TOWNSHIP OF NORTH HURON

BRIDGE INSPECTION REPORT

2016

BMROSS
engineering better communities

TOWNSHIP OF NORTH HURON

BRIDGE INSPECTION REPORT

2016

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File No. 77048

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1.0 INTRODUCTION

Bridges are an important and sometimes expensive component within a road network system. The purpose of a bridge inspection report is to not only identify safety concerns and structural deficiencies but to help prioritize improvements in an effort to minimize the costs to maintain the bridges. Bridges are defined as structures with a span of 3.0 m or more. In the cases of barrel culverts, the span is measured on the normal. BMROSS completed inspections of 8 road bridges and 3 pedestrian bridges in the Township of North Huron in 2016. This report includes a summary of our observations, some general recommendations and a suggested priority list of the needs to help maintain the bridges within the Township.

The bridges were last inspected in 2015. The last time OSIM reports were generated for each structure was in 2013. For this round of inspections, the structures were reviewed to the OSIM format and no new OSIM reports were completed.

Appendices A and B list an inventory of the structures reviewed while Appendix C contains a map showing locations of the structures.

2.0 SCOPE OF THE WORK

This study is to help the Township prioritize the structural improvements, address identified safety concerns in a cost effective way and help predict future costs. It is understood that some of this information will be incorporated into an overall asset management plan by the Township.

In general, the assessment process is divided into the following major components:

1. Prepare an inventory of the bridges based on past inspections completed by our office and information from the Township.
2. The inspections are completed in general accordance with the Ontario Structural Inspection Manual (OSIM) procedures. This includes a review of the bridges looking for safety or structural deficiencies. New OSIM reports, BCI values, and photographs are not included in the scope of work.

3. Develop a probable cost estimate to address the recommended maintenance tasks and structural rehabilitation recommendations identified for each structure. These are divided into tasks required in the short term, within less than 5 years and anticipated within the next 6 to 10 year period.

4. Identify a list of recommended additional investigation work, if warranted, to further evaluate the condition of the structures.

5. Incorporate the information gathered into a needs report that provides general comments about the condition of the structures, provides a priority list of the recommended needs and maintenance work with probable cost estimates.

Note, although a projection of future needs up to 10 years in the future is provided, the Municipality is still required to have biennial inspections completed under the direction of a Professional Engineer as other safety concerns may develop overtime or the integrity of the structures may deteriorate quicker than anticipated.

The site inspections were completed between September 22, 2016, and September 29, 2016 by Ryan Munn, P.Eng. The report and recommended priority list were reviewed by Andrew Ross, P.Eng.

3.0 GENERAL COMMENTS

3.1 Load Limits

At the time of the inspection no structures were posted with load limits. The bridges over the Howson Dam were closed to vehicle traffic.

3.2 Guiderail

Recommendations to replace bridge railings or guiderails on the approaches to bridges has only been included for a few structures in the list of improvements but may also be warranted at other locations not included in the list. Provincial regulations dictate that guiderail is to be installed where warranted in conformance with the *Roadside Safety Manual* of the Ministry of Transportation. The warrants include the need for steel beam guiderail on the approaches to all bridges that have railings. It will also include the need for cable guiderail for most culverts with fill as all of these represent roadside hazards.

Most municipalities find that the guiderail needs are overwhelming in cost and the addition of guiderail to existing structures is usually left until the structure is replaced or rehabilitated. Regardless, the regulations apply to all roadside hazards for all public roads. Consideration should especially be given to structures on roads that are now paved where most of their service life has been as a gravel road. The change to hard surface tends to increase the volume and the velocity of traffic, which increases the probability and consequence of an errant vehicle at any bridge site. Generally, an additional $30,000 + HST should be budgeted for new steel beam guiderail, channel, and end treatments.

Consideration should also be given to sites of poor horizontal alignment or steep fills. The budget figures given do not include the cost of approach guiderail except where listed.

3.3 Single Lane Bridges

Bridges that have widths less than 6.0 m between curbs or railings should be posted as single lane crossings. The deficient width means that repairs to these structures should be given a lower priority with a view to replacing the bridges at the end of their service life rather than extending their service life.

3.4 Waterproofing

In the 1970s, the MTO had a policy of leaving concrete bridge decks exposed so that the deterioration could be monitored. Experience has shown that this visibility has not been worth the deterioration caused by de-icing salts. The MTO now recommends that all concrete decks on paved roads be protected with waterproofing and paving. In the MTO's Structural Financial Analysis Manual, they suggest that the service life of the waterproofing is about 30 years.

At the time of rehabilitation, the deck can be inspected and repaired, if necessary. Some bridges may not be able to accommodate the extra weight of the pavement and an engineer should be consulted before adding new pavement on a bridge deck.

3.5 Routine Maintenance

Bridges require periodic maintenance by staff or contractors. Beam bridges and trusses require bearing seats to be cleaned about once every 2 to 5 years, depending on the site. Expansion joint seals should be cleaned by pressure washer annually; usually in the spring or early summer.

Open footing culverts should be reviewed for erosion of the footings and rip rap should be placed to prevent failure by undermining. Brush and logs should be cleared from under structures or at entrances. Debris jams can cause failure of the entire structure by wash-out during flood events.

3.6 Footing Struts for Open Footing Culverts

Cracks can sometimes develop between the top slab and the top of the abutment wall at articulated frame concrete culverts. This can indicate that the abutment walls are rotating due to inward movement of the footings. This behavior is more concerning at structures where the concrete footings are exposed due to scour or drain lowering. Where both the cracking and the drain lowering exist we typically recommended that concrete footing struts be installed between the footings to resist their inward motion.

3.7 Pedestrian Bridges

Bridges 9, 10 and 11 are older structures, designed and built for roadway or railway purposes. All of these are being used for pedestrian purposes. Their structural ability is assumed since they were designed for much heavier loads. No structural analyses have been completed.

Some structural components show significant deterioration. The individual reports should be read to better understand the deterioration.

Structure #10, the southern portion of the bridge over the Howson Dam is in an advanced state of deterioration and it is not likely that a repair would be practical. It is possible that one of the future safety inspections will identify structural deterioration advanced enough that closure of the bridge to pedestrian traffic will be required. It may be desired to physically remove the bridge to reduce liability from collapse, but consideration must be given to how the removal could affect the dam. Removal of the mass of the bridge could cause de-stabilization of the dam.

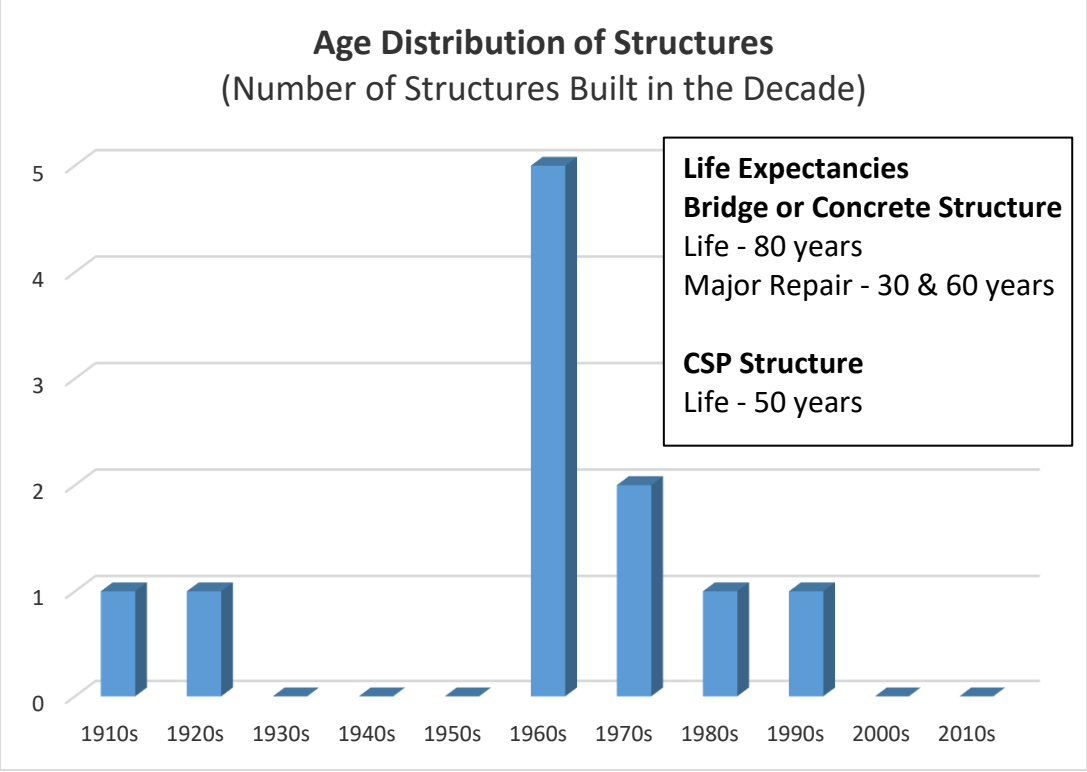
The former Railway Bridge (#11), has some significant deterioration of the north abutment, pier tops, and some secondary truss members. Consideration should be given to a program of rehabilitation if the bridge is to be maintained in the long term.

4.0 SUMMARY OF BRIDGE DATA COLLECTED

4.1 Age of Road Bridges

The Ontario Ministry of Transportation's *Structural Financial Manual* from 1993 suggests that the average service life of a bridge in Ontario is about 50 years. Other references and the new Bridge Code suggest bridges should provide a service life of 75 years. It is our opinion that rural bridges in this part of Ontario can be expected to provide a service life of about 80 years if properly maintained and repaired. The Township has 8 road structures. On average, the Township should be replacing one structure in every 10 year period to avoid a concentrated replacement program in the future. No structures were identified as requiring replacement in the next 10 years. Figure No. 1 shows an age distribution of the structures in the Township based on documented (Contract drawings, or plaques) and estimated dates of construction.

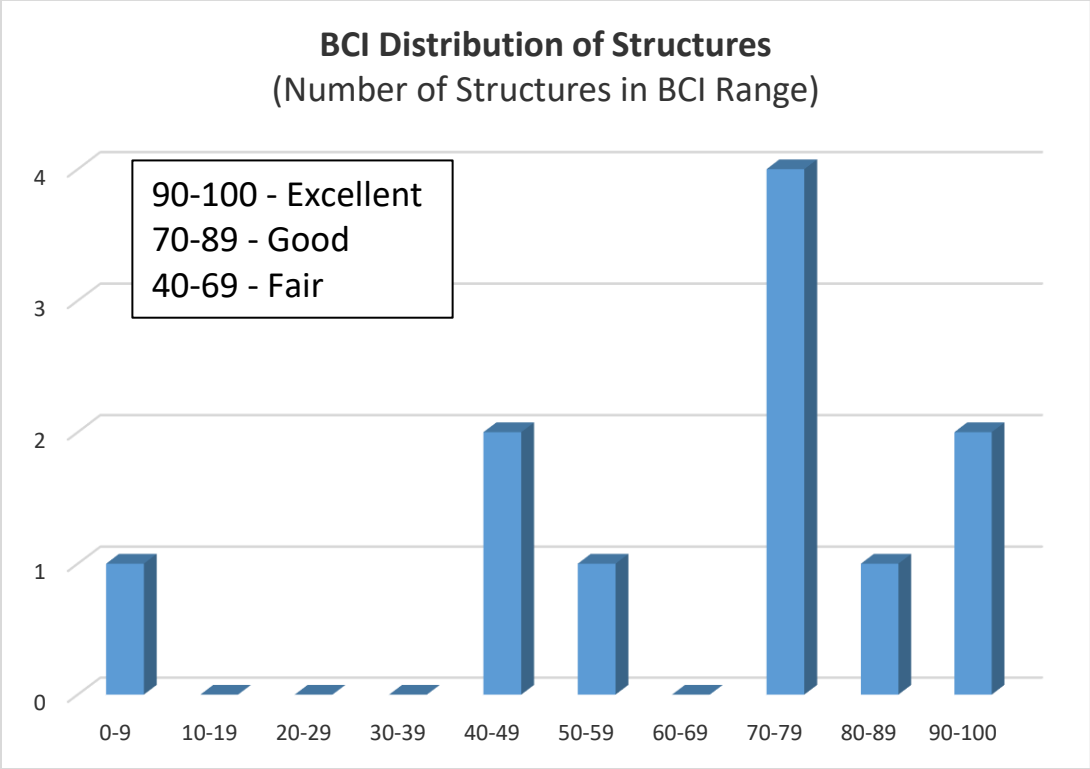
Figure No. 1



4.2 Bridge Condition Index

Figure 2 provides a breakdown of the Bridge Condition Index (BCI) range for the Township's bridges. The Ontario Ministry of Transportation's Bridge Condition Index information from 2009 indicates that the BCI is a measure of the overall structural condition of the bridge. The score is developed with a weighted average of the condition ratings for the individual components assessed. Generally, a structure with a BCI greater than 90 would be considered to be in excellent condition, 70 to 90 in good condition, 40 to 70 in fair condition and below 40 in poor condition.

Figure No. 2



5.0 RECOMMENDED WORK FOR ROAD BRIDGES

The list of recommended repairs and structure replacement type improvements has been assembled in Table 1 and 2. Table 1 includes the higher priority tasks recommended for completion within the next 5 years and Table 2 has tasks recommended for completion in the 6 to 10 year period. The needs have been prioritized based on the opinion of the Engineer. This priority list is only a recommended sequence and the ultimate decision on the order of repairs or replacement should be made by the Municipality.

One influence on the priority list may be the Municipality's schedule for road reconstruction or resurfacing. Priority may be shifted to those structures on roads scheduled to be resurfaced to allow for deck patching, waterproofing or other repairs that are best done ahead of road resurfacing.

Table 1
Suggested Priority List of Repair and Replacement Needs
1 to 5 Year Period

Site Number	Location	Repair Description	Probable Cost	2013 BCI
006	Moncrieff Road	Erosion Protection	$5,000	75
005	Marnoch Line	Patch repair curbs	$16,000	75
002	Currie Line	Replace handrails and Patch repair deck top	$32,000	72
007	Scott Line	Repair Handrail	$3,000	
		TOTAL	**$56,000**	

Table 2
Suggested Priority List of Repair and Replacement Needs
6 to 10 Year Period

Site Number	Location	Repair Description	Probable Cost	2013 BCI
003	Nature Centre Road	Patch repair deck, allowance for waterproofing and paving	$70,000	51
004	Nature Centre Road	Patch repair deck, waterproof and pave	$70,000	74
		TOTAL	**$140,000**	

Please note that the probable cost of repairs has been calculated based on 2016 construction costs. Appropriate inflation factors should be applied for other years. The costs in Table 1 and 2 include engineering, design, administration, and a 10% contingency. It is becoming increasingly difficult to provide a budget price for projects as the industry demand fluctuates. It is recommended that an updated estimate be obtained when the preliminary designs are prepared. As mentioned previously, efficiency can be gained by grouping like projects together to keep costs down.

To aid in long-term budgeting we have included repairs and replacements which have been identified for the 6 to 10 year period in Table 2. Probable costs for these structures are based on 2016 prices and 2016 quantities, it is expected that quantities for repairs will increase over time, and the extent of deterioration should be re-evaluated with future bridge inspections and when the preliminary designs are prepared. It may be determined then that the condition of the structure has deteriorated more or less than anticipated and the recommended method of repair may have to be changed.

To complete all the work recommended within the next 5 years would cost on average about $11,200 + HST per year over 5 years and within the 10 year period would be about $19,600 + HST per year over 10 years, not considering any new or emerging deficiencies. If this amount exceeds the Municipality's budget, it may be possible to address some of the short fall with

money from grants, addressing the safety concerns with temporary repairs instead of replacements or by delaying the work. If the work is delayed, it is possible that costs will increase and that load limits or bridge closures may be recommended in the future.

6.0 RECOMMENDATIONS FOR PEDESTRIAN BRIDGES

The Township should be aware of the deteriorations listed in the individual reports for all three structures (9, 10, and 11).

Rehabilitation or replacement of the crossings would be very expensive. It is recommended that the Township consider a long-term plan to determine if it is desirable to maintain both crossings or concentrate efforts and funds on one of the crossings. Allowances for repairs are included in Table 3 and Table 4 below. The actual costs could vary significantly depending on the scope of work.

Plans and approvals for a repair program could be prepared in readiness to apply to a grant program. There are sometimes grants for recreational or heritage projects for which these bridges may qualify. However, the timelines are often short and having plans and approvals in place would increase the chances of a successful grant application.

Table 3
Suggested Priority List of Repair and Replacement Needs
1 to 5 Year Period

Site Number	Location	Repair Description	Probable Cost	2013 BCI
011	Railway Pedestrian Bridge	Reinforce ends of guardrails and replace missing lag bolts	$8,000	44
011	Railway Pedestrian Bridge	Allowance to install shoring and inspect structure for deterioration and remove debris	* $50,000	44
011	Railway Pedestrian Bridge	Allowance to Repair North abutment	$80,000	44
		TOTAL	**$138,000**	

* The costs could vary significantly depending on the scope of inspection required. A Contractor will be required to assist with the inspection.

Table 4
Suggested Priority List of Repair and Replacement Needs
6 to 10 Year Period

Site Number	Location	Repair Description	Probable Cost	2013 BCI
011	Railway Pedestrian Bridge	Allowance to repair components identified in the structural inspection including piers and truss components	$200,000	44
010	Howson Dam – South	Allowance to restrict pedestrian access on and below the bridge	$5,000	7
009	Howson Dam – North	Allowance to Repair railings	$50,000	7
		TOTAL	**$255,000**	

7.0 FURTHER INSPECTIONS

Provincial regulations require all bridges with spans greater than 3 m to be reviewed every two years under the supervision of a Professional Engineer. As such, the structures should be reviewed again in 2018.

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED

Per _____
R.J. Munn, P. Eng.

Per _____
A.I. Ross, P. Eng.

:hv

APPENDIX A

INVENTORY SORTED BY STRUCTURE NUMBER

Township of North Huron
Bridge Inventory Summary by Structure Number

Site Number	BMROSS Number	Structure Type	Structure Name	Road Name	Structure Location	Total Span Length (m)	Year Built	BCI	Probable Cost of 1-5 Year Recommended Work
001	BR403	I-beam or Girders	10th Line Bridge	Belfast Road	Lot 30, Concession 10-11, over Maitland River	83.4	1989	96	$0
002	BR157	Rigid Frame, Vertical Legs	McLean Bridge	Currie Line	Lot 39-40, Concession 8, over Belgrave Creek	9.1	1968	73	$32,000
003	BR238	Rigid Frame, Vertical Legs	Taylor Bridge	Nature Centre Road	Lot 32, Concession 6-7, over Belgrave Creek	15.2	1970	51	$0
004	BR158	Rigid Frame, Vertical Legs	Scott Bridge	Nature Centre Road	Lot 37, Concession 6-7, over Belgrave Creek	10.7	1967	74	$0
005	BR159	Rigid Frame, Vertical Legs		Marnoch Line	Lot 33-34, Concession 6, over Belgrave Creek	12.1	1967	75	$16,000
006	BR239	Rectangular Culvert	Toll Culvert	Moncrieff Road	Lot 37, Concession 2-3	4.3	1969	75	$5,000
007	BR281	Rigid Frame, Vertical Legs	Patterson Bridge	Scott Line	Lot 36-37, Concession, over Blyth Brook	13.7	1971	82	$3,000
008	BR602	Rigid Frame, Vertical Legs	Potter Bridge	Currie Line	Lot 39-40, Concession 2, over Blyth Brook	10	1994	92	$0
009	BR476	Solid Slab	Howson Dam - North Structure	Water Street	Over Maitland River	11.6	1966	44	$0
010	BR476	Rigid Frame, Vertical Legs	Howson Dam - South Structure	Water Street	Over Maitland River	43.6	1920	7	$0
011		Deck Truss	Railway Pedestrian Bridge		Downstream of Water Street	66.9	1915	44	$138,000

APPENDIX B

INVENTORY SORTED BY BRIDGE CONDITION INDEX

Township of North Huron
Bridge Inventory Summary by BCI Number

Site Number	BMROSS Number	Structure Type	Structure Name	Road Name	Structure Location	Total Span Length (m)	Year Built	BCI	Probable Cost of 1-5 Year Recommended Work
010	BR476	Rigid Frame, Vertical Legs	Howson Dam - South Structure	Water Street	Over Maitland River	43.6	1920	7	$0
009	BR476	Solid Slab	Howson Dam - North Structure	Water Street	Over Maitland River	11.6	1966	44	$0
011		Deck Truss	Railway Pedestrian Bridge		Downstream of Water Street	66.9	1915	44	$0
003	BR238	Rigid Frame, Vertical Legs	Taylor Bridge	Nature Centre Road	Lot 32, Concession 6-7, over Belgrave Creek	15.2	1970	51	$0
002	BR157	Rigid Frame, Vertical Legs	McLean Bridge	Currie Line	Lot 39-40, Concession 8, over Belgrave Creek	9.1	1968	73	$32,000
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006	BR239	Rectangular Culvert	Toll Culvert	Moncrieff Road	Lot 37, Concession 2-3	4.3	1969	75	$5,000
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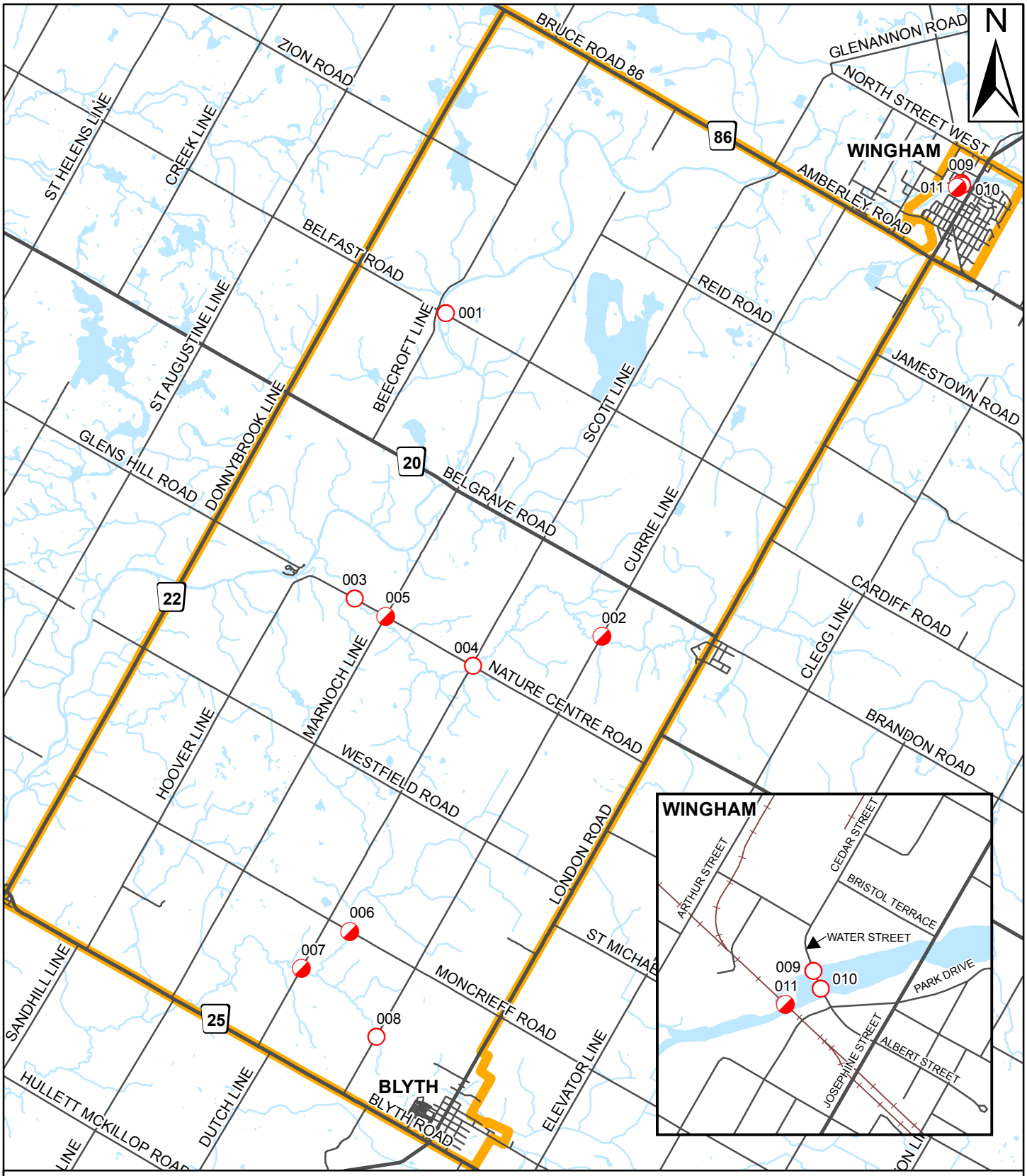
008	BR602	Rigid Frame, Vertical Legs	Potter Bridge	Currie Line	Lot 39-40, Concession 2, over Blyth Brook	10	1994	92	$0
001	BR403	I-beam or Girders	10th Line Bridge	Belfast Road	Lot 30, Concession 10-11, over Maitland River	83.4	1989	96	$138,000

APPENDIX C

MAP



BMROSS engineering better communities

TOWNSHIP OF NORTH HURON

BRIDGE NEEDS STUDY

1-5 YEARS

DATE	PROJECT No.
OCT. 2016	77048
SCALE	FIGURE No.
1 : 100,000	1