **Impact on Developable Lands:** This criterion measures the impact on the amount of developable land within the Paris Grand Estates Development. Alternatives which minimize the land requirements, measured in metres of new collector roads outside of the existing roadway rights-of-way are preferred.

6.3 Evaluation of Alternatives

The alternatives were evaluated using the comparative criteria from **Section 6.2**. The Technical Advisory Committee prioritized the competing criteria and the relative importance of the criteria are illustrated in **Figure 19**.

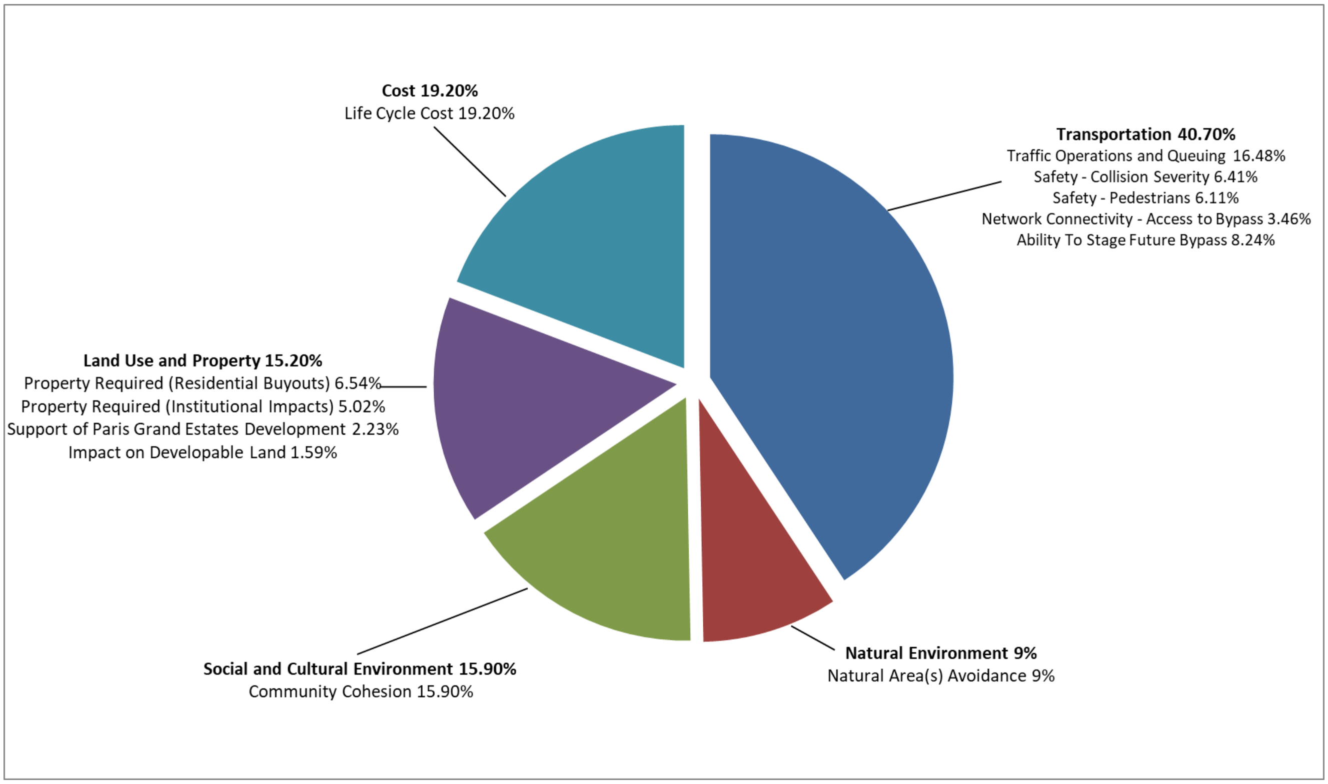

Figure 19: MATS Weighting Results for the Paris Links Road Alternatives

The results of the weights for each sub-factor are illustrated in **Figure 20** and the rankings from the MATS evaluation are illustrated in **Table 2**.

Table 2: Grand River Street North - Paris Links Road Evaluation Weighted Scores

	S1-I1	S2-I1	S3-I1	S4-I1	S5-I1	S6-I2	R2-I1	R3-I1	R4-I1	R5-I1	R6-I2	ER1-I1	TR1-I1
Transportation													
Traffic Queuing	0.0	0.0	0.0	0.0	0.0	0.0	16.9	16.9	16.9	16.9	16.9	16.9	16.9
Safety - Collision Severity	0.0	0.0	0.0	0.0	0.0	0.0	6.4	6.4	6.4	6.4	6.4	3.2	6.4
Network Connectivity - Access to Bypass	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0	0.0	0.0	6.1	0.0	0.0
Stage Future Bypass	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	3.9	0.0	0.0
Stage Future Bypass	8.2	8.2	8.2	8.2	8.2	8.2	4.1	4.1	4.1	4.1	4.1	0.0	0.0
Natural Environment													
Natural Area(s) Avoidance	9.0	9.0	8.7	7.5	5.9	0.0	9.0	8.7	7.5	5.9	0.0	9.0	9.0
Social and Cultural Environment													
Community Cohesion	0.0	0.0	0.0	0.0	8.0	15.9	0.0	0.0	0.0	8.0	15.9	0.0	0.0
Land Use and Property													
Property Required (Residential Buyouts)	6.5	1.6	0.0	3.3	6.5	6.5	1.6	0.0	3.3	6.5	6.5	1.6	1.6

Property Required (Institutional Impacts)	5.0	0.0	5.0	5.0	5.0	5.0	0.0	5.0	5.0	5.0	5.0	0.0	0.0
Support of Paris Grand Estates Development	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	2.1	0.0	0.0
Impact on Developable Land	1.5	1.5	1.5	1.5	0.0	0.6	1.5	1.5	1.5	0.0	0.6	1.5	1.5
Cost													
Future Life Cycle Cost	19.2	14.5	16.4	14.4	6.3	2.8	11.7	13.6	11.6	3.5	0.0	16.4	16.4
Total	**49.5**	**34.9**	**39.9**	**39.9**	**40.0**	**51.2**	**51.3**	**56.3**	**56.3**	**56.4**	**67.6**	**48.7**	**51.9**

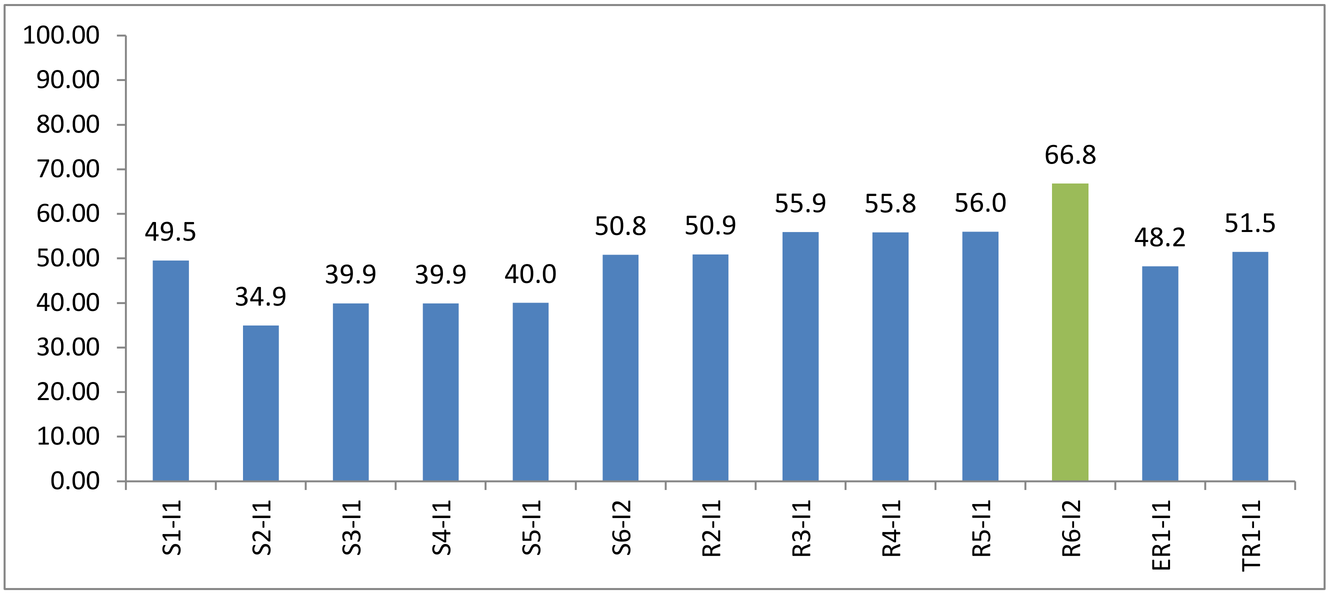

Figure 20: Paris Links Road Alternatives MATS Evaluation Ranking Results

6.4 Recommendations

The Technically Preferred Alternative (based on the technical evaluation team's recommendations) represents the best balanced alternative to carry forward for further evaluation. The Technically Preferred Alternative (TPA) was identified as Alternative R6-I2, and combines: a roundabout at Silver Street/Grand River Street North; a new road corridor on the former rail corridor; and property protection for an intersection with the future eastern bypass at the former rail corridor. The TPA is illustrated in **Figure 21** and **Figure 22** overlaid on the Paris Grand Estates draft site plan.

The evaluation presented in this report will be presented to the public at PIC No. 1 for review and comments. Should there be either no public comments objecting to this technical recommendation then this will be the preferred corridor (Paris Links Road easterly) carried forward for more detailed review, refinements and mitigation.

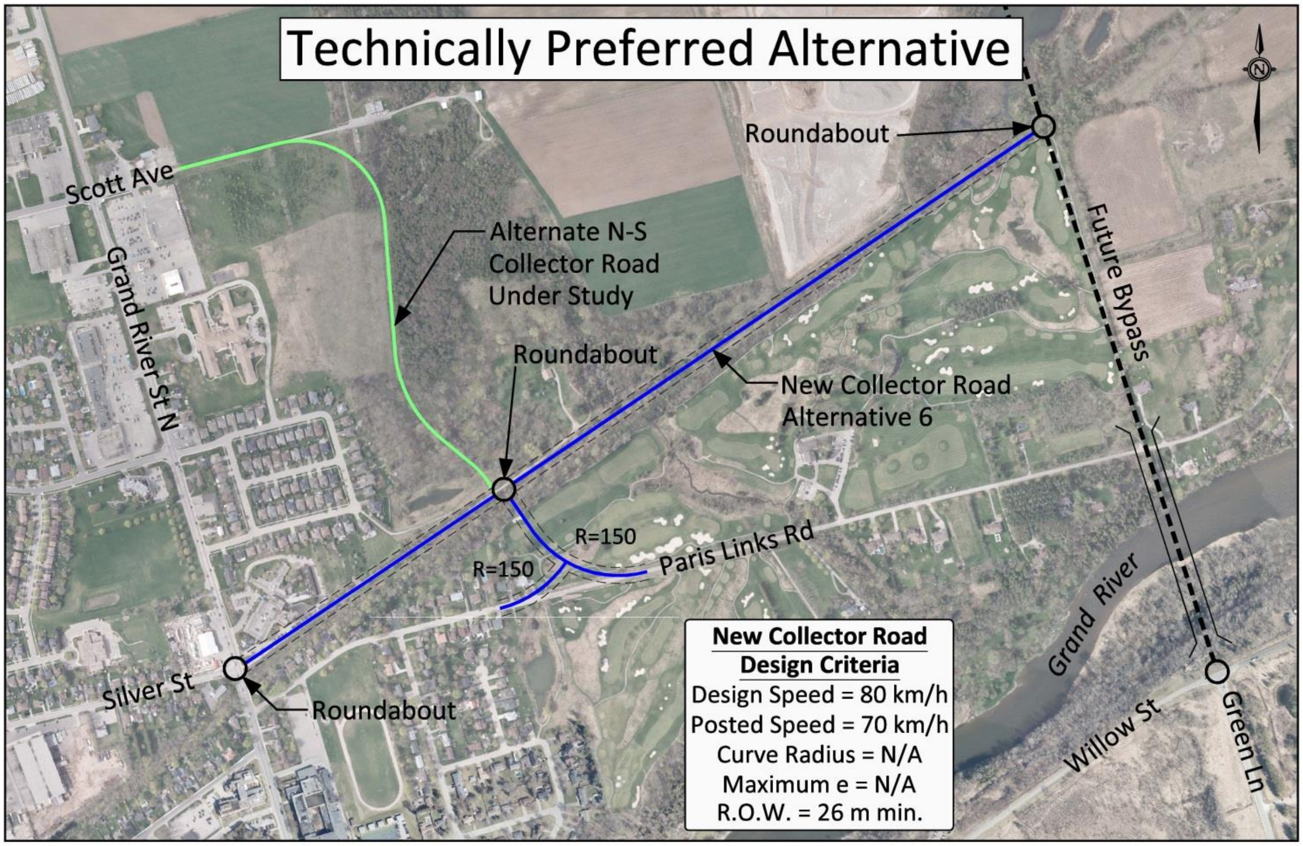

Figure 21: Technically Preferred Alternative

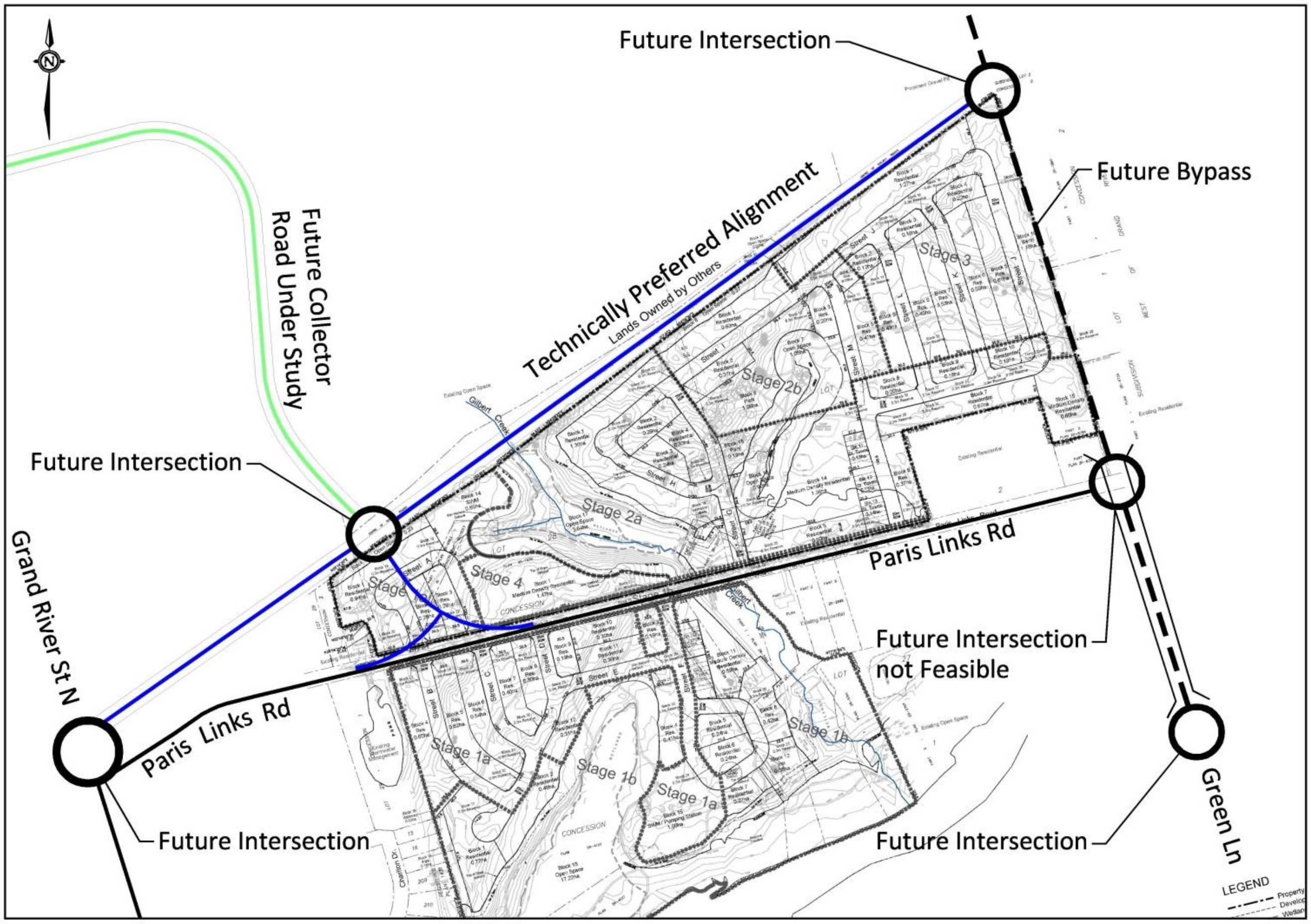

Figure 22: Technically Preferred Alternative overlaid on the Paris Grand Estates Draft Site Plan

Appendix A
Evaluation Methodology Report

EVALUATION METHODOLOGY REPORT

Grand River Street North Environmental Assessment Study

Presented to:

County of Brant
26 Park Avenue
Burford, Ontario
N0E 1A0

BTE Project No. 2017-033
April 2018

EXECUTIVE SUMMARY

A Schedule 'C' Environmental Assessment (EA) is being carried out by the County of Brant, under the Municipal Class Environmental Assessment (2007 as amended in 2011 and 2015), for the planning of operational improvements along Grand River Street North as it turns into Pinehurst Road, just north of Watts Pond Road and St. Patrick Street.

The analysis and evaluation process is a requirement of the EA process; the framework is provided by the Ministry of the Environment and Climate Change (MOECC) Evaluation Methods in Environmental Assessment.

This document describes the qualitative and the quantitative methods of evaluation and which approaches will be utilized for different groups of alternatives. An evaluation method may be defined as a formal procedure for establishing an order of preference among alternatives.

BT ENGINEERING

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GLOSSARY OF TERMS

AASHTO	American Association of State and Highway Transportation Officials
Adjacent	Adjacent indicates lying near MTO or Municipal roadway rights-of-way, although not necessarily contiguous to them.
Aesthetics	Methods of providing visual relief and appealing characteristics to planned noise barriers thorough the application of landscaping designs.
Alternative	Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between Alternatives to the Undertaking and Alternative Methods of Carrying out the Undertaking.
Coarse Screening	Initial screening of a group of alternatives. Also see Screening.
Criterion(a)	Explicit feature or consideration used for comparison of alternatives.
Dichotomous Utility Function	A utility function that represents a desirable or undesirable response from a criterion (yes/no, present/absent, true/false).
Dimensionless Number	A number that does not have a unit of measurement, such as length (m), time (s), mass (kg) associated with it. Examples include Utility Score and Overall Score.
Do Nothing Alternative	This alternative is a mandatory requirement of the Class EA. This option is the null or no action alternative and it becomes the baseline to which all alternatives are compared.
Double Counting	Unintentional accounting for a particular factor or attribute more than once in the evaluation.
EA	Environmental Assessment
Evaluation	The outcome of a process that appraises the advantages and disadvantages of alternatives.
Evaluation Criteria	See Criteria.

Evaluation Process	The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, aggregation of weights, and rating to produce an ordering of preference of alternatives.
Factor	See Global Factors.
Freeway	Freeway is defined as an existing completed, partially developed (staged) or proposed divided highway with full control of access and grade separated intersections. This definition may include some highways that are not officially designated as freeways.
Function Form	See Utility Function
Global Factors	The main categories of factors, (i.e. Transportation, Economic Environment, Natural Environment, Social and Cultural, Land Use and Property and Cost). All sub-factors are components or a subset of global factors.
Linear Utility Function	A function that can be defined using a linear equation of the form: $y = a + bx$, where y is the dependent variable (raw score) x is the independent variable (measurement) b is the slope of the function, and a is the y intercept, normalized in this study to be equal to one or zero
Matrix	A rectangular array of criteria and values.
Mitigation	Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives.
Overall Score	The final value of an alternative's score derived by summing all of the weighted scores.
Performance Factor	See Utility Function
PIC	Public Information Centre
Ranking	The ordering of alternatives from first to last for comparison purposes.

Raw Data	The measurement of the impact, or measured data, under each criterion.
Risk	Probability that a given outcome will or will not materialize. Distinct from uncertainty in that the alternative outcomes are known or defined and that the probability of each is measureable.
Screening	Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements.
Step Function	A utility function can be defined by several linear functions within separate ranges that have a slope equal to zero. For this study, two step functions are used: Case A: y = 1, for x = desirable and y = 0, for x = undesirable Case B: y = 1 for x = desirable, y = 0.5 for x = medium performance and y = o for x = undesirable
Sub-factor	A single criterion used for the evaluation. Each sub-factor is grouped under one of the factors.
TPA	Technically Preferred Alternative
Traceability	Characteristic of an evaluation process which enables its development and implementation to be followed with ease.
Environmental Study Report (ESR)	This report is prepared in compliance with the EA Act requirements and the Ministry of the Environment for acceptance, approval, informational or monitoring purposes and the public record.
Utility Function	A function (linear, step, dichotomous) that represents the Utility Score versus the criterion measurement or desirableness.
Utility Score	The “y” value derived from the Utility Function of the measurement of the impact induced by a particular alternative’s criterion. A measurement of the usefulness or attractiveness of an alternative with respect to an individual evaluation criterion based on its measured effect (a number between 0 and 1). The utility score is dimensionless.

Weight	The importance attributed to a criterion relative to other criterion. The value of the weight is expressed in a percentage and the sum of all criterion weights is equal to 100%.
Weighted Additive Method	The method used in the quantitative evaluation of alternatives, which reduces the project's numerous criteria into a dimensionless number for each alternative suitable for comparison.
Weighted Score	A raw score that has been multiplied by the criterion weights. The weighted scores reflect the social value or importance of the specific group providing weights.

1 INTRODUCTION

The analysis and evaluation process is a requirement of the Environmental Assessment (EA) Process; the framework is provided by the Ministry of the Environment and Climate Change (MOECC) Evaluation Methods in Environmental Assessment.

This document describes the qualitative and quantitative methods of evaluation and which approaches will be utilized for different groups of alternatives for this study. An evaluation method may be defined as a formal procedure for establishing an order of preference among alternatives[1]. The use of a formal evaluation method has two main advantages: it provides a better basis for decision-making than would otherwise exist and it results in reasons for decisions that, on examination, can be traced.

The selection of an evaluation methodology should consider:

- Various methods have different capabilities which make possible different planning processes that may be better suited to a particular project or stage of the EA.
- With any particular planning process, all the steps (such as identifying alternatives, selecting criteria, consulting and involving interested parties, as well as evaluating) must be reasonable and provide a systematic assessment of the net effects of the project.

The selection of the appropriate evaluation methodology depends upon:

- Complexity of the decision-making;
- The number of alternatives;
- The number of criteria; and
- The sensitivity of the decision.

These issues are described in the following sections and explain the rationale for utilizing the most appropriate evaluation methodology in each stage of the EA study.

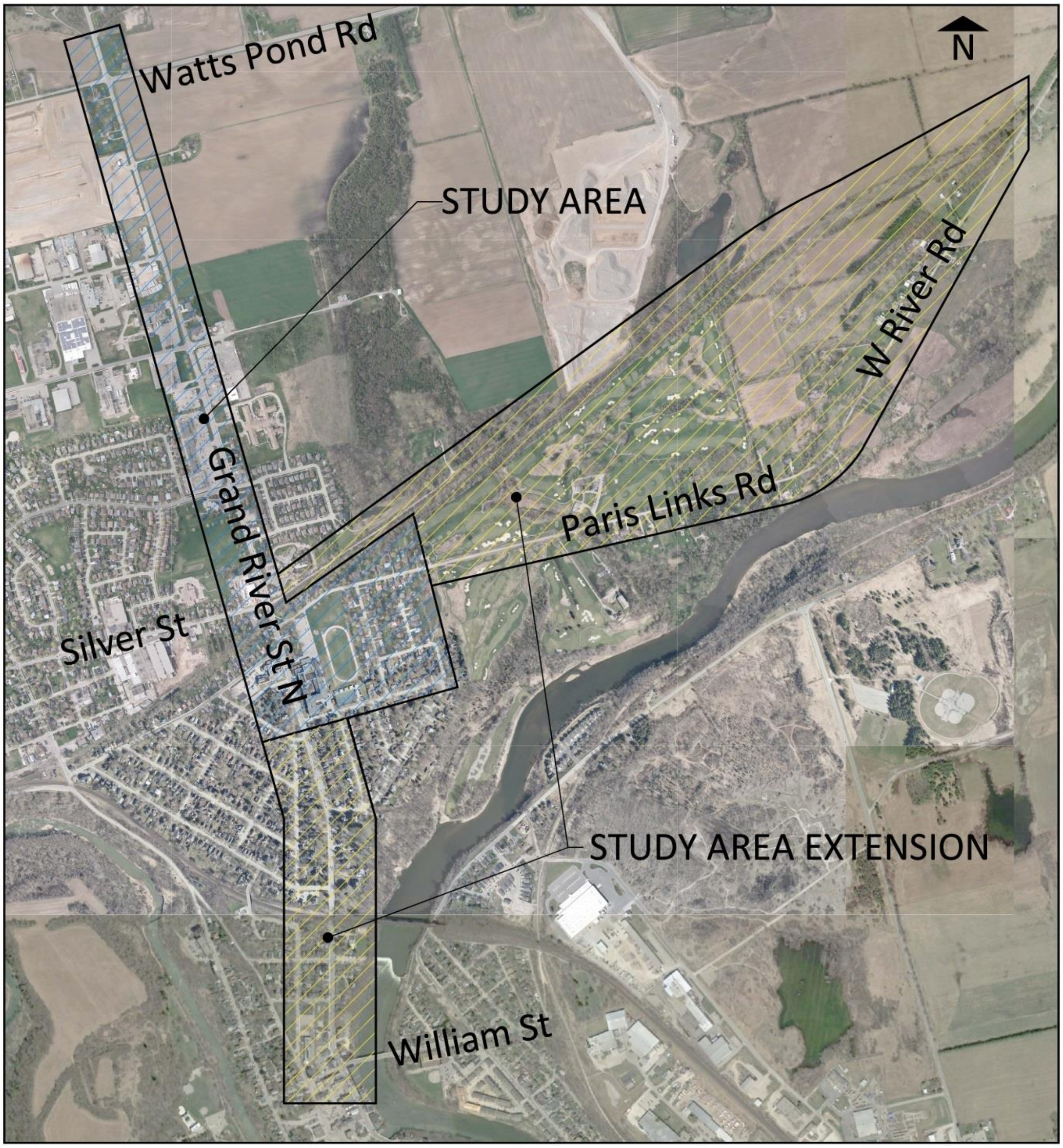
2 STUDY AREA

The County of Brant has retained BT Engineering Inc. (BTE) to undertake a preliminary design and environmental assessment study for the planning of operational improvements along Grand River Street North as it turns into Pinehurst Road, just north of Watts Pond Road and St. Patrick Street. The Study Area, as shown in **Figure 2.1**, is located in the Town of Paris.

Several alternatives will be reviewed for the intersection configuration, roadway alignment and bypass connections. In addition, engineering, environmental, and property requirements will be established, along with the identification of mitigation measures to reduce or negate short and long term residual effects.

[1] Evaluation Methods in Environmental Assessment, Ministry of Environment, 1990.

Figure 2.1: Study Area



3 PUBLIC PARTICIPATION

Public participation is a key component of this project. Early public involvement provides a sound understanding of the public's concerns and views, to identify areas of concern and major study issues, and to promote a cooperative working relationship with the public.

3.1 Public, Property Owner, and Stakeholder Consultation

The public will be engaged through the use of Public Information Centre (PIC) meetings and one-on-one meetings with directly affected property owners. This includes meetings and consultation with utilities, businesses and stakeholders who have an interest in providing comments on the design.

3.2 Public Information Centre No. 1

The purpose of the first PIC is to present background information, inventories, a preliminary list of evaluation factors and a long list of Preliminary Design Alternatives.

3.3 Public Information Centre No. 2

The second PIC will present the Technically Preferred Alternative (TPA) for the combined alternative and respond to questions and concerns from the public.

4 QUALITATIVE EVALUATION METHODOLOGY

A qualitative evaluation method involves describing impacts in narrative terms, or through qualitative measures, without the explicit specification of criteria, ratings or weights. This method, often termed “professional judgment” is widely used in EA’s to assess ‘alternative planning solutions’. For example, an EA involving the selection of a corridor might evaluate alternative routes in considerable detail using a formal quantitative evaluation, but the evaluation of ‘alternatives to’ might be done using a qualitative approach. See **Table 4.1** for an example of the qualitative evaluation approach.

A disadvantage of the qualitative approach is the difficulty in recognizing when a comparison will have intuitive choice or universal support (public), i.e. a simple decision easily accepted. A qualitative approach may also be less defensible or subject to criticism. Risk management is an important issue and should the public or stakeholders question early decisions, additional information may be required to substantiate or detail the rationale for the early decisions. When alternatives are not systematically compared against a specified set of criteria, it may be difficult to follow how the decision was made and what evidence supports it.

Some advantages of using a qualitative approach over a quantitative approach include: reduced cost, reduced time, and ease of presentation to the public. A qualitative approach is predominantly used to evaluate alternatives where there is a clear conclusion and low complexity. The use of a qualitative approach is best suited where there are few alternatives and few criteria where there are measureable and meaningful differences between alternatives being considered.

Table 4.1: Sample Qualitative Evaluation

Factor Group	Alternatives		
	Alt 1 Two Leg Stop Control	Alt 2 Three Leg Stop Control	Alt 3 Roundabout
Transportation			
Traffic Operations	-	-	✓
Safety	-	-	✓
Property/Land Use			
Property Impacts	✓	✓	×
Natural Environment			
Impacts to Natural Environment	-	-	-
Social/Cultural			
Social Environment	-	-	✓
Cost			
Cost	✓	✓	-
Evaluation Results	×	×	✓ Carried forward

✓ Good in Comparison - Fair in Comparison ✖ Poor in Comparison Preferred Alternative

Where there are few criteria, such as in **Table 4.1**, it is generally acceptable to use a qualitative analysis because the trade-offs are clear and understandable. A more rigorous definition of the attributes of each alternative, as would be possible using a quantitative approach, is not required because there are too few variables. In the Grand River Street North study, the qualitative approach will be used to assess Alternatives to the Undertaking and for the coarse screening of the initial long list of preliminary design alternatives.

The use of a more comprehensive evaluation technique becomes necessary as the complexity increases (i.e. number of alternatives and number of criteria). In these situations, as described in **Section 5**, this study will utilize a quantitative approach.

5 QUANTITATIVE EVALUATION METHOD

Key principles of the EA Act and MOECC's Guidelines on Environmental Assessment Planning and Approval are that there be accountability and traceability. A quantitative evaluation method allows both of these key principles to be achieved. A quantitative method based on the simple "Weighted Additive Method" will be used for this study and is referred to as the "Multi-Attribute Trade-off System" (MATS).

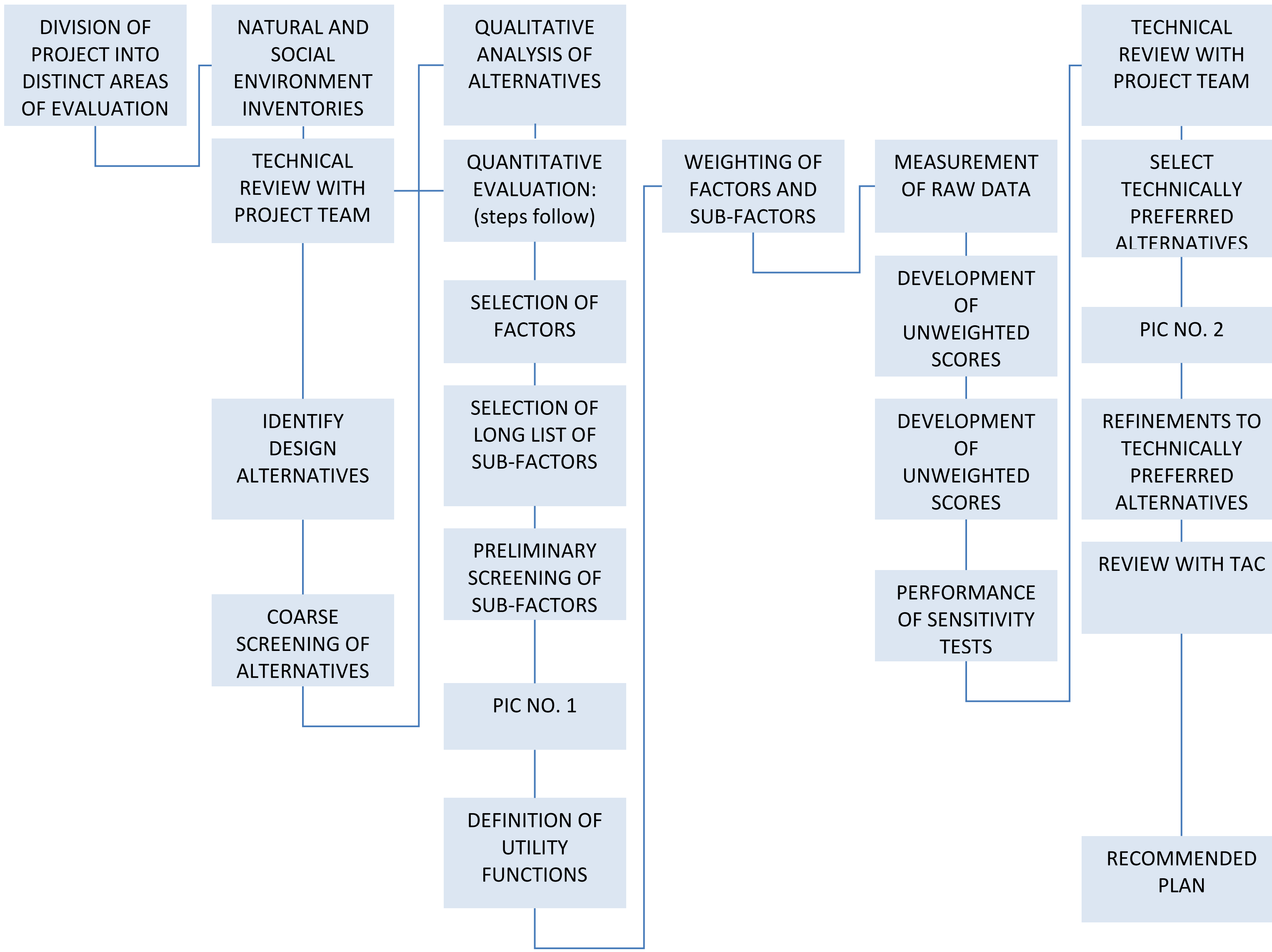
The Weighted Additive Method has proven to be effective for the evaluation of complex groups of alternatives. The methodology allows for sensitivity testing and the ability to answer "what if" questions. This method is used on projects where alternatives are to be evaluated and the decision making process is faced with either a large number of alternatives or a large number of competing criteria among the alternatives being evaluated.

This systematic approach is consistent with MOECC practices for the evaluation of alternatives. It avoids many of the pitfalls associated with qualitative assessments by using an analytical approach that measures scores based on a mathematical relationship, i.e. the degree of subjectivity by the Study Team is minimized. A traceable process allows the Study Team and public an opportunity to assess trade-offs involved in the evaluation and use this information in the decision-making process. In addition, this quantitative method allows sensitivity tests to be performed to determine if the highest ranked alternative is affected by changing the weights (perspective of importance) of the assessment factors.

For this study, preliminary design alternatives will be compared and scores assigned to each of the various assessment factors and a sensitivity-testing program will be completed in consultation with the public and external agency interaction.

When using the Weighted Additive Method, each member of the Study Team assigns a weight to the Global Factors and sub-factors. The Average Study Team Weight is assigned to each of the alternatives. The alternative with the highest score is selected as the TPA. The steps followed to arrive at an overall score for each alternative are shown in **Figure 5.1**.

Figure 5.1: Quantitative Evaluation Process



This systematic approach includes the following steps:

- Collection of data/environmental inventories
- Development of a long list of reasonable alternatives (including alternatives screened out as unfeasible or unreasonable in comparison to those being carried forward)
- Development of a long list of evaluation criteria/performance factors
- Short listing of sub-factors to those where there are meaningful differences among the alternatives to be compared
- Establish Social Utility Functions (Performance Factors or Function Forms) for the short listed sub-factors
- Weighting of Evaluation Criteria (assigning importance based on the specific set of alternatives)
- Rating of Alternatives
- Sensitivity Testing
- Selection of TPAs
- Public Review
- Refinements to the Technically Preferred Plan
- Recommended Plan

These steps, as they relate to this study, are described in the following sections.

5.1 Evaluation Criteria – Factors

The initial test in the evaluation is to develop evaluation criteria from which alternatives will be assessed. This is broken down into a two-step process that involves the selection of a "global" group of factors and a number of "local" sub-factors under the global groups.

The global factors groups will be presented to the public, and following this consultation will be accepted as describing the broad definition of the environment to be evaluated. Factors considered for this study may include:

- Traffic and Transportation;
- Natural Environment;
- Hydraulics;
- Structures;
- Heritage;
- Social and Cultural Environment;
- Land Use and Property;
- Economic Environment; and
- Cost.

While these factor groups are the starting point for the evaluation, one or more factors could be removed if it was determined that there was no sub-factor in this category i.e. there is not a meaningful and measureable difference among the alternatives being assessed in this category. When a particular factor is carried forward, then one or more sub-factors are considered under this group. These sub-factors are the individual descriptors for the evaluation. The selection of the sub-factors is very important to the decision making process because they must adequately describe the issues to be evaluated and the alternatives being compared. See **Table 5.1** for a sample preliminary listing of sub-factors. Any information regarding an alternative, where there are differences among alternatives, is incorporated into the decision-making process by including it as a sub-factor. The benefit to incorporating two levels of evaluation criteria (global factors and local sub-factors) is the prevention of the unbalancing of the evaluation (that could occur by adding more criteria under one group). Weights are assigned to the global factors to eliminate any possibility of skewing the results by selecting a large number of sub-factors in one particular factor group.

Table 5.1: Sample Long List of Evaluation Criteria (Global Factors and Sub-factors)	
Traffic and Transportation	
1. Highway 401 Safety	✗
2. Highway 401 Detour Duration	✓
3. Cornwall Centre Road Detour Duration	✓
4. Out-of-Way Travel	✓
5. Traffic Delay, Highway 401	✗
6. Risk of Queuing	✓
7. Disruption to Bicycles and Pedestrians	✓
8. Design Standard	✓
9. Design Speed	✗
10. Radius of Horizontal Curves	✗
11. Radius of Vertical Curves	✗
12. Consistency with Adjacent Highway Design Elements	✗
13. Safety of Residential Entrances	✗
14. Sight Distances	✗
15. Level of Service on Cross Streets	✗
16. Ability to be implemented for 2011 construction contract	✗
17. Consistency with Southern Ontario Highways Plan	✗
18. Ease of driver task	✗
Natural Environment	
1. Area of Wetland Impacted	✗
2. Fish Habitat Impacted	✓
3. Impact to Natural Woodland Habitat	✗
4. Wildlife Corridors Impacted	✗

Table 5.1: Sample Long List of Evaluation Criteria (Global Factors and Sub-factors)	
5. Number of Watercourse Crossings	✘
6. Number of Groundwater Wells Impacted	✘
7. Stormwater Impact	✓
Cultural Environment	
1. Areas of Archaeological Potential Impacted	✓
2. Loss of Visual Screening along the north side of Hwy 401	✓
3. Cultural Landscape Features Impacted	✘
4. Built Heritage Features Impacted	✘
5. Community Cohesion	✘
6. Impact to Existing Bicycle Path	✘
7. Snowmobile Trails Impacted	✘
8. Vibration Impacts	✘
9. Bridge Aesthetics	✓
Socio-Economic Environment	
1. Out-of-way travel to businesses	✓
2. Impact to Cornwall Motor Speedway	✓
3. Impact to McGregor Grain Impact to McGregor Grain	✘
4. Impact to Cornwall Landfill	✘
5. Impact to Aggregate Resources	✘
6. Impact to Farming Activities	✓
7. Impact to Existing Utilities	✓
8. Number of Noise-Sensitive Areas Impacted	✓
9. Out-of-Way Travel, Emergency Services	✘
10. Out-of-Way Travel, School Buses	✘
11. Potential to Support Regional Development	✘
12. Loss of Surface and Mineral Rights	✘
Land Use and Property	
1. Temporary Limited Interest Required	✓
2. Number of Properties Impacted (Total)	✓
3. Number of Buyouts (Total)	✘
4. Area of Residential Property Required	✘
5. Number of Residential Buyouts	✘
6. Area of Industrial Property Required	✘
7. Number of Industrial Buyouts	✘
8. Area of Institutional Land Required	✘
9. Number of Institutional Buyouts	✘
10. Area of Public Service Facility Land Required	✘

Table 5.1: Sample Long List of Evaluation Criteria (Global Factors and Sub-factors)	
11. Number of Public Service Facility Buyouts	✗
12. Area of Prime Agricultural Land Required	✗
13. Number of Agricultural Buyouts	✗
14. Area of Commercial Land Required	✗
15. Number of Commercial Buyouts	✗
16. Parks/Open Space Area Required	✗
17. Utility Corridors Impacted	✗
18. Potentially Contaminated Sites Impacted	✗
Cost	
1. Life Cycle Cost	✓
2. Durability	✓
3. Maintenance	✓
4. Constructability	✓
5. Long Term Lighting	✓
6. Potential for Settlement	✗
Legend: ✓ Carried Forward ✗ Not Carried Forward	

Generally, the process begins by establishing a long list of potential sub-factors through discussions with community associations, the Study Team and interest groups or from previous studies of the same nature. Then, for each group of alternatives being evaluated, the sub-factors are reviewed and screened by eliminating those that are considered equal among alternatives being considered as well as those that do not apply to the study area, based on the site inventories carried out.

Table 5.2 provides a sample of a typical Factor, Sub-Factor, Unit and Utility Function Type from a similar transportation study. Similar Factor, Sub-factor and Utility functions will be developed for this study.

Table 5.2: Typical Evaluation Factors and Sub-Factors

Factor	Sub-Factor	Unit	Utility Function Type
Traffic and Transportation	• Level of Service (LOS)	Letter (A, B, C, D, E or F)	Stepped Function
	• Number of conflicts	Number	Linear
	• Number of intersections	Number	Linear

Table 5.2: Typical Evaluation Factors and Sub-Factors			
Factor	**Sub-Factor**	**Unit**	**Utility Function Type**
	• Number of entrances	Number	Linear
	• Out-of-way travel	Minutes	Linear
	• Flexibility for staged construction	Yes/No	Dichotomous
	• Ease to implement detour for new structure	Yes/No	Dichotomous
	• Design consistency	Yes/No	Dichotomous
	• Ability to stage construction	Yes/No	Dichotomous

5.2 Factor and Sub-factor Weights

The selection of weights for the factors and the sub-factors is based on assessments by the Study Team of their relative importance. Within a group of factors, inevitably there is an ordering, with some factors having more importance than others. This is accounted for by each individual assigning a weight to each factor, which is reflected in the "Factor Weight" and "Sub-Factor Weight" columns. An example of typical weights is shown in **Table 5.3**.

Table 5.3: Sample Study Team Average Weights for a Factor Group and Sub-Factors in that Group		
Factors	**TAC**	
	Factor Weight	**Sub-Factor Weight**
Traffic and Transportation	40.9%	
• Level of Service (LOS)		27.6%
• Number of conflicts		13.5%
• Number of intersections		7.3%
• Number of entrances		6.1%
• Out-of-way travel		2.6%
• Flexibility for staged construction		9.6%

Table 5.3: Sample Study Team Average Weights for a Factor Group and Sub-Factors in that Group		
Factors	**TAC**	
	Factor Weight	**Sub-Factor Weight**
• Ease to implement detour for new structure		13.9%
• Design consistency		9.2%
• Ability to stage construction		10.2%
	Total	**100%**

As shown in **Table 5.3**, in this example, the group of evaluators judged the Traffic and Transportation Factor Group to be valued at 40.9% of the overall importance of the decision between the alternatives being considered.

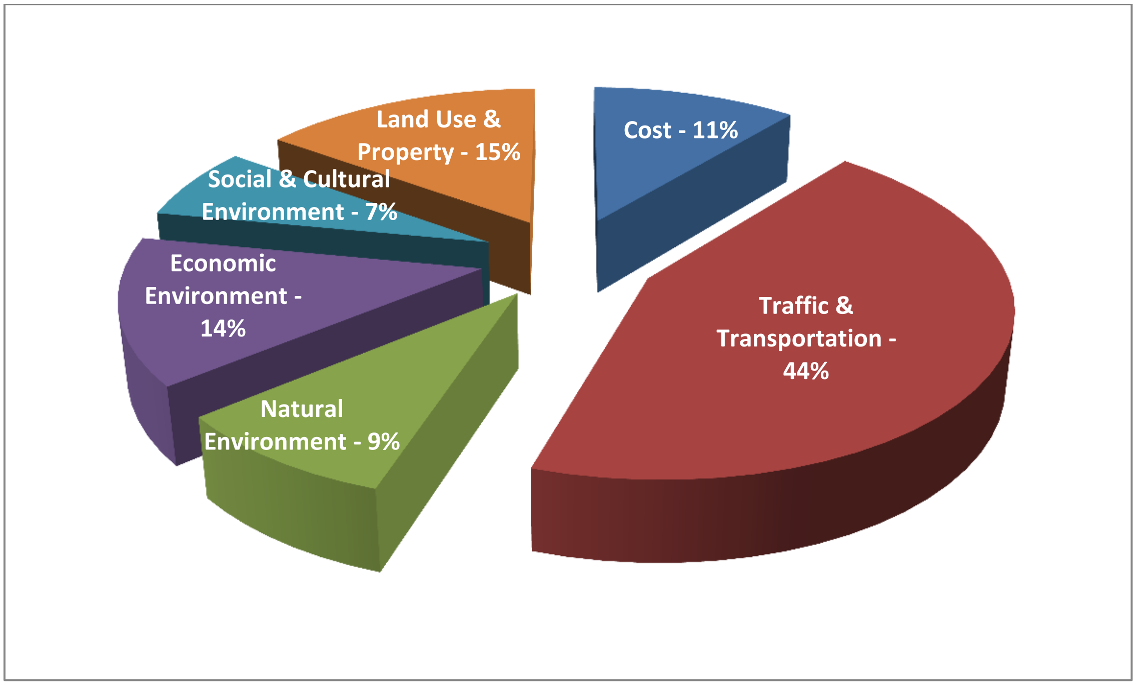
Within each Factor Group the sum of the percentage weights of all sub-factors listed under each factor totals 100%. As shown in Table 5.3 several of the sub-factors were judged to be more important /less important when compared to each other for this specific evaluation of alternatives being considered.

The weights for each factor and sub-factor are determined by averaging the weights assigned by the Study Team (Evaluation Committee). Each member gives a judgement of the importance of each global factor and local sub-factor (a percentage value) based on his or her personal assessment and professional judgement, considering the net effects and input of stakeholders and the public.

There is usually a range of perspectives in deciding the weights (importance) of factors and sub-factors. Every person assigning weights has a personal perspective and understanding of the scope of the project. Hence, there is an advantage to having a diversified team of professionals with varied backgrounds performing the evaluation.

An example of the weighting of each of the global factors is shown in **Figure 5.2**. The weighting of sub-factors within each factor group would be distributed among the available sub-factors.

Figure 5.2: Sample Weighting of Global Factors



5.3 Social Utility Functions

The Weighted Additive Method used to evaluate alternatives relates the performance or attractiveness of alternatives using a mathematical relationship. This includes two variables: the first is the raw data or measured or modelled data and the second is the utility or utility score, which is the measure of attractiveness of the alternative.

For this project, the relationship between these two variables is described, as shown in **Figure 5.3**, by either a dichotomous, stepped, or linear social utility function. A dimensionless utility score between zero (0) and 1 is assigned to an alternative for each sub-factor. The shape of this function can vary from linear to stepped or exponential, and is defined by a subject area specialist.

The use of utility curves or functions is a step that transforms each of the measured effects to a dimensionless number and measure of utility. This step is required because the effects of each sub-factor are measured in different units (length, area, time, volume, dollars etc). To produce a mathematical measure of the performance, each effect is transformed to a measure of utility. The combined effect or performance of each alternative is a measure of utility (attractiveness) which is a dimensionless measure. The utility function (also commonly described as performance factor or function form) defines the relationship of effect to the attractiveness (utility). These utility functions are defined by subject area specialists in the field of study.

Examples of Social Utility Functions for the ‘Ease of Maintenance’ sub-factor definition are shown below in **Figure 5.4**.

A dichotomous utility function enables the decision-maker to establish criteria that presents an “either–or” situation (desirable or undesirable, negative or positive, present or absent). If it were decided beforehand that a “yes” answer is desirable, then a utility score of one would be assigned to this criterion, otherwise zero would be assigned. One or zero are the available options; no other utility score is available.

A linear function is used to convert scores for sub-factors that have varying measurements. Given a measurement, a unique utility score between zero and one can be assigned to a sub-factor. The slope of the linear utility function can be negative or positive depending on desirability of the impact.

Figure 5.3: Sample Utility Functions

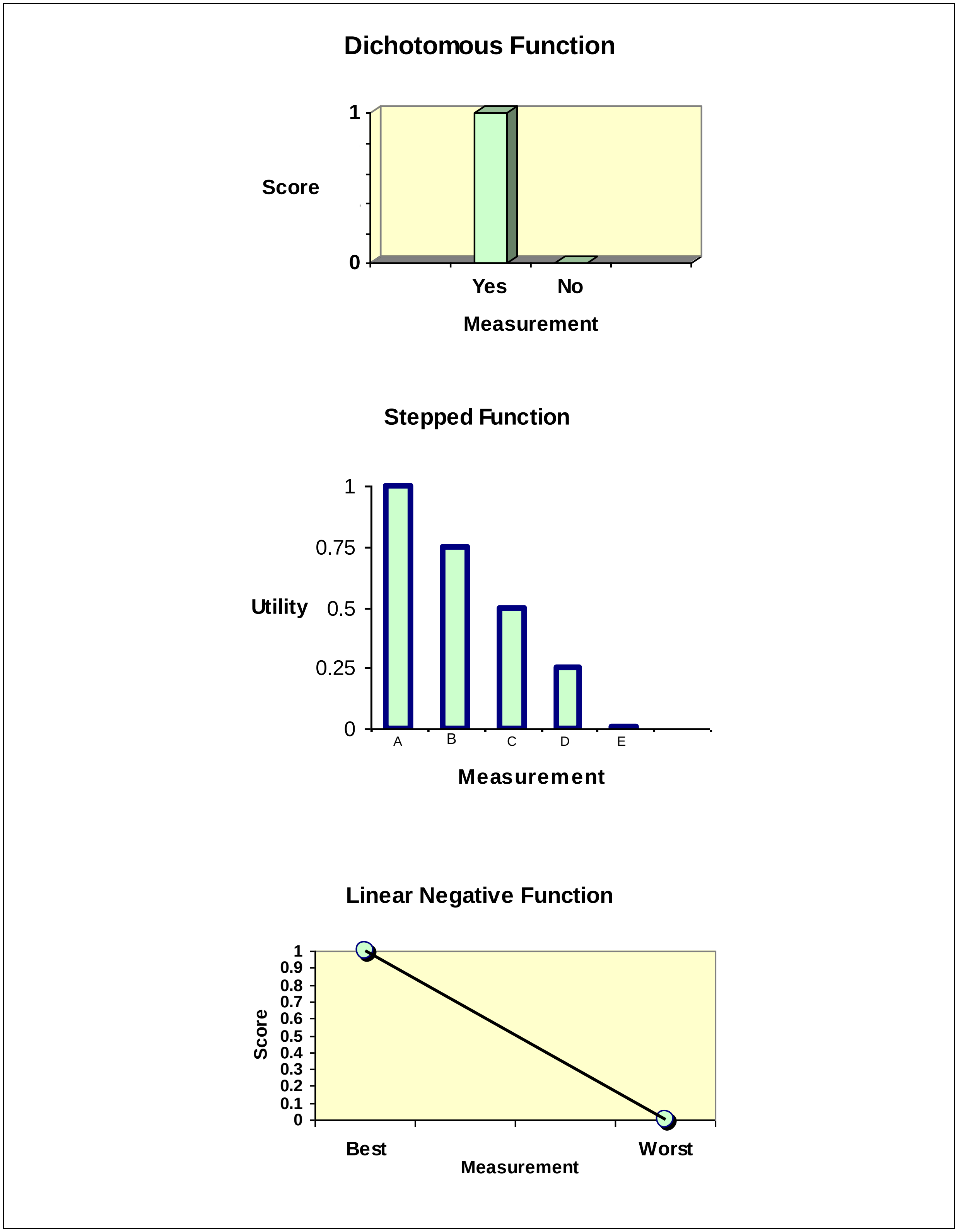
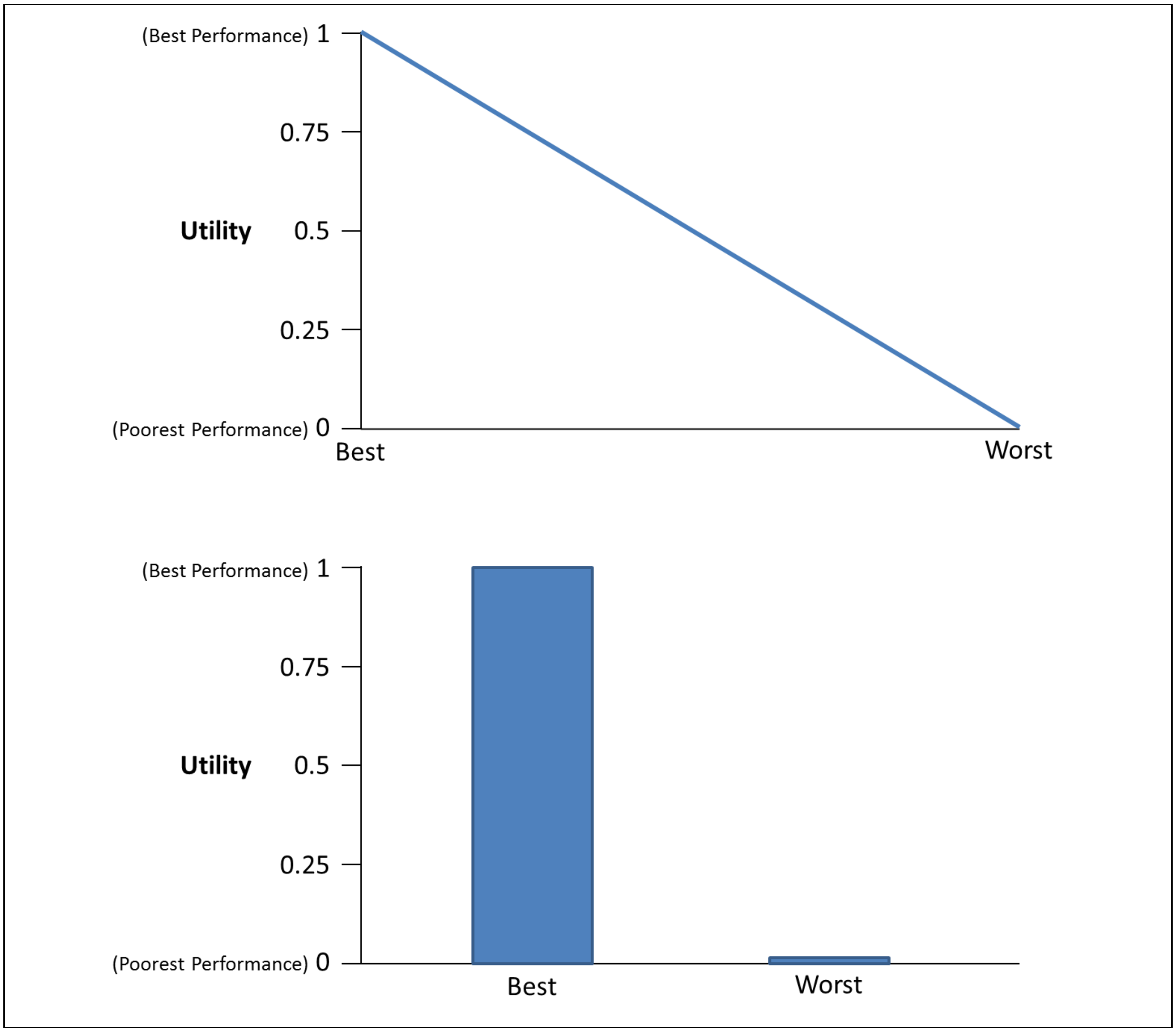


Figure 5.4: Social Utility Function



5.4 Weighted Score

The total un-weighted utility score of a given alternative can be expressed as:

U (Alternative A) = $\varnothing_1 X_1 + \varnothing_2 X_2 \ldots.. + \varnothing_n X_{n,}$ where

U (A) = Total un-weighted utility score for Alternative A

$\varnothing_1$ = attractiveness with respect to parameters

X_1 = measurement of parameter X

Weighted scores are computed using the weights selected by the TAC. The weighted score for each alternative under a specific sub-factor is calculated as follows:

(weighted score) = (utility score x [(factor weight) x (sub-factor weight)])

Using this approach, a generic weighted attractiveness function can be expressed as:

U_w (Alternative A) = $U_1W_1 + U_2W_2 + \ldots. + U_nW_n$

OR

U_w (Alternative A) = $W_1\varnothing_1X_1 + W_2\varnothing_2X_2 \ldots. + W_n\varnothing_nX_n$

Where: U = Total un-weighted utility score for Alternative A

U_w (A) = Total weighted utility score for Alternative A

W_1= Weighted parameter (factor weight x sub-factor weight)

$\varnothing_1$ = Attractiveness with respect to parameter 1

X_1 = Measurement of parameter

The weighted scores of all the sub-factors are then added to give total score for each alternative.

$$U_w(A) = \sum_{X=1}^{n} W_n \varnothing_n X_n$$

5.5 Rating Alternatives

Following the selection of evaluation factors and sub-factors, measurements of the impacts are made using topographic plans, field surveys, and numerical modelling. These measurements result in data being available under each of the evaluation criteria from which ratings are made for each alternative.

The Weighted Additive Method focuses on the differences of the alternative, addresses the complexity of the base data collected and provides a traceable and defensible decision-making process. This process is a numerical calculation where alternative scores are determined through the use of a mathematical relationship to equate impacts to scores. It eliminates any possible subjective opinions of scores for alternatives because the team does not estimate the score for an alternative.

The scores for each alternative under each of the respective sub-factors are normalized based on measured impacts. Social utility functions are defined to relate impacts to the attractiveness of an alternative. This means that under each sub-factor, the alternative receives an un-weighted rating of between zero and one based on these measurements. The mathematical relationships for calculating scores are developed in consultation with the Study Team.

5.6 Sensitivity Testing Program

It should be recognized that the scope of the evaluation and determination of weights for the evaluation criteria are a matter of personal and professional judgement. Accordingly, it is considered essential to conduct sensitivity testing to determine the effect of changing weights assigned to each criterion.

To test how sensitive the outcome of the evaluation is with respect to the assigned weights (i.e. would the result have changed if different weights were used), a sensitivity testing program is undertaken. This results in greater confidence in the selection process and reduces the potential that the average weights bias the outcome of the evaluation.

Often, there is a diversity of opinion in the group as to what weight is appropriate for a factor or sub-factor. When an average weight is used to capture the preferences of the group it loses valuable information on the range of values of the group. To test the range of perspective of the Study Team, the highest and lowest weights suggested by anyone in the group are defined as a reasonable range of weights to test. A series of sensitivity tests are performed for the evaluation of alternatives. This allows the team an opportunity to assess the outcome of the evaluation if different weights (different perspectives of importance) are assigned to the factors and sub-factors from the average weights defined by the Study Team members. In this way, trade-offs can be identified, credibility can be achieved with the public, and “what if” questions can be answered quickly. See **Figure 5.5** for an example of the typical range of project team weights and **Table 5.4** for a sample ranking of alternatives.

Following the above methodology, a series of tests can be performed varying the weights for each factor. These tests include:

- Average Study Team Weight
- Highest Weight by any Team Member
- Lowest Weight by any Team Member

Following this series of tests, the results can be reviewed to assess whether the preferred alternative changes when the weights are varied.

Using this information alone is not the only justification for selecting a particular alternative, but it does provide a level of confidence in the selection. This information is used in the decision-making process before the TPAs are recommended to be carried forward.

Figure 5.5: Sample Range of Weights for Traffic and Transportation

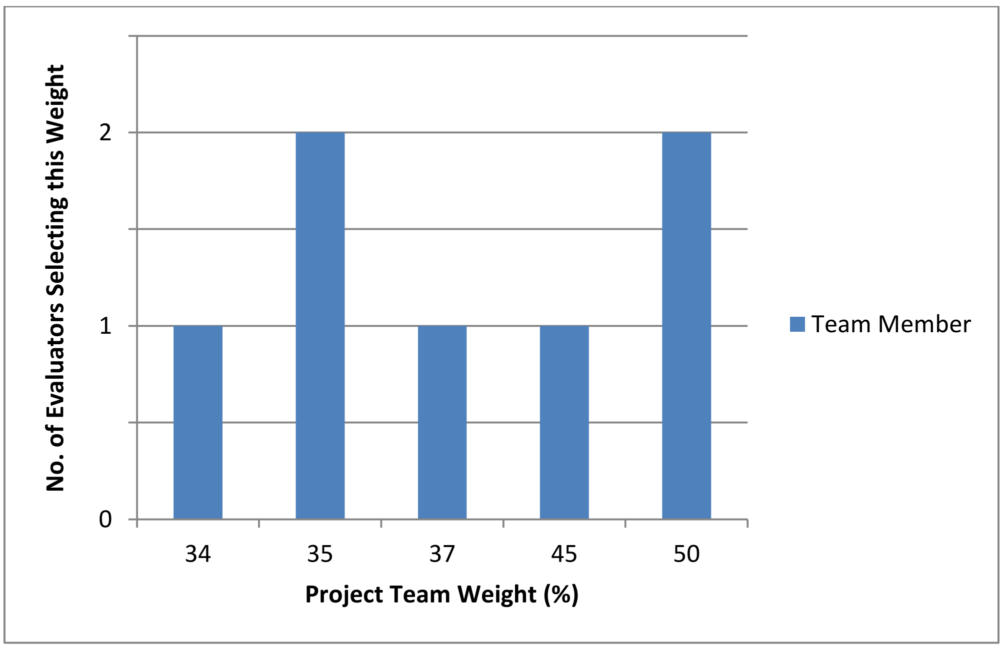


Table 5.4: Sample Ranking of Alternatives					
Testing	**Weight**	**Alt 1A**	**Alt 1A'**	**Alt 1B**	**Alt 1C**
Study Team Average Team Scores	N/A	2	1	3	4
High Traffic and Transportation	65%	2	1	3	4
Low Traffic and Transportation	30%	2	1	3	4
High Natural Environment	20%	2	1	3	4
Low Natural Environment	5%	1	2	3	4
High Economic Environment	30%	1	2	3	4
Low Economic Environment	5%	2	1	3	4

5.7 Selection of Technically Preferred Alternatives

The Technically Preferred Alternative (TPA) is determined by taking into account the technical analysis, environmental considerations and comments of all study participants.

The TPA is then presented to the public and external stakeholders at the second PIC. This allows for any comments or questions regarding the proposed design.

It should be recognized that the information and conclusions obtained using the evaluation method are only tools used to assist in the evaluation process and identifying trade-offs. In the end, it is the Study Team (Evaluation Committee) which makes the final decision on the selection of the TPA(s), using both the information obtained throughout the evaluation process and their individual experience and expertise, and through additional input from senior management on funding availability or other program constraints.

The findings of the analysis and evaluation process will be included as a component of the EA Process and documented in the Environmental Study Report (ESR). The principles and methodology of the EA process assist the Study Team in the analysis and evaluation of alternatives and the selection of the TPA. The public and government agencies have the opportunity to provide input throughout the course of the study.