TG

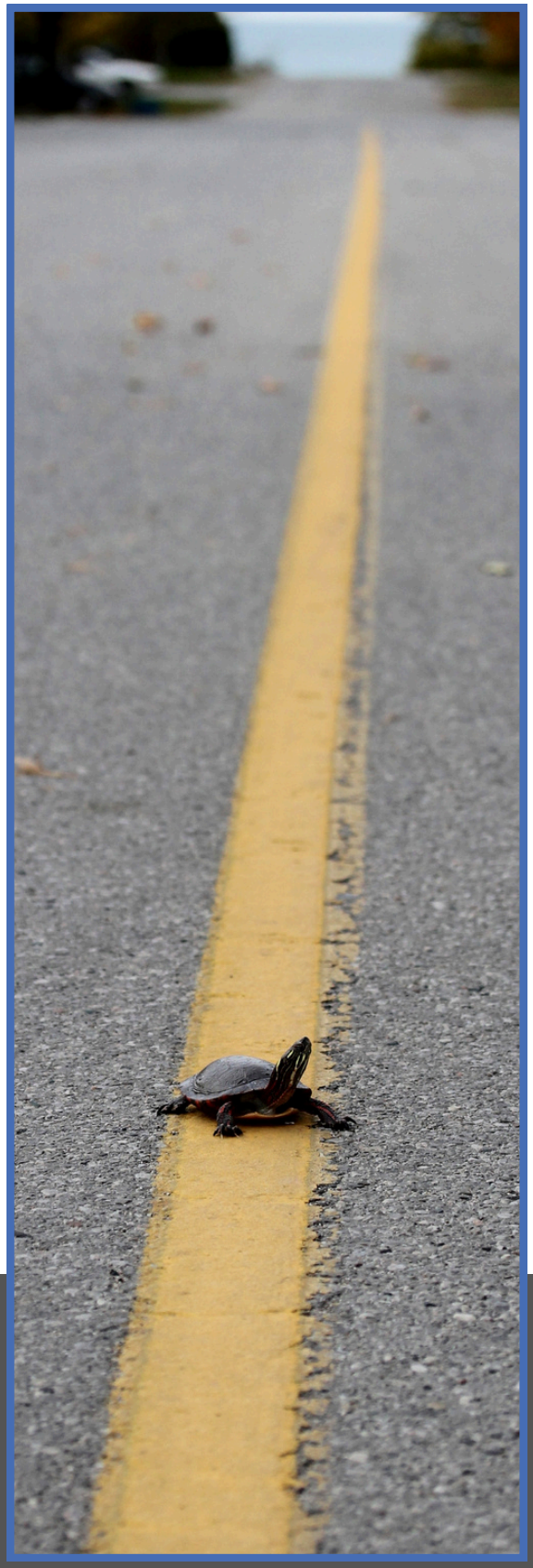
RESEARCH & MITIGATION

RESEARCH PROPOSAL:

ROAD MITIGATION: POST-INSTALLATION SUCCESS MONITORING AND WILLINGNESS TO USE CULVERTS BY TURTLES

OBJECTIVE

Post-installation monitoring for success of a road mortality mitigation system is crucial in ensuring the success of the structure and upholding maintenance requirements. Similarly, evaluating culverts for willingness to use (WTU) ensures that connectivity between and within populations is upheld, reducing the risk of contributing to habitat fragmentation and restricted gene flow. By monitoring for post-effects, unprecedented adverse outcomes can be corrected early.



The objective of this study is to quantify the effectiveness of promoting connectivity at two road mitigation sites in Haliburton county. These mitigation systems consist of half-cut steel food grade barrels (see design and specifications) that guide reptiles toward pre-existing under-road culverts.

The Land Between
TG Research and Monitoring Team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STUDY DESIGN:
METHODOLGY

METHODOLOGY

1. Mark-Recapture Surveys: May-July in 2025 & 2026

Mark recapture surveys will occur at each site from 01 May to 01 July of 2025 and 2026 in the form of **driving surveys** and **pitfall traps**.

Driving surveys

will take place at 0900, 1800, and 2200 on a 2 km stretch of road that contains the mitigation system, occurring simultaneously by one surveyor or citizen scientist each. The surveyor will drive each side of the road once, noting start and end time, as well as any time taken to process a turtle. Upon capturing a turtle, the surveyor will note the following information: **species, age class, activity of the turtle, geospatial reference, sex, and time.** No morphometric data was collected unless it was needed to determine age or sex, and both living and dead turtles were recorded, since all road observations are indicative of fence failure. Using water resistant nontoxic paint (Craftsmart paint pen), the surveyor will mark a unique identification code on the carapace of the turtle's shell. If the turtle is nesting, the surveyor will wait until nesting is complete to process the turtle, subtracting this time from road survey time.

Pitfall traps

will also be used and checked directly after driving surveys are completed (0900, 1800, and 2200). Pitfall traps consist of 10 G buckets with drainage holes drilled into the bottom and buried so that their rim is flush with the ground. The buckets must be white to reflect heat and will be fitted with a geotextile canopy for rain and shade protection. Additionally, the buckets will hold a moist sponge (for amphibians), a small section of PVC pipe (to provide concealment for small animals), and a wooden stick (to allow small mammals to exit the bucket). **The pitfalls will occur on the 'safe sides' of the road, at 25 m, 50 m, 75 m, and 100 m from the culvert.** A section of temporary geotextile fencing will connect the pitfall traps with the barrel fencing to funnel turtles into the traps. Turtles found by the surveyor in the pitfalls will be assumed to have been interested in crossing the road, and will be marked with a unique code, as were the turtles found during road surveys. **Pitfalls must be checked 3x daily.** The following field season, unique identification codes will not repeat numbers from the previous season, in the event that marks are remaining on some turtles (to prevent replicates).

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2. Monitoring for Turtle Use: May-Sep in 2025 & 2026

Motion-sensing wildlife cameras will take photos to passively monitor tunnel usage by turtles.

Wildlife cameras

(Reconyx PC900 Hyperfire Professional) will be used to monitor tunnel usage by turtles. Cameras will be active from **01 May to 30 September 2025 and 2026.** The cameras will be fixed to the ceiling of the ecopassage entrance and exits, and set to the highest sensitivity to trigger photo capture. When triggered, the cameras take 3 consecutive images followed by a 10 minute lag to reduce temporal autocorrelation and double counting of individuals (assuming they could not be distinguished). At night, because slow moving animals are difficult to capture with infrared motion sensors, cameras are programmed to take an image every minute between 1830 and 0630. Using a concrete ramp at the entrance and exit of the culverts, turtles will be forced to reveal their carapace out of the water level to allow for better detection by the cameras. To avoid bias toward 'culvert happy' turtles, the cameras will capture the unique identification code on the carapace of the turtle. The memory cards of the cameras are replaced monthly and new batteries are replaced every 3 months.

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3. Data Analysis

Please note: Due to the importance of connectivity within populations for both sexes, **the data was pooled for the following analyses**.

Cross referencing images on entrance and exit cameras are used to **determine whether the turtle successfully crossed the culvert.** Use is categorized into three levels: 1) *Successfully cross*, 2) *Potential cross*, 3) *Avoidance*. This will be compared between species using an ANOVA (analysis of variance) to **determine if use is limited based on species, and a post-hoc test will be used if a significant difference is detected**.

Successful crossing of the pooled species, sexes, and age classes is compared between sites using a two-sample t-test, **to assess for differences in use**. Frequency distributions are used to visualize temporal patterns of turtle tunnel usage.

To determine whether tunnel usage was influenced spatially or demographically, binomial Generalized Linear Models (GLMs) are used, only including marked individuals to meet the assumption of equal detectability (subject to change based on data availability).

Population size estimates were calculated using the Schnabel Method, and determined for each site. To adhere to the assumption that marks are permanent and visible, each year is considered independent, as marks may be lost over winter. **Population size estimates are compared between sites and years using a two sample t-test**.