
APPENDIX F
DESCRIPTION OF GROUPINGS,
FACTORS AND INDICATORS

Groupings, Factors and Indicators

The Groupings, Factors and Indicators from the Original EA were reviewed and updated. The environmental effects of the alternatives need to be analysed using a defined set of groupings and factors. The groupings and factors to be used in the analysis of the alternatives were developed through the consideration of the following:

- The need to determine the manner in which the alternatives would address the transportation and planning issues within the study area.
- The type of factors that have been found to be of significance on highway projects carried out by the Ministry of Transportation over the past several years.
- The specifics of the study area that reflect the unique characteristics of this particular study as understood by the Project Team and expressed by interested groups and agencies through the Original EA study and the current MTO Review.

In preparation for the 1999/2000 evaluation of the Highway 7 alternative alignments, the environmental issues identified during the development of the Original EA were reviewed and updated to better reflect current policies and processes. In particular, the Natural Environment and the Agriculture Factors and Indicators were reviewed and modified. Based on current information (background and additional field assessments), indicators are used to determine the relative merits of the alternative alignments and ultimately lead to the selection of a preferred solution. A combination of quantitative and qualitative measures has been developed.

The Environmentally Significant Issues identified during the study, along with the study objectives, form the basis for the broad groupings and sixteen factors identified as the framework for the analysis and evaluation of the alternatives. The groupings have been identified as:

- Socio-Economic Environment
- Natural Environment
- Agriculture
- Transportation
- Cost

Each of the sixteen factors was further defined by the use of indicators. Wherever possible, indicators were used which would provide a quantitative measure when used. If this was not possible, qualitative indicators were used. Qualitative indicators were labelled as subjective. The subjective rating (i.e. minor, moderate, and major) was based on a combination of technical facts and professional judgement. Seventy-three indicators were identified in all.

The following is a discussion of the Factors and Indicators for the Socio Economic Environment, Natural Environment, Agriculture and Transportation Groupings. There were no changes to the Cost Groupings.

Socio Economic Environment

Community Effects

The Community Effects factor measures the impact to the built environment, particularly the displacement or severance of properties. Residential, industrial, commercial and institutional properties were identified. The factor would also measure community facilities affected, including schools and religious places of worship. In the Phase 3 analysis and evaluation the indicators in the Community Effects factor were modified to include: 'Overall Effect of Business Accessibility', 'Location of Access / Change in access', 'Level of Visibility' and 'Overall effect on emergency response routes'. These changes were made as a result of discussions with business owners in the central rural section of the study area.

Noise

The Noise factor would measure the noise increase that the alternative would have on a noise sensitive area. Noise sensitive areas include residences and schools where there are dormitory facilities. Noise increases would be measured based on future traffic volumes with and without the alternative. Noise increases are based on 0 – 5, 5- 10 and over 10 dBa.

Land Use

Land use considers the effect that the alternative would have on planned development based on Official Plan designation. The factor was expanded in the MTO Review to assess the potential for induced development. Induced development is defined as the alternative influencing the conversion of non-urban land uses to urban uses.

Natural Environment

The following criteria and indicators were developed to measure potential impacts of the alternatives on the natural environment and present a means of comparing those effects. It should be emphasized however, that although they are represented as individual indicators in this evaluation, the natural environment is a dynamic integrated system and impacts to one component of the system will not be restricted to that particular component.

Every effort has been made to not only illustrate in a numerical fashion the potential impacts associated with each alternative (i.e. area of high capability soil removed) but also to illustrate in a qualitative manner the degree of impact associated with the quantitative measure (i.e. effect on future flexibility of farm operations). In the description of the various factors there is reference to high, moderate and low ratings. It should be noted that mixed ratings, such as high-moderate and moderate-low were used in the analysis. This allows a better understanding of the "bigger picture" impacts associated with each alternative.

Fisheries and Aquatic Habitat

This factor examines the impact each alternative will have on surface water quantity, quality, fish species and aquatic habitat.

MNR resource mapping, air photos, field observation and agency contacts were used to describe surface water characteristics within the study area and to evaluate potential effects of each alternative.

Waterbody types are defined as follows:

Rivers: Permanently flowing major watercourse capable of supporting coldwater or warmwater communities but are generally larger than streams and directly draining to a larger waterbody (lake). Rivers are generally considered navigable watercourses.

Permanent Streams: Capable of supporting coldwater or warmwater sportfish or baitfish fishery. Contains permanent flow and includes direct river tributaries and large agricultural drainage canals.

Ponds: Natural or constructed permanent surface water feature, which may or may not be hydrologically connected to another watercourse. It is considered potential habitat for species which have colonized from a connecting watercourse or have been introduced by some other means (birds, human introduction).

Other: This designation includes field swales, roadside and smaller agricultural drainage ditches. They are generally ephemeral or intermittent in nature. An intermittent stream contains flowing water for less than 9 months of the year and may or may not contain fish on a seasonal basis. Intermittent systems are connected to the water table at certain times of the year. Ephemeral systems rely solely on runoff events.

Wetlands: Include evaluated or un-evaluated wetland areas which may or may not be hydrologically connected to other surface water systems but are potentially capable of supporting fish habitat directly or indirectly.

Indicators

a) Water crossings or encroachments (lakes, rivers/streams, and wetlands)

This indicator is measured both quantitatively and qualitatively. The quantitative measure is represented by a direct count of the number of waterbodies that each alternative will affect. This includes crossings, modifications, relocation, channelization or paralleling within a buffer area (i.e. 30 m). Streams identified as ephemeral were not included during the stream count.

A qualitative measure was also applied to this indicator to reflect the degree of significance of the number of watercourse crossings or encroachments. The following rating system was applied:

- High: Alignment requires a new river encroachment or crossing and/or significant coldwater (or coolwater) systems may be impacted. Stream crossings include new disturbances to permanent systems. **Mitigation is difficult or not practicable.**
- Moderate: Alignment requires a river crossing at an existing or disturbed crossing site or a new crossing of an intermittent watercourse. May also require crossing or modification to permanent (warmwater) ponds. **Mitigation is feasible.**
- Low: No river crossing required. Alignment may require new crossings of minor permanent warmwater streams or ponds or requires only modifications (widening) of existing crossings. **Effects are easily mitigated.**

b) Presence of species at risk

This indicator recognizes those species identified by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and/or the Ministry of Natural Resources (MNR) or are recognized as a regionally significant species. Based on field observation and type of habitat documented in the original EA as well as that in the current review process, the potential presence of such species will be represented by a "present" or "not present". If the presence of such species is suspected, the impact to the species is qualitatively evaluated by assessing the potential impact to suitable habitat using the following rating system.

- High: Significant species are most likely affected; alternative will impose a high degree of habitat fragmentation and habitat loss. **Mitigation is not practicable.**
- Moderate: Significant species may be affected by minor fragmentation, but habitat will remain functional. **Mitigation is feasible.**
- Low: No significant species are likely to be affected. Disturbance may be an existing condition or includes edge effects only. **Residual impacts are easily mitigated.**

c) Areas of critical fish habitat (included spawning areas, migratory runs)

Critical fish habitat is defined as those areas that are limiting to the overall productive capacity of the watercourse/waterbody (i.e. if these areas were harmfully altered, the productive capacity would be expected to decrease). These habitat areas are supported by specific attributes related to cover, groundwater discharge, substrate character, and depth and velocity necessary for spawning and subsequent incubation or rearing of fish (e.g. spawning or nursery areas with specific physical, biological attributes, highly productive feeding areas). Impact is assessed by evaluating the potential impact associated with construction (crossings by access roads, pier location, and erosion potential) and by the operation of the facility (salt and sediment). The impact is summarized by number of areas affected and by degree of potential detrimental affects summarized as follows:

- High: Alignment affects critical habitat areas(s) directly or indirectly which cannot or will be difficult to mitigate based on Department of Fisheries and Oceans "no net loss" principle. **Compensation is not likely possible.**
- Moderate: Alignment affects important habitat component(s) but **effects are mitigatable or compensation is feasible.**
- Low: Minor habitat components may be affected by alternative but **effects are easily mitigated or could be compensated.**

d) Presence of warmwater/coldwater communities.

The community type is classified based on background information supplemented by field studies. This indicator is a direct count of the number of warmwater and/or coldwater communities potentially affected by each alternative by habitat removal or alteration based on the following definitions.

Coldwater Community: A stream that possesses the physical characteristics capable of supporting coldwater or coolwater species. Coldwater streams usually have sufficient groundwater discharge to maintain year round flow and relatively low water temperatures.

A watercourse that presently or potentially supports coldwater or coolwater species is counted as one coldwater community for each crossing, encroachment or paralleling within a 30 meter buffer area.

Warmwater Community: A stream that does not possess the physical habitat characteristics capable of supporting coldwater species. Fish species commonly designated as warmwater species include Largemouth Bass, Smallmouth Bass, Rock Bass, Sunfish, Bullhead, Carp, Northern Pike, Walleye and Yellow Perch. Common warmwater baitfishes include Blacknose Dace, Creek Chub, Common Shiner and Bluntnose Minnow. A permanent or intermittent watercourse that potentially supports a fish community of typical warmwater species is counted as one warmwater community for each time an alternative crosses, encroaches upon or parallels it.

A 30 metre MNR recommended buffer area for coldwater streams is also used here for warmwater assessment for consistency.

e) Degree of interaction with groundwater (presence of highly permeable soil).

This indicator represents the degree of potential impact to groundwater discharge zones with respect to fisheries and aquatic habitat. Existing soils and geology reports were used and confirmed by reconnaissance field investigation. The following qualitative measure was used.

- High: Alternative will require removal of highly permeable soils or known discharge area(s). Such removal potentially affects groundwater movement and/or potentially affects supply to downstream aquatic

communities or increase risk of contamination. **High degree of mitigation is required or is not practicable.**

- Moderate: Alternative will require removal of highly permeable soils but is not expected to impact known discharge areas. **Mitigation may or may not be required to protect downstream aquatic communities.**
- Low: Alternative does not require removal of highly permeable soils or removal will not affect surface water or groundwater systems. **Residual impacts are easily mitigated.**

Wildlife

This Factor examines the impact each alternative will have on wildlife species and habitat. Indirect indicators evaluate the terrestrial wildlife component. The disruption and fragmentation of potential wildlife habitat is measured. The concept of corridor movements of wildlife is also integrated.

Data Sources include: MNR Resource mapping, air photos, field observation and agency contacts are used to classify and assess potential effects to wildlife and wildlife habitat within the study area. Local naturalist groups provided data as well as assistance for some of the field work.

Indicators

- a) **Encroachment on or severance of forested vegetation or non-forested successional areas.**

Measures the total potential impact to wildlife habitat for each alternative. Reported in hectares. All vegetation communities are considered potential wildlife habitat for this indicator (i.e. successional areas, riparian strips, large hedgerows).

- b) **Encroachment on or severance of greenways and open space linkages (wildlife travel corridors).**

This indicator qualitatively measures the potential of disruption to wildlife movement along potential or identified corridors by fragmentation or removal using the following rating system.

- High: The encroachment on or severance of greenways or open space linkages is unavoidable and **results in major fragmentation of greenways to extent that maintenance of function is unlikely and mitigation is not practicable.**
- Moderate: The encroachment on or severance of greenways or open space linkages is unavoidable or likely but **fragmentation is reduced and wildlife travel opportunities are not eliminated. Mitigation is feasible.**
- Low: The encroachment on or severance of greenways or open space linkages is not likely or is an existing condition. **Residual impacts are easily mitigated.**

c) Encroachment on or severance of significant wildlife habitat (waterfowl areas, deer yards, heronries).

This indicator is a measure in hectares of the quantity of potential significant wildlife habitat that will be directly affected by each alternative or located within 50 meters of the proposed right-of-way. It is also measured qualitatively to represent the significance of that impact.

Examples of significant wildlife habitat include the following:

Waterfowl Area: Areas in which large numbers of waterfowl concentrate to nest or to feed and rest during migration.

Deer Wintering Area: Areas in which white-tailed deer concentrate in winter, typically with dense coniferous cover which provides more favourable microclimatic conditions (local insulation, reduced wind chill, reduce snow depth). These areas are important during extreme winter conditions.

Large Diverse Woodland Blocks: Large woodland (> 10 ha) areas displaying diverse community structure and having high potential to support wildlife populations and tend to be used over a number of years.

Heronries: Areas where breeding herons congregate and nest.

- High: Alternative route causes major severance/fragmentation or isolation of large contiguous blocks of potential wildlife habitat (>10 ha) to the point where its functional role may be directly or indirectly threatened. **Mitigation is difficult or not practicable.**
- Moderate: Moderate impact to significant wildlife in terms of severance, fragmentation and isolation; functional role is not threatened. Woodland blocks (5-10 ha) may be isolated, habitat diversity is moderate. **Mitigation is feasible.**
- Low: Impacts to potential wildlife habitat areas are easily mitigated or disturbance may be an existing condition. Includes edge effects, small isolated woodlots (< 5 ha) and/or habitat diversity is low. **Residual impacts are easily mitigated.**

d) Presence of species at risk

The presence of species identified by COSEWIC and/or MNR as vulnerable, threatened or endangered, or are identified as significant regionally is determined through available background information. If the presence of such species is suspected, the impact to the species is qualitatively evaluated by the potential impact to suitable habitat using the following rating system.

- High: Significant species are most likely affected; alternative will impose a high degree of habitat fragmentation and habitat loss. **Mitigation is not practicable.**

- Moderate: Significant species may be affected by minor fragmentation, but habitat will remain functional. **Mitigation is feasible.**
- Low: No significant species are likely to be affected. Disturbance may be an existing condition or includes edge effects only. **Residual impacts are easily mitigated.**

Wetlands

This Factor examines the potential impact each alternative will have on wetland resources. Background information was collected from previous studies, published data, agency contacts and field observation. There was extensive additional field work carried out during the MTO Review in 1999 and 2000.

Indicators

a) Loss of function (biological, hydrological, special features) of all wetlands within or adjacent to study area.

This indicator measures the potential effect each alternative has directly or indirectly on wetland function as defined in the "Wetland Policy Statement". These functions include aquifer recharge zones, fish/wildlife habitat and production areas, flood protection, toxic buffers and water storage. Function can also include cultural factors such as recreation and education.

The potential effect is measured qualitatively as follows:

- High: Potential for impact is high. Wetland area loss and loss of function will likely occur within or adjacent to the study area and **mitigation is not practicable.**
- Moderate: Potential for impact is likely within or adjacent to the study area but nature of wetland impact is peripheral or there is a reasonable expectation that residual wetland functions can be maintained.
- Low: Potential for impact is low. Wetland area and function would not likely be affected. **Residual impacts are easily mitigated.**

b) Loss of wetland area of all wetlands within study area.

This indicator measures impacts to total wetland area affected by each alternative. It considers both un-evaluated and evaluated wetland areas.

Wetland boundaries were determined using MNR Wetland Resource mapping at 1:10,000, air photos, topographic maps, agency contacts and field interpretation. In the instance where a section of functional wetland area would be severed from the main wetland complex, the entire severed section is measured if the function of that section would no longer continue.

c) Degree of interaction of all wetlands with groundwater.

This indicator measures qualitatively the potential for groundwater **impacts when in association with wetlands.**

- High: Groundwater is at or near the surface or will be intercepted leading to change in wetland water levels. **Mitigation is not practicable.**
- Moderate: Groundwater is near the surface or will be intercepted but **impacts are mitigatable.**
- Low: Groundwater is at depth and impacts are unlikely. **Residual impacts are easily mitigated.**

d) Encroachment on (within) or severance of Provincially Significant (Class 1–3) wetlands.

This indicator measures the area of evaluated provincially significant wetlands potentially impacted by each alternative. This measure is also included in Indicator 2.3b but now serves to identify the proportion of provincially significant Class 1, 2 or 3 wetlands included in that measurement.

Secondary sources such as MNR Resource mapping were used to define the boundaries of evaluated wetlands within the study area. Given the prominence of wetlands in this study, investigations have gone beyond only secondary source information with augmentation of field investigations to confirm presence of wetland communities and boundaries. Only those areas presently evaluated and mapped as provincially significant wetlands are included; additional significant wetland areas could be identified with additional field assessment.

The area of Class 1, 2 or 3 (provincially significant) wetlands that would be encroached upon or severed is measured using a planimeter. Wetland boundaries are transferred from MNR Wetland Resource mapping. In the instance where a section of wetland would be severed from the main wetland area the whole severed section is measured if the function of that section would no longer continue.

Vegetation

This Factor examines the impact each alternative will have on vegetation units and individual specimens. MNR Resource mapping, air photos and field observation were used to assess and evaluate the vegetation resources of the study area.

Indicators

a) Encroachment on or severance of high quality forest stands (not including wetlands), based on dominant species, age, size, shape.

This indicator quantitatively measures the potential impact of each alternative on the significant woodland resources in the study area. Vegetation communities were evaluated during reconnaissance surveys (winter, spring and summer) and assigned a quality rating based on dominant species, age, and habitat diversity. A high quality or significant woodland community is defined as a late successional community (or older) and composed of native species. These communities were defined and the area potentially impacted by each alternative alignment was calculated and recorded in hectares.

b) Presence of significant species or specimens at risk

The presence of species identified by COSEWIC and/or MNR as vulnerable, threatened or endangered or are identified as significant regionally is determined through available background information. If the presence of such species is suspected the impact to the species is qualitatively evaluated by the potential impact to suitable habitat using the following rating system.

- High: Significant species are most likely affected; alternative will impose a high degree of habitat fragmentation and habitat loss. **Mitigation is not practicable.**
- Moderate: Significant species may be affected by minor fragmentation, but habitat will remain functional. **Mitigation is feasible.**
- Low: No significant species are likely to be affected. Disturbance may be an existing condition or includes edge effects only. **Residual impacts are easily mitigated.**

c) Erosion potential on steep slopes.

This indicator assesses the erosional stability of soils for each alternative and to what degree vegetative cover is necessary on steep slopes to prevent excessive sedimentation and erosion during construction and post-construction stages as they relate to vegetation and/or fisheries habitat impacts.

The following qualitative rating system will apply in evaluating this indicator:

- High: Erosion potential is high (sandy) on steep slopes and will require a **high degree of mitigation to protect vegetation and/or fisheries habitat.**
- Moderate: Moderate erosion potential. **Mitigation is required but fisheries habitat will not be affected.**
- Low: Soils have low erosion potential so that erosion is not generally an issue. **Residual construction related impacts are easily mitigated.**

d) Presence of riparian habitat.

This indicator measures the potential impacts to vegetation communities associated with watercourses within the study area. Riparian vegetation functions in flood control, stream cover, erosion control and provides wildlife habitat. It is measured qualitatively based on species composition, maturity and density using the following:

- High: New crossing of Grand River where there is good riparian cover and/or at least 2 new creek crossings elsewhere that have mid to late successional cover. **Mitigation is difficult or not practicable.**
- Moderate: New crossing of Grand River where there is good riparian cover, and/or at least 2 new creek crossings elsewhere that have early to mid successional riparian cover. **Alternative will impact riparian vegetation but mitigation is possible.**

- Low: Crossing of Grand River at existing crossing or previously disturbed site and/or up to 2 other creek crossings with riparian cover limited or dominated by early to mid successional vegetation. **Residual impacts are easily mitigated.**

Groundwater

This Factor examines the impact each alternative will have on commercial and domestic water supplies.

For each alternative, secondary sources such as soils reports were used to identify groundwater resources. The investigation would identify, where possible, the following:

- 1) Areas of high water table,
- 2) Areas of groundwater discharge,
- 3) Areas of high groundwater overburden permeability, and
- 4) Location and usage of private and/or municipal wells.

The average depth to groundwater was determined using well records. Flowing (artesian) wells if recorded will be investigated in greater detail along the preferred alignment.

Indicators

a) Implications of roadway grading on groundwater discharge.

Areas of deep road cuts in proximity to groundwater discharge areas could influence both water quality (salt) and quantity. This indicator measures the potential impact of re-grading on groundwater discharge for each alternative by counting the number of anticipated cut zones along an alternative in proximity (within 120 m) of dependent aquatic or wetland areas.

b) Shallow groundwater wells (contaminant implications)

This indicator assesses the potential impacts associated with groundwater contamination that could be associated with freeway construction, maintenance and accidental spills. The indicator is measured by the number of shallow (<15 m in depth to aquifer) groundwater wells within 300m of each alternative. The impact risk may be reduced for alignments that are down gradient of shallow wells, and such comments are provided where relevant.

c) Municipal / private water supply wells(s).

This indicator combines a quantitative measure with a qualitative impact assessment to evaluate potential effects on private and/or municipal wells. It does not include those areas within established urban envelopes. It is assumed that each rural dwelling will have at least one well associated with it even if no well record exists. It is also assumed that farms, particularly those raising livestock and nursery operations, will probably have 2 or more wells. More detailed

investigation will apply at the preferred alternative stage. This indicator is measured as follows:

- High: Large number (>50) of potential well locations within 300 meters of the centre line of proposed facility and/or affects urban water sources.
- Moderate: Moderate number of wells (25-50) within 300 meters of centre line of facility.
- Low: Few wells (<25) within potential impact zone.

Agriculture

Agriculture

This Factor examines the impact each alternative will have on agricultural soil resources and farming operations.

Using air photo interpretation, OMAFRA land use mapping and windshield surveys, the existing agricultural land uses were identified. This section of the evaluation identifies land currently involved in agricultural production regardless of its suitability. The impact ratings are based on land ownership, leasing arrangements and current agricultural activity.

Indicators

a) Land currently used for agricultural production based on 1999 land-use survey

The area of active agricultural land required for an alternative was defined as lands currently used directly (i.e. crop production, pasture) or indirectly (i.e. fuel wood) for agricultural production. Lands may be owned or leased. Areas were measured with a planimeter and recorded in hectares of land required.

b) Specialty crop operations affected.

This indicator is a counted measure of how many individual specialty crop operations will be affected by each alternative. OMAFRA defines specialty agriculture for the study area as including the following:

Extensive Field Vegetables: Large field of cucumbers, broccoli, tomatoes, peas etc. Includes associated fallow or plough-down crops.

Nursery: Intensive production of trees, shrubs, vines or flowers for transplant or sale. Included associated fallow or plough-down crops.

Impact in this instance is defined as direct encroachment of actively farmed land. The area directly affected is measured with a planimeter and recorded in number of hectares of land impacted or potentially lost from production.

The number of operations affected, based on ownership/lease also summarizes this indicator.

c) Loss of specialty crop soil (organics only).

This indicator will represent the loss of organic soils that may or may not be currently used for speciality crop purposes. It is measured in hectares.

d) Dairy/livestock operations affected.

These operations were identified by field observation. This indicator is measured by the direct count of livestock operations impacted by each alternative. Impact in this instance is defined as direct encroachment from edge of right-of-way of actively farmed lands. It is noted that the majority of livestock operations also include field crop areas, which were assumed to be used exclusively for livestock.

e) Field crop operations affected.

This indicator is the number of individual field crop operations that will be impacted by each alternative. Impact in this instance is defined as direct encroachment of actively farmed land. The areas are measured with a planimeter and recorded in number of hectares of land affected or potentially lost from production.

OMAFRA defines field crop operations as including the following:

Continuous Row Crops: Single intensive crop type, i.e. corn or beans. Also includes any combination of corn, white beans, soybeans or other varieties of beans in rotation. The entire area except for topographically limited portions and non-systems use must be row crop. Corn dryers and elevator storage systems are good indicators. Often barns are absent except for a machine shed(s). There must be no grain crops or hay. Usually very large fields often with no fence boundaries.

Corn System: A rotation system in which corn and/or grains occupy more than 40%, but less than 100% of the area. The remainder is composed of grain and hay. A small proportion (less than 10%) may be pasture. Usually silos and corn crops are good indicators of this system. There may also be a complex of barns that indicate feeding of dairy, beef or hogs.

Mixed System: A rotational system composed of grain, corn, or beans and hay in roughly equal proportions. No crop dominates the system and fields are generally small. Barns are usually older types and silos are smaller and less numerous. Associated with a traditional farming system. Sod crops cover more than 20% of the area. Corn and beans together occupy less than 40% of the area.

Grain System: A combination of sod crops and grains in which grain is predominant, occupying more than 85% of the area and in some cases as much as 100%. The field sizes are usually large with fences often absent. A lower intensity cash cropping system. There are no row crops; good quality hay or pasture may compose up to 15% of the area.

h) Effect on future flexibility of farm operations.

This indicator is concerned with the individual farm effects resulting from limitations of access or effect on farm operation. The number of farm accesses affected represents the number of farm properties where farm access is affected by a proposed route, not the number of individual effects as each farm may have more than one access and therefore some farm properties may be affected in more than one way.

To qualify this indicator, impacts may include ability to move equipment between buildings and fields as well as between various fields off of the farm. Impacts could result in no access, limited access, new access and/or reduced access.

The degree of impact (access) was rated based on the following definitions:

No Access: Occurs when the existing access to a property no longer exists and cannot be replaced.

Limited Access: Related to a loss of some frontage including the existing driveway as a result of a new limited access facility alternative.

New Access: Occurs when the existing access is removed but a new access is possible from a sideroad or service road.

With these definitions, the impact for each of the alternatives was evaluated as follows:

- High: Alternative will result in limited or no access to existing property on at least 3 properties and mitigation is difficult or not practicable. Severed part of farm will not be readily accessible from farm buildings or will result in small or awkward shape. Off-farm movement opportunities limited by directional restrictions (i.e. one-way travel) and results in greater out-of-the way travel requirements and increased safety concerns.
- Moderate: Alternative will result in limited or no access to existing property on 1 or 2 properties, or some division of more properties, but access and continued operation possible. Facility may result in greater out-of-the way travel; however farm machinery has access to service roads with decreased safety concerns.
- Low: Little or no loss of property access. Farm fields retain reasonable size and shape.

i) Effect on farm woodlots.

Aerial photographs and field reconnaissance were used as sources of information to make an assessment of the potential impact of each alternative on any farm woodlots that may be present. A farm woodlot is defined as follows: Woodlots that for reasons of topography or inaccessibility cannot be farmed. These areas can provide the owner with a source of timber, fuel, fence posts and possibly valuable material for market. This indicator qualitatively assesses the potential impacts to this farm resource.

The indicator is assessed using the following definitions of potential impact:

- High: The majority or large portion of at least 2 woodlots will no longer be accessible or will be removed by the alternative.
- Moderate: Fragmentation of at least 2 woodlots, however, woodlot is still functional and accessible.
- Low: Edge effects only, woodlot is still functional and accessible or no impact expected.

j) Effect on capital investment in agricultural operations.

The potential for effect on capital investment in agricultural operations was measured qualitatively by using the following:

- High: Alignment severely affects at least 3 high capital investment operation. Includes speciality crops, nurseries, research facilities and/or dairy operations. **Operations may be lost and mitigation is not practicable.**
- Moderate: Alignment affects 1 - 2 operations(s) of high capital investment, or more if effects are easily mitigated. **No operations are likely to cease functioning.**
- Low: Effects to operations with high capital investment in specialty crops, or dairy are expected but are minor (i.e. edge effects).

k) Significant farm operation severances.

This indicator is based on the number of farm property severances representing the number of existing farm properties where farm fragmentation occurs as a result of a proposed highway alternative. A divided property is considered to be one where the proposed highway route crosses a property leaving land parcels on both sides of the proposed highway. This is not the total number of fragmented parcels. A farm operation is defined as property or group of properties actively farmed by one family, the land may be leased or owned.

Degree of impact (fragmentation) can be assessed based on the following criteria:

- High: More than 5 operations are divided, includes fragmented lands less than 10 hectares in size and/or viability of fragment is questionable due to location, access or awkward shape.
- Moderate: 3 – 5 properties divided, includes fragmented lands less than 10 hectares in size and/or viability of fragment is questionable due to location, access or awkward shape.
- Low: Less than 3 properties divided, no fragmented lands less than 10 hectares.

l) Significance of detrimental effects to ongoing viability of farm operations.

Indicator is concerned with the combination of potential impacts of inter-farm movement interference, degree of fragmentation and limitations to access.

This indicator is evaluated using the following:

- High: Three or more farm operations are affected to the extent that farm viability may be affected.
- Moderate: 2 to 3 farm operations may be affected to the extent that farm viability may be affected.
- Low: 0 - 2 operations may be affected to the extent that viability is compromised.

m) Significance of detrimental effects to ongoing viability of farm communities.

The potential for farm community disruption was rated qualitatively based on two considerations. The first is highway design where existing travel routes may have to be modified. The second relates to the following characteristics of farm communities:

- Farm families with common interests,
- Meeting areas, and
- Neighbours (awareness of each other and interaction between neighbours).

The indicator is assessed using the following:

- High: The alignment passes through an area where existing farm settlement remains intact as indicated by farm ownership and active farming. Access to community may be restricted.
- Moderate: Alignment is located in area where urban pressures are already in evidence as indicated by rural residential development, non-owner operated farms and good access will be maintained to remaining community.
- Low: Alignment will have minimal impact on farm community because it is located in a non-farm area along existing major highway or predominantly non-owner operated farm area.

As an additional qualitative measure of agricultural community effects, a ratio of owner-operated versus tenant-operated (leased) parcels affected by each alternative is provided. This measure represents the proportion of land currently used for agricultural purposes but that is owned by non-agricultural interests and may represent lands with potential for higher development pressure (that is, not likely long term agricultural land use).

Transportation

Traffic Operations

This Factor examines the ability of the alternative to relieve the transportation system deficiencies. Data Sources include existing traffic counts and future traffic forecasts.

Indicators

a) Level of Service

Level of Service measures the level of congestion on a roadway as a ratio of the forecast (or existing) volume to the capacity of the roadway. The Level of Service is represented as a letter from A to F, where A through D is acceptable volume, E is considered to be congested and F is volume is beyond capacity. At the 'planning stage' a road is typically designed to have a Level of Service not greater than the threshold between D and E. Level of Service for forecast years 2011 and 2016 were assessed.

b) Conflicts with Existing Intersections / Entrances

The indicator is a measure of the existing intersections and entrances within a length of the alternative. For the controlled access alternatives there would be no intersections or entrances. The fewer intersections / entrances for an alternative would translate to a lower potential for conflict or 'side friction'. Traffic operations would be better with fewer intersections /entrances.

c) Service Life

In general, the planning horizon for a roadway is approximately 20 years. This is because the forecast land use for most municipalities would not extend beyond the 20-year time frame. For the Highway 7 study, consideration of long range traffic forecasts beyond the 20 year horizon were developed (2028). The service life of the facility would be the approximate year when the growth in traffic would be approaching Level of Service F. For traffic volumes beyond 2028, growth would be extrapolated. Similarly, alternatives that would provide a very long service life would be shown as 'more than 30 years' (2030 +).

Safety

The Safety factor assesses the potential for conflicts with moving hazards such as farm equipment and vehicles entering the road from an intersection or driveway. Alternatives that would have a low potential for conflict would be considered best.

Indicators

a) Conflicts with Agricultural equipment

The movement of large agricultural equipment frequently occurs within the study area, particularly within the central rural section. The equipment can be wider than the standard lane and is therefore a potential hazard to other vehicles on the road. Alternatives that are not controlled access would have a high potential for conflict with agricultural equipment. Controlled Access alternatives would have no potential conflict because farm equipment is not permitted on controlled access highways.

b) Conflicts with Intersections / Entrances on through lanes

This indicator would assess the potential conflicts with intersections and entrances from a safety perspective.

c) Comparative Collision Rate

This indicator would assess the Provincial average collision rate for the alternative cross-sections.

Network Compatibility

This factor assesses the overall compatibility of the alternative within the network in terms of traffic operations, driver compatibility, staging, and future roadway and transit expansion.

Indicators

a) Effects on traffic operations on parallel / crossing roads

This indicator would assess the impact to traffic operations due to the potential diversion of traffic to a parallel route.

b) Driver comfort and expectation

An assessment of design consistency based on road type, cross-section, interchange configuration and transition areas.

c) Ability to stage implementation of the facility

This indicator would assess the ability to stage construction of the facility and the associated impacts such as disruption to emergency vehicles, potential for business loss, impacts to residences and delays.

d) Compatibility with future network

This indicator would assess the overall future network and how each alternative would fit into the network. The future network assumes that the Hanlon Expressway would be fully grade separated and that the extension of the Hanlon northerly is not precluded. The KWE would be assumed to be a ten lane facility.

e) Flexibility for future expansion

This indicator would assess the future ability of the facility to be upgraded with additional lanes or interchanges as required.

f) Ability to accommodate future transit

This indicator would assess the opportunity for transit to be integrated within and beyond the right of way. The bus technology assessed included mixed flow and dedicated bus lanes.