APPENDIX C

ASSESSMENT OF CONCEPTUAL DESIGN ALTERNATIVES

- C.1 – Screening of Long List of Alignment Alternatives
- C.2 – Detailed Assessment of Short-Listed Alignment Alternatives
APPENDIX C.1
SCREENING OF LONG LIST OF ALIGNMENT ALTERNATIVES
### SUMMARY ASSESSMENT MATRIX

<table>
<thead>
<tr>
<th>EVALUATION FACTOR</th>
<th>WEST</th>
<th>CENTRAL</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Environment</td>
<td>W1</td>
<td>C1</td>
<td>E1</td>
</tr>
<tr>
<td>Terrestrial Ecosystems</td>
<td>W2</td>
<td>C2</td>
<td>E2</td>
</tr>
<tr>
<td>No significant loss of natural vegetation. No significant impacts to wetlands.</td>
<td>W3</td>
<td>C3</td>
<td>E3</td>
</tr>
<tr>
<td>No alignments cross through vegetation communities of size or configuration that provide interior habitat function. Crossings use existing corridors or cross natural features at existing pinch or constriction points.</td>
<td></td>
<td>E4</td>
<td></td>
</tr>
</tbody>
</table>

#### EVALUATION FACTOR

- **Least Preferred**
- **Most Preferred**

#### ALIGNMENT ALTERNATIVE

<table>
<thead>
<tr>
<th>WEST</th>
<th>CENTRAL</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E1</strong></td>
<td>Crosses regulated SAR habitat.</td>
<td>Avoids regulated SAR habitat.</td>
</tr>
<tr>
<td><strong>E2</strong></td>
<td>Crosses regulated SAR habitat.</td>
<td>Crosses regulated SAR habitat.</td>
</tr>
<tr>
<td><strong>E3</strong></td>
<td>Crosses regulated SAR habitat.</td>
<td>Avoids regulated SAR habitat.</td>
</tr>
<tr>
<td><strong>E4</strong></td>
<td>Crosses regulated SAR habitat.</td>
<td>Crosses regulated SAR habitat.</td>
</tr>
</tbody>
</table>

- **No significant loss of natural vegetation.**
- **No significant impacts to wetlands.**
<table>
<thead>
<tr>
<th>EVALUATION FACTOR</th>
<th>WEST</th>
<th>ALIGNMENT ALTERNATIVE</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W1</td>
<td>C1</td>
<td>E1</td>
</tr>
<tr>
<td></td>
<td>(SWD7-2): Impacts to a hedge row located at south of the study area.</td>
<td>disruption of wetland hydrology, negatively affecting remaining areas to the east.</td>
<td>located west of Reidel Drive. Alignment likely to have direct impacts. Some potential disruption of wetland hydrology, negatively affecting remaining areas to the east.</td>
</tr>
<tr>
<td></td>
<td>W2</td>
<td>C2</td>
<td>E2</td>
</tr>
<tr>
<td></td>
<td>W3</td>
<td></td>
<td>E3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C1</td>
<td>E4</td>
</tr>
<tr>
<td>Groundwater Resources</td>
<td>No obvious issues. Within Regional Recharge Area. Intersects relatively small cross-section of</td>
<td>No obvious issues. Within Regional Recharge Area but avoids most sensitive</td>
<td>No obvious issues. Within Regional Recharge Area. Intersects relatively small cross-section of</td>
</tr>
<tr>
<td>Aquatic Ecosystems</td>
<td>Avoids all potential impacts to Blair Creek (no new crossing). No direct or indirect impact to fish/fish habitat. No loss of riparian vegetation.</td>
<td>New crossing of Blair Creek, resulting in indirect impact to fish/fish habitat (ephemeral reach of Blair Creek within the Blair Creek Swamp PSW). Loss of riparian vegetation (greater than W1). Overall, no HADD of fish/fish habitat is expected as a result of the works, with the application of mitigation. Potential to disrupt contribution to downstream flow (see Groundwater).</td>
<td>New crossing of Blair Creek, resulting in direct impact to fish/fish habitat (ephemeral reach of Blair Creek where the flow regime changes from ephemeral to permanent within Blair Creek crossing. Overall, no HADD of fish/fish habitat is expected as a result of the works, with the application of mitigation. Potential to disrupt contribution to downstream flow (see Groundwater).</td>
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<td></td>
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</tbody>
</table>
### EVALUATION FACTOR

<table>
<thead>
<tr>
<th>WEST</th>
<th>CENTRAL</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>C1</td>
<td>E1</td>
</tr>
<tr>
<td>W2</td>
<td>C2</td>
<td>E2</td>
</tr>
<tr>
<td>W3</td>
<td></td>
<td>E3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>E4</td>
</tr>
</tbody>
</table>

#### recharging area.
- Lowest impact option of all possible combinations.
- Greenbelt, minor water interception issues. Intercepts relatively small area in northern portion of most sensitive recharge area. Proximity of some additional concerns.
- Greenbelt, minor water interception issues. Intercepts relatively small area in northern portion of recharge area. Proximity of smaller portions of wetland to the north and south of alignment in at least 4 locations may result in additional concerns.
- Greenbelt, minor water interception issues. Divides most sensitive recharge area into two sections; therefore, possible issues with recharge/discharge considerations. Proximity of very small sub-portions of wetland to the north and south in one area may result in additional concerns.
- Out within existing Reidel Drive corridor, and passes just south of man-made farm pond. Minor water interception issues; possible issues with recharge/discharge considerations. Proximity of smaller portions of wetland to the north or south of alignment in at least 2 locations may result in additional concerns. Has relatively long run through most sensitive recharge area.

#### Surface Drainage

- Two (2) new crossings of Blair Creek sub-catchment areas will be required. Some potential change of hydrology parameters; affecting remaining areas to the east.
- Three (3) new crossings of Blair Creek sub-catchment areas will be required. Some potential impacts to the regulated floodplain. Some potential change of hydrology parameters, affecting remaining areas to the east.
- Three (3) new crossings of Blair Creek sub-catchment areas will be required. Some potential disruption of wetland hydrology. Some potential impacts to the regulated floodplain. Some potential change of hydrology parameters, affecting remaining areas to the east.
- Three (3) new crossings of Blair Creek sub-catchment areas will be required. Some potential disruption of wetland hydrology. Some potential impacts to the regulated floodplain. Some potential change of hydrology parameters, affecting remaining areas to the east.
- Reconstructed existing crossing Blair Creek crossing. Some potential disruption of wetland hydrology. Some potential impacts to the regulated floodplain. Some potential change of hydrology parameters, affecting remaining areas to the east.
- New crossing Blair Creek sub-catchment areas will be required. Some potential disruption of wetland hydrology. Some potential impacts to the regulated floodplain. Some potential change of hydrology parameters, affecting remaining areas to the east.
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- New crossing Blair Creek sub-catchment areas will be required. Some potential disruption of wetland hydrology. Some potential impacts to the regulated floodplain. Some potential change of hydrology parameters, affecting remaining areas to the east.

#### SUMMARY

- W1 is the preferred option with respect to potential impacts to natural heritage features because it avoids crossings of the Blair Creek corridor (including the major Dry Fresh Sugar Maple-Beech Forest (FOD 5-2) at the west end, the Blair Swamp Provincially Significant Wetland (PSW) and Species at Risk habitat regulated area) and the most sensitive groundwater recharge area. It would also create less of a barrier to wildlife movement because it does not cross contiguous natural features associated with the creek corridor.
- Central and West alternatives that involve new crossings of the Blair Creek corridor are slightly preferred to more easterly ones with respect to potential impacts to aquatic resources because the creek is more ephemeral/intermittent in that area. E1 is the only alternative that would displace the pond north of Stauffer Drive.
- Alternatives with alignments close to and parallel with the new corridor (W3 and C2) may be more problematic with respect to potential impacts to the groundwater regime and flood plain.
### EVALUATION FACTOR

<table>
<thead>
<tr>
<th>Socio-Economic Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Use</strong></td>
</tr>
<tr>
<td>Incompatible with COARK/MOW land use policies (encroachment on Protected Countryside in Rural Areas designation). Potential pressure for expansion into Rural Areas designation. Displaces some prime (Class 1-3; Specialty Crop) agricultural land.</td>
</tr>
</tbody>
</table>

| **Communities**             |
| Severs all 3 properties (working farms). | Severs all 4 affected properties (working farms). | Severs 2 properties (working farms). | Severs 2 properties (working farms). | Least impact to existing community/property fabric. Severs 1 property (working farm) occupies full length of existing Reidel Drive. Displaces one residence. | Severs 2 properties (working farms). | Severs 2 properties (working farms). |

| **Noise**                   |
| Potential sound level increase for 1 existing noise sensitive receptor. | Potential sound level increase for 1 existing noise sensitive receptor. | Potential sound level increase for 2 existing noise sensitive receptors. | Potential sound level increase for 2 existing noise sensitive receptors. | Potential sound level increase for 1 existing noise sensitive receptor. Assumes Monika's B&B is displaced. | Potential sound level increase for 2 existing noise sensitive receptors. | Potential sound level increase for 2 existing noise sensitive receptors. |

### SUMMARY
- Alternative W1 is the least compatible with City of Kitchener and Region of Waterloo land use policy initiatives with respect to protection of agricultural land and rural areas. The further west of the designated Countryside Line (Reidel Drive) an alignment is, the more pressure there would be for expansion of the urban area into designated Protected Countryside in the Prime Agricultural Area and the Rural Area. E1 exhibits a high degree of compatibility because it is the alignment identified in the existing City of Kitchener Official Plan and appears to have been used to define the north-south segment of the Countryside Line in this area.
- W1 would take the most land with highest capability to support agricultural uses (Class 1-3; Specialty Crop) out of production. Alignments that utilize the existing Reidel Drive corridor to the largest degree (E1 and E2) would displace the least agricultural land. Other East alignments (E3 and E4) would affect only a nominal amount of prime agricultural land (mostly Class 4-7 land).
- Impacts to the agricultural community are generally similar for all alternatives, based on the number of severances, with E1 creating only one severance. Alternative C2 makes good use of existing property lines and existing Reidel Road to minimize severances. E1 represents the highest potential for displacement of the existing bed and breakfast/farm operation north of Stauffer Drive due to proximity to the buildings and encroachment on the associated outdoor living areas.
**Heritage Resources**

- No known impacts to identified cultural heritage resources.

**Archaeological Resources**

- No concerns at this time. Possible presence of yet unidentified archaeological sites in this alignment (proximity to water, sandy soil, early historical transportation corridor).

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**EVALUATION FACTOR**

- 4E

**SUMMARY**

- Alignments W1 and W2 exhibit the least potential for disturbance of heritage resources due to their distance from existing/former historic transportation corridors and limited impact to the Blair Creek corridor.

- Alignments that will significantly alter the existing Reidel Drive cultural heritage landscapes/corridor (W3, C2, E1, E2) are less preferable than the more westerly options.

- Alignment E1 is least preferred due to its potential to displace the century farm on Stauffer Drive, combined with its impacts on Reidel Drive.
### Transportation/Utilities

<table>
<thead>
<tr>
<th>Transportation Network/Infrastructure</th>
<th>WEST</th>
<th>CENTRAL</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil to minimal traffic diversion from Huron Road/ Homer Watson Blvd. and New Dundee Road.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Least traffic volumes from full build-out Brigadoon and Doon South Communities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forecast traffic volumes will not warrant four-lane cross-section.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest traffic infiltration onto the neighbouring road network within existing Brigadoon Community.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nominal traffic diversion from Huron Road/ Homer Watson Blvd. and New Dundee Road. Lower traffic volumes from full build-out Brigadoon and Doon South Communities. Forecast traffic volumes might not warrant four-lane cross-section. High traffic infiltration onto the neighbouring road network within existing Brigadoon Community.

### Municipal Services/Utilities

<table>
<thead>
<tr>
<th>Municipal Services/Utilities</th>
<th>WEST</th>
<th>CENTRAL</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services along future Strasburg Road will most likely not be fully utilized as there are fewer proposed subdivisions abutting/close to the alignment. Services/utilities to be extended highest distance along the required roadway extensions, resulting in additional long term maintenance and replacement costs. Extensions of watermain may require additional network modelling, and may not be consistent with current proposals to change the Zones Kit 2W and Kit 4.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Services along future Strasburg Road will be relatively under-utilized, as the proposed alignment is not in close proximity to future developments. Services/utilities to be extended longer distance along the required roadway extensions, resulting in additional long term maintenance and replacement costs. Extensions of watermain may require additional network modelling, and may not be consistent with current proposals to change the Zones Kit 2W and Kit 4. | | | |

| Services along future Strasburg Road will be relatively under-utilized, as the proposed alignment is not in close proximity to future developments. Services/utilities to be extended longer distance along the required roadway extensions, resulting in additional long term maintenance and replacement costs. Extensions of watermain may require additional network modelling, and may not be consistent with current proposals to change the Zones Kit 2W and Kit 4. | | | |

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| Services along future Strasburg Road will be utilized by the proposed Huron Woods Subdivision (South of Huron Road and West of future Strasburg Road) and by the Stauffer Woods Subdivision (north of New Dundee Road and east of future Strasburg Road. | | | |

| Services along future Strasburg Road will be utilized by the proposed Huron Woods Subdivision (South of Huron Road and West of future Strasburg Road) and by the Stauffer Woods Subdivision (north of New Dundee Road and east of future Strasburg Road. | | | |

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**EVALUATION FACTOR**

<table>
<thead>
<tr>
<th>WEST</th>
<th>ALIGNMENT ALTERNATIVE</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>Additional pumping or pressure reduction valves may be required. Future sanitary sewer outlet elevation may be impacted, as the sewer is moved further west from the outlet.</td>
<td>Additional pumping or pressure reduction valves may be required. Future sanitary sewer outlet elevation may be impacted, as the sewer is moved further west from the outlet.</td>
</tr>
<tr>
<td>W3</td>
<td>Moderate risk of encountering contaminated soil.</td>
<td>Moderate risk of encountering contaminated soil.</td>
</tr>
</tbody>
</table>

**SUMMARY**

- Alignment W1 is least preferred because it has the least potential to meet traffic service objectives and will result in the greatest impacts to existing local roads. Traffic from new development in Doon South will not use the new roadway to the intended level and traffic from that area will infiltrate existing neighbourhoods to the north.
- Alternatives E1 and E2 are the most likely to meet traffic service objectives, including diverting traffic from Homer Watson Boulevard and Huron Road.
- Similarly, the West alignments are least compatible with City of Kitchener and Region of Waterloo municipal servicing objectives and plans, requiring extension and additional infrastructure to properly serve the Doon South Community, whereas Alignments E1 and E2 would best meet City and Regional objectives.

**Financial/Technical**

<table>
<thead>
<tr>
<th>Financial</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction cost: approximately $12M. Approximate property requirement: 7.65 ha.</td>
<td>Moderate risk of encountering contaminated soil. Feasible to provide acceptable road gradient balancing cut and fill volume. Rolling topography. Exclusively private property acquisition.</td>
</tr>
<tr>
<td>Construction cost: approximately $12M, but excludes cost to buy out B&amp;M's farm. Approximate property requirement: 5.76 ha. Moderate maintenance cost.</td>
<td>Moderate risk of encountering contaminated soil. Feasible to provide acceptable road gradient balancing cut and fill volume. Rolling topography. Exclusively private property acquisition.</td>
</tr>
</tbody>
</table>

*Note: The table contents are extracted from the text and formatted for readability.*
<table>
<thead>
<tr>
<th>EVALUATION FACTOR</th>
<th>WEST</th>
<th>CENTRAL</th>
<th>EAST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W1</td>
<td>W2</td>
<td>W3</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
<td>E1</td>
</tr>
<tr>
<td></td>
<td>E2</td>
<td>E3</td>
<td>E4</td>
</tr>
</tbody>
</table>

**SUMMARY**

- Alignments W1 and W2 are the least preferred alternatives with respect to construction cost, primarily because of the greater length of east-west collector roads (Robert Ferrie Drive and Street A in Doon South) and the associated services carried in the those corridors. W1 would also have the highest operations/maintenance costs.
- Alignment E1 has the least construction cost, but the City would likely incur significant costs associated with a full buy-out of the bed and breakfast/farm operation on Stauffer Drive (not estimated here).
- The construction costs of the remaining alternatives would be relatively similar.
- The technical aspects of the alternatives are generally similar, but E1 may be the least complex to construct with respect to accessibility (greatest use of an existing road allowance - Reidel Drive).

**COMPREHENSIVE SUMMARY COMMENTS**

<table>
<thead>
<tr>
<th>RECOMMENDED FOR FURTHER STUDY BASED ON CAPABILITY TO MINIMIZE FULL RANGE OF ENVIRONMENTAL IMPACTS</th>
<th>NOT RECOMMENDED FOR FURTHER STUDY</th>
<th>NOT RECOMMENDED FOR FURTHER STUDY</th>
<th>RECOMMENDED FOR FURTHER STUDY BASED ON A BALANCE OF ENVIRONMENTAL AND TRANSPORTATION SERVICE CONSIDERATIONS</th>
<th>NOT RECOMMENDED FOR FURTHER STUDY</th>
<th>RECOMMENDED FOR FURTHER STUDY BASED ON A BALANCE OF ENVIRONMENTAL AND TRANSPORTATION SERVICE CONSIDERATIONS</th>
</tr>
</thead>
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</tbody>
</table>

**Legend:**

- Least Preferred
- Most Preferred
APPENDIX C.2
DETAILED ASSESSMENT OF SHORT-LISTED ALIGNMENT ALTERNATIVES
### Natural Environment (including Species at Risk)

<table>
<thead>
<tr>
<th>Terrestrial Ecosystems</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wetlands</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Encroachment on PSWs or other wetlands (area; classification/quality, relative extent in relation to entire complex)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- No ELC Wetland removals (1)</td>
</tr>
<tr>
<td>- 0.62 ha of ELC Wetland removals (4)</td>
<td>- 0.24 ha of ELC Wetland removals (2)</td>
<td>- 0.35 ha of ELC Wetland removals (3)</td>
<td>- 0.73 ha of ELC Wetland removals (5)</td>
<td>- No PSW removals (1)</td>
<td></td>
</tr>
<tr>
<td>- Primarily Willow Organic Thicket Swamp</td>
<td>- Primarily Willow Organic Thicket Swamp</td>
<td>- Primarily Willow Organic Thicket Swamp</td>
<td>- Primarily Broad-leaved Sedge Organic Meadow Marsh</td>
<td>- No PSW removals (1)</td>
<td></td>
</tr>
<tr>
<td>- 0.60 ha of PSW removals constitute 1.2% of total Blair Creek PSW Complex (5) (based on MNR data)</td>
<td>- 0.20 ha of PSW removals constitute 0.4% of total Blair Creek PSW Complex (3) (based on MNR data)</td>
<td>- 0.25 ha of PSW removals constitute 0.5% of total Blair Creek PSW Complex (4) (based on MNR data)</td>
<td>- 0.13 ha of PSW removals constitute 0.3% of total Blair Creek PSW Complex (2) (based on MNR data)</td>
<td>- No PSW removals (1)</td>
<td></td>
</tr>
</tbody>
</table>

| **Designated Environmentally Sensitive Policy Areas / Areas of Natural and Scientific Interest** |    |    |    |    |    |
| - Encroachment on ESPAs/ANSlS (area; relative extent in relation to entire designated area) | - Route passes close to Stauffer Woods ESPA #33. | - No encroachment on Designated ESPA/ANSI | - No encroachment on Designated ESPA/ANSI | - No encroachment on Designated ESPA/ANSI | - No encroachment on Designated ESPA/ANSI |

| **Vegetation communities** |    |    |    |    |    |
| - Encroachment on vegetation communities (area, type, quality, composition, relative extent; and potential for mortality, stress, composition change) | - 1.01 ha of Cultural vegetation removals (4) | - 0.64 ha of Cultural vegetation removals (2) | - 0.88 ha of Cultural vegetation removals (3) | - 1.64 ha of Cultural vegetation removals (5) | - No Cultural removals (1) |
| - 0.18 ha of Forest community removals (2) | - 0.25 ha of Forest community removals (3) | - 0.25 ha of Forest community removals (3) | - 0.25 ha of Forest community removals (3) | - 0.08 ha of Forest community removals (1) – Woodlot affected is considered significant forest during assessment, but impacts limited to small portion of northwest edge | - No PSW removals (1) |
| - 0.38 ha of Hedgerow removals (3) | - 0.57 ha of Hedgerow removals (4) | - 0.20 ha of Hedgerow removals (1) | - 0.33 ha of Hedgerow removals (2) | - 0.68 ha of Hedgerow removals (5) | - No PSW removals (1) |

| **Significant vegetation species (including Species at Risk)** |    |    |    |    |    |
| - Effects on vegetation SAR or species of local/regional significance | - Potential to impact a Federally and Provincially protected Species at Risk (Butternut) west of Reidel Drive | - None identified | - None identified | - None identified | - None identified |

Notes: Numbered ranks of vegetation removals for each category are ranked from (1) lowest impact to (5) highest impact

ELC Wetland and PSW Wetland removals are not additive, and are derived from separate data sets
EVALUATION DISCUSSION FOR TERRESTRIAL (VEGETATION) CRITERIA

Terrestrial vegetation variables under consideration include:

**Wetlands**
- Encroachment on PSWs or other wetlands (area; classification/quality, relative extent in relation to entire complex)

**Designated ESPAs/ANSIs**
- Encroachment on Environmentally Sensitive Policy Areas / Areas of Natural and Scientific Interest (area; classification/quality, relative extent in relation to entire designated area)

**Vegetation Communities**
- Encroachment on vegetation communities (area, type, quality, composition, relative extent; and potential for mortality, stress, composition change)

**Significant Vegetation Species (including Species At Risk)**
- Effects on vegetation SAR or species of local/regional significance

**Wetlands**

Wetlands associated with Blair Creek form part of the Roseville-Cedar Creek Complex Provincially Significant Wetland (PSW), which runs directly through the study area, crossing Reidel Drive approximately 200 m south of the intersection with Stauffer Drive and continuing to the east. This area is a dendritic network of upland and lowland forest systems often paralleling Bechtel Bowman Creeks located in the City of Cambridge/Township of North Dumfries. A significant portion of fine mixed swamp forest supports trout quality sections of Bowman Creek. Small sections of dense White Pine and cedar swamp occur intermittently, one of which contains a very dense Skunk Cabbage population.

In addition to the designated PSW, there are a number of small unevaluated wetlands located nearby, most of which share a hydrologic connection to the overall wetland complex. In general wetland communities within the study are a combination of thicket swamp and open meadow marsh patches.

It is important to note that the removals associated with the ELC wetland designations and the MNR PSW are not additive. They are derived from two separate datasets of the same area, and as result there is significant overlap or extension/reduction of areas in a number of locations.
depending on what was observed during the field program. Given the hydrologic connectivity observed in the field between the officially designated PSW, and the wetland units delineated as part of the ELC work program, all wetland removals were considered significant in terms of impacts.

Encroachment on PSWs or other wetlands

**E2** – This alternative has the highest amount of designated PSW removals (0.6 ha) owing to crossing the PSW at the widest area. It also impacts ELC wetland communities along Reidel Drive to the south, which, while not part of the PSW, likely contribute to function of the overall system through hydrologic linkage. Overall it is worst among the eastern alignment alternatives with respect to wetlands

**E3 and E4** – have similar amounts of PSW (0.2 ha, 0.25 ha) and overall wetland removals (0.24 ha, 0.35 ha). In each case these alternatives involve lower amounts of wetland removals than E2 due to crossing the PSW at a narrow area (E3 is slightly superior in this regard), as well as avoiding wetland areas further south along Reidel Drive. Overall E3 has the lowest wetland removals of any of the eastern alignment options.

**C2** – has a smaller amount of designated PSW removal (0.13 ha) than any of the eastern alignment options since it crosses Blair Creek at a gap in the PSW designation. However, it has the largest amount of ELC wetland removals (0.73 ha), owing primarily to the removal of the meadow marsh and pond feature located at the west end of Stauffer Drive. Given the extent of wetland removals this alignment is considered equal to E2.

**W1** – does not involve the removal of any wetland community and therefore is the preferred option in this regard.

In summary, given the significance of designated PSW, this may be the primary consideration in assessing terrestrial vegetation impacts. In this respect, **Alignment W1 avoids wetland removals and the preferred option**. Alignments E3, and E4 have the smallest wetland removals among the other alignments, with E3 being slightly preferred to E4. Alignments E2, and C1 exhibits the highest amount of wetland removals and are the least preferred options.
Designated ESPAs/ANSIs

Encroachment on ESPAs/ANSIs

There is one ESPA within the study area. The Stauffer Woods ESPA (recognized as a Core Environmental Feature by the Region’s Official Plan) is located at the south east of the intersection of Reidel Drive and Stauffer Drive.

Stauffer Woods ESPA is avoided by all alignments; however, E2 passes close to the intersection of Reidel Drive and Stauffer Drive and consequently is the least preferred option in this regard. No other alignments impact this designated area.

The woodlot at the west end of the study area has not been designated as an ESPA, but is listed as a Core Environmental Feature. It has been evaluated against MNR’s Natural Heritage Reference Manual’s criteria for Significant Woodlots, and is found to meet the criteria. W1 removes a small amount (0.08 ha) of this woodlot; however, these impacts are limited to removal of forest edge and are unlikely to have any significant impact on the overall function of the woodlot in terms of interior habitat.

Vegetation Communities

Encroachment on Vegetation Communities

Impacts to vegetation communities (not including wetlands) have been separated into forest communities, cultural communities, and hedgerows based on the ELC field program. Removals for each type have been ranked among alternatives with 1 representing the lowest amount of removals for a given category, and higher numbers representing larger amounts of removals.

E2: The construction of the first eastern route alternative will result in 2.21 ha of vegetation removals consisting of 1.01 ha of cultural vegetation (4), 0.18 ha of forest community (2), and 0.38 ha of hedgerow (3). The cultural vegetation removals are of limited significance due to the previously disturbed nature of these communities. The forest removals are considered to be of moderate significance. Though the forest communities affected are of lower quality, with few mature specimens, they are associated with the slopes of valley containing the PSW and provide a good buffer between the wetland and agricultural activities to the north and south. Hedgerow removals are of minor significance from a vegetation standpoint due to the presence of some significant trees. This route alternative also has the potential to impact a butternut located west of Reidel Drive which is protected by Federal and Provincial legislation.
E3: The construction of the second eastern route alternative will result in 1.71 ha of vegetation removals consisting of 0.64 ha of cultural vegetation (1), 0.25 ha of forest community (3), and 0.57 ha of hedgerow (4). The cultural vegetation removals are of limited significance due to the previously disturbed nature of the communities. The forest removals are considered to be of moderate significance. Though the forest communities affected are of lower quality, with few mature specimens, they are associated with the slopes of valley containing the PSW and provide a good buffer between the wetland and agricultural activities to the north and south. Hedgerow removals are of minor significance from a vegetation standpoint due to the presence of some significant trees.

E4: The construction of the second eastern route alternative will result in 1.51 ha of vegetation removals consisting of 0.68 ha of cultural vegetation (2), 0.25 ha of forest community (3), and 0.20 ha of hedgerow (1). The cultural vegetation removals are of limited significance due to the previously disturbed nature of the communities. The forest removals are considered to be of moderate significance. Though the forest communities affected are of lower quality, with few mature specimens, they are associated with the slopes of valley containing the PSW and provide a good buffer between the wetland and agricultural activities to the north and south. Hedgerow removals are of minor significance from a vegetation standpoint due to the presence of some significant trees.

C2: The construction of the central route alternative will result in 2.95 ha of vegetation removals consisting of 1.64 ha of cultural vegetation units (5), 0.25 ha of forest (3), and 0.33 ha of hedgerow (2). The cultural vegetation removals are considered to be of limited significance due to the prevalence of non-native species. The forest removals are considered to be of moderate significance. Though the forest communities affected are of lower quality, with few mature specimens, they are associated with the slopes of valley containing the PSW and provide a good buffer between the wetland and agricultural activities to the north and south. Hedgerow removals are of minor significance from a vegetation standpoint due to the presence of some significant trees.

W1: The construction of the western route alternative will result in 0.76 ha of vegetation removals, consisting of 0.08 ha of Sugar Maple Beech forest (1), and 0.68 ha of hedgerow (5). This is the smallest amount of total vegetation removal are of any of the short listed alternatives. These are edge removals along the large mature woodlot at the west of the study area. This woodlot qualifies as a Significant Woodlot when evaluated against MNR’s Natural Heritage Reference Manual, but given that the forest removals represent less than 1% of the overall woodlot, and are limited to the edge they are of minor significance. There is no fragmentation of the woodlot, and the loss of interior forest habitat is minimized. Hedgerow removals are the highest among the route alternatives and include the removal of one significant tree.
Future Collector Roads: Removals associated with the future Robert Ferrie Drive and Blair Creek Drive extensions to Strasburg Road vary depending on the route alternative, but are limited entirely to hedgerow and cultural meadow. Extending these collector roads to the W1 alternative would result in an additional 0.11 ha of hedgerow removal and 0.05 ha of cultural meadow removal. For the C2 alternative an additional 0.02 ha of hedgerow removals would result, while an additional 0.03 ha of hedgerow would be removed by extending the collector roads to the E3 and E4 alternatives. Additional cultural community removals are limited to an additional 0.05 ha of cultural meadow associated with extending the collector roads to the W1 alignment alternative.

In summary W1 results in the lowest amount of overall vegetation removals, and while the forest removals associated with this alignment alternative come from a Significant Woodlot, they do not represent a significant impact due to their location. From a vegetation community removals standpoint **W1 is the preferred alternative.** All other alignments are broadly similar in terms of removals. South of the Blair Creek crossing E3 is slightly less preferred due to the elimination of a hedgerow located near its intersection with New Dundee Road which is avoided by all other alternatives.

**Significant Vegetation Species**

Only one Species At Risk was identified within the study area, this is a butternut (*Juglans Cinerea*) located west of Reidel Drive near the Blair Creek crossing. **E2 is the only alignment alternative which will impact this tree, and as such is the least preferred option in this regard.**

**Cumulative Effects**

While W1 is the preferred alternative in terms of terrestrial vegetation communities, owing to its avoidance of wetlands, and limited overall removals it is worth examining non direct effects to these communities as well. Development of any of the western routes (W1, and to a lesser extent C2, E3, and E4) could increase development pressures currently un-allowed west of Reidel Drive. Urban development adjacent to the major system components described above could lead to further degradation of the system west of Reidel Drive. In these terms W1 would be **the least preferred option** as it maximized exposure of both the wetland and the woodlot to future impacts.
### Natural Environment

<table>
<thead>
<tr>
<th>Terrestrial Ecosystems (Wildlife)</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impacts to interior habitat, such as fragmentation.</strong></td>
<td>The northern end of the alignment may result in edge or off-site effects from the road that may extend into interior habitat. Common for all routes. No additional impacts to interior habitat anticipated.</td>
<td>The northern end of the alignment may result in edge or off-site effects from the road that may extend into interior habitat. Common for all routes. No additional impacts to interior habitat anticipated.</td>
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</tr>
<tr>
<td><strong>Impacts to animal movement corridor SAR habitat, corridors between critical habitat features, such as upland/breeding ponds.</strong></td>
<td>Directly intersects animal movement corridors, including those that may serve as dispersal habitat or corridor for SAR. Directly intersects animal movement corridors, including those that may serve as dispersal habitat or corridor for SAR. Directly intersects animal movement corridors, including those that may serve as dispersal habitat or corridor for SAR. Directly intersects animal movement corridors, including those that may serve as dispersal habitat or corridor for SAR.</td>
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<td>Avoids intersecting Blair Creek corridor and SAR habitat, and the associated animal movement corridors.</td>
<td></td>
</tr>
<tr>
<td><strong>Increased animal-vehicle conflicts.</strong></td>
<td>All of these alternatives cross existing contiguous vegetated corridors associated with Blair Creek tributary. SAR habitat, and may include potential dispersal habitat for SAR species. The area is also identified as a potential risk for animal-vehicle conflicts.</td>
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<td>Some potential for animal-vehicle conflicts, as a result of new road in open agricultural land. Animal-vehicle conflicts should be less than for routes that intersect established corridors (such as along watercourses, riparian vegetation, minor valleys).</td>
</tr>
<tr>
<td><strong>Construction disturbance related impacts to breeding timing windows or habitat for birds/frogs.</strong></td>
<td>Vegetation removal moderate to high; high level of breeding frog activity where features are adjacent to the Reidel Drive corridor.</td>
<td>Vegetation removal lower than E2 and C2, and away from areas with more frog breeding activity. Some disturbance to amphibian breeding habitat possible in wetlands along creek corridor.</td>
<td>Vegetation removal low-moderate compared to E2 and C2. Some disturbance to amphibian breeding habitat correlated with large number of breeding frogs.</td>
<td>Limited to impacting the edge of forest communities and hedgerows for direct removal of vegetation. Disturbance is limited to breeding birds as no amphibian breeding habitat identified in vicinity of route.</td>
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</tr>
<tr>
<td><strong>Direct habitat loss associated with road footprint, and indirect habitat effects associated with road effects that extend into habitat.</strong></td>
<td>Slightly increased amount of vegetation removal (over option E3) associated with footprint. Indirect effects similar to options E3, E4 and C2.</td>
<td>Slightly increased amount of vegetation removal associated with footprint. Indirect effects similar to options E2, E4 and C2.</td>
<td>Slightly increased amount of vegetation removal (over option E3) associated with footprint. Indirect effects similar to options E2, E3 and C2.</td>
<td>Largest amount of direct habitat loss associated with vegetation removal and also naturalized pond that is used by multiple species of frog. Indirect effects similar to options E2, E3 and E4.</td>
<td>Very limited vegetation removal at woodlot corners and hedgerows. Indirect habitat impacts have greater implications for extension into the larger woodlot units, where effects may extend 100 or more into larger woodlots.</td>
</tr>
<tr>
<td><strong>Cumulative impacts to these wildlife features/functions associated with long term land use scenario as the area transitions from rural to urban residential/commercial etc.</strong></td>
<td>Least implications for potential for area to be brought into urban area line (or extension of countryside line). Keeps road limit at western edge of future urban residential development at Reidel Drive.</td>
<td>Least implications for potential for area to be brought into urban area line (or extension of countryside line). Keeps road limit at western edge of future urban residential development at Reidel Drive.</td>
<td>Least implications for potential for area to be brought into urban area line (or extension of countryside line). Keeps road limit at western edge of future urban residential development at Reidel Drive.</td>
<td>Intermediate between E2 and W1</td>
<td>Implication for cumulative impacts may increase if countryside line is extended to this route. Level of impacts would be related to development type, with rear lots adjacent to Core environmental features posing impacts associated with encroachment, invasive species, dog/cat disturbance, increased human use of core feature.</td>
</tr>
</tbody>
</table>

**Note:**
- **Natural Environment**
- **Wildlife Habitat**
- **Environmental Study Report**
- **Appendix C.2 – Detailed Assessment of Short-Listed Alignment Alternatives**
- **Draft April 2012**

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**Environmental Study Report**

**Appendix C.2 – Detailed Assessment of Short-Listed Alignment Alternatives**

**Draft April 2012**

**Strasburg Road Extension**

**From North of Stauffer Drive to New Dundee Road**

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**Natural Environment**

- **Terrestrial Ecosystems (Wildlife)**
- **Natural Environment**
- **Wildlife Habitat**
- **Environmental Study Report**
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**Appendix C.2 – Detailed Assessment of Short-Listed Alignment Alternatives**

**Draft April 2012**

**Strasburg Road Extension**

**From North of Stauffer Drive to New Dundee Road**
Alignment E2 crosses the smallest area footprint of regulated SAR habitat, reflecting a smaller footprint to construct across Blair Creek corridor.

E2 directly intersects the vegetated corridor of Blair Creek and an identified dispersal corridor for SAR species, but also a local and resident wildlife movement corridor. Existing roadkill patterns based on LGL Ltd field investigations indicate that amphibians are at risk moving across the existing Reidel Drive at the creek, but also in areas where wetland pockets occur adjacent to Reidel Drive (as indicated in orange arrows in the screen cap below).

E2 may also serve as a new barrier between the dug agricultural pond at the B&B to the wetland unit to the northeast, or to communities to the southeast (this is also common to E3 and E4).

E3 northern alignment coincides with E2, and may result in barrier effects at B&B pond to the northeast, and to the communities to the southeast.

Direct habitat loss and indirect habitat loss associated with E2, E3 northern alignment coincides with E2 and may result in barrier effects at B&B to northeast and to the southeast, same as for options E2 and E3.

Direct habitat loss is measured at 0.66 ha of wetland and 0.25 ha of forest habitat. A slightly higher amount of wetland associated with the Blair Creek corridor is impacted by this option.

This option has slightly more direct wetland removal impacts than Alignment E3 and is therefore 3rd in preference from a wildlife perspective.

Direct habitat loss and indirect habitat loss are similar to E2 in the northern portion. In the southern portion, direct habitat loss includes 0.44 ha of wetland and 0.25 ha of forest habitat.

Due to the reduction in wetland habitat impacted for this route, it is the 2nd preferred from a wildlife perspective. 2nd to W1.

Direct habitat loss associated with E2, E3 crosses the Blair Creek corridor with same functions as identified for E2. E3 provides some opportunities to shift away from existing roadkill areas, but may have an increase in impacts shifting closer to the online pond/wetland feature on the tributary to Blair Creek.

E4 northern alignment coincides with E2 and may result in barrier effects at B&B to northeast and to the southeast, same as for options E2 and E3.

Direct habitat loss is measured at 0.66 ha of wetland and 0.25 ha of forest habitat. A slightly higher amount of wetland associated with the Blair Creek corridor is impacted by this option.

This option has slightly more direct wetland removal impacts than Alignment E3 and is therefore 3rd in preference from a wildlife perspective.

Direct habitat loss and indirect habitat loss are similar to E2 in the northern portion. In the southern portion, direct habitat loss includes 0.44 ha of wetland and 0.25 ha of forest habitat.

Due to the reduction in wetland habitat impacted for this route, it is the 2nd preferred from a wildlife perspective. W1 alignment avoids regulated habitat for SAR. This alignment further avoids intersection of the Blair Creek corridor and the contiguous vegetation communities. The alignment poses a slightly lower risk to animal movement corridor impacts, as great movement of resident animals is anticipated to occur within the minor valley and vegetated system of Blair Creek. Notwithstanding, there is diffuse animal movement northwesterly and westerly within the agricultural fields, and animal-vehicle conflicts are still likely to occur.

The option reduces construction disturbance related to sensitive timing windows for birds or amphibians, as it is outside of existing habitat features and has limited vegetation removal. Proximity to core features, and hedgerow removal, may result in some disturbance to resident and breeding birds. No amphibian breeding habitat is identified along this route that might be impacted during construction.

Impacts to interior habitat may occur at the same woodlot corners where off-site effects as a result of road operation may alter habitat 100 m or more into the woodlot feature.

The direct habitat loss for this footprint is low, and is limited to hedgerows and ‘clipping’ of corners of woodlots. It is anticipated that the design could be adjusted to avoid or minimize impacting woodlot edges and...
are similar in scale to E3 and E4 options. Direct loss includes 1.22 ha of wetland, 0.18 ha of forest habitat. Hedgerows and cultural communities are also removed.

Due to the largest direct wetland habitat impacted and proximity to amphibian breeding habitat along Reidel Road, and proximity to confirmed SAR breeding habitat, this option and Alignment C2 are least preferred from a wildlife perspective.

such impacts are limited to hedgerow removals. Indirect impacts may be greater for potential impacts to interior habitats, as off-site road impacts may extend 100 m or more into woodlots.

This option results in the highest potential impacts associated with cumulative effects, and may result in areas of agricultural activity to shift to urban development (of which the type is unknown). Residential development, and particularly rear lots adjacent to the core features pose a higher level of impact due to impacts associated with encroachment, invasive species, dog/cat disturbance, and increased human use/recreation within core features, if unmitigated.

Given that the core features are identified as high constraints, including Provincially Significant Wetlands and habitat for SAR species, it is anticipated that a high level of mitigation would be required should future residential (or other) development surround these features. As such, as Alignment W1 removes the road corridor from within existing SAR habitat, wetland features and vegetation losses are limited to hedgerows and very small portion of woodlots, this option is preferred from a wildlife perspective. Operational off-site effects from the road may extend into the larger woodlots and impact interior habitat and, as such, a high level of mitigation is anticipated to be required to mitigate impacts to the woodlots.
<table>
<thead>
<tr>
<th>NATURAL ENVIRONMENT</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Ecosystems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Watercourses Providing Fish Habitat</td>
<td>- Number of watercourses</td>
<td>- Important (direct) fish habitat. Requires crossing through contiguous natural heritage features at the existing Reidel Drive alignment.</td>
<td>- Marginal (indirect) fish habitat. Requires crossing through contiguous natural heritage features.</td>
<td>- Marginal (indirect) fish habitat. Requires crossing through contiguous natural heritage features.</td>
<td>- No fish habitat. Crossing is through agricultural land – there are no watercourses on site.</td>
</tr>
<tr>
<td></td>
<td>- Sensitivity of the watercourse</td>
<td>- Requires crossing through contiguous natural heritage features at the existing Reidel Drive alignment.</td>
<td>- Approximately 5,900 m² of indirect fish habitat of Blair Creek and associated riparian vegetation will be affected by the crossing.</td>
<td>- Approximately 7,200 m² of indirect fish habitat of Blair Creek and associated riparian vegetation will be affected by the crossing.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Extent and type of fish habitat</td>
<td>- Blair Creek has a combination of permanent and intermittent flow conditions at Reidel Drive – downstream is permanent; upstream is intermittent.</td>
<td>- Blair Creek has intermittent flows at this location in the watershed.</td>
<td>- Blair Creek has intermittent flows at this location in the watershed.</td>
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<tr>
<td></td>
<td></td>
<td>- The reach functions as nursery, rearing or feeding habitat. No spawning habitat in this reach.</td>
<td>- A small portion of a private pond located north of Blair Creek that is considered to be fish habitat will be lost with this alignment (can be mitigated).</td>
<td>- A small portion of a private pond located north of Blair Creek that is considered to be fish habitat will be lost with this alignment (can be mitigated).</td>
<td></td>
</tr>
<tr>
<td>▪ Aquatic Species at Risk (SAR)</td>
<td>- Effects on aquatic SAR</td>
<td>- There are no designated aquatic SAR in Blair Creek.</td>
<td>- There are no designated aquatic SAR in Blair Creek.</td>
<td>- There are no designated aquatic SAR in Blair Creek.</td>
<td>- This option does not cross a watercourse.</td>
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</tr>
<tr>
<td>▪ Water Quality, Thermal Regime or Baseflow</td>
<td>- Encroachments on headwater areas</td>
<td>- This alignment crosses a second order stream at an existing culvert crossing at Reidel Drive.</td>
<td>- This alignment crosses a second order intermittent stream.</td>
<td>- This alignment crosses a second order intermittent stream.</td>
<td>- Crossing is through agricultural lands – there are no watercourses on site.</td>
</tr>
<tr>
<td></td>
<td>- Degree of Interference with known groundwater discharge areas</td>
<td>- Potential to disrupt the groundwater recharge function that is crucial to downstream brook trout spawning habitat.</td>
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</tr>
<tr>
<td></td>
<td>- Effects on surface drainage/flood plain contributions to fish habitat</td>
<td>- This alignment crosses a second order stream at an existing culvert crossing at Reidel Drive.</td>
<td>- This alignment crosses a second order intermittent stream.</td>
<td>- This alignment crosses two first order ephemeral streams.</td>
<td></td>
</tr>
</tbody>
</table>
EVALUATION DISCUSSION FOR AQUATIC ECOSYSTEMS

Aquatic ecosystem variables under consideration include:

Watercourses Providing Fish Habitat
- Number of watercourse crossings, sensitivity of fish and fish habitat and thermal regime (warm, cool or cold water)
- Extent (area) and function of riparian habitat removed
- Extent and type of fish habitat altered/displaced at the proposed crossing including importance to aquatic ecosystem (spawning, nursery, rearing, feeding)

Aquatic Species at Risk
- Effects on designated aquatic SAR

Water Quality, Thermal Regime and Baseflow
- Encroachment on headwater areas (1st or 2nd order streams)
- Degree of interference with known groundwater discharge areas the contribute to baseflow
- Effects on surface drainage/floodplain contribution to fish habitat

Watercourses Providing Fish Habitat

Blair Creek is a productive and healthy coldwater stream that supports brook trout and other coldwater species throughout its length. The presence of groundwater, a reasonable baseflow and gravel substrates provide ideal habitat for brook trout.

The entire length of Blair Creek is considered to be a natural channel with little anthropogenic disturbance noted. There are a couple of known barriers to the upstream passage of fish including the v-notch weir at the Reidel Road culvert and a residential driveway culvert that is perched presenting a seasonal barrier to fish passage.

Existing fish habitat information for Blair Creek suggests that the watercourse supports a diverse assemblage of cold, cool and warmwater fish species and that there is suitable habitat to support highly sensitive coldwater species such as brook trout. The review of the Grand River Watershed Management Plan identified that Blair Creek is managed as a coldwater system by MNR and GRCA, with suitable thermal and habitat conditions that support a self-sustaining population of brook trout.

E2 - Crossing E2 is located at the existing culvert crossing of Blair Creek at Reidel Road. Through this reach Blair Creek is considered to be a permanent watercourse downstream of Reidel Road and an intermittent watercourse upstream of Reidel Road. The culvert at Reidel Road is considered to be a barrier to fish passage due to a v-notch weir that is located at the
outlet of the culvert. Replacement of this culvert for the proposed road widening will result in the removal of this barrier and the new open bottom culvert could provide enhanced fish habitat and allow for the upstream movement of fish into the reaches of Blair Creek that they have been previously unable to utilize. While the barrier to fish passage may be removed at Reidel Road, the reach of Blair Creek upstream of Reidel Road is very diffuse and undefined through a thicket wetland.

Approximately 10,000 m² of fish habitat consisting of Blair Creek and associated riparian vegetation will be affected by option E2.

**E3** - Crossing E3 is located approximately 200 m upstream of Reidel Road. The stream channel is fairly defined through this reach although it is classified as intermittent providing indirect fish habitat through allochthonous matter inputs and seasonal contribution to downstream habitats.

A small portion of a privately owned pond will be impacted by this alignment. The pond provides habitat for a very limited fish community that is likely stocked by local residents. Limited fish community sampling within the pond resulted in the capture of a single brown bullhead (*Ameiurus nebulosus*).

Approximately 6,000 m² of fish habitat consisting of Blair Creek and associated riparian vegetation with be affected by option E3.

**E4** - Crossing E4 is located approximately 200 m upstream of Reidel Road. The stream channel is fairly defined through this reach although it is classified as intermittent providing indirect fish habitat through allochthonous matter inputs and seasonal contribution to downstream habitats.

Approximately 7,300 m² of fish habitat consisting of Blair Creek and associated riparian vegetation with be affected by option E3.

**C2** – Crossing C2 is located approximately 400 m upstream of Reidel Road and the two tributaries that are crossed by this alignment are ephemeral. Both reaches have defined stream channels but provide only very limited indirect fish habitat mainly through conveyance of storm event flows and the spring freshet.

Approximately 10,000 m² of indirect fish habitat consisting of the Blair Creek tributaries and associated riparian vegetation will be affected by Option C2.

**W1** - This alignment crosses through agricultural lands and there are no watercourses within this alignment.

In summary, based on the potential proximity effects to sensitive aquatic ecosystems, **Alignment W1 is the preferred option**, and the East alignments are least preferred.
Aquatic Species at Risk

The designation of aquatic species of national significance is given by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), which may then qualify for legal protection and recovery under the federal Species at Risk Act (SARA). Endangered, Threatened or Extirpated species on Schedule 1 of the SARA are afforded protection under the Act. The designation of species of provincial significance is based on recommendations made by the Committee on the Status of Species at Risk in Ontario (COSSARO). Species classified as "at risk" (i.e., Extirpated, Endangered, Threatened or Special Concern) by COSSARO are placed on the Species at Risk List in Ontario (SARO List) and are afforded protection under the Ontario Endangered Species Act, with the exception of species of “special concern”.

From the review of background information, there are no designated aquatic species at risk present in Blair Creek within the study area.

Water Quality, Thermal Regime or Baseflow

Blair Creek in the study area is reported to be a coldwater stream, and therefore maintenance of water quality and low water temperatures is essential to the health of the watershed and supporting known coldwater species in the system.

Background information suggests that Blair Creek is considered to have fair to good water quality. However, water quality in the watershed is being impacted by:

- Agricultural land use and management practices (drainage, nutrients, fertilizer and pesticides application)
- Urbanization (stormwater runoff from commercial/residential land uses and roadways
- Loss of riparian vegetation
- Point source discharges
- Stream features – on-line ponds

Water temperature and its stability are important characteristic to the distribution of fish in a system and are critical to some species, such as brook trout for spawning and rearing. For Blair Creek it is assumed that groundwater influences are moderating warming trends in the watercourses and that stream temperatures are likely variable depending on local influences (e.g., on-line pond, stormwater pond outfalls, extent of riparian vegetation, etc) in the reach.

The thermal classification of the Blair Creek in the study area is, for the most part, consistent with that identified by GRCA and others. The entire length of Blair Creek is considered to be a coldwater system based on the review of background information.
Future developments within this watershed will likely cause significant stress for this system as urbanization can result in significant changes to hydrology and groundwater recharge/discharge functions. The groundwater function is of vital importance to this system as the self-sustaining populations of brook trout absolutely require groundwater upwellings for successful reproduction.

**E2** – This alignment crosses a second order stream at the existing culvert at Reidel Road. This alignment could result in disruption to the groundwater recharge function that is crucial to the maintenance of coldwater flows for downstream brook trout habitat. If this alignment is chosen the existing culvert at Reidel Road will be replaced and the v-notch weir that is currently a barrier to the upstream passage of fish will be removed thereby increasing the potential for the upstream movement of fish into reaches that they have previously been unable to access.

**E3** – This alignment crosses a second order stream intermittent stream. This alignment could result in disruption to the groundwater recharge function that is crucial to the maintenance of coldwater flows for downstream brook trout habitat.

**E4** – This alignment crosses a second order stream intermittent stream. This alignment could result in disruption to the groundwater recharge function that is crucial to the maintenance of coldwater flows for downstream brook trout habitat.

**C2** - This alignment crosses two first order ephemeral streams. This alignment could result in disruption to the groundwater recharge function that is crucial to the maintenance of coldwater flows for downstream brook trout habitat.

**W1** – This alignment is located through active agricultural lands and there are no watercourses on site.

In summary, based on the potential effects to groundwater discharge/recharge and the resulting affects to the coldwater thermal regime of Blair Creek, **Alignment W1 is the preferred option**, and the East alignments are least preferred.
### Natural Environment

#### Groundwater Resources

- **Groundwater Recharge Areas**
  - Encroachment on significant groundwater recharge areas (removal/disruption of function - area; depth)
  - Intersects two cross-sections of wetland, and passes just south of pond. Minor water interception issues; possible issues with recharge/discharge considerations. Proximity of smaller portions of wetland to the south of alignment in at least two locations may result in additional concerns. Has relatively long run through recharge area.

#### Groundwater Quality

- Potential for impacts to vulnerable areas (area)
  - Pond at 500 Stauffer Drive is spring-fed and connected to well, just to the west of the pond (shallow aquifer). This is consistent with MOE water well records that identify a shallow overburden well in the area.
  - Area is mixed recharge/discharge zone. Impacts (primarily road salt related) would likely remain in stormwater, with small portion of stormwater
  - Pond at 500 Stauffer Drive is spring-fed and connected to well, just to the west of the pond (shallow aquifer). This is consistent with MOE water well records that identify a shallow overburden well in the area.
  - Area is mixed recharge/discharge zone. Impacts (primarily road salt related) would likely remain in stormwater, with small portion of stormwater
  - Pond at 500 Stauffer Drive is spring-fed and connected to well, just to the west of the pond (shallow aquifer). This is consistent with MOE water well records that identify a shallow overburden well in the area.
  - Area is mixed recharge/discharge zone. Impacts (primarily road salt related) would likely remain in stormwater, with small portion of stormwater
  - No impacts to groundwater wells/users identified.
  - Area is mixed recharge/discharge zone. Impacts (primarily road salt related) would likely remain in stormwater, with small portion of stormwater infiltrating on a seasonal basis to upper groundwater. Direct impacts to regional bedrock aquifer unlikely due to depth of overburden.

- No impacts identified.
| Alternative | Shallow Groundwater Movement | Potential for interference with existing flow patterns (baseflow) relative to proximity to surface water and significant groundwater discharge areas | Limited impacts anticipated in general. This alternative has the least proposed length intercepting swamp thicket, implying the smallest area that would require infilling. Therefore, it is the least likely of the three East series alignments to have an impact. | Limited impacts anticipated in general. This alternative has the greatest proposed length intercepting swamp thicket, implying the greatest area that would require infilling. Therefore, it is the most likely of the three East series alignments to have an impact. | Limited impacts anticipated in general. This alternative has a moderate length intercepting or paralleling the swamp thicket, implying a moderate area that would require infilling. Therefore, it is considered to be the middle of the three East series alignments in terms of having an impact. | Cuts across a shallow marsh that connects two PSW areas – potential subsurface design or other connection requirements to maintain groundwater connection. Could maintain flow could be maintained by using equalization culverts. Intersects small subsection of unevaluated wetland in central portion of site that may need infilling in its entirety. Aforementioned impacts could result in small, localized impacts but are unlikely to result in significant impacts to shallow groundwater baseflow in the area, which is governed by the local topography. Nonetheless, this option would have the greatest likelihood of impact in comparison to the others. | No impacts identified. |
EVALUATION DISCUSSION FOR HYDROGEOLOGY CRITERIA

Groundwater Resources
The following threats to groundwater quality and quantity have been identified:

1. Development can restrict recharge to the underlying aquifer systems, which can result in a reduction of groundwater flows to municipal water supply wells and local baseflow to Blair Creek.

2. The long term cumulative loading of road salt could have consequences for water quality in the underlying aquifers. This not only has the potential to impact existing

Groundwater Recharge Areas
W1 – falls west of the area identified as a significant recharge area. There is no potential for interference.
E2, E3 and E4 – are co-incident and would each intersect two cross-sections of wetland, and pass just south of the pond on a private property. Minor water interception issues and possible issues with the identified recharge area and discharge to the creek. Proximity of smaller portions of wetland to the south of alignment in at least 2 locations may result in additional concerns. Each of these routes has relatively long run through the designated recharge area.
C2 - Divides recharge area into two sections and also parallels the edge of recharge area, therefore there are possible issues with recharge/discharge considerations. The route also intersects a small subsection-section of unevaluated wetland in central portion of site that may need infilling in its entirety, passes in proximity in western portion to another unevaluated wetland, joins Reidel drive near PSW, passes adjacent to unevaluated wetland further west. Minor water interception issues likely if cuts are required in this area and there is the strong potential for localized recharge disruption in the central portion of the study area where an unevaluated wetland is likely to be removed in entirety.

In summary, given the sensitivity attached to the designated recharge area, it is likely that both the Conservation Authority and the Region of Waterloo would strongly prefer alignment alternatives that minimize impacts to the regional recharge area. In addition, portions of the recharge area are also designated as a PSW, with some alignments directly encroaching on unevaluated areas, that may yet be assessed to be part of the PSW. In this respect, **Alignment W1 is exhibits the highest degree of compatibility and is the preferred option.** Alignments E2, E3 and E4 exhibit substantially lower degrees of compatibility, but are considered equal in the overall assessment (moderate to low degree of compatibility). Alignment C2 exhibits the lowest degree of compatibility and is the least preferred option.

Groundwater Quality

Groundwater quality impacts relate predominantly to two items, the first being the application of road salt, which is considered equally likely for all options. The second is the potential for impact to vulnerable areas, with include the recharge areas and PSW noted in the preceding section and water users.
W1 – has no known water users identified along the route, falls furthest away from the area identified as a potential future Regional groundwater source, and is furthest from the PSW that would have direct discharge implications for Blair Creek.

E2, E3 and E4 – are considered equally likely to impact the pond at 500 Stauffer Drive, which is spring-fed and connected to their personal supply well via the shallow aquifer. This is consistent with MOE water well records that identify a shallow overburden well in the area. While the area crossed is a mixed recharge/discharge zone, the majority of impacts would be expected to discharge into Blair Creek and the PSW, with a small portion of impacted surface water also infiltrating on a seasonal basis to the upper groundwater. The depth of overburden between the surface and regional bedrock aquifer is suitable to make direct impacts unlikely in the short-term. C2 – does not fall in immediate proximity to any water users, however, like the E routes, the area it crosses is a mixed recharge/discharge zone, the majority of impacts would be expected to discharge into Blair Creek and the PSW, with a small portion of impacted surface water also infiltrating on a seasonal basis to the upper groundwater. The depth of overburden between the surface and regional bedrock aquifer is suitable to make direct impacts unlikely in the short-term.

In summary, while all routes are assumed to have the same degree of road salt applied to them, only one potential water user would be likely to experience any impacts, and this would be most likely for any of the E routes. The three E routes and C2 are considered equally likely to impact shallow groundwater via interactions with seasonal infiltration from the PSW and ultimately impact the bedrock aquifer, although this is considered unlikely in the short term. As a result, **Alignment W1 is exhibits the highest degree of compatibility and is the preferred option**. Alignment C2 exhibits a notable lower degree of compatibility (moderate to low degree of compatibility) and due to the potential for impact to a vulnerable user, Alignments E2, E3 and E4 exhibit are equally considered to have the lowest degree of compatibility and are the least preferred option.

**Shallow Groundwater Movement**

W1 – has no identified potential for interference with existing groundwater flow patterns, surface water or groundwater discharge areas

E3 - limited impacts anticipated. This alternative has the least proposed length intercepting swamp thicket, implying the smallest area that would require infilling. Therefore it is the least likely of the 3 “E” routes to have an impact.

E4 - Limited impacts anticipated. This alternative has a moderate length intercepting or paralleling the swamp thicket, implying a moderate area that would require infilling. Therefore it is considered to be the middle of the 3 “E” routes in terms of having an impact.

E2 - Limited impacts anticipated although this alternative has the greatest proposed length intercepting swamp thicket, implying the greatest area that would require infilling. Therefore it is the most likely of the 3 “E” routes to have an impact.

C2 - cuts across a shallow marsh that connects two designated PSW areas and intersects a small section of unevaluated wetland in central portion of site that may need infilling in its entirety. Both of these could result in small, localized impacts but are unlikely to result in significant impacts to shallow groundwater baseflow in the area which is governed by the local topography.
In summary, none of the routes are likely to have any significant impact to shallow groundwater baseflow on anything other than a very localized scale. **Alignment W1 would be expected to have the least potential for impact and is the preferred option.** Alignments E3, E4 and E2 are listed in order of likelihood of having localized impacts, but are considered nearly equal in terms of potential impact and are considered moderately compatible. **Alignment C2 has the greatest likelihood of impact, if any, in comparison to the others and is the least preferred option.**
### Surface Water

#### Natural Environment

<table>
<thead>
<tr>
<th>Item</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Watercourses/Drainage</strong></td>
<td>New bridge or culvert</td>
<td>One new/reconstructed drainage crossing (E2a) of Blair Creek will be required</td>
<td>Estimated three new local drainage crossings will be required (E3a and E3c), and one new crossing (E3b) of tributary of Upper Blair Creek</td>
<td>Estimated three new local drainage crossings will be required (E4a, E4b and E4d), and one new crossing (E4c) of tributary of Upper Blair Creek</td>
<td>Estimated two new local crossings (W1a and W1b), and one new crossing (W1c) of tributary of Upper Blair Creek will be required</td>
</tr>
<tr>
<td><strong>Catchments</strong></td>
<td>Need for diversion/channelization of Blair Creek (length) and catchment area impacts (area)</td>
<td>New culvert to replace poor/fair condition Culvert C2</td>
<td>Culvert C2 is in good condition</td>
<td>Culvert C2 is in good condition</td>
<td>Culvert C2 is in good condition</td>
</tr>
<tr>
<td></td>
<td>11.9 ha drainage area for Culvert E2a (no flow diversion)</td>
<td>211.4 ha drainage area for Culvert C4, including 0.9 ha of flow diversion from Subcatchment 107 to Culvert C4</td>
<td>17.3 ha drainage area for Culvert E3a (no flow diversion)</td>
<td>22.5 ha Drainage Area for Culvert E4a (no flow diversion)</td>
<td>12.8 ha drainage area for Culvert E4e (no flow diversion)</td>
</tr>
<tr>
<td></td>
<td>- All proposed outlets are located at sag points and can provide positive drainage</td>
<td>- Some potential disruption of wetland</td>
<td>- All proposed outlets are located at sag points and can provide positive drainage</td>
<td>- All proposed outlets are located at sag points and can provide positive drainage</td>
<td>- All proposed outlets are located at sag points and can provide positive drainage</td>
</tr>
<tr>
<td></td>
<td>- Impact to wetland function</td>
<td>No impact identified</td>
<td>- No impact identified</td>
<td>- No impact identified</td>
<td>- No impact identified</td>
</tr>
<tr>
<td></td>
<td>- Impact to existing depression storage area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flood Plain Function</strong></td>
<td>Impact to regulatory flood plain of Blair Creek</td>
<td>Some potential impact to the regulated flood plain (crosses regulated area)</td>
<td>Some potential impact to the regulated flood plain (crosses regulated area)</td>
<td>Some potential impact to the regulated flood plain (crosses regulated area)</td>
<td>No impact on Blair Creek flood plain (avoids regulated area)</td>
</tr>
<tr>
<td></td>
<td>Changes (+/-) to Blair Creek flood plain hydrologic function</td>
<td>Some potential change of hydrology parameters, affecting remaining areas to the east</td>
<td>Some potential change of hydrology parameters, affecting remaining areas to the east</td>
<td>Some potential change of hydrology parameters, affecting remaining areas to the east</td>
<td>Some potential change of hydrology parameters, affecting remaining areas to the east</td>
</tr>
</tbody>
</table>
### NATURAL ENVIRONMENT

<table>
<thead>
<tr>
<th>Surface Water</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stormwater Management</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opportunities to enhance roadway stormwater management measures, including coordination with/use of adjacent development facilities</td>
<td>- For water quantity control, measures will be applied to control post-development peak flow rates to pre-development peak flow rates.&lt;br&gt; - Proposed roadway stormwater management plan will be incorporated for water quality control.&lt;br&gt; - Mitigation measures could include use of the future Stauffer Woods Subdivision SWM Pond (SWM Facility – 5) east of Reidel Drive, if feasible.&lt;br&gt; - New stormwater management ponds are not feasible, as all subcatchment areas for roadway drainage are less than 5.0 ha.</td>
<td>- For water quantity control, measures will be applied to control post-development peak flow rates to pre-development peak flow rates.&lt;br&gt; - Proposed roadway stormwater management plan will be incorporated for water quality control.&lt;br&gt; - Alternative mitigation measures include enhanced grass swales and oil-grit separators will be utilized.&lt;br&gt; - Utilizing the Stauffer Woods Subdivision SWM pond (SWM Facility – 5) east of Reidel Drive is not feasible, as the road alignment is too far from the proposed pond location. Also, the road outlet elevations do not match with the proposed pond elevations.&lt;br&gt; - New stormwater management ponds are not feasible, as all subcatchment areas for roadway drainage are less than 5.0 ha.</td>
<td>- For water quantity control, measures will be applied to control post-development peak flow rates to pre-development peak flow rates.&lt;br&gt; - Proposed roadway stormwater management plan will be incorporated for water quality control.&lt;br&gt; - Alternative mitigation measures include enhanced grass swales and oil-grit separators will be utilized.&lt;br&gt; - Utilizing the Stauffer Woods Subdivision SWM pond (SWM Facility – 5) east of Reidel Drive is not feasible, as the road alignment is too far from the proposed pond location. Also, the road outlet elevations do not match with the proposed pond elevations.&lt;br&gt; - New stormwater management ponds are not feasible, as all subcatchment areas for roadway drainage are less than 5.0 ha.</td>
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<td>- For water quantity control, measures will be applied to control post-development peak flow rates to pre-development peak flow rates.&lt;br&gt; - Proposed roadway stormwater management plan will be incorporated for water quality control.&lt;br&gt; - Alternative mitigation measures include enhanced grass swales and oil-grit separators will be utilized.&lt;br&gt; - Utilizing the Stauffer Woods Subdivision SWM pond (SWM Facility – 5) east of Reidel Drive is not feasible, as the road alignment is too far from the proposed pond location. Also, the road outlet elevations do not match with the proposed pond elevations.&lt;br&gt; - New stormwater management ponds are not feasible, as all subcatchment areas for roadway drainage are less than 5.0 ha.</td>
</tr>
</tbody>
</table>
EVALUATION DISCUSSION FOR SURFACE WATER CRITERIA

Road Drainage and Storm Water Management under Different Alternatives

The storm sewer system draining the pavement for the proposed roadway under different alternatives is to be designed to convey the 10 year design storm. It is assumed that under all alternatives, urban cross section will be constructed with curbs and gutters, catchbasins and storm sewer network are installed to convey the pavement runoff generated under the minor system (flow resulting from the 10 year storm event).

The major system flow will be conveyed on surface to the road sag points and then conveyed along sewer outlets to the watercourses.

**Alternative E2**

- Between approx. Station 8+360 and Station 9+500, runoff will be conveyed on both directions to the sag point at approx. Station 9+260 and discharging along sewer outlet to the existing culvert C4. Culvert C4 is in poor condition and is recommended to be replaced.
- Between approx. Station 9+500 and Station 9+800, runoff will be conveyed southward along new sewer outlet and discharging to the new crossing culvert E2a at approx. Station 9+500.
- North of Station 9+800, runoff will be conveyed northward to the watercourse located just north of the north limit of the study area.

All sub catchments of the new paved areas are less than 5 ha and hence, it was decided that new stormwater management ponds are not feasible because the storage SWMPs require a drainage area of at least 5 hectares to sustain the permanent pool of water which is critical to their effectiveness. Water quality control will be achieved by installing enhanced grass swales and/or Oil/Grit Separators as feasible.

**Alternative E3**

- South of Station 8+440, runoff will be conveyed southward to the New Dundee Road.
- Between approx. Station 8+440 and Station 8+800, runoff will be conveyed northward to approx. Station 8+760 and discharging along sewer outlet to the new crossing culvert E3a at approx. Station 8+760.
- Between approx. Station 8+800 and Station 9+460, runoff will be conveyed on both directions along new sewer outlet and discharging to the new crossing culvert E3b at approx. Station 9+380.
- Between approx. Station 9+460 and Station 9+800, runoff will be conveyed on both directions along new sewer outlet and discharging to the new crossing culvert E3c at approx. Station 9+510.
- North of Station 9+800, runoff will be conveyed northward to the watercourse located just north of the north limit of the study area.

All sub catchments of the new paved areas are less than 5 ha and hence, it was decided that new stormwater management ponds are not feasible because the storage SWMPs require a drainage area of at least 5 hectares to sustain the permanent pool of water which is critical to their
effectiveness. Water quality control will be achieved by installing enhanced grass swales and/or Oil/Grit Separators as feasible.

**Alternative E4**

- Between approx. Station 8+320 and Station 8+675, runoff will be conveyed northward to approx. Station 8+675 and discharging along sewer outlet O1 to the new crossing culvert E4a at approx. Station 8+710.
- Between approx. Station 8+675 and Station 8+800, runoff will be conveyed northward to approx. Station 8+800 and discharging along sewer outlet O2 to the new crossing culvert E4b at approx. Station 8+820.
- Between approx. Station 8+800 and Station 9+350, runoff will be conveyed on both directions along new sewer outlet and discharging along sewer outlets O3 and O4 to the new concrete box culvert crossing for Upper Blair Creek (E4c) at approx. Station 9+365.
- Between approx. Station 9+350 and Station 9+560, runoff will be conveyed on both directions and discharging along sewer outlet O5 to the new concrete box culvert crossing for Upper Blair Creek (E4c) at approx. Station 9+365.
- Between approx. Station 9+560 and Station 9+810, runoff will be conveyed southward to approx. Station 9+560 and discharging along sewer outlet O6 to the new crossing culvert E4d at approx. Station 9+525.
- Between approx. Station 9+810 and Station 10+450, runoff will be conveyed northward to approx. Station 10+450 and discharging along sewer outlet O7 to the new crossing culvert E4e at approx. Station 10+470.
- North of Station 10+450, runoff will be conveyed northward to approx. Station 10+800 and discharging along sewer outlet O8 to the watercourse located just north of the north limit of the study area.

All sub catchments of the new paved areas are less than 5 ha and hence, it was decided that new stormwater management ponds are not feasible because the storage SWMPs require a drainage area of at least 5 hectares to sustain the permanent pool of water which is critical to their effectiveness. Water quality control will be achieved by installing enhanced grass swales and/or Oil/Grit Separators as feasible.

**Alternative C2**

- Between approx. Station 8+400 and Station 8+860, runoff will be conveyed northward to approx. Station 8+850 and discharging along sewer outlet to the existing culvert C1. Culvert C1 is in poor condition and is recommended to be replaced.
- Between approx. Station 8+860 and Station 9+340, runoff will be conveyed on both directions along new sewer outlet and discharging to the existing culvert C2.
- Between approx. Station 9+340 and Station 9+500, runoff will be conveyed on both directions along new sewer outlet and discharging to the new crossing culvert C2a at approx. Station 9+460.
- Between approx. Station 9+500 and Station 9+680, runoff will be conveyed on both directions along new sewer outlet and discharging to the new crossing culvert C2b at approx. Station 9+650.
• Between approx. Station 9+680 and Station 10+160, runoff will be conveyed on both directions along new sewer outlet and discharging to the new crossing culvert C2c at approx. Station 9+720.
• North of Station 10+160, runoff will be conveyed northward to the watercourse located just north of the north limit of the study area.

All sub catchments of the new paved areas are less than 5 ha and hence, it was decided that new stormwater management ponds are not feasible because the storage SWMPs require a drainage area of at least 5 hectares to sustain the permanent pool of water which is critical to their effectiveness. Water quality control will be achieved by installing enhanced grass swales and/or Oil/Grit Separators as feasible.

**Alternative W1**

• South of Station 8+500, runoff will be conveyed southward to the New Dundee Road.
• Between approx. Station 8+500 and Station 9+080, runoff will be conveyed on both directions to approx. Station 8+850 and discharging along sewer outlet to the new crossing culvert W1a at approx. Station 8+840.
• Between approx. Station 9+080 and Station 9+480, runoff will be conveyed northward along new sewer outlet and discharging to the new crossing culvert W1b at approx. Station 9+480.
• Between approx. Station 9+480 and Station 10+350, runoff will be conveyed on both directions along new sewer outlet and discharging to the new crossing culvert W1c at approx. Station 10+160.
• North of Station 10+350, runoff will be conveyed northward to the watercourse located just north of the north limit of the study area.

All sub catchments of the new paved areas are less than 5 ha and hence, it was decided that new stormwater management ponds are not feasible because the storage SWMPs require a drainage area of at least 5 hectares to sustain the permanent pool of water which is critical to their effectiveness. Water quality control will be achieved by installing enhanced grass swales and/or Oil/Grit Separators as feasible.
### Environmental Study Report

#### Appendix C.2 – Detailed Assessment of Short-Listed Alignment Alternatives

<table>
<thead>
<tr>
<th>SOcio-Economic Environment</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Use</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Land use/resource designations and policies</td>
<td>- Degree of compatibility with provincial and municipal growth/development goals/objectives (high, moderate, low)</td>
<td>- High. Minor encroachment into Rural designation of Countryside lands south of Stauffer Drive. Alignment east of Countryside Line north of Stauffer Drive may offset this encroachment</td>
<td>- Moderate. Encroachment into Rural designation of Protected Countryside lands south of Stauffer Drive may create pressure for westerly relocation of urban envelope (Doon South Community Phase 2 boundary)</td>
<td>- Moderate. Encroachment into Rural designation of Protected Countryside lands may create pressure for westerly relocation of urban envelope (Doon South Community Phase 2 boundary)</td>
<td>- Low. Encroachment into Protected Countryside area is almost exclusively within Prime Agricultural Land designation</td>
</tr>
<tr>
<td>• Approved private development proposals</td>
<td>- Encroachment on development lands (area)</td>
<td>- Encroachment on Doon South Community Phase 2 lands along west periphery adjacent to Reidel Drive (open space, stormwater management, residential, commercial) (1.72 Ha)</td>
<td>- No impacts identified</td>
<td>- Minor encroachment on Doon South Community Phase 2 lands at southwest corner (commercial) (0.05 Ha)</td>
<td>- No impacts identified</td>
</tr>
<tr>
<td>• Agricultural operations (physical resource consumption; facility resource consumption; operational impacts)</td>
<td>- Prime agricultural land out of production (Class 1-3; specialty crop) (area)</td>
<td>- 1.49 Ha</td>
<td>- 2.05 Ha</td>
<td>- 1.75 Ha</td>
<td>- 1.00 Ha</td>
</tr>
<tr>
<td></td>
<td>- Total farm properties affected (number; type; area; severances)</td>
<td>- 7; all cash crop (1 owner-occupied; 5 held by development interests; 1 CoK)</td>
<td>- 6; all cash crop (1 owner-occupied; 4 held by development interests; 1 CoK)</td>
<td>- 7; all cash crop (1 owner-occupied; 5 held by development interests; 1 CoK)</td>
<td>- 6; all cash crop (1 owner-occupied; 4 held by development interests; 1 CoK)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Severances (4)</td>
<td>- Severances (5)</td>
<td>- Severances (5)</td>
<td>- Severances (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Property 5 – 2 (including internal access to woodlot in north central area)</td>
<td>- Property 5 – 2 (including internal access to woodlot in north central area)</td>
<td>- Property 5 – 2 (including internal access to woodlot in north central area)</td>
<td>- Property 2 – 2 (SE corner residual non-viable for agriculture; likely acquired with road ROW)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Property 7 – 2 (NE corner residual non-viable for agriculture)</td>
<td>- Property 7 – 3 (NE corner residual may be non-viable for agriculture)</td>
<td>- Property 7 – 3 (NE corner residual may be non-viable for agriculture)</td>
<td>- Property 7 – 3 (including internal access to woodlot in north central area)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Close to Property 5 pond (used for irrigation purposes) (can be mitigated)</td>
<td>- Close to Property 5 pond (used for irrigation purposes) (can be mitigated)</td>
<td>- Close to Property 5 pond (used for irrigation purposes) (can be mitigated)</td>
<td>- No impacts identified</td>
</tr>
<tr>
<td>• Other business operations</td>
<td>- Business infrastructure, employees displaced (type; number)</td>
<td>- Alignment corridor is located approximately 80 m from main building of bed and breakfast at 500 Stauffer Drive (noise, visual impacts). Reduced viability</td>
<td>- Alignment corridor is located approximately 80 m from main building of bed and breakfast at 500 Stauffer Drive (noise, visual impacts). Reduced viability</td>
<td>- Alignment corridor is located approximately 80 m from main building of bed and breakfast at 500 Stauffer Drive (noise, visual impacts). Reduced viability</td>
<td>- Alignment corridor is located approximately 670 m from main building of bed and breakfast at 500 Stauffer Drive</td>
</tr>
<tr>
<td></td>
<td>- Changes (+/-) in business exposure/viability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### SOCIO-ECONOMIC ENVIRONMENT

<table>
<thead>
<tr>
<th></th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communities</td>
<td>• Encroachment on Communities/Individual Properties</td>
<td>• Requires land from 7 individual private properties; 7.70 Ha</td>
<td>• Requires land from 5 individual private properties; 10.76 Ha, including 1.11 Ha for future Blair Creek Drive</td>
<td>• Requires land from 5 individual private properties; 9.22 Ha, including 0.21 Ha for future Blair Creek Drive</td>
<td>• Requires land from 5 individual private properties; 12.36 Ha, including 1.21 Ha for future Robert Ferrie Drive</td>
</tr>
<tr>
<td></td>
<td>• Influence in defining proposed community areas (high, moderate, low)</td>
<td>• High. Coincident with western boundary of Doon South – Phase 2 over most of its length south of Stauffer Drive. Most consistent with Brigadoon Community plan with respect to Strasburg Road location</td>
<td>• Moderate. Somewhat remote from western boundary of Doon South – Phase 2. Most consistent with Brigadoon Community plan with respect to Strasburg Road location</td>
<td>• Moderate. Somewhat remote from western boundary of Doon South – Phase 2. Most consistent with Brigadoon Community plan with respect to Strasburg Road location</td>
<td>• Low. Remote from western boundary of Doon South – Phase 2. Least consistent with Brigadoon Community plan with respect to Strasburg Road location (potential for significant relocation of community boundary into Countryside/Agricultural area)</td>
</tr>
<tr>
<td></td>
<td>• Community Connectivity (Cultural/Social Linkages)</td>
<td>• Displacement of 1 km of existing Reidel Drive</td>
<td>• Full length of Reidel Drive corridor can be retained for use as trail by Doon South Community</td>
<td>• Displacement of 200 m of existing Reidel Drive at south end. Remainder of Reidel Drive corridor (1.1 km) can be retained for use as trail by Doon South Community</td>
<td>• Displacement of 760 m of existing Reidel Drive</td>
</tr>
<tr>
<td></td>
<td>• Changes to delivery of community services (emergency; school transportation)</td>
<td>• New roadway maintains/enhances community connections for delivery of community services with planned collector roads (Robert Ferrie Drive/Blair Creek Drive) in place</td>
<td>• New roadway maintains/enhances community connections for delivery of community services with planned collector roads (Robert Ferrie Drive/Blair Creek Drive) in place</td>
<td>• New roadway maintains/enhances community connections for delivery of community services with planned collector roads (Robert Ferrie Drive/Blair Creek Drive) in place</td>
<td>• New roadway maintains/enhances community connections for delivery of community services with planned collector roads (Robert Ferrie Drive/Blair Creek Drive) in place</td>
</tr>
<tr>
<td></td>
<td>• Community Amenities</td>
<td>• No significant changes</td>
<td>• No significant changes</td>
<td>• No significant changes</td>
<td>• No significant changes</td>
</tr>
</tbody>
</table>

Notes:
Properties 6A, 6B and 6C are contiguous parcels under single ownership and have been considered as one holding.
EVALUATION DISCUSSION FOR SOCIO-ECONOMIC CRITERIA

Socio-economic variables under consideration include:

**Land Use**

- Compatibility with provincial, Region of Waterloo and City of Kitchener growth/development goals/objectives
- Encroachment on approved development proposals
- Impacts to agricultural resources and operations
- Impacts to other business operations

**Communities**

- Impacts on established communities and/or influence on community boundaries
- Changes in community connectivity and delivery of services to communities
- Changes in access to community amenities, such as formal recreational facilities

**Land Use**

Lands in the study area are used primarily for agricultural activities and rural residential uses (one owner occupied (500 Stauffer Drive) and one tenant occupied (271 Reidel Drive)). The majority of the study area is situated within an area in the southwest segment of the City of Kitchener that is designated for agricultural and/or rural uses by both the City and the Region of Waterloo. The Region’s Countryside Line represents the long-term boundary between the existing Urban Area/Township Urban Areas and the Countryside. It is essentially defines the eastern boundary of the study area (Reidel Drive and the current Strasburg Road Extension shown in the City’s Municipal Plan). The north end of the study area (approximately 15%) is situated within an urban area designated for low density residential uses. The other designated land uses in the study area are Open Space (by the City) and Core Environmental Features (by the Region), principally within the Blair Creek corridor.

The Countryside includes Rural Area and Prime Agricultural Area designations, overlain by a Protected Countryside designation, where urban uses are generally not permitted. Future expansions to the boundaries of the Urban Area are only permitted onto lands within the Countryside Line under certain conditions, including that the existing or planned infrastructure required to accommodate the proposed expansion can be provided in a financially and environmentally sustainable manner and is consistent with any applicable Regional and/or Area Municipal infrastructure master plan.

Where the Countryside Line coincides with the Protected Countryside designation, as shown on ROP Map 7, the Countryside Line is considered a permanent boundary. It is expected that the Region of Waterloo will vigorously assert and apply the policy positions on the Countryside Line in southwest Kitchener taken in its June 2009 recommendations to Regional Council and its June 2010 Report to Council in relation to protection of the Countryside Area and Regional Recharge...
Area from development, particularly in light of the potential additional impacts/costs associated with infrastructure needed to support urban development in this part of the City.¹

The study area comprises soils with high capability to support agriculture. Over half (54.4%) of the area is considered prime agricultural land (Class 1 to Class 3 soils) and 42.1% are Class 4 soils, the remainder (3.5%) being low capability (organic) soils within the Blair Creek corridor. The vast majority (80%) of lands in the study area are owned by five non-resident owners (developers – Activa, Freure, Hallman, Stonefield, Sunvest Reid); 10% is owned by a resident owner (500 Stauffer Drive); and the City owns 10%. Activa owns four (4) parcels in the area – 3 west of Reidel Drive and 1 east of Reidel Drive; the 3 parcels west of Reidel are being considered as one holding for the purposes of this assessment. All agricultural lands in the study area are used for cash crops (corn, soybeans) and are worked (custom planting and harvesting) by two operators out of Cambridge.

Land Use/Resource Designations and Policies

E2 – exhibits a high degree of compatibility with RMOW and City of Kitchener land use and community planning objectives and policies, particularly with respect to protection of rural and agricultural uses, and defining the west limit of the Doon South Community south of Stauffer Drive. This is because it is the closest to the current Strasburg Road Extension alignment shown in the City’s Official Plan. There is minor encroachment into the Region’s Countryside area (Rural designation, with Protected Countryside overlay) south of Stauffer Drive, but this can generally be recouped with the alignment that is east of the Countryside Line north of Stauffer Drive, if the Countryside Line is adjusted to the E2 alignment.

E3 and E4 – being coincident with E2 north of Stauffer Drive, these alignments exhibit a high degree of compatibility with City and Regional policies. However, they both encroach into the Rural designation of the Region’s Protected Countryside lands south of Stauffer Drive, which may create pressure for westerly relocation of urban envelope (Doon South Community Phase 2 boundary). E3 is less desirable than E4 in this regard, since it has the potential to relocate the urban boundary further west.

C2 – similarly encroaches into Rural designation of the Region’s Protected Countryside lands, but does so north of Stauffer Drive, with less encroachment than E3 and E4 south of Stauffer Drive, since it is coincident with the Countryside Line over about half the length of Reidel Drive. In this respect, it is compatible with the current City of Kitchener Official Plan.

W1 – exhibits a low degree of compatibility with City and Regional land use policies related to protection of agricultural and rural resources. Its encroachment well into Protected Countryside area is almost exclusively within the Prime Agricultural Land designation. This alignment has the potential to create the greatest shift in the urban envelope, including the western boundary of the Doon South Community. If this scenario is realized, the natural heritage features avoided with the alignment may ultimately come under increased pressure from urban development, thereby compromising the original objectives of developing the alignment in the first place.

In summary, given the current high profile and sensitivities attached to the Countryside Line (objections under consideration at the Ontario Municipal Board) the Region of Waterloo will likely object to alignment alternatives that encroach on the proposed Protected Countryside area (anywhere west of Reidel Drive), and this may be the primary consideration in assessing land use policy compatibility. In this respect, **Alignment E2 is exhibits the highest degree of compatibility and the preferred option.** Alignments E3, E4 and C2 exhibit different degrees of compatibility, but are considered equal in the overall assessment (moderate degree of compatibility). Alignment W1 exhibits the lowest degree of compatibility with policy directions and is the least preferred option.

Approved Private Development Proposals

Although much of the land within the study area is being held by owners with recognized development interests and aspirations in the City and the Region, with the exception of the Doon South Community – Phase 2 (east of Reidel Drive), there are no approved development proposals that will be affected by the candidate Strasburg Road Extension alignments. The footprint of alignment alternatives that use the Reidel Drive corridor may occupy lands outside the corridor, on the western periphery of Doon South – Phase 2. Alignments E2 (1.72 ha) and C2 (1.65 ha) may encroach on lands designated for agricultural uses, as well as stormwater management, multiple residential uses and commercial uses within a draft approved plan of subdivision in the southwest quadrant of the community. However, it is expected that such impacts can be mitigated through roadway cross-section adjustments, or developers of residential and commercial properties will be required to dedicate lands for the Strasburg Road Extension. Therefore, this assessment element is considered a non-determinant factor.

Agricultural Operations (Physical Resource Consumption; Facility Resource Consumption; Operational Impacts)

**E2** – will result in taking 1.49 ha of prime (Class 1-3) agricultural land out of production. Seven (7) farmed properties will be directly affected, all but 2 of which are being held for speculative purposes by developers. In addition, this option will create four (4) severed parcels, 2 on the farm at 500 Stauffer Drive (including severance of access to the woodlot in the north central portion of the property) and 2 on the Stonefield lands. The residual parcel in the northeast corner of the Stonefield lands may no longer be considered viable for agricultural uses, due to size (0.22 ha) and the area occupied by the Blair Creek corridor, and may be acquired with the road right-of-way. The alignment will be close to the pond at 500 Stauffer Drive, which is used for irrigation (grass watering) purposes; further investigations are required to determine whether this impact can be avoided.

**E3** – will result in taking 2.05 ha of prime agricultural land out of production. Six (6) farmed properties will be directly affected, all but 2 of which are being held for speculative purposes by developers. In addition, this option will create five (5) severed parcels, 2 on the farm at 500 Stauffer Drive and 3 on the Stonefield lands, including that created by the westerly extension of future Blair Creek Drive. Similar to E2 the residual parcel in the northeast corner of the Stonefield lands may no longer be considered viable for agricultural uses and may be acquired with the road right-of-way. The alignment will be close to the pond at 500 Stauffer Drive, which is used for irrigation (grass watering) purposes; further investigations are required to determine whether this impact can be avoided.
E4 - will result in taking 1.75 ha of prime agricultural land out of production. Seven (7) farmed properties will be directly affected, all but 2 of which are being held for speculative purposes by developers. In addition, this option will create five (5) severed parcels, 2 on the farm at 500 Stauffer Drive and 3 on the Stonefield lands, including that created by the westerly extension of future Blair Creek Drive. Similar to E2 the residual parcel in the northeast corner of the Stonefield lands may no longer be considered viable for agricultural uses and may be acquired with the road right-of-way. The alignment will be close to the pond at 500 Stauffer Drive, which is used for irrigation (grass watering) purposes; further investigations are required to determine whether this impact can be avoided.

C2 - will result in taking the least amount (1.00 ha) of prime agricultural land out of production, since it traverses primarily Class 4 lands. Six (6) farmed properties will be directly affected, all but 2 of which are being held for speculative purposes by developers. In addition, this option will create five (5) severed parcels, 3 on the farm at 500 Stauffer Drive, including that created with the extension of future Robert Ferrie Drive, and 2 on the Stonefield lands. There are no impacts to farm infrastructure.

W1 - will result in taking the largest amount (9.98 ha) of prime agricultural land out of production, since it traverses primarily Class 2 and 3 lands. Six (6) farmed properties will be directly affected, all but 2 of which are being held for speculative purposes by developers. In addition, this option will create eight (8) severed parcels, 2 on the Freure lands, 3 on the farm at 500 Stauffer Drive, including that created with the extension of future Robert Ferrie Drive, and 3 on the Activa lands (3 parcels considered as one holding; includes impacts of westerly extension future Robert Ferrie Drive). There are no impacts to farm infrastructure.

In summary, Alignment C2 has will require the least prime agricultural land (1.00 ha), while the East alignments are similar with respect to the amount of prime agricultural land taken out of production and impose a nominal impact (maximum 2.05 ha). Conversely, Alignment W1 traverses primarily Class 2 and Class 3 agricultural soils and would require almost ten times the amount of prime agricultural land occupied by Alignment C2. The alignments are relatively similar with respect the number of severances created, with the exception of W1, which even when considering the Activa lands as on holding, imposes greater impacts principally due to the extensions of future Robert Ferrie Drive and Blair Creek Drive. All alignments have the potential to create undesirable impacts to the only owner occupied farm (500 Stauffer Drive) - the East alignments may be more significant based on potential impacts to the pond; all alignments would sever internal access to the farm’s woodlot, as a result of either the Strasburg Road Extension itself of the extension of Robert Ferrie Drive. Based on these considerations, W1 is the least preferred option and Alignment E2 is the preferred option, based on the least severance effects associated with the future Robert Ferrie Drive and Blair Creek Drive.

Other Business Operations

Apart from agricultural operations, the only other business operation in the study area is the bed and breakfast and conference centre at 500 Stauffer Drive (Monika’s Farm B&B). Therefore, only the alignment segments north of Stauffer Drive have been considered for this assessment element.
Alignments E1, E2 and E3 are coincident and identical in their potential impacts to this business. At its closest point, the Strasburg Road Extension corridor is located approximately 80 m from the main building of bed and breakfast/conference centre, creating potential concerns over noise and visual impacts.

At its closest point, the Alignment C2 corridor is located approximately 150 m from the main building of bed and breakfast/conference centre, but to west, so the outside grounds most used by guests (on the east side of the main building) are shielded to some degree by the building. However, one must also account for extension of the future Robert Ferrie Drive corridor, which would be located approximately 270 m from main building, thereby adding some potential concerns over noise and visual impacts (refer also to noise impact assessment).

At its closest point, the Alignment W1 corridor is located approximately 670 m west of the main building of bed and breakfast/conference centre. The influence of the Robert Ferrie Drive would be similar to that described for Alignment C2.

In summary, based on the potential proximity effects (noise and visual intrusion), Alignment W1 is the preferred option, and the East alignments are least preferred.

Communities

Encroachment on Communities/Individual Properties

None of the alignment options encroach on existing residential communities. The impacts of the alignment alternatives on the farming community have been described under agricultural operations. Alignments that require the least extension of future Robert Ferrie Drive and Blair Creek Drive will result in the least property takings. E2 requires the least amount of private property (7.70 ha of property from 6 individual private properties), with no lands needed for the east-west collector roads. E3 and E4 have similar property requirements for the main line, but E3 requires about 5 times as much land for the Blair Creek Drive extension. E2 and C2 offer the benefit of using a large proportion of the existing Reidel Drive corridor, but E2 makes optimum use of public lands.

From combined perspective, Alignment E2 is preferred based on its potential to minimize property takings and define the Doon South – Phase 2 community.

Community Connectivity

This assessment element relates to changes in existing infrastructure used to by community residents for social and cultural linkages (roads/trails), or to deliver services, such as emergency response or school transportation, to the community.

The main road under consideration is Reidel Drive, since Stauffer Drive east of Reidel will not be directly altered and, west of Reidel, serves only two properties, one of which is vacant. Further, development of the alignment alternatives respected the intent of the Doon South – Phase 2 plan to ultimately close the west end of Stauffer Drive and the north end of Reidel Drive (i.e., the existing Reidel Drive connection between communities north of Stauffer Drive and New Dundee Road would likely be lost in any event).

Alignment E2 will displace a large segment (1 km) of Reidel Drive, retaining only the north 200+ m for connection to other (trail) purposes, as proposed in the Doon South Community Plan.
Other alternatives will create varying opportunities for conversion of the Reidel Drive corridor to a trail system to serve the Doon South Community, based on the degree to which they avoid the corridor, with E3 and W1 representing the greatest opportunity (little or no direct impact to the Reidel corridor).

All alternatives are considered similar with respect to the potential for maintaining or enhancing community connections for the delivery of community services, with the planned collector roads (Robert Ferrie Drive/Blair Creek Drive) in place. The exception may be W1, which will result in slightly more circuitous routing for service delivery than other options.

In summary, **E3 or E4 are considered to represent the best opportunities** for maintaining or enhancing community connectivity.

**Community Amenities**

There are no public amenities in the study area that will be affected by the alignment alternatives. Therefore, this assessment element is deemed a non-determinant factor and could be removed from further consideration.
### SOCIO-ECONOMIC ENVIRONMENT

<table>
<thead>
<tr>
<th>Noise</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Noise sensitive receivers experiencing resultant absolute noise levels over 55 dBA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Noise sensitive receivers experiencing increases (5 dBA ranges) in sound levels over pre-existing conditions</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**POR1**  
Guideline: 45 dB $L_{eq}$  
- With Project: 47 dB $L_{eq}$  
- Impact: 2 dB

<table>
<thead>
<tr>
<th>5-9 dB Increase</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>

10-14 dB Increase  
1

15 dB or More Increase  
1

**Notes:**  
POR1 - Residence located on Heatherwood Drive  
POR2 - Residence located at 500 Stauffer Drive  
POR3 - Residence at 271 Reidel Drive  
POR4 - Residence on New Dundee Road, east of Cameron and east of all proposed Strasburg Road alternatives  
POR5 - Residence on New Dundee Road, west of Cameron road and west of all proposed Strasburg Road alternatives
### CULTURAL ENVIRONMENT

#### Archaeological Resources

<table>
<thead>
<tr>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Known Archaeological Sites</strong></td>
<td>- Number/type/significance of direct/indirect impacts to registered archaeological sites</td>
<td>- Archaeological potential (previously registered site, proximity to water, sandy soil, early historical transportation corridor, Euro-Canadian settlement), Stage 2 Archaeological Assessment required</td>
<td>- Archaeological potential (previously registered site, proximity to water, sandy soil, early historical transportation corridor, Euro-Canadian settlement), Stage 2 Archaeological Assessment required</td>
<td>- Archaeological potential (previously registered site, proximity to water, sandy soil, early historical transportation corridor, Euro-Canadian settlement), Stage 2 Archaeological Assessment required</td>
</tr>
</tbody>
</table>

#### Heritage Resources

<table>
<thead>
<tr>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Built heritage Features and Cultural Heritage Landscapes (historic; scenic-heritage roads, farm complexes, etc.)</strong></td>
<td>- Number/type/significance of direct/indirect impacts to above ground heritage resources</td>
<td>- Full or partial displacement of CHL 1, CHL 2, CHL 3, and CHL 6. Alteration to CHL 5</td>
<td>- Alteration, through disturbance, to CHL 1, CHL 2, CHL 3, and CHL 5</td>
<td>- Full or partial displacement of CHL 1 and CHL 6; alteration through disturbance to CHL 7</td>
</tr>
<tr>
<td></td>
<td>- Number/type/significance of direct/indirect impacts to cultural heritage landscapes</td>
<td></td>
<td>- Alteration, through disturbance, to CHL 1, CHL 2, CHL 3, CHL 5, and CHL 6. Other impacts include isolation and direct obstruction of significant views from CHL 1.</td>
<td></td>
</tr>
</tbody>
</table>

**Archaeological Potential**

- Previously registered site, proximity to water, sandy soil, early historical transportation corridor, Euro-Canadian settlement.

**Stage 2 Archaeological Assessment Required**

- For sites with significant archaeological potential.
EVALUATION DISCUSSION FOR CULTURAL ENVIRONMENT

Archaeological Resources

All alignments have archaeological potential. Once a preferred alignment has been chosen, a Stage 1 Archaeological Assessment will be completed for that particular alignment. The Stage 1 Archaeological Assessment will identify which sections of the preferred alignment have archaeological potential and which require a Stage 2 Archaeological Assessment.

Heritage Resources

W1 - is the preferred alignment because it generally avoids the agricultural context associated with CHL 1, CHL 2 and CHL 7, and does not impact any of the identified historic roadscapes or the viability of the farm complexes. While the three east-west connectors would extend much further across identified agricultural fields in order to meet this alignment alternative, their impacts could be mitigated, such as by reducing the width of the road right-of-way and through development of landscape screening.

E2 and C2 - are considered to be the least preferred options given that both alignments will result in the displacement of CHL 6, as well as the farmhouse at CHL 1, given its close proximity to Reidel Drive. E2 would also impact CHL 2, CHL 3, CHL 4 and CHL 5 through disruption. C2 will also impact CHL 7 through disruption.

E3 and E4 - Are the next least preferred alignments. E3 was found to impact CHL 1, CHL 2, CHL 4 and CHL 5 through disruption, but avoids CHL 3 and CHL 6. E4 was found to have similar impacts as E3, with the exception that the proposed alignment cuts through a field to the north of CHL 1, effectively isolating the resource from its context and obstructing the views from the farm complex to the fields to the north permanently.

In summary, W1 is the preferred alignment because it does not impact any of the identified cultural heritage resources and generally avoids the agricultural context associated with CHL 1, CHL 2 and CHL 7.
### Transportation Network
- Provision of Doon South Community access (Robert Ferrie Drive, Blair Creek Drive) - Average Annual Daily Traffic (AADT)
  - 2031 (AADT) volumes of 8,740 vehicles on Robert Ferrie Drive and 7,440 vehicles on Blair Creek Drive are in the upper range limit for residential collector roads.
  - By 2031, the AADT on New Dundee Road would reach about 18,000 vehicles and, therefore, it should be classified as an arterial roadway instead of a collector road (i.e., traffic movement should be considered more important than land access).
- Compatibility with RMOW’s New Dundee Road proposal
  - By 2031, the AADT on New Dundee Road would reach about 18,760 vehicles and, therefore, it should be classified as an arterial roadway instead of a collector road (i.e., traffic movement should be considered more important than land access).

### Traffic Operations
- Road safety and accessibility (sight distance; turning movements)
  - A single intersection will be formed at Strasburg Road/Cameron Road and New Dundee Road.
  - A staggered intersection (260 m apart) will be formed at Strasburg Road/Cameron Road and New Dundee Road.
  - Signal controlled intersections at the new intersections of Strasburg Road/New Dundee Road and Cameron Road/New Dundee Road.
- Compatibility with RMOW’s New Dundee Road proposal
  - A single intersection will be formed at Strasburg Road/Cameron Road and New Dundee Road.
  - Signal controlled intersections at the new intersections of Strasburg Road/New Dundee Road and Cameron Road/New Dundee Road.
  - A minimum distance of 200 m is required to back vehicle storage is provided at adjacent intersections. However, for a progression speed of about 50 km/h and a cycle length of 60 seconds, the corresponding distance is approximately 400 m. The close spacing in this option does not permit signal.

### Environmental Study
**Appendix C.2 – Detailed Assessment of Short-Listed Alignment Alternatives**

<table>
<thead>
<tr>
<th>Provision/Demand/Compatibility</th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation Network</td>
<td>- Provision of Doon South Community access (Robert Ferrie Drive, Blair Creek Drive) - Average Annual Daily Traffic (AADT)</td>
<td>- About 30% of Doon South Community traffic will use Strasburg Road and do so via future Robert Ferrie Drive and Blair Creek Drive</td>
<td>- About 28% of Doon South Community traffic will use Strasburg Road and do so via future Robert Ferrie Drive and Blair Creek Drive</td>
<td>- About 30% of Doon South Community traffic will use Strasburg Road and do so via future Robert Ferrie Drive and Blair Creek Drive</td>
<td>- About 28% of Doon South Community traffic will use Strasburg Road and do so via future Robert Ferrie Drive and Blair Creek Drive</td>
</tr>
<tr>
<td>Compatibility with RMOW’s New Dundee Road proposal</td>
<td>- Compatibility with RMOW’s New Dundee Road proposal</td>
<td>- By 2031, the AADT on New Dundee Road would reach about 18,000 vehicles and, therefore, it should be classified as an arterial roadway instead of a collector road (i.e., traffic movement should be considered more important than land access).</td>
<td>- By 2031, the AADT on New Dundee Road would reach about 18,760 vehicles and, therefore, it should be classified as an arterial roadway instead of a collector road (i.e., traffic movement should be considered more important than land access).</td>
<td>- By 2031, the AADT on New Dundee Road would reach about 17,760 vehicles and, therefore, it should be classified as an arterial roadway instead of a collector road (i.e., traffic movement should be considered more important than land access).</td>
<td>- By 2031, the AADT on New Dundee Road would reach about 17,410 vehicles and, therefore, it should be classified as an arterial roadway instead of a collector road (i.e., traffic movement should be considered more important than land access).</td>
</tr>
</tbody>
</table>
| Traffic Operations | - Traffic Operations | - A single intersection will be formed at Strasburg Road/Cameron Road and New Dundee Road | - A single intersection will be formed at Strasburg Road/Cameron Road and New Dundee Road | - A single intersection will be formed at Strasburg Road/Cameron Road and New Dundee Road | - A single intersection will be formed at Strasburg Road/Cameron Road and New Dundee Road | - An additional intersection will be formed at Strasburg Road/New Dundee Road about 730 m west of the existing intersection at Reidel Drive/Cameron Road and New Dundee Road.
  - Signal controlled intersections are warranted at the new intersections of Strasburg Road/New Dundee Road and Cameron Road/New Dundee Road.
  - Signal progression is permitted in this option and traffic mobility can be optimized.
**TRANSPORTATION / UTILITIES**

<table>
<thead>
<tr>
<th><strong>Transportation Policy Initiatives</strong></th>
<th>E2</th>
<th>E3</th>
<th>E4</th>
<th>C2</th>
<th>W1</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Capability to support municipal policy initiatives (transit, active transportation, roundabouts)</td>
<td>- This alignment is preferred from a transit catchment perspective and about 3,600 auto trips (AADT 2-way) in 2031 may be eliminated due to support from transit initiatives</td>
<td>- This alignment is less preferred from a transit catchment perspective and fewer daily auto trips would be eliminated (estimated at about 1,800 AADT 2-way in 2031)</td>
<td>- A staggered signal intersection on New Dundee Road is not supported from the functional viewpoint that New Dundee Road would be classified as an arterial roadway based on its AADT volumes</td>
<td>- This alignment is less preferred from a transit catchment perspective and fewer daily auto trips would be eliminated (estimated at about 1,800 AADT 2-way in 2031)</td>
<td>- This alignment is not supported from a transit catchment perspective. Additional auto trips (about 3,600 AADT 2-way in 2031) will infiltrate the surrounding neighbourhood road network</td>
</tr>
<tr>
<td>- Roundabouts are preferably sited on level ground or in sags rather than at or near the crests of hills because it is difficult for drivers to appreciate the layout when approaching on an up gradient. A roundabout at the new intersection of Strasburg Road/Cameron Road and New Dundee Road may be difficult to implement due to the gradient on New Dundee Road westbound approach leg</td>
<td>- This alignment is preferred from a transit catchment perspective and about 3,600 auto trips (AADT 2-way) in 2031 may be eliminated (estimated at about 1,800 AADT 2-way in 2031)</td>
<td>- Roundabouts are preferably sited on level ground or in sags rather than at or near the crests of hills because it is difficult for drivers to appreciate the layout when approaching on an up gradient. A roundabout at the new intersection of Strasburg Road/Cameron Road and New Dundee Road may be difficult to implement due to the gradient on New Dundee Road westbound approach leg</td>
<td>- Not feasible to retain services and utilities on Reidel Drive corridor</td>
<td>- This alignment is less preferred from a transit catchment perspective and fewer daily auto trips would be eliminated (estimated at about 1,800 AADT 2-way in 2031)</td>
<td>- Roundabouts are preferably sited on level ground or in sags rather than at or near the crests of hills because it is difficult for drivers to appreciate the layout when approaching on an up gradient. A roundabout at the new intersection of Strasburg Road/Cameron Road and New Dundee Road may be difficult to implement due to the gradient on New Dundee Road westbound approach leg</td>
</tr>
</tbody>
</table>

**Municipal Services and Utilities**

<table>
<thead>
<tr>
<th><strong>Municipal Services</strong></th>
<th>- Opportunities for connections to existing services</th>
<th>- Highest potential for connectivity and usage</th>
<th>- Medium potential for connectivity and usage</th>
<th>- Medium potential for connectivity and usage</th>
<th>- High potential for connectivity and usage</th>
<th>- Lowest potential for connectivity and usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Provision of standard cross-section location for series</td>
<td>- Possibly retain services and utilities on Reidel Drive corridor</td>
<td>- Possibly retain services and utilities on Reidel Drive corridor</td>
<td>- Possibly retain services and utilities on Reidel Drive corridor</td>
<td>- Not feasible to retain services and utilities on Reidel Drive corridor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Provision of continuous services</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Utilities (Existing and Proposed Plant)</strong></th>
<th>- Degree of exposure of utilities and/or utility conflicts with road design</th>
<th>- Highest potential for connectivity and usage</th>
<th>- Medium potential for connectivity and usage</th>
<th>- Medium potential for connectivity and usage</th>
<th>- High potential for connectivity and usage</th>
<th>- Lowest potential for connectivity and usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Utility conflicts in Reidel Drive corridor</td>
<td>- Utility conflicts in Reidel Drive corridor</td>
<td>- Possibly locate services and utilities on Reidel Drive corridor</td>
<td>- Possibly locate services and utilities on Reidel Drive corridor</td>
<td>- Utility conflicts in Reidel Drive corridor</td>
<td>- Not feasible to locate services and utilities on Reidel Drive corridor</td>
<td></td>
</tr>
</tbody>
</table>
### Technical Requirements

**Structural/Foundation/Pavement Design Requirements**
- Conformance to TAC and City of Kitchener standards
- Good soil conditions with minimized crossings of wetlands and watercourses
  - A 6 m wide culvert will be installed at the creek crossing, with 3.5 m height for wildlife passage. This is the most sensitive watercourse crossing location.
  - Retaining wall of average 2 m height and 35 m length to be installed at farm pond

**Topographic, Earth Balance**
- Potential for excessive borrow quantity or excessive off-site disposal of earth material (volume)
- Requirements for excessive (steep) grades
- Each option has significant borrow requirements due to method of setting profile. However, this will be refined upon selection of the preferred alignment

### Cost
- Total estimated capital cost ($) - $13.7M, including 20% contingency estimate
- Property cost not considered, but would be lowest given the usage of the Reidel Drive corridor and existing City ROW at the north end
- Lowest relative operation/maintenance costs
- Total estimated capital cost ($) - $16.9M, including 20% contingency estimate
- Property cost not considered, but would be medium-high given the use of the existing City ROW at the north end, but the severance of a property at the south end
- Medium relative operation/maintenance costs
- Total estimated capital cost ($) - $16.3M, including 20% contingency estimate
- Property cost not considered, but will be medium, given use of the existing Reidel Drive corridor
- Medium relative operation/maintenance costs
- Total estimated capital cost ($) - $16.6M, including 20% contingency estimate
- Property cost not considered, but will be high given the use of the existing Reidel Drive corridor
- Medium relative operation/maintenance costs
- Total estimated capital cost ($) - $20.1M, including 20% contingency estimate
- Highest construction cost due to the greater length of the alignment, and future Blair Creek Drive and Robert Ferrie Drive and associated services
- Property cost not considered, but would be highest
- Highest relative operation/maintenance costs

### Topographic, Earth Balance
- Each option has significant borrow requirements due to method of setting profile. However, this will be refined upon selection of the preferred alignment
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TRANSPORTATION/UTILITIES

Transportation

Regardless of the alignment options, the geometry of the future Strasburg Road would be established according to design criteria consistent with a minimum design speed of 70 km/h (i.e., minimum 10 km/h over proposed posted speed of 60 km/h), and assumes a continuous 4-lane road cross-section with a boulevard extending to the ROW limit consistent with the City of Kitchener’s “Secondary Arterial” standard cross-section.

From access, traffic operations and transit service viewpoints, Options E2 and E4 are preferred among the other options. Albeit there are some safety issues if the future Strasburg Road is going to be connected with the intersection at Cameron Road and New Dundee Road, the issues could be mitigated by implementing a traffic signal at the intersection and installing proper signage/advanced warning signals etc. on the approaches. The Region of Waterloo may have long term plans for improvement of New Dundee Road sight lines. However in the near term, it is recommended to reduce the 80 km/h speed limit of New Dundee Road at the intersection approaches to 60 km/h.

By 2031, the ADT on New Dundee Road would reach about 18,000 vehicles and therefore, it should be classified as an arterial roadway instead of a collector road. Traffic movement on New Dundee Road should therefore be considered more important than land access. Option E3 is not supported from the functional viewpoint that the close spacing between the two new signal intersections on New Dundee Road does not permit signal progression and hence, traffic mobility cannot be optimized in this option.

Moreover, Options E3 and C2 are less preferred from transit catchment perspective. While a roundabout at the new intersection of Strasburg Road and New Dundee Road is considered feasible with Option W1, this alignment option is not supported from the transit service perspective.

Municipal Services/Utilities

Municipal Services

Each option was assumed to be an urban cross-section with a 30m ROW consistent with the City of Kitchener’s “Secondary Arterial” standard cross-section, and therefore will have standard locations for services and utilities.

For the purposes of the cost estimate, it was assumed that each option would require servicing, including watermain and sanitary sewer equal to the length of road including the east-west roads.

With regard to feasibility, network connectivity, future maintenance, and potential usage, Options E2 and C2, within the existing Reidel Drive corridor, is ranked the highest

There is a potential that the servicing infrastructure will need to be located closer to the proposed development lands east of Reidel Drive, and that their distance from Reidel Drive will deem any servicing on the other options useless. However, depending on the development requirements, the watermain and sanitary sewers for Options E3 and E4 could potentially still be located on the existing Reidel corridor. This would create additional impact foot print, but would be minimal and contained within the existing Reidel Drive and Stauffer Road corridors, which may need to be kept partially open for access to local buildings and/or as a trail system. This will not be possible with Option W1, as there is no connectivity to the north end of the W1 Strasburg Road alignment from the Reidel Drive corridor.

Based on the above discussion, the options are ranked as follows: E2, C2, E4, E3, W1, with the difference between E2, C2, E4 and E3 being marginal, and W1 significantly lower.

Utilities (existing and proposed plant)

Each option was assumed to be an urban cross-section with a 30m ROW consistent with the City of Kitchener’s “Secondary Arterial” standard cross-section, and therefore will have standard locations for services and utilities.

For the purposes of the cost estimate, it was assumed that each option would require servicing, including watermain and sanitary sewer equal to the length of road including the east-west roads.

With regard to feasibility, network connectivity, future maintenance, and potential usage, Options E2 and C2, within the existing Reidel Drive corridor, is ranked the highest for proposed utilities. However, it is noted that Options E2 and C2 also have the most impact with existing utilities, as there is an existing hydro pole line that would need to be relocated within the Reidel Drive corridor. However, regardless of option, this existing pole line would likely require relocation if the usage of Reidel Drive changes.

There is a potential that the future utilities (hydro, gas, communications) will need to be located closer to the proposed development lands east of Reidel Drive, and that their distance from Reidel Drive will deem any servicing on the other options useless. However, depending on the development requirements, the utilities for Options E3 and E4 could potentially still be located on the existing Reidel corridor. This would create additional impact foot print, but would be minimal and contained within the existing Reidel Drive and Stauffer Road corridors, which may need to be kept partially open for access to local buildings and/or as a trail system. This will not be possible with Option W1, as there is no connectivity to the north end of the W1 Strasburg Road alignment from the Reidel Drive corridor.
Based on the above discussion, the options are ranked as follows: E2, C2, E4, E3, W1, with the difference between E2, C2, E4 and E3 being marginal, and W1 significantly lower.

FINANCIAL/TECHNICAL

Financial

Cost

The costs are proportional to the length of roadway and number of structures required. The costs include full urbanization with storm sewers, as well as assumed watermain and sanitary sewer along the full length of roadway. The cost also assumes full build out of the roadway without phasing. The costs do not include property costs.

The approximate capital cost in order of preference is as follows:

- E2 - $13.7 million
- E4 - $16.3 million
- C2 - $16.6 million
- E3 - $16.9 million
- W1 - $20.1 million

The associated maintenance costs are proportional, in that E2 requires the least amount of infrastructure to be built and maintained and W1 has the most amount of infrastructure to be built and maintained.

Technical

Roadway geometric design requirements

Each option meets the defined design criteria established prior to determining alternative alignments, including conformance to TAC, COK and RMOW standards for a design speed of 80 km/h for the horizontal alignment, vertical profile and cross-section. The design speed can be lowered to 70 km/h if required to address any localized constraints, and would be acceptable for the proposed 60 km/h posted speed.

It is noted that for the purposes of developing options, a profile was determined based on providing adequate wildlife passage at the creek crossing culverts, and minimizing the amount of cut, given that much of the intersecting study area provides groundwater recharge. However, each can be adjusted to provide better earth balance and reduced impacts to sensitive locations. This will be done as a refinement to the preferred option.

An urban section was assumed for each option. However, depending on the proximity of development and the need for utilities and servicing, it is possible that W1 or portions of C2, E3 or E4 could be built with a rural cross-section.

Therefore, all options are rated equally with regard to geometric road design requirements. Subjectively and from an aesthetics perspective, one may desire a more direct route such as C2 rather than the other options that have with additional and/or shorter curves.

Structural Foundation/pavement design requirements

Each option will require culvert structures. However the structures for the central and east alignments will be larger structural culverts and accommodate wildlife passage.

The following structural requirements are required, and correspond with the option preference from highest to lowest:

- W1 – two small culverts and no structural culvert requirements (assumed that wildlife passage is not required)
- E2, E3 and E4 – one 6m wide culverts assumed, with 3m minimum height to accommodate wildlife passage. However, it is noted that the E2 crossing is more sensitive, given that it has continuous flow, whereas the others are intermittent. A retaining wall would also be required to avoid the open water pond north of Stauffer Drive.
- C2 – two 6m widen culverts assumed, with 3m minimum height to accommodate wildlife passage.

From a desktop review, the geology is generally equal, with sand, silty sand, sandy silt to sand and gravel deposits under topsoil in the agricultural fields. In the area of stream/creek crossings, one can expect thicker topsoil and organic deposits in the lower areas adjacent to the creek/stream, with high water table, which will be more of a challenge from a geotechnical perspective. Therefore, the geological preference is directly related to the number of water crossings and are consistent with the list above.

Also from a geotechnical perspective, there is likely no opportunity to reuse the existing pavement on Reidel Drive.

The above criteria are also related to relative complexity for construction, with W1 being the least complex as there are no watercourse crossings and associated geotechnical challenges, very little clearing and grubbing requirements, no related timing windows, and no utility relocations. Whereas, C2 would be the most complex, with two watercourses and associated geotechnical challenges, clearing and grubbing, timing windows (fisheries, migratory bird), and utility relocations. However, all options are viewed equally with regard to construction access.
Therefore, based on the above discussion, W1 is preferred with regard to structural requirements (including geotechnical and constructability concerns), followed by E3 and E4 with equal weighting and then E2 and C2.

Topographic; earth balance

A profile was assumed for each option based on providing adequate wildlife passage at the culverts, and minimizing the amount of cut given that the area provides groundwater recharge. At the same time, each can be adjusted to provide better earth balance and reduced impacts to sensitive locations. This will be done as a refinement to the preferred option.

Therefore, all options are rated equally with regard to topography and earth balance.
2031 Strasburg Road / New Dundee Road Traffic Flows

Options E2/E4:

Option E3:

2031 AM Peak (veh/hr) 2031 PM Peak (veh/hr)
Option C2:

2031 AM Peak (veh/hr)  
2031 PM Peak (veh/hr)

Option W1:

2031 AM Peak (veh/hr)  
2031 PM Peak (veh/hr)
### Strasburg Road Extension AADT Volumes (2-way)

<table>
<thead>
<tr>
<th>Strasburg Road</th>
<th>No Strasburg Road Extension</th>
<th>Western Alignment (W1)</th>
<th>Central Alignment (C2)</th>
<th>Central Alignment (E3)</th>
<th>Eastern Alignment (E2 &amp; E4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2031</td>
<td>2016</td>
<td>2031</td>
<td>2016</td>
</tr>
<tr>
<td>Huron Road</td>
<td>2,000</td>
<td>2,320</td>
<td>12,780</td>
<td>21,770</td>
<td>13,250</td>
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<tr>
<td>Rush Meadow Street</td>
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<td>n/a</td>
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<td>20,900</td>
<td>12,500</td>
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<td>Rockcliffe Drive</td>
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<td>n/a</td>
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<tr>
<td>Biehn Drive</td>
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<td>18,760</td>
<td>11,740</td>
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<tr>
<td>Robert Ferrie Drive</td>
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<td>n/a</td>
<td>11,780</td>
<td>18,360</td>
<td>12,140</td>
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<tr>
<td>Blair Creek Drive</td>
<td>1,130</td>
<td>1,310</td>
<td>11,270</td>
<td>17,010</td>
<td>11,560</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>New Dundee Road</th>
<th>No Strasburg Road Extension</th>
<th>Western Alignment (W1)</th>
<th>Central Alignment (C2)</th>
<th>Central Alignment (E3)</th>
<th>Eastern Alignment (E2 &amp; E4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2016</td>
<td>2031</td>
<td>2016</td>
<td>2031</td>
<td>2016</td>
</tr>
<tr>
<td>East of Cameron Road</td>
<td>4,780</td>
<td>5,550</td>
<td>10,260</td>
<td>17,410</td>
<td>10,390</td>
</tr>
<tr>
<td>East of Strasburg Road</td>
<td>4,780</td>
<td>5,550</td>
<td>19,000</td>
<td>28,870</td>
<td>10,390</td>
</tr>
<tr>
<td>West of Strasburg Road</td>
<td>6,280</td>
<td>7,290</td>
<td>8,160</td>
<td>12,580</td>
<td>8,070</td>
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</table>
## CITY OF KITCHENER
**STRASBURG ROAD EXTENSION – CLASS EA**
**NORTH OF STAUFFER DRIVE TO NEW DUNDEE ROAD**

<table>
<thead>
<tr>
<th>Access to Strasburg Road</th>
<th>No Strasburg Road Extension</th>
<th>Western Alignment (W1)</th>
<th>Central Alignment (C2)</th>
<th>Central Alignment (E3)</th>
<th>Eastern Alignment (E2 &amp; E4)</th>
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</thead>
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<tr>
<td></td>
<td>2016</td>
<td>2031</td>
<td>2016</td>
<td>2031</td>
<td>2016</td>
</tr>
<tr>
<td>Robert Ferrie Drive</td>
<td>n/a</td>
<td>n/a</td>
<td>3,910</td>
<td>8,870</td>
<td>4,280</td>
</tr>
<tr>
<td>Blair Creek Drive</td>
<td>n/a</td>
<td>n/a</td>
<td>2,220</td>
<td>6,050</td>
<td>2,530</td>
</tr>
</tbody>
</table>

Note:
The following are typical percentages assumed for a rural minor arterial road:
1. Daytime traffic (0700-2300): 90-95% of AADT
2. Night time traffic (2300-0700): 5-10% of AADT
3. Single-Unit Trucks (incl. buses): 3-4%
4. Combination Trucks (incl. multi-trailer trucks): ~5%