The Region of Peel Road Ecology Case Study

The Gore Road (Patterson Side Road to Highway 9): Baseline Monitoring Results

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Toronto and Region Conservation for The Living City

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1. Introduction

The Region of Peel Road Ecology Study completed in 2013, through the application of analytical desk-top models, predicted a number of strategic locations within the Region of Peel, where the application of appropriate mitigation measures will likely minimize the impacts of road networks on wildlife movement, particularly amphibians associated with wetland and forest habitats (TRCA, *in prep*). These strategic locations identify two things: (i) the road segments with high potential for amphibian road mortality, and (ii) the critical areas for maintaining long term regional connectivity among wetland and forest habitats to facilitate amphibian population persistence in the landscape. The Gore Road between Patterson Side Road and Highway #9 in the Town of Caledon has been identified as one of the strategic locations in the Peel Road Ecology Study (Figure 1). In order to validate the model and to determine if there is a real need for mitigation, the TRCA collected baseline road kill data along The Gore Road during the 2013 field season and augmented with some additional data from the spring of 2014.

The impetus for this project was due to the Region of Peel's Environmental Assessment (EA) along The Gore Road which included improvements to 8 of the 16 existing CSP culverts. It was discussed with the Region of Peel at the time of the EA, and added as a commitment in the EA, that the Region would further examine possible mitigation measures that could be put in place while the update of the existing structures was underway, to potentially assist with wildlife passage across the roadway.

The purpose of this document is to provide the results of the baseline road kill survey and provide options for mitigation to be considered in the detailed design phase. It is important to note that while the benefits of this particular pilot case study may be limited due to the fact that this proposal is being drafted at the end of the EA phase when the crossing structures (type, size, and locations) have already been determined, it is worth highlighting that this case study will contribute significantly as a pilot to the larger database of case studies that will continue to be a part of ongoing road ecology initiatives in the Region of Peel. If resources permit during this project or if they become available in the future, amphibian populations along this stretch of The Gore Road would benefit from additional structures that enhance wildlife connectivity.

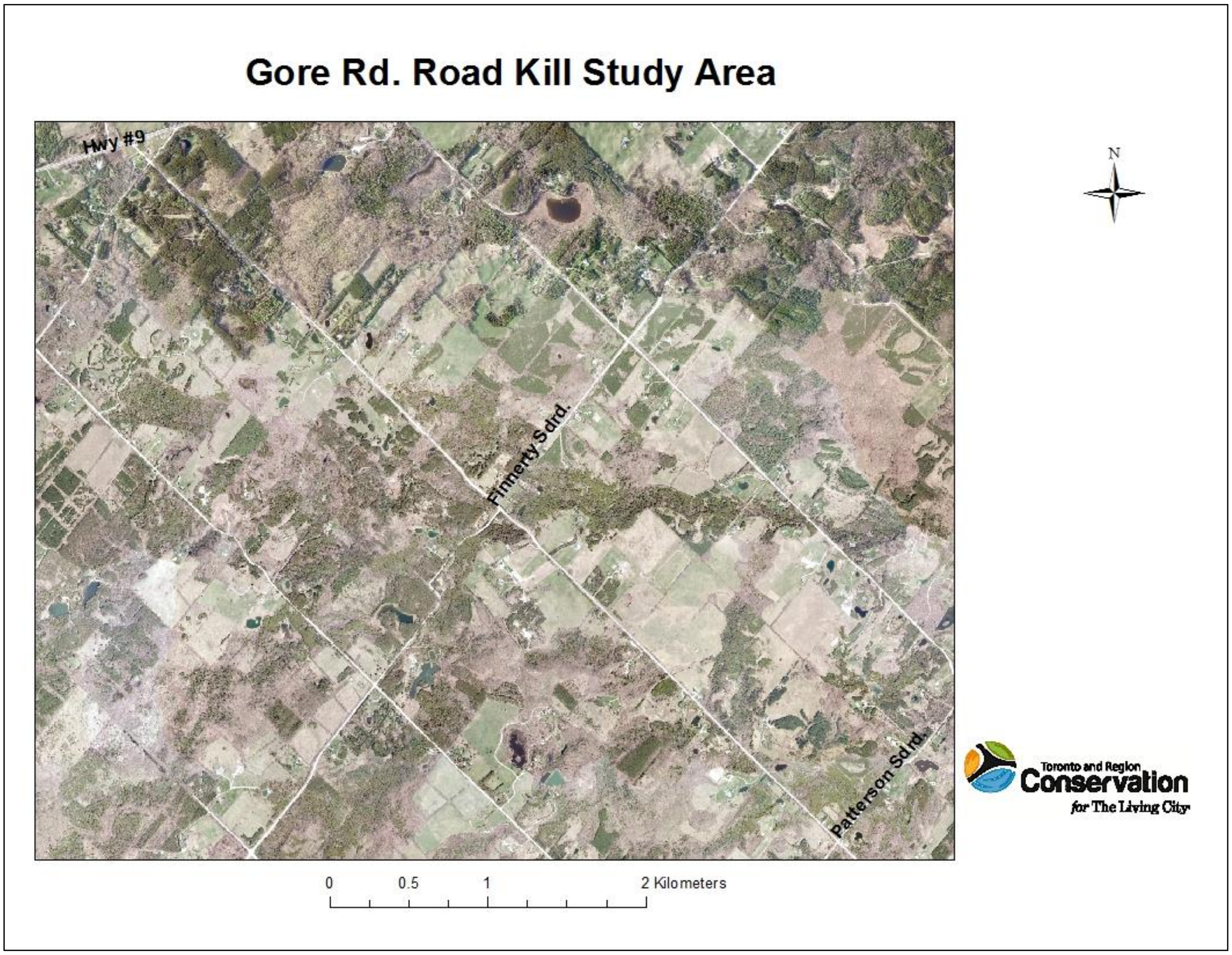

Figure 1. Gore Rd. road kill study area in the Region of Peel.

2. Methodology

As resources are limited, it is not possible to survey and provide mitigation for all taxonomic species that could potentially become road kill. Therefore, based on scientific literature a group of species that are most vulnerable to road effects were selected for this project. The target species selected were the amphibian and reptiles (herptefauna) that are known to be located within the Region of Peel (Table 1). Although other taxa such as some species of mammals are known to have a high occurrence of becoming road kill it was determined that the ecology of these species is such that it is unlikely that these fatalities will have a large impact on their population persistence at this time. Species such as raccoon (*Procyon lotor*) and skunk (*Mephitis mephitis*) have a high occurrence of being road kill; however, they are generalist species that have a high reproductive capacity compared to some of the other species such as snapping turtle (*Chelydra serpentina*) that requires a more specific habitat type and is not sexually mature for approximately a decade. White-tailed deer (*Odocoileus virginianus*) are somewhat different in that even though their populations are not in decline, vehicle collisions are a threat to human safety. Deer were not a target species for this particular part of the project however, other studies and collaboration are currently underway between Peel Region and the Ontario Ministry of Natural Resources to try and mitigate this issue.

Table 1. Target species for the Gore Rd. road ecology case study project

Taxonomic Group	Common Name	Scientific Name
Amphibians	American toad	*Anaxyrus americanus*
	Northern leopard frog	*Lithobates pipiens*
	Wood frog	*Lithobates sylvatica*
	Spring peeper	*Pseudacris crucifer*
	Green frog	*Lithobates clamitans*
	Bullfrog	*Lithobates catesbeianus*
	Pickeral frog	*Lithobates palustris*
	Gray treefrog	*Hyla versicolor*
	Eastern newt	*Notophthalmus viridescens*
	Spotted salamander	*Ambystoma maculatum*
	Jefferson salamander	*Ambystoma jeffersonianum*
	Blue-spotted salamander	*Ambystoma laterale*
Reptiles	Snapping turtle	*Chelydra serpentina*
	Painted turtle	*Chrysemys picta*
	Common gartersnake	*Thamnophis sirtalis*
	Dekay's brownsnake	*Storeria dekayi*
	Red-bellied snake	*Storeria occipitomaculata*
	Milksnake	*Lampropeltis triangulum*

2.1 Survey Timing

Survey timing was based on the peak periods for movement of the different amphibian and reptile species. Amphibian surveys were conducted at least ½ hour after sunset and when weather conditions were appropriate (warm nights with light rain and little wind). These surveys targeted the key breeding periods of the different amphibians. Early spring surveys coincided with wood frog (*Lithobates sylvatica*) and spring peeper (*Pseudacris crucifer*) breeding, late spring surveys coincided with American toad (*Anaxyrus americanus*), northern leopard frog (*Lithobates pipiens*), and pickeral frog (*Lithobates palustris*) and early summer surveys coincided with the breeding periods for green frog (*Lithobates clamitans*) and bullfrog (*Lithobates catesbeianus*). Reptile surveys were conducted during the daytime on sunny days starting in June when turtles are quite often seen on roadways. Fall surveys were conducted to capture incidences of snakes when they are often attracted to the warm surface of the roadway.

2.2 Survey Methodology

Road kill surveys are always conducted in teams of two with at least one person experienced in identifying road kill according to the TRCA road kill data collection protocol (TRCA, 2014). As with any work that coincides along a busy roadway such as The Gore Rd., safety was a primary concern. Night surveys required all staff to have reflective coats / shirts and a working flashlight. Due to the long length of road (6 km) and the high volume of traffic, a decision was made to drive the road in order to conduct the surveys. Often this type of survey would be completed on foot, but safety was a concern. Some observations may have been missed based on this survey method however, because of the length of road that was being surveyed the total number of observations missed may be minuscule based on the amount of time required to survey the entire 6 km by foot versus vehicle. In addition, the headlights on the vehicle travelling on the road gave the observers a larger field of view compared to what is available from a flashlight shining from the road's edge.

Surveys started at Patterson Sideroad and went north to Hwy #9 and then back south again to the starting point. Cars were driven approximately 10 km/hr along the road while having four way flashers and a roof top flashing light that rotated 360^0 when activated. When something was spotted on the road the car was driven as far off the road as possible and one staff member would exit the vehicle to identify the animal. The second person stayed to the side of the road and watched for any on-coming traffic in order to signal to the other staff person. Once the animal was identified it was removed from the roadway to ensure that it would not be counted again. A GPS point was taken and documented on the field sheets along with the identity of the animal, whether it was found alive or dead and an indication of what direction the animal was travelling (if found alive) (see Appendix A for a sample data sheet). On occasion it was obvious that something had been hit on the road based on a stain on the road however, these observations were not recorded.

2.3 Identifying Road Kill Hotspots

All the road kill observations were mapped in ArcGIS 10.2 and a point density calculation of 150 m radius was applied to each point observation in order to determine where the highest density observations were located. This calculation essentially looks at each road kill observation and determines how many other observations are within 150 m radius of that particular observation; providing a gradient of road kill observation densities. The distance of 150 m radius was selected as this represents the approximate distance that most of the target species would travel for the seasonal migration movements. This also reflects the mitigation fencing that would be required on either side of the ecopassage to funnel the wildlife movement into the ecopassage. The point density data was categorized into low, medium, and high to highlight the road kill hotspots in the study area.

3. Results

A total of 47.5 survey hours were completed during the 2013 field season, with an additional 5 survey hours in 2014 (Table 2). Approximately 14 hours were spent conducting day time searches and 38.5 hours were spent on night time searches in 2013 whereas the survey hours in 2014 were all night time searches only.

Table 2. Survey dates and effort for 2013 and 2014 survey periods.

Date	Night or Day Time Survey	Total Survey Hours
2013		
May 22nd	night	7
May 28th	night	5
May 30th	night	1
June 6th	night	3
June 10th	night	4
June 14th	day	1
June 21st	day	1
June 23rd	night	1.5
July 9th	night	7
July 10th	night	5
July 18th	day	3.5
September 24th	day	4
October 8th	day	3
October 18th	day	1.5
2014		
April 10th	night	1.5
April 29th	night	3.5
TOTAL		**52.5**

A total of 596 observations were documented during the survey hours and 72% (431 records) of these were found dead on arrival. The other 28% were found alive crossing the road. Approximately 88% (527) of the records observed were frogs and salamanders (Figure 2). Out of these, gray treefrogs with 100 records followed closely behind by American toad with 98 records and green frog with 96 records were the most frequently encountered species. Only 17 reptiles were found which included 10 turtles (7 painted turtles, 1 snapping turtle, and 2 unidentifiable turtles) and 7 snakes (6 eastern garter snakes and 1 red-bellied snake). A complete list of all road kill observations can be found in Appendix 1.

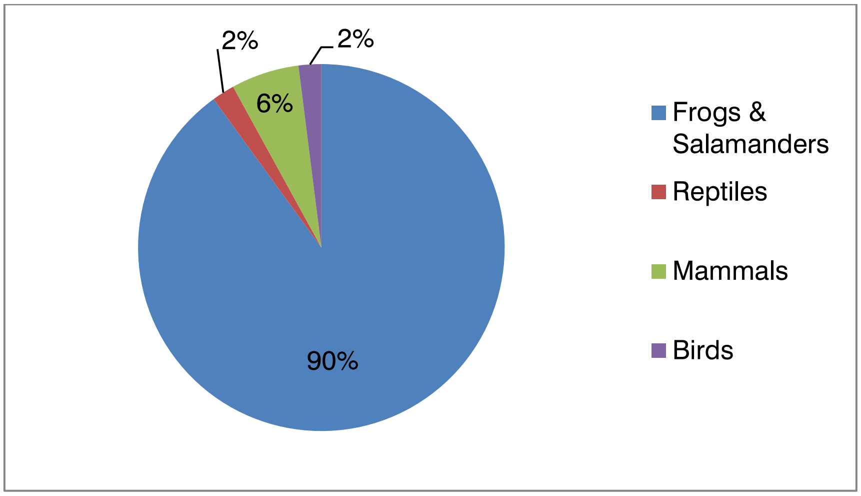

Figure 2. Percentage of each of the four taxa found during road kill surveys along The Gore Road. in 2013 / 2014.

The field observations were spread out along the entire 6 km stretch of The Gore Road however there were key areas that stood out as hot spots when a 150 m radius point density calculation was applied to the data (Figure 3). There were two spots identified as having a high density and three larger spots as having a medium density. There were a couple of additional medium density areas that were considerably smaller.

Comparing the high density areas identified through field surveys (Figure 3) to the desktop model output (Figure 4) not only was the model validated but the field observations also added a refinement to the model output. Based on the desktop analysis, the model predicted that The Gore Road north of Finnerty Side Road was relatively a medium priority for mitigation opportunities and south of Finnerty Side Road a high priority. The field observations identified high density of road kill observation both to the north and south of Finnerty Side Road.

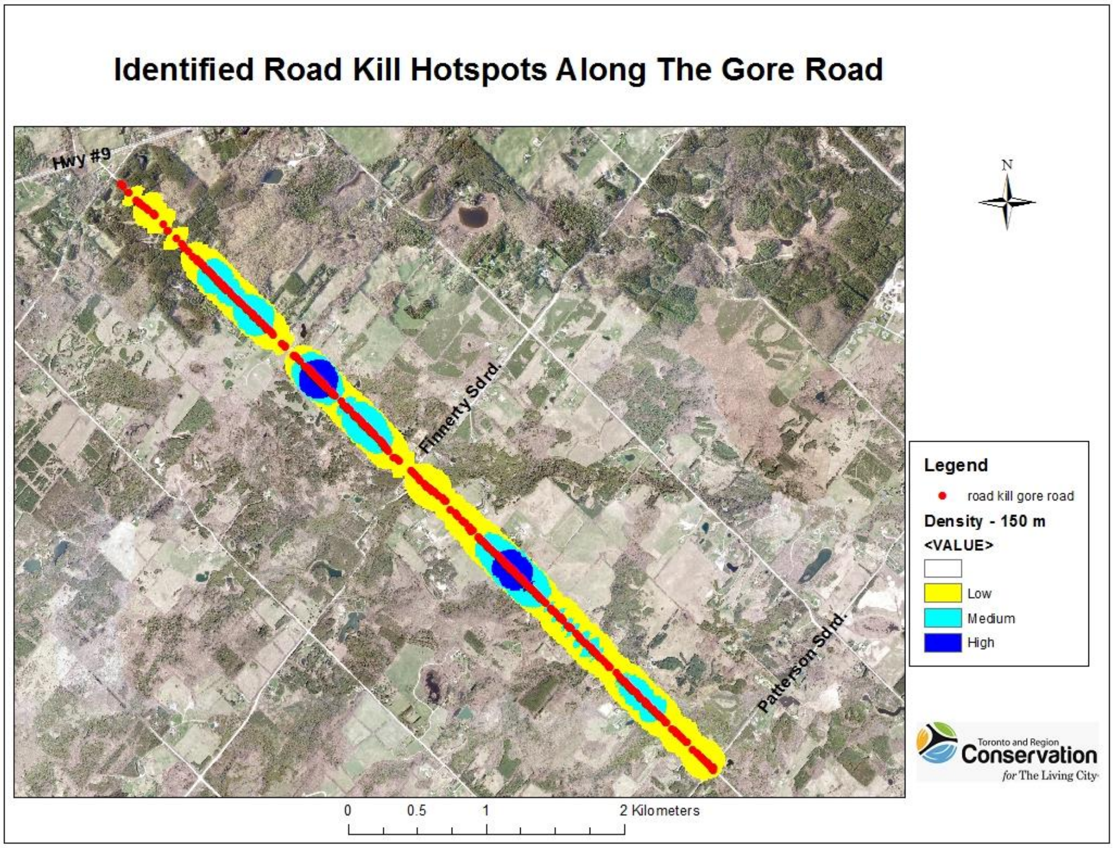

Figure 3. Road kill hotspots identified along The Gore Road through field surveys. Red dots indicate a single road kill observation.

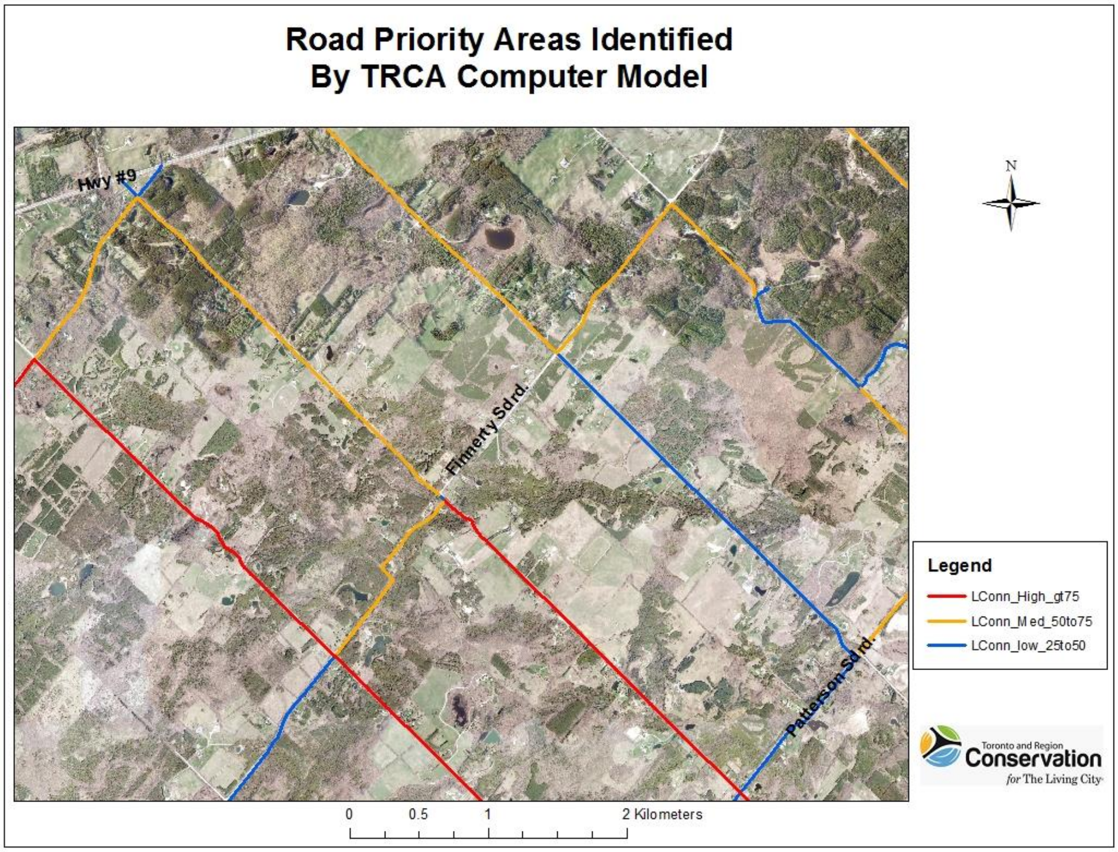

Figure 4. The Gore Road identified as a medium priority for possible mitigation north of Finnerty Side Road and high priority south of Finnerty Side Road based on the TRCA desktop computer model.

4. Discussion

The baseline survey data collected has validated the TRCA's computer model that identified The Gore Road between Patterson Sideroad and Highway #9 as an area of importance for amphibian mitigation and wildlife habitat connectivity. By placing the observational field data into a gradient of three categories of low to high density, a level of priority for mitigation of road kill has been identified.

Given that The Gore Road project is going to the detailed design phase, the mitigation strategies may be constrained to accommodate the pre-determined crossing structures (type, size, and locations) that are based on factors other than wildlife movement. However, it was recommended at the EA stage that culverts may be modified and new culverts designed to target wildlife movement are added to assist local amphibian populations at the strategic locations.

4.1 Mitigation goals

Clearly defined goals of the implemented mitigation measures should be documented so that the overall success of The Gore Road project can be determined with an effective monitoring strategy. The lessons learnt will add value to future mitigation work in other road projects in the Region of Peel and beyond. As the principles, science, and practice of road ecology are a relatively new, especially in urban and near-urban areas, there is much to learn about the effectiveness of mitigation strategies placed in different landscapes with different contexts including climatic conditions.

The overarching goal of The Gore Road project is to reduce the number amphibians becoming road kill on the specified segment between Highway 9 and Patterson Sideroad, where appropriate ecopassages and fencing are implemented. It is anticipated that there may be some individuals that go around the fencing however, the vast majority should be guided away from the road and into the ecopassage for safe movement across the road. The mitigation success can and will be determined through additional monitoring once mitigation has been put in place.

4.2 Priority Locations for Mitigation

The priority locations for mitigation to enhance wildlife connectivity through The Gore Road project are illustrated in the map that highlights the gradient of low to high likelihood of road kill hotspots (Figure 3).

4.2.1 High Priority Locations

The best mitigation option would be to focus on the two areas identified as having a high density of amphibian observations (Figure 5). The area of high density road kill to the north of Finnerty Side Road is approximately 300 m in length whereas the area to the south is 350 m. These two areas represent approximately 30% of all road kill observations.

By extending the high priority zone identified north of Finnerty Side Road to 425 m both the medium and high density priority areas along this stretch could be captured at this location (Figure 6). Similarly, by extending the high priority zone identified to the south of Finnerty Side Road to 670 m both the medium and high density priority areas could be captured (Figure 7). These areas cover approximately 37% of all road kill observations.

Figure 5. High priority areas identified for mitigation along The Gore Road based on survey results.

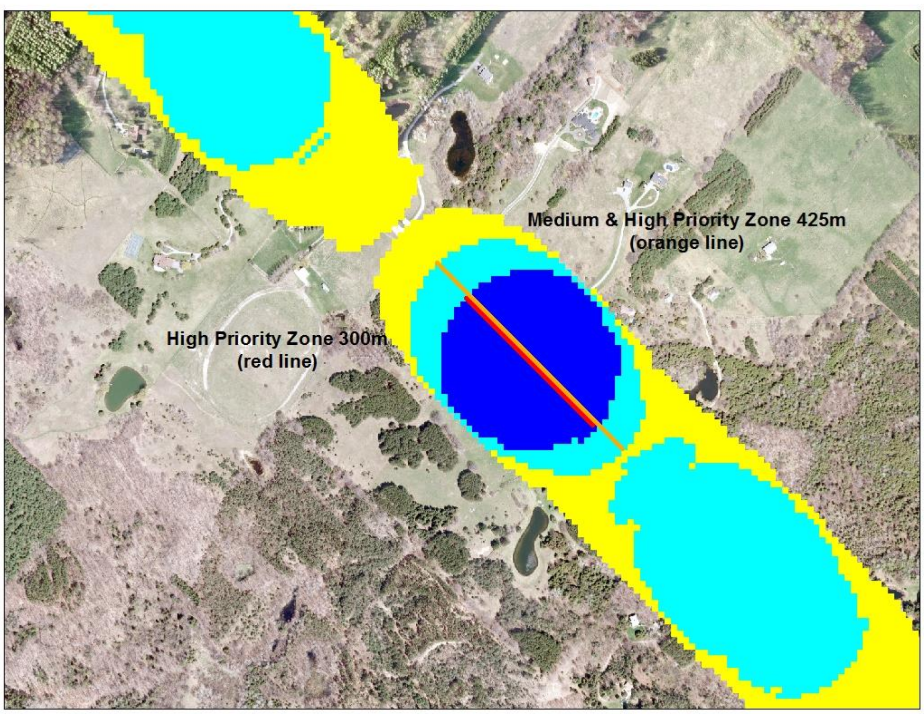

Figure 6. High and medium priority zones combined at the high priority mitigation location identified north of Finnerty Side Road along The Gore Road based on survey results.

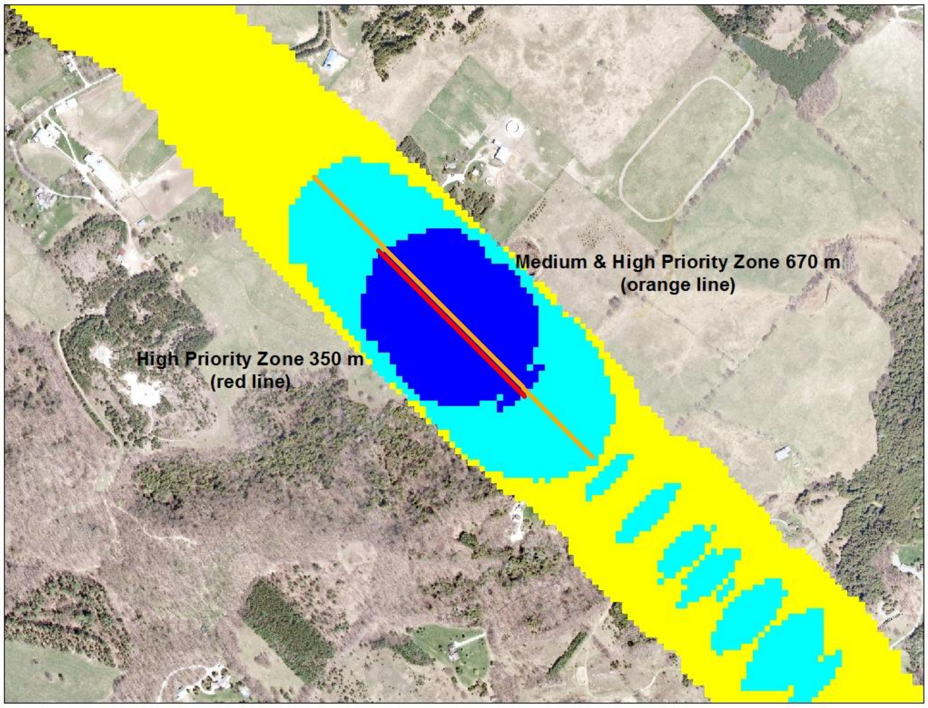

Figure 7. High and medium mitigation priority zones combined at the high priority location identified south of Finnerty Side Road along the Gore Road based on survey results.

Determining the number and distance between the ecopassages should be based on the following criteria:

- minimum movement distances of the target species
- logistics around installing fencing such as ensuring that there is enough space to properly angle the fencing towards the ecopassage, property ownership, existing structures and the gradient of the slope from the road are all influencing factors to be considered

The Long Point Causeway Study (Ecoplans Limited 2008) maintained a distance of 200 m between culverts; however, another study in Florida has suggested up to 300 m for slow moving species such as turtles (Aresco 2003). Based on the logistics of having the space to angle the fencing, the shorter the distance the easier it will be to construct, however this may require additional ecopassages to be installed. Using these criteria, the area to the north of Finnerty Side Road would require one ecopassage if the mitigation was only to target the highest density of road kill (300 m) with 150 m of fencing on either side of the ecopassage. If however, the medium and high density areas were to be covered (425 m) two ecopassages would be required.

There are a variety of configurations that could be investigated to determine what would be most appropriate given the exact site conditions. Further discussions and site visits to assess local conditions should be conducted.

4.2.2 Medium Priority Locations

Under this option, the areas identified as having a high density of road kill as described above along with the areas described as having medium density road kill are mitigated. There are a total of three main medium density road kill spots in addition to the two high density locations. As shown in Figure 8, two of the main medium density locations are to the north of Finnerty Side Road and one to the south. The areas to the north are 715 m and 500 m in length whereas the area south of Finnerty Side Road is approximately 450 m. These three areas combined represent 33% of the road kill observations.

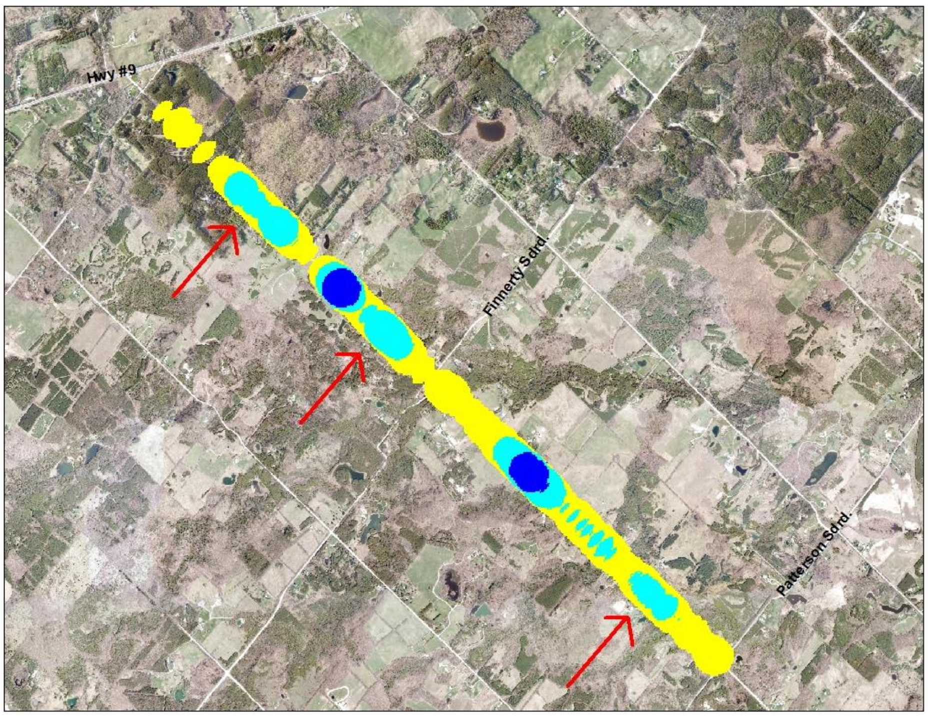

Figure 8. Three identified medium density locations of road kill observations along The Gore Road based on survey results.

4.3 Options for Mitigation Measures

4.3.1 Key Features of Amphibian and Reptile Ecopassages

Previous studies have demonstrated that there are some key design elements of ecopassages for amphibian and reptiles that are important for the overall success of the mitigation project (Ministry of Transportation 2006). These are:

1. The amount of light penetration into the tunnel,
2. The amount of moisture in the tunnel,
3. The substrate of the tunnel, and
4. A funnel wall

Amphibian and reptiles regulate their body temperature through exchange with their surroundings and are therefore sensitive to changes in temperature. Smaller tunnels are generally darker and colder than larger tunnels; as more light is able to penetrate as the size increases. This is referred to as the openness ratio and is calculated by taking the cross sectional area of the culvert opening and dividing by the length of the culvert. The openness ratio recommended for reptiles is 0.25 (Ecoplans Limited 2008). The openness ratio is not only important for reducing the temperature gradient from outside to inside the culvert, but it is also important as many nocturnal amphibians use celestial navigation in order to migrate to and from breeding ponds.

Given that amphibians and reptiles are sensitive to changes in temperature, the substrate of the culvert will be an important feature in the mitigation. Natural substrates are needed in order to reduce the temperature gradient. Wood chips can help to maintain a level of moisture and a few small logs placed throughout the tunnel provide cover. The aim is to make the environment inside of the culvert as close as possible to the environment outside of the tunnel. Culverts inundated with water are not suitable ecopassages; however, culverts that are too dry are also not suitable for most amphibians and reptiles.

A funnel wall is a necessary structure for mitigation as it directs amphibians and reptiles to the ecopassage rather than travelling across the road surface. There are many suitable materials that can be used in the construction of the wall as long as they provide a solid smooth surface so that amphibians cannot climb over or through the structure. Materials such as armourstone, concrete and some plastics have been used in other similar projects. Factors to consider in determining the most appropriate material will be the long-term durability of the product given the extreme climatic conditions of the region and the hydrology of the area. Fencing made out of cloth and some plastics will be susceptible to tears and therefore not effective for mitigation.

In addition, the wall should be high enough that animals cannot jump over it towards the road and designed so that it angles back away from the road with a lip on the top (Figure 9) to facilitate egress for animals trapped within the road corridor. Whatever the material chosen, it will need to be buried into the soil approximately 10 cm and angled so that wildlife is funneled towards the culvert entrance.

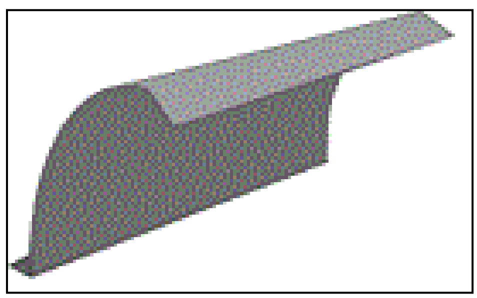

Figure 9. ACO wildlife ecopassage fence design.

4.3.2 Gore Rd. Mitigation

Based on the key features that were described above, ecopassages that provide conditions that have similar temperatures, light, and ground surface to the external environment, will be the most successful in mitigation. These factors alongside other logistical (property ownership, hydrology, etc.) and financial aspects should be considered in order to determine the most feasible solution for mitigation. There are basically two possible options for mitigation:

1. Add funnel fencing to existing culverts in identified hotspot locations
2. Add additional dry culverts and fencing for ecopassage

Several of the existing culvert locations match up well with the identified medium and high density road kill observations (Figure 10). However, only some of these culverts are being replaced with larger structures by the Region. For example, culvert #1346, North of Finnerty Side Road is located in the middle of an area identified as a high priority for mitigation however this culvert is not being replaced at this time. Similarly, at the high density priority area to the south of Finnerty Side Road there is a culvert (#1350) that lies along the northern edge of the priority area that is going to be updated. This update however is minimal with the resulting openness ratio being 0.01 which is well below the 0.25 recommended openness ratio suggested for reptiles (Ecoplans Limited 2008) and amphibians. The only culvert identified by the Region of Peel that will be upgraded, comes close to the suggested openness ratio needed for amphibians and also falls within an identified medium or high density of road observations is culvert #1353. With the upgrade (2 m diameter, 17.1 m length) the openness ratio would be 0.18. Culvert #1352 lies along the southern edge of a medium density of road observations and with the proposed culvert upgrades the openness ratio would be 0.14.

There has been some documented success of adding fencing to funnel amphibians towards existing culverts. However, it is not clear if all types of amphibians would use the culvert if they are inundated with water. Early breeding species such as wood frog and spring peepers travel to the wetlands after the first warm spring rain arrives. Given that the water would most likely freeze in the winter, the gradient temperature inside to outside the culvert would more than likely be too great during the early spring and therefore, would not provide suitable safe passage for these species. In addition, frogs would not swim against a current if it were present in the water.

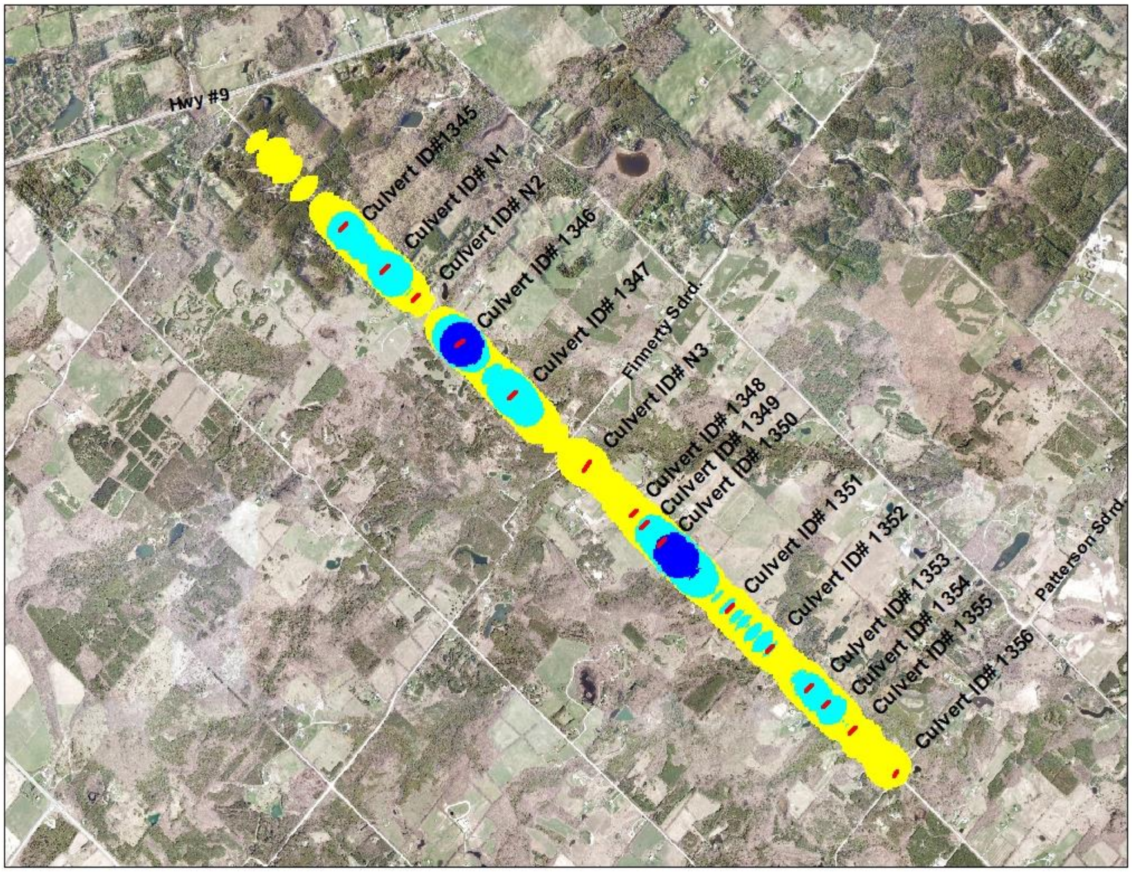

Figure 10. Existing culvert locations (red lines) with road kill hot spots along The Gore Road.

The optimum solution for mitigation would be to install additional dry structures with appropriate dimensions, substrate and funnel fencing. These structures could allow passage for all amphibian species if properly designed. The following are examples that should be considered for this project:

<u>ACO Wildlife Tunnels</u>

These ecopassages are constructed with open grates across the top to allow for optimum light, temperature, and moisture within the tunnel (Figures 11 and 12). A natural substrate will need to be added to the floor of the tunnel including soils from within the study area and cover objects such as small branches and logs. These tunnels are designed so that when set into the road they are flush with the road surface.

There has been some skepticism over the use of this design in cold climates. Frost heaving has been voiced as a concern, however if the tunnels are implemented correctly this will not be an issue. An additional consideration is that there is an opportunity for these tunnels to fill with road salt / sand and other materials from the road surface. This will need to be addressed in the maintenance schedule however, with any type of tunnel there are opportunities for a variety of substances and debris to enter. There are several examples of this product being used in Canada. Most recently, these structures were installed at Long Point Causeway in Norfolk County, Ontario. They have also been installed at Waterton Lakes National Park, Alberta in 2008. From the follow-up monitoring they have found a significant reduction in road mortality of amphibians.

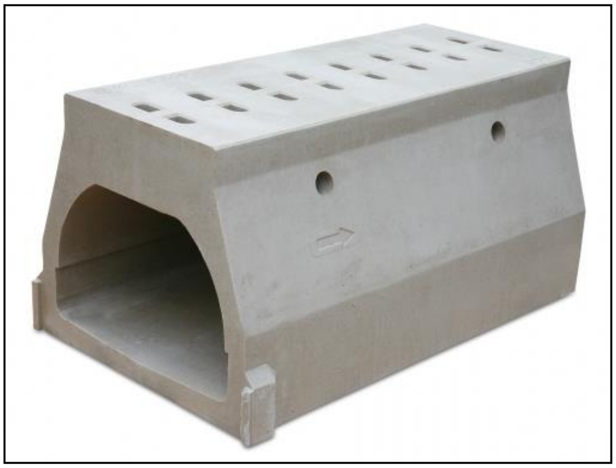

Figure 12. ACO Wildlife amphibian tunnel design with air slots.

Figure 11. ACO Wildlife tunnel flush with road surface.

<u>Box and Concrete Elliptical Culverts</u>

Concrete elliptical (Figure 13) and box culverts have also been shown to be effective provided that the openness ratio allows for enough light to penetrate into the tunnel. A recommended height for box culverts is 1.7 m as this would require the least change in the profile of the road (Ecoplans Limited 2008). If the road length was 20 m, the width of the box culvert would need to be approximately 3 m in order to give an openness ratio of 0.25. Again, these culverts will need to be lined with a natural substrate.

Figure 13. Concrete elliptical ecopassage (photo credit: Ecoplans Limited).

Elliptical culverts can also be created with corrugated steel piping (CSP) which may be the most cost effective solution. Provided the opening is of a sufficient size, a natural substrate can easily be incorporated into the design.

4.3.3 Maintenance

Regardless of the selected mitigation measure a certain level of maintenance will be required. Fencing will need to be checked annually to ensure that the structure has no holes or gaps and that vegetation (trees or shrubs) is not growing next to it. Culverts (ecopassages) will need to be kept clear of debris and if they are meant to be dry culverts that they are acting accordingly.

5. Recommendations

The field data collected provides evidence for the need and the location of some form of mitigation in order to protect and promote amphibian populations along The Gore Road. The next step in the project would be to determine the precise location of these structures on the ground and the best type of mitigation structure(s) to be implemented. Further dialogue between the TRCA and Region of Peel would aim to resolve these issues.

From this pilot study some early lessons are as follows:

1. Ground truthed surveys are necessary not only to validate the TRCA model but to also accurately pinpoint the areas requiring mitigation.

2. Ground truthed surveys need to occur well in advance of road work to ensure that proper planning and mitigation techniques can be applied to the project.

3. Two years of baseline ground truthed surveys should be conducted in order to accurately determine the need and location of mitigation. Due to the unpredictability of seasonal weather conditions allocate 3 years of baseline ground truthed surveys into the project planning to increase the probability that weather conditions will be suitable enough to capture at least 2 years of data within that 3 year period.

4. Ground truthed surveys should ideally be completed on foot with surveyors walking up and down both sides of the road. However, where safety is a concern, surveying by vehicle at a slow speed (10 km/h) is recommended.

From the baseline survey work some recommendations can be identified as follows:

1. If resources are available, dry tunnels should be constructed with directional fencing in areas identified as having a high and medium density of amphibian road kill observations. The areas identified as high density should be first priority for mitigation.

2. If resources are not available to implement dry tunnels directional fencing should be added to culvert #1353. Examine opportunities to retrofit the design of culvert #1350 to increase the openness ratio to better accommodate amphibian movement.

3. If the current resources available only allows for directional fencing to be added to existing culverts, future road work projects along The Gore Road within this study area should aim to incorporate dry tunnels in the areas identified as having a medium and high density of road kill observations.

4. The Region of Peel should use the results from this pilot study and the TRCA's computer model to determine additional opportunities to mitigate reptile / amphibian mortality associated with road crossings throughout their jurisdiction.

5. As the variety of mitigation strategies available to practitioners continues to develop, it is important to document and share the lessons learned with others that are aiming to improve wildlife connectivity in the landscape.

6. As additional pilot projects within TRCA's jurisdiction become available the TRCA can use the ground truthed data collected to improve the accuracy of the computer model.

The key next step for the implementation of this project will be for staff from both agencies to meet in order to identify any limitations and constraints of the project. From this, a determination of which mitigation solutions will be the most appropriate and effective at the site can be planned for implementation.

6. References

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Appendix A: All observations recorded along The Gore Road during surveys in 2012 and early 2013.

Taxa	Species	Dead on Arrival	Alive on Arrival	Total Number Observed
Frogs & Salamanders	American Toad	78	20	98
	Gray Treefrog	68	32	100
	Green Frog	71	25	96
	Northern Leopard Frog	47	12	59
	Pickeral Frog	1	2	3
	Spring Peeper	31	26	57
	Wood Frog	49	30	79
	Unidentified Frog	13	0	13
	Yellow Spotted Salamander	1	0	1
	Eastern Newt	6	15	21
	TOTAL	**365**	**162**	**527**
Reptiles	Eastern Gartersnake	6	0	6
	Red-bellied Snake	1	0	1
	Painted Turtle	7	0	7
	Snapping Turtle	1	0	1
	Unidentified Turtle	2	0	2
	TOTAL	**17**	**0**	**17**
Mammals	Deer Mouse	1	0	1
	Eastern Chipmunk	4	2	6
	Eastern Cottontail	1	0	1
	Grey Squirrel	3	0	3
	Red Squirrel	2	0	2
	Little Brown Bat	1	0	1
	Mink	3	0	3
	Porcupine	2	0	2
	Raccoon	7	0	7
	Striped Skunk	3	1	4
	Virginia Opossum	3	0	3
	Unidentified Rodent	1	0	1
	Unidentified Mammal	6	0	6
	TOTAL	**37**	**3**	**40**
Birds	American Crow	3	0	3
	American goldfinch	1	0	1
	Black-capped Chickadee	2	0	2
	Brown-headed Cowbird	1	0	1
	Cedar waxwing	1	0	1
	Red-winged Blackbird	1	0	1
	Rose-breasted Grosbeak	1	0	1
	Unidentified bird	2	0	2
	TOTAL	**12**	**0**	**12**
	GRAND TOTAL	**431**	**165**	**596**