TOWNSHIP OF HURON-KINLOSS

BRIDGE INSPECTION REPORT

2021

BMROSS
engineering better communities

TOWNSHIP OF HURON-KINLOSS

BRIDGE INSPECTION REPORT

2021

April 18, 2022

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street
Goderich, ON   N7A 2T4
Phone: 519-524-2641
www.bmross.net

File No. 03012

Table of Contents

List of Tables

List of Figures

List of Appendices

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4
p. (519) 524-2641 www.bmross.net

File No. 03012

TOWNSHIP OF HURON-KINLOSS
BRIDGE INSPECTION REPORT - 2021

1.0 INTRODUCTION

In accordance with the Township's instructions, BMROSS completed inspections of 99 structures in the Township of Huron-Kinloss. Bridges are defined as structures with a span of 3.0m or more; however, there were numerous structures below 3.0m which are included in this survey for consistency with past reports. In the case of barrel culverts, the span is measured normal to the stream. Appendix A lists an inventory of these structures by structure number, Appendix B lists an inventory of these structures by BCI number, and Appendix C contains maps showing the locations of the structures. Appendix D illustrates the priority scoring factors in a table format.

The intent of the survey was to identify safety problems, structural deficiencies, and other recommended maintenance needs for the Township's structures and determine probable costs to address these needs. The goal of the study was to develop a priority list of bridge repairs and replacements, for the next five year period and explain any general observations. In addition, a prediction of the anticipated future costs to maintain the bridge network has been performed to assist with long term budgeting. Inspection reports were completed for each structure to the format of the Ontario Structural Inspection Manual (OSIM). The OSIM reports are bound separately.

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 updated inventory of the bridges using information supplied by the Township or obtained from previous inspections.
2. The inspections are completed in general accordance with the Ontario Structural Inspection Manual (OSIM) procedures. This includes a review the bridges looking for safety or structural deficiencies, taking measurements and assigning condition ratings of the key bridge elements to develop a Bridge Condition Index (BCI) as per the OSIM. Photographs were taken of all sites and of some defects to better illustrate the condition of the bridges.

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 less than 1 year, 1 to 5 years and 6 to 10 years. These costs are included on the OSIM forms.
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 Township is still required to have bi-annual 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.

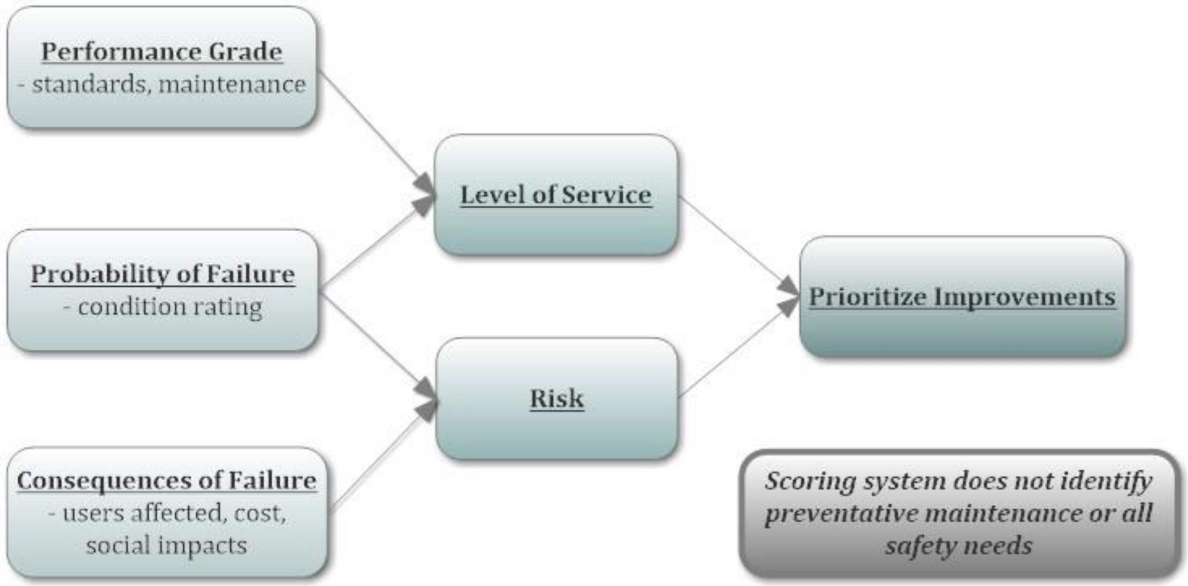
The site inspections were done between May 2021 to October 2021. The structures were reviewed by Jeff Jones, P. Eng. The report and recommended priority list were reviewed by Ken Logtenberg, P. Eng.

3.0 METHODOLOGY TO PRIORITIZE IMPROVEMENTS

When prioritizing the recommended capital improvements for a Bridge Needs Assessment or an Asset Management Plan for other municipal assets, we believe there are generally three key factors that should be taken into consideration; the probability of failure, the consequence of failure and the performance grade. While these factors can include many components, the **probability of failure** factor is generally represented by the condition rating or age of an asset. The **consequence of failure** is a score based on the number of users affected if the asset cannot be used safely or other social impacts and the cost of the asset. The **performance grade** should incorporate the relative maintenance requirements of the asset and a comparison of how the asset was built versus the appropriate design standard for that particular asset. In a simplified way these components were used, as illustrated in Figure 1, to develop a theoretical **priority score** for the improvements.

BMROSS has developed a scoring system to help prioritize the improvement needs as per the relationship shown in Figure 1 and as a starting point, we are using two parameters to assign a score for the performance grade. For this study, the width of the bridge or culvert and the presence or lack of a load limit was used to calculate a performance grade for each road section. If the Township desires, in the future, other characteristics could be used to further refine this scoring system. If the width of the structure was, in our opinion, appropriate for a two-lane road a score of 1 was applied. If the width was somewhat narrow to accommodate two lanes of traffic, a score of 3 was applied and if the bridge was only suitable for a single lane of traffic, a score of 5 was applied. Similarly, the good score of 1 was assigned if the structure does not have a load limit and a score of 5 was assigned if there is a current or pending load limit. The average of the structure width and load limit score was used in the evaluation.

Figure 1
Relationship between Data Collected and Calculated Theoretical Priority Scores



The BCI value calculated as per the OSIM format was used to determine the probability of failure score. Structures with BCI scores below 40 were assigned a score of 5 and structures with a BCI scores above 85 were assigned scores of 1. Between those values the score changes by one unit as the BCI score increases by 15 points. Meanwhile, the consequence of failure value has been calculated based on the assumed or supplied traffic volumes on each road section. A score of 1 means it has an average annual daily traffic value of less than 50 and a road with greater than a 1000 vehicles per day would have a score of 5. A table showing how the scores were assigned is provided in Appendix D and the respective scores for the bridges is provided in D-1.

The scores assigned for the three key factors were added together as illustrated in the figure to determine the theoretical level of service score, risk score and priority for improvement score for each asset. Although these are just relative numbers, municipalities may choose to define a targeted average level of service or risk value for their bridges system using these values. They can also monitor and track these average scores over time for future comparison purposes. The theoretical priority score for each asset is the combined score of the level of service factor and the risk factor. Defining the desired level of service or acceptable levels of risk are beyond the scope of this study, so only the priority score has been presented and used.

The theoretical priority scoring system has been used as a guide to help prioritize improvement work on the assets however there are other factors that should be taken into account when prioritizing the road improvements. Factors including preventative maintenance activities, scheduling tasks to coincide with integrated assets within the same area, addressing specific safety concerns, financial and timing restraints and other activities taking place within the vicinity must be considered by Township staff. It is impossible to take into account all of these other factors in a simplified scoring system. For this reason, the theoretical score of highest priorities established on an individual asset basis is only used as a guide and the priority list provided in this report is, in the opinion of the inspecting engineer, the best sequence to incorporate the identified preventative maintenance and the specific safety concerns. The suggested priority for the structures is provided in Tables 1 and 2, and the theoretical priority is just provided for information purposes. Note, as the condition of the structures may deteriorate differently than anticipated overtime and we are not aware of the other activities taking place in your Township or other financial obligations of the Township, adjustments to the sequence of the improvements may need to be made overtime by the Township.

4.0 GENERAL COMMENTS

4.1 Load Limits

At the time of the inspections, four structures had load limits at the time of the review. They are as follows:

- H26 11 tonnes
- H28 12 tonnes - Proposing a reduction to 8 tonnes
- H30 16 tonnes
- H35 8 tonnes

We are recommending that the load limit for structure H28 be reduced because it appears additional concrete has spalled off the bottom of one of the girders and the cracks on the sides and bottom of the girders previously identified appear slightly more pronounced. Changes to the signage at the bridge and at each end of the block in which the structure is located, will be required.

With structure K3, we are concerned about the condition of this bridge given its age, but we could not get under the structure to review the soffit when on site this year. We are not proposing a load reduction at this time since photos from the previous inspections did not suggest a load reduction was warranted at that time.

It is proposed the load limits on the other structures remain the same at this time and until further deterioration is observed.

4.2 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 $40,000 + 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.

4.3 Single Lane Bridges

Structures 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.

4.4 Waterproofing

In the 1970's, 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. It is generally now recommended 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 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.

4.5 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.

Where obvious maintenance needs were identified they were included in the list of maintenance needs table. Some of these are also listed within the list of repairs on the OSIM reports. It has been assumed that this work will be completed by Municipal staff; therefore, no engineering costs have been included in the cost estimate for this work.

At several structures, the existing approach shoulders are loose, steep, built up or washing out. Additionally, material at the wingtips is severely eroded to the point that the asphalt/approach slabs are being undermined. The Township should routinely review the condition of the above noted elements and place riprap or compacted granular material as required.

4.6 Footing Struts for Open Footing Culverts

Cracks between the top slab and the top of the abutment wall at articulated frame concrete culverts 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 have typically recommended that concrete footing struts be installed between the footings to resist their inward motion. Based on our observations no existing structures currently required footings struts.

4.7 Corrugated Steel Pipe Arch Structures

Within the Township, there are some multi-plate corrugated steel pipe arched (CSPA) culverts that possess cracks along a portion of the haunch. It has been identified that when assembled incorrectly and with inadequate compaction, cracking often occurs. The structures have been recommended to be replaced in the near future. The condition of these structures should be monitored during future inspections, and they should be scheduled for replacement, as required. Several bolted corrugated steel pipes have had springline crack repairs and although the installation of reinforcing helps extend the lifespan of these culverts this process only slows down the deterioration process. Structures H45 and H56 all have springline cracking. While we have proposed that these be replaced within 6 to 10 years they may not deteriorate as quickly as assumed. Regardless, it is anticipated that the Township will have to replace these structures within the next 20 years. Costs associated with replacement of the other structures have not been included.

A few CSP structures have minimal, to no embedment. The structures may be undermined over time reducing their life span. For these structures, rehabilitation includes placement of riprap at the ends of the culvert. Depending on the existing condition, concrete grout may need to be placed in the eroded void where the stream bed elevation is significantly lower than the invert of the culvert

5.0 SUMMARY BRIDGE DATA COLLECTED

5.1 Age of Bridges

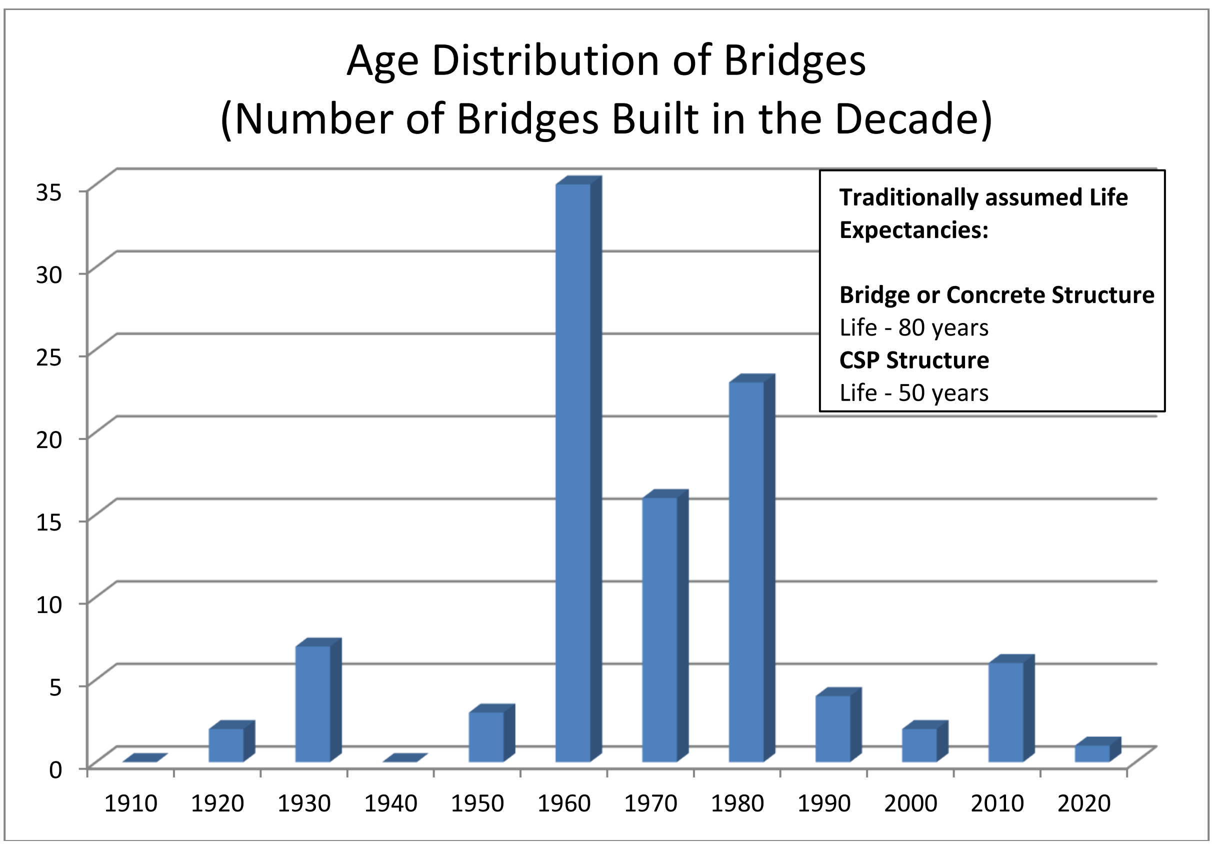
The Ontario Ministry of Transportation's *Structural Financial Manual* from 1993 suggests that the average service life of a bridge in Ontario is about 50 years. Other references and the new Bridge Code suggest bridges should provide a service life of 75 years. Traditionally it has been our opinion that rural bridges in this part of Ontario can be expected to provide a service life of about 80 years or more if properly maintained. That said, with some structures it may be determined that it is more cost effective to perform rehabilitation work that extends the life of the bridge well beyond 80 years. The Township has 99 structures. We discuss the life expectance for bridges further in section 5.3 but if we assume a life expectancy of 80 years, on average, the

Township should be replacing between 6 to 7 structures in any five-year period to avoid a concentrated replacement program in the future.

It has traditionally been assumed that corrugated steel pipe structures will last about 50 years. More recently, these structures are coated with a polymer coating that the suppliers suggest will extend the life of the culvert to about 75 to 100 years, but the coated pipes have not been around that long so we are a little skeptical. The life expectancy of corrugated steel culverts is discussed further in section 5.3 but it has generally been our opinion that the service life of a CSP will be about 50 years if it is not coated and about 75 years if it is coated.

Figure No. 2 shows an age distribution of the bridges in the Township using the assumed year-built information provided, or when it was not provided, the year built estimated by BMROSS was used. The average assumed age of the structures within the Township is 49 years.

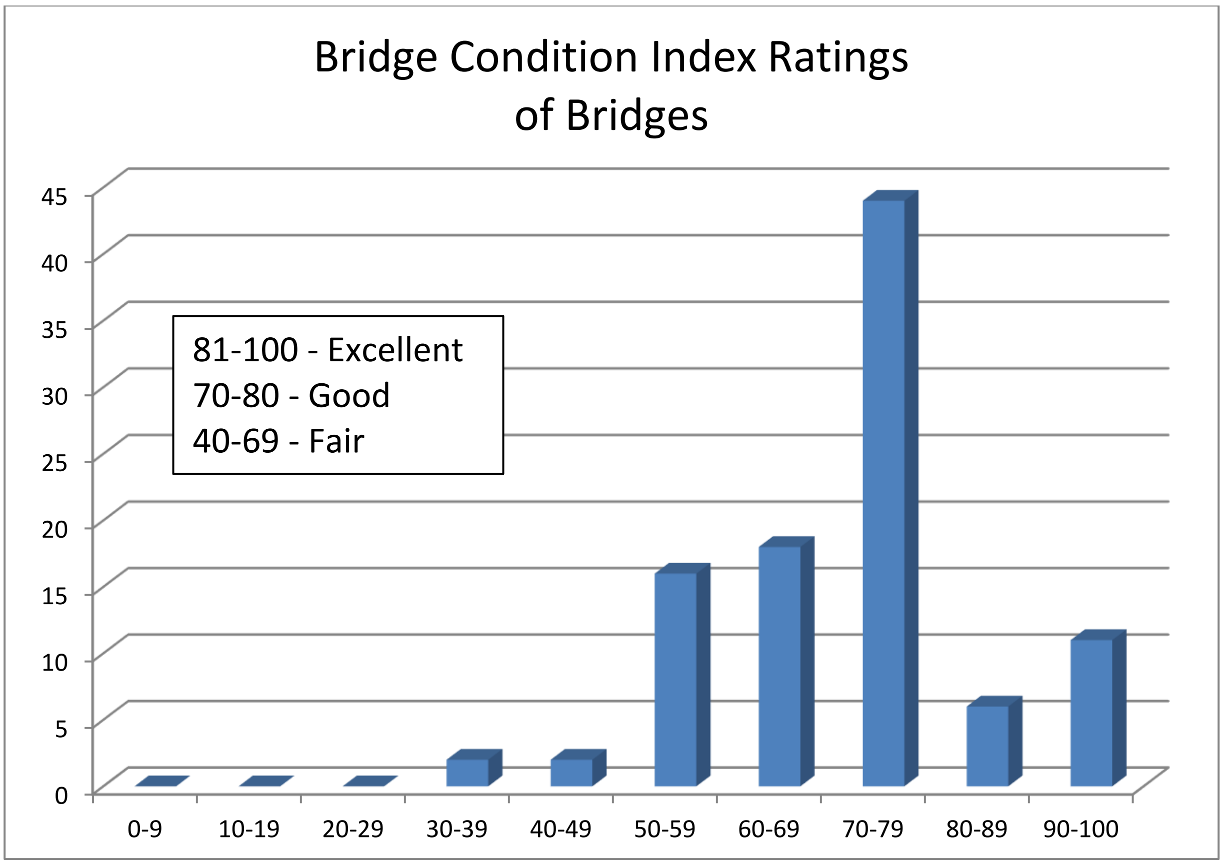
Figure 2
Age Distribution of Bridges



5.2 Bridge Condition Index

Figure 3 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 is in excellent condition, 75 to 89 good condition, 40 to 74 is in fair condition and below 40 the structure is in poor condition. The average BCI score for the structures in the Township is 71.

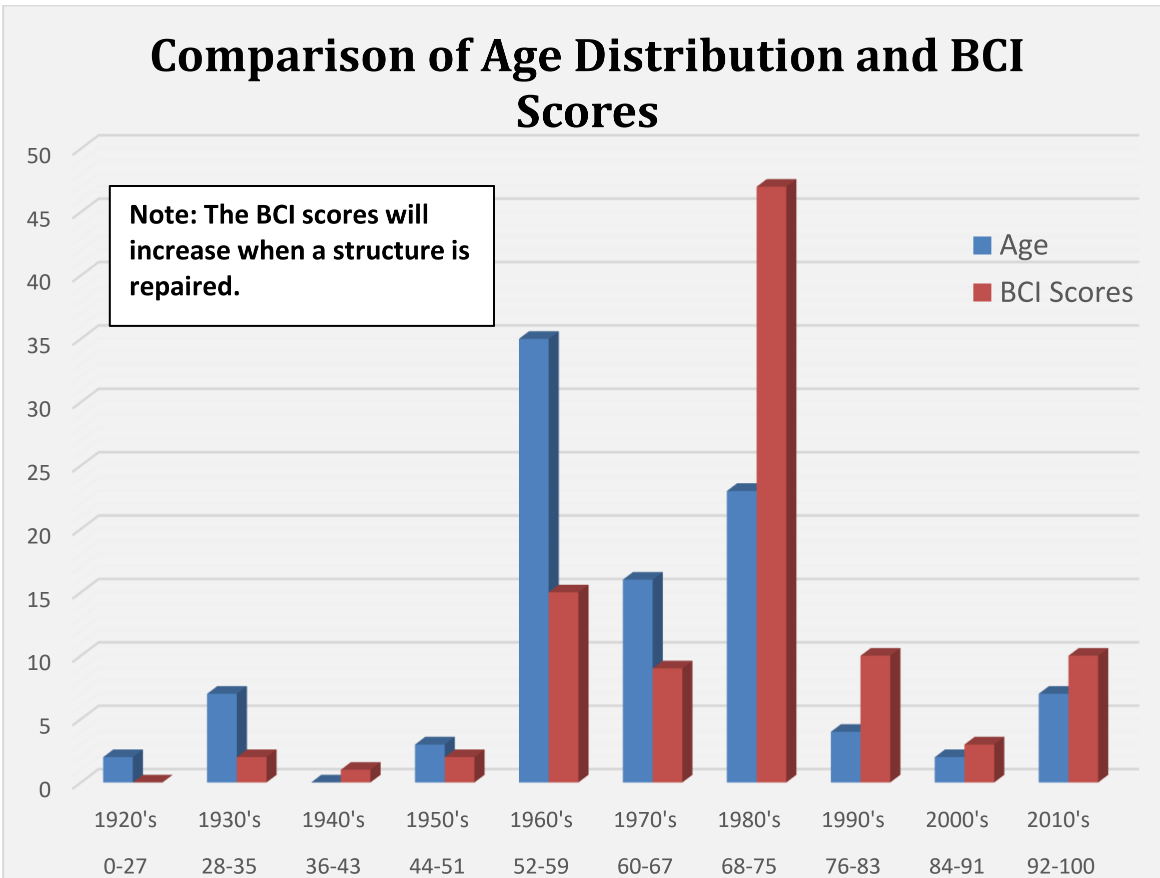
Figure 3
BCI Distribution of Bridges



5.3 Comparison of Bridge Age with Bridge Condition Index

Figure 4 provides a comparison of the bridge ages with the bridge condition ratings within the Township. The MTO has suggested that a bridge with a condition rating below 40, as calculated using the OSIM scoring method, should be considered for replacement. As noted earlier, we have suggested that the average service life of bridges in a lower tiered municipality should be higher suggested by the MTO. We had suggested an average service life for bridges to be 80 years and uncoated CSPs to be 50 years. When comparing the condition rating with the expected service life of the bridges, we have assumed the over-all average service life for all the structure will be 80 years. If our service life and condition score assumptions are correct, after 80 years a structure should have a condition rating of about 40. Figure 4 was prepared to match up the assumed timelines of these two parameters. When reviewing the figure, it appears that the condition scores are not deteriorating at the same pace as expect for the age of the structure.

Figure 4
Comparison of Age Distribution and BCI Scores



The average age of the bridges within the Township is 50 years old. If the average life expectancy is 80 years, that suggests that they are on average 61% of their way through their service life. Meanwhile, the average BCI rating is 71 which suggests that the structures, on average, are only 48% of their way through their life expectancy. Based on this statistic and a review of Figure 4; which suggests the BCI scores are on average higher than they should be for the average ages of the structures, we are of the opinion that the average life expectancy of your structures will be greater than 80 years. We performed a more detailed review of each structure and using engineering judgement we tried to predict when further rehabilitation and replacements will be required. Based on this review, we suspect that the average life expectancy of the bridge structures within your Township could be greater than 100 years, concrete culverts greater than 100 years and CSP will be about 60 years, if proper maintenance and rehabilitation work completed at the appropriate time. To help ensure the life expectancy of the bridges is greater than 100 years, we have included a cost allowance to perform a major rehabilitation on the bridge structures and minor repairs to the concrete culverts when they are about 75% of their way through their life.

To help predict the annual costs to perform the necessary replacements and rehabilitation work on the structures within the Township in the future, we performed a review of each structure and have created a table that is presented in Appendix E. This table was prepared with repair and replacement expenses presented in today's dollars. It suggests that on average, $700,000, excluding HST, should be spent on bridge repair and replacement costs over the long term. To help compensate for inflation, the amount of money set aside to maintain the bridge structures should be increase by the amount of inflation each year. Note, when preparing the table, we made the following assumptions:

- No allowance for inflation has been provided
- No allowance for bridge upgrades to comply with changes to design standards and expansions to the road network.
- The work required in year 1-5 and 6-10, generated when creating the OSIM reports, was used in the table.
- As structures are typically replaced with a larger structure than the existing, the proposed replacement costs were estimated to be 20% greater than the anticipated replacement cost of the existing structures.
- Life expectancy for bridges will be 100 to 120 years but the bridge will experience a major rehabilitated project at least once in its lifetime to help achieve that life expectancy.
- Life expectancy for a concrete culvert is between 100 and 120 years with a minor rehabilitation project at least once in its lifetime to help achieve that life expectancy.
- Corrugated steel culverts replaced in the future will have a maximum life expectancy of 60 years. Based on a review of numerous CSP structures, it appears that on average they will last about that long.
- A contingency factor to account for premature failure of a structure due to flooding, or failure to complete rehabilitation work at the appropriate time has not been provided.

6.0 RECOMMENDED WORK

A list of recommended repairs and structure replacement type improvements has been assembled in Tables 1 and 2. Table 1 includes, in order, 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 using the method explained in Section 3 and the opinion of the Engineer for the work in the 1-5 year range in Table 1. As explained in Section 3.0, sometimes projects that have a lower theoretical priority score are moved ahead to complete preventative maintenance work or for other reasons not incorporated in the scoring system. Structures with a higher calculated theoretical priority score should generally be replaced or rehabilitated sooner. That said, this priority list is only a recommended sequence and the ultimate decision on the order of repairs or replacement should be made by the Township.

Table 1 includes expected years for replacements or rehabilitations for each of the structures listed. Structures with similar needs and/or are in close proximity have been grouped together and could possibly be completed under the same contract. Tables 2 and 3 list structures in priority and alpha numeric order. It should be noted that these structures will continue to deteriorate at different rates. These structures should be monitored during future inspections and the time frame adjusted as required.

Another influence on the priority list may be the Township's schedule for road reconstruction and 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.

Please note that the probable cost of repairs has been calculated based on 2021 construction costs. Appropriate inflation factors should be applied for other years. The costs in Table 1 and Table 2 include engineering, design, administration, and a 10% to 20% 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 usually be gained by grouping like projects together to keep costs down. When creating probable costs for replacements and rehabilitations, assumptions were made including species at risk at site, full road closure, or replacement expected to match existing structure (unless specified otherwise).

To complete all the repair and replacement work recommended within the next 5 years would cost on average about $696,600 per year, within the 6 to 10 year period would be about $508,800 per year. These totals do not include the maintenance work that we have assumed can be completed by municipal staff. If the entirety of the work was spread over 10 years, it would average $602,700 per year. If this amount is more than available within the municipal 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 additional load limits or lower load limits will be recommended in the future or bridge closures may become necessary.

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. It should be noted 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 will have to be changed. Structures in the 6-10 year period listed in table 2 should be continued to be monitored during future inspections, replacement or rehabilitation of these structures may be delayed beyond the 10 year mark.

A list of recommended maintenance work is provided in Table 3. Completion of these tasks should be a very cost-effective way to delay the need for capital improvements to these structures. With some of the maintenance work, such as cleaning out deck drains and bearing seat locations, that work should be done annually. Staff should monitor for a build-up of debris at the inlet to culverts and remove when time permits to avoid the risk of flooding. With other maintenance work, such as placement of rip rap to prevent erosion, it is hoped that completion of that would will be adequate to address the concerns for many years. We generally recommend the work identified be completed within the next couple of years. It has generally been assumed these tasks may be completed by municipal staff; therefore, an allowance for engineering has not been provided.

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

Priority	Site Number	Location	Repair Description	Probable Cost	BCI	Theoretical Priority Score
1	H66	Concession 8	Patch repair abutment, wingwall, soffit, and deck top. Install guiderail, place riprap, waterproof and pave	$341,000	64	8
2	L1	Ludgard Street	Replace barriers, curbs, and deck drains. Scarify and overlay deck, waterproof and pave	$203,000	69	8
3	L2	Gough Street	Replace barriers, curbs, and deck drains. Scarify and overlay deck, waterproof and pave	$203,000	70	6
4	L3	Wheeler Street	Replace barriers, curbs, and deck drains. Patch deck, waterproof and pave	$191,000	69	8
5	H38	Lake Range Drive	Convert to semi integral abutment, patch beams, jack and replace bearings. Patch deck top, waterproof and pave, install guiderail	$630,000	73	10
6	K3	Langside Street	Replace structure	$590,000	50	11
7	H28	Sideroad 20	Replace structure	$720,000	30	14
8	P1	West side of Sideroad 10	Cast concrete at base of piers, repair railings install retaining wall, replace sleeper with concrete, reinforce galvanized channels	$218,000	44	11
9	H51	Sideroad 10	Grout ends of culvert, install riprap	$40,000	80	6
10	L6	Canning Street	Patch repair deck and curb, waterproof and pave	$81,000	69	8
11	L7	Havelock Street	Waterproof and pave	$56,000	76	7
12	H71	Sideroad 20	Reset culvert, install erosion protection	$90,000	57	8
13	H32	Concession 12	Replace drains, patch repair curbs	$40,000	74	8
14	H27	Concession 6	Install Guiderail	$40,000	74	8
15	H35	Baseline	Install guiderail	$45,000	59	11
16	H46	Concession 2	Install Guiderail	$40,000	57	9
17	H55	Sideroad 25	Install Guiderail	$40,000	54	10
			Total	**$3,568,000**		

[1]Replacement costs assumes smaller sized structure installed, structure size to be confirm with hydrology.

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

Priority	Site Number	Location	Repair Description	Probable Cost	BCI	Theoretical Priority Score
1	H7	Sideroad 20	Patch repair curbs and parapet walls	$47,000	75	6
2	H11	Sideroad 10	Replace barriers	$85,000	74	6
3	H29	Concession 10	Replace sidewalk, barriers and deck drains. Patch deck top, waterproof and pave, install guiderail	$259,000	72	6
4	H44	Concession 4	Replace curbs, install guiderail on approaches and over structure	$472,000	63	11
5	H45	Sideroad 20	Replace structure	$342,000	57	8
6	H56	Huron-Kinloss Boundary	Replace structure	$352,000	66	9
7	K8	Kairshea Ave	Replace structure	$497,000	57	9
8	K19	Kincardine-Kinloss Road	Replace structure	$490,000	31	13
			Total	**$2,544,000**		

Table 3
Suggested List of Maintenance Needs

Site Number	Location	Repair Description	BCI
H1	Concession 2	Replace Caulking, remove debris, clear drains	75
H2	Sideroad 30	Replace Caulking, remove debris, clear drains	76
H3	Sideroad 25	Remove Tree	90
H5	Concession 2	Remove vegetation at south end	64
H6	Concession 2	Place riprap, remove trees and clear drains	74
H7	Sideroad 20	Replace Caulking, clear drains	75
H8	Concession 2	Clear deck drains	75
H9	Concession 2	Replace caulking, replace rail endcaps, clear drains	75
H10	Sideroad 20	Remove gate from stream	88
H11	Sideroad 10	Replace caulking	74
H12	Concession 2	Place riprap	75
H13	Concession 4	Place riprap	75
H15	Sideroad 5	Remove Trees	75
H16	Sideroad 10	Replace caulking, clear deck drains	75
H21	Concession 6	Place riprap, clear debris	75
H30	Sideroad 5	Replace damaged offset blocks	77
H31	Sideroad 20	Clear gravel from deck	77
H33	Sideroad 25	Clear deck drains	75
H34	Concession 10	Remove built up silt	74
H36	Concession 6 West	Clear deck drains	74
H37	Concession 6	Replace caulking, clear gravel from deck	75
H39	Victoria Road	Place riprap	74
H40	Lake Range Drive	Place riprap	74
H41	South Baseline	Clear of deck top	57
H45	Sideroad 20	Remove tree	57
H47	Huron-Kinloss Boundary	Place riprap	68
H53	South Baseline	Remove debris	68
H54	Sideroad 25	Remove debris	54
H60	Sideroad 20	Place riprap	75
H61	Huron-Kinloss Boundary	Remove gate in stream	87
H69	Concession 4	Place riprap	64
L6	Canning Street	Replace caulking	69
P2	East of County Road 1	Remove debris	57

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 a minimum, it is proposed that all structures be reviewed in 2023 with a letter outlining any new safety concerns. In 2025, a more detailed review and an updated assessment of the replacement and rehabilitation needs should be completed to replace this report.

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED

Per ______________________________
Jeff Jones, P. Eng.

Per______________________________
Ken Logtenberg, P. Eng.

:hv

APPENDIX A

BRIDGE INVENTORY SUMMARY BY STRUCTURE NUMBER

Bridge Inventory Summary by Structure Number									
Site Number	BMROSS Number	Structure Type	Structure Name	Road Name	Structure Location	Span Length (m)	Assumed Year Built	BCI	Probable Cost of 1-5 Year Recommended Work
H1	BR270	Rigid Frame, Vertical Legs		Concession 2	Lot 35, Huron Township	9.1	1971	75	-
H2	BR390	Rigid Frame, Vertical Legs		Sideroad 30	Lot 30-31, Concession 2, Huron Township	7.3	1978	76	-
H3	BR452	Rectangular Culvert		Sideroad 25	Lot 25-26, Concession 3, Huron Township	6	1985	90	-
H4	BR624	Rectangular Culvert		Sideroad 25	Lot 50-51, Concession 1, Huron Township	6.66	2007	98	-
H5		Arch Culvert		Concession 2	Lot 24, Huron Township	6	1970	64	-
H6	BR142	Rigid Frame, Vertical Legs	McTavish Bridge	Concession 2	Lot 21, Huron Township	15.2	1966	74	-
H7	BR142	Rigid Frame, Vertical Legs		Sideroad 20	Lot 20-21, Concession 2, Huron Township	14	1975	75	-
H8	BR181A	Rigid Frame, Vertical Legs		Concession 2	Lot 18, Huron Township	14.2	1968	75	-
H9	BR181B	Rigid Frame, Vertical Legs	McTavish Bridge East	Concession 2	Lot 36, Huron Township	15.2	1968	75	-
H10	BR436	Rectangular Culvert		Sideroad 20	Lot 20-21, Concession 3, Huron Township	6.1	1981	88	-
H11	BR461	Rigid Frame, Vertical Legs		Sideroad 10	Lot 10-11, Concession 2, Huron Township	10.5	1983	74	-
H12	BR992	Rigid Frame, Vertical Legs		Concession 2	Lot 5, Huron Township	9.3	1950	75	-
H13	BR035	Rectangular Culvert		Concession 4	Lot 1, Huron Township	7	1960	75	-
H14	BR453	Rectangular Culvert		Sideroad 5	Lot 5-6, Concession 7, Huron Township	6.2	1982	72	-
H15	BR430	Rectangular Culvert		Sideroad 5	Lot 5-6, Concession 7, Huron Township	6.2	1993	75	-
H16	BR336A	Rigid Frame, Vertical Legs		Sideroad 10	Lot 10-11, Concession 6, Huron Township	10.7	1974	75	-
H17	BR048B	Rigid Frame, Vertical Legs		Concession 6	Lot 17, Huron Township	12.2	1961	74	-
H18	BR109	Rigid Frame, Vertical Legs		Concession 6	Lot 18, Huron Township	12.3	1964	73	-
H19		Rigid Frame, Vertical Legs	Murray Bridge	Concession 6	Lot 19, Huron Township	13.3	1964	68	-
H20	BR038	Rigid Frame, Vertical Legs		Concession 2	Lot 38, Huron Township	9.1	1964	81	-
H21	BR269	Rigid Frame, Vertical Legs		Concession 6	Lot 24, Huron Township	12.8	1970	75	-
H22	BR498	Rigid Frame, Vertical Legs		Sideroad 25	Lot 25-26, Concession 6, Huron Township	13.2	1987	75	-
H23	BR472	Rectangular Culvert		Sideroad 25	Lot 25-26, Concession 7, Huron Township	6.1	1984	75	-
H24	BR525	Rectangular Culvert		Sideroad 25	Lot 25-26, Concession 8, Huron Township	7.9	1991	75	-
H25	BR484	Rigid Frame, Vertical Legs		Sideroad 30	Lot 30-31, Concession 7, Huron Township	9	1985	80	-
H26	BR668	I-beam or Girders		Sideroad 30	Lot 30-31, Concession 6, Huron Township	15.1	1935	63	-
H27	BR068	Rigid Frame, Vertical Legs	Hunter Bridge	Concession 6	Lot 33, Huron Township	15.2	1962	74	$ 40,000.00
H28		T-Beam		Sideroad 20	Lot 20-21, Concession 9, Huron Township	10.7	1930	30	$ 720,000.00
H29	BR050	Rigid Frame, Vertical Legs		Concession 10	Lot 15, Huron Township	10.7	1965	72	-
H30	BR916	I-beam or Girders	Purple Grove Bridge	Sideroad 5	Lot 5-6, Concession 10, Huron Township	8.4	1935	77	-
H31	BR041	Rigid Frame, Vertical Legs		Sideroad 20	Lot 20-21, Concession 12, Huron Township	10.7	1961	77	-
H32	BR204	Rigid Frame, Vertical Legs	McDonald Bridge	Concession 12	Lot 23, Huron Township	10.7	1967	74	$ 40,000.00
H33	BR353	Rigid Frame, Vertical Legs		Sideroad 25	Lot 25-26, Concession 11, Huron Township	10.7	1978	75	-
H34	BR241	Rigid Frame, Vertical Legs		Concession 10	Lot 31, Concession 9-10, Huron Township	12.2	1969	74	-
H35	BR1123	I-beam or Girders		Baseline	Lot 34, Huron Township	15.1	1930	59	$ 45,000.00
H36	BR327	Rigid Frame, Vertical Legs		Concession 6 West	Lot 37, Huron Township	15.2	1980	74	-
H37	BR490	Rigid Frame, Vertical Legs		Concession 6	Lot 40, Huron Township	18.3	1986	75	-
H38		I-beam or Girders	Bell Bridge	Lake Range Drive	Lot 27, Huron Township	47	1963	73	$ 545,000.00
H39	BR386	I-beam or Girders		Victoria Road	Lot 10, Huron Township	11.65	1930	74	-
H40	BR247	Rigid Frame, Vertical Legs	Smeltzer Bridge, Lot 12	Lake Range Drive	Lot 12, Huron Township	12.2	1969	74	-
H41	BR598	I-beam or Girders	Smeltzer Bridge, Lot 13	South Baseline	Lot 13, Lake Range Concession, Huron Township	10.6	1955	57	-
H43	BR1210	Arch Culvert		Sideroad 30	Lot 30-31, Concession 2, Huron Township	3.1	2016	100	-
H44	BR042	Rectangular Culvert		Concession 4	Lot 22, Huron Township	5.5	1960	63	-
H45	BR221	CSP Arch Culvert	Wylds Culvert	Sideroad 20	Lot 20-21, Concession 4, Huron Township	3.8	1968	57	-
H46	BR307	CSP Arch Culvert		Concession 2	Lot 4, Huron Township	3.9	1973	57	$ 40,000.00
H47		Rectangular Culvert		Huron-Kinloss Boundary	Lot 1, Huron Township	6.2	1960	68	-
H48	BR283	CSP Arch Culvert		Concession 6	Lot 5, Huron Township	2.6	2013	95	-
H49	BR437	CSP Arch Culvert		Sideroad 30	Lot 30-31, Huron Township	4.4	1981	66	-
H50	BR518	Rectangular Culvert		Sideroad 20	Lot 20-21, Concession 13, Huron Township	6.1	1987	75	-
H51		CSP Arch Culvert		Sideroad 10	Lot 10-11, Concession 13, Huron Township	4.3	1980	80	$ 40,000.00
H52	BR1212	Arch Culvert		South Baseline	Lot 40, Concession 5, Huron Township	3.5	2016	98	-
H53		CSP Arch Culvert		South Baseline	Lot 40, Concession 5, Huron Township	4.3	1965	68	-
H54	BR473	CSP Arch Culvert		Sideroad 25	Lot 25-26, Concession 6, Huron Township	3.2	1984	54	-
H55	BR475	CSP Arch Culvert		Sideroad 25	Lot 25-26, Concession 9, Huron Township	3.8	1984	54	$ 40,000.00
H56	BR240	CSP Arch Culvert		Huron-Kinloss Boundary	Lot 1, Concession 11, Huron Township	3.8	1968	66	-
H57	BR1223	Arch Culvert		North Baseline	Lot 57, Huron Township	5.6	1930	98	-
H59	BR049	Rectangular Culvert		Concession 4	Lot 16-17, Huron Township	6.4	1962	73	-
H60		CSP Arch Culvert		Sideroad 20	Lot 40-41, Concession 1, Huron Township	5.3	1965	75	-

H61	BR503	Rectangular Culvert		Huron-Kinloss Boundary	Lot 1, Concession 7, Huron Township	5.2	1986	87	-
H62	BR494	Rectangular Culvert		Sideroad 10	Lot 20-21, Concession 1, Huron Township	3.1	1986	75	-
H63		CSP Round Culvert		Huron-Kincardine East	Lot 4, Concession 14, Huron Township	3.3	2015	100	-
H64	BR1055	CSP Round Culvert		Kincardine-Huron East	Lot 6, Concession 14, Huron Township	3.3	2016	95	-
H65	BR1211	CSP Arch Culvert		Sideroad 20	0.25 km North of Concession 6	2.7	2016	98	-
H66	BR1441	Rigid Frame, Vertical Legs	Pine River West	Concession 8	1.3 km West of Highway 21	12.3	1960	64	$ 341,000.00
H67		CSP Round Culvert		Concession 12	0.15km East of Lake Range Drive	2.7	1990	69	-
H68		Arch Culvert		Concession 4	0.35km East of South Baseline	2.4	1980	57	-
H69		Rectangular Culvert		Concession 4	0.9 km East of Side road 30	2.4	1970	64	-
H70		CSP Arch Culvert		Sideroad 10	0.65km North of Concession road 4	2.7	1980	54	-
H71		CSP Round Culvert		Sideroad 20	0.2kmk North of Bruce Road 86	2.4	1990	57	$ 90,000.00
K1	BR581	Rectangular Culvert		South Kinloss Avenue	Lot 22, Concession 1	3.9	1980	79	-
K2		CSP Round Culvert		Wolfe Street	Lot 30-31, Concession 2	3	1965	68	-
K3	BR591	T-Beam		Langside Street	Lot 25-26, Concession 2	7.7	1930	50	$ 590,000.00
K4		CSP Arch Culvert		Grey Ox Ave	Lot 21, Concession 3-4	3.2	1960	57	-
K5	BR414	CSP Arch Culvert		Paradise Lake Street	Lot 20-21, Concession 5	7.2	1982	54	-
K6		CSP Arch Culvert		Hayes Lake Ave	Lot 13, Concession 11-12	3.4	1970	64	-
K7	BR413	CSP Arch Culvert		Guest Avenue	Lot 15, Concession 12	5.4	1980	40	-
K8		CSP Arch Culvert		Kairshea Ave	Lot 12, Concession 5-6	8.8	1975	57	-
K9	BR466	CSP Round Culvert		Grey Ox Ave	Lot 16, Concession 3-4	5.4	1980	75	-
K10		CSP Arch Culvert		Grey Ox Avenue	Lot 14, Concession 3-4	4.8	1970	54	-
K11		CSP Arch Culvert		Grey Ox Avenue	Lot 13, Concession 3-4	4.8	1965	54	-
K12		CSP Arch Culvert		Grey Ox Avenue	Lot 11, Concession 3-4	9.2	1970	64	-
K13	BR101	CSP Round Culvert		Grey Ox Avenue	Lot 3, Concession 3-4	3.3	1964	97	-
K14		Rectangular Culvert		Grey Ox Avenue	Lot 1, Kinloss Township	4.9	1950	76	-
K15	BR717	CSP Round Culvert		Huron-Kinloss Boundary	Lot 80, Concession 2, Kinloss Township	6.6	2001	72	-
K16	BR1049	Rigid Frame, Vertical Legs		South Kinloss Avenue	Lot 11, Concession 2, Kinloss Township	9.1	1962	81	-
K17	BR718	Rigid Frame, Vertical Legs		South Kinloss Avenue	Lot 57, Concession 11, Kinloss Township	9.2	1960	75	-
K18		Rectangular Culvert		Terrace Street	Lot 50-51, Concession 1, Kinloss Township	3.8	1980	75	-
K19		Rectangular Culvert		Kincardine-Kinloss Rd	0.25 km South of North Line	3.55	1960	31	-
K20		CSP Arch Culvert		Kairshea Ave	0.17km East of Langside Street	2.4	2020	98	-
L1		Rigid Frame, Vertical Legs		Ludgard Street	Ludgard Street over the Lucknow River	9.1	1967	69	$ 203,000.00
L2	BR174	Rigid Frame, Vertical Legs		Gough Street	Gough Street, over the Lucknow River	9.1	1967	70	$ 203,000.00
L3	BR036	Rigid Frame, Vertical Legs		Wheeler Street	Wheeler Street over the Lucknow River	9.1	1960	69	$ 191,000.00
L5	BR123	Rigid Frame, Vertical Legs		Willoughby Street	Willoughby Street over the Lucknow River	10.7	1965	75	-
L6	BR318	Rigid Frame, Vertical Legs		Canning Street	Canning Street over the Lucknow River	16.8	1974	69	$ 81,000.00
L7	BR342	Rigid Frame, Vertical Legs		Havelock Street	Havelock Street over Dickies Creek	13.7	1976	76	$ 56,000.00
L8	BR070	Rigid Frame, Vertical Legs	Willoughby Street Bridge	Willoughby Street	Willoughby Street over Dickies Creek	12.2	1963	75	-
L10		CSP Arch Culvert		Bob Street		6.6	1976	68	-
P1	BR437	Box Beams of Girders		West side of Sideroad 10	West of Sideroad 10 along old railway line over the South Pine River	28.1	1920	44	$ 218,000.00
P2		Box Beams of Girders		East of County Road 1	East of County Road 1, North of Lucknow along old railway line over the Ackert Drain	30.6	1920	57	-

APPENDIX B

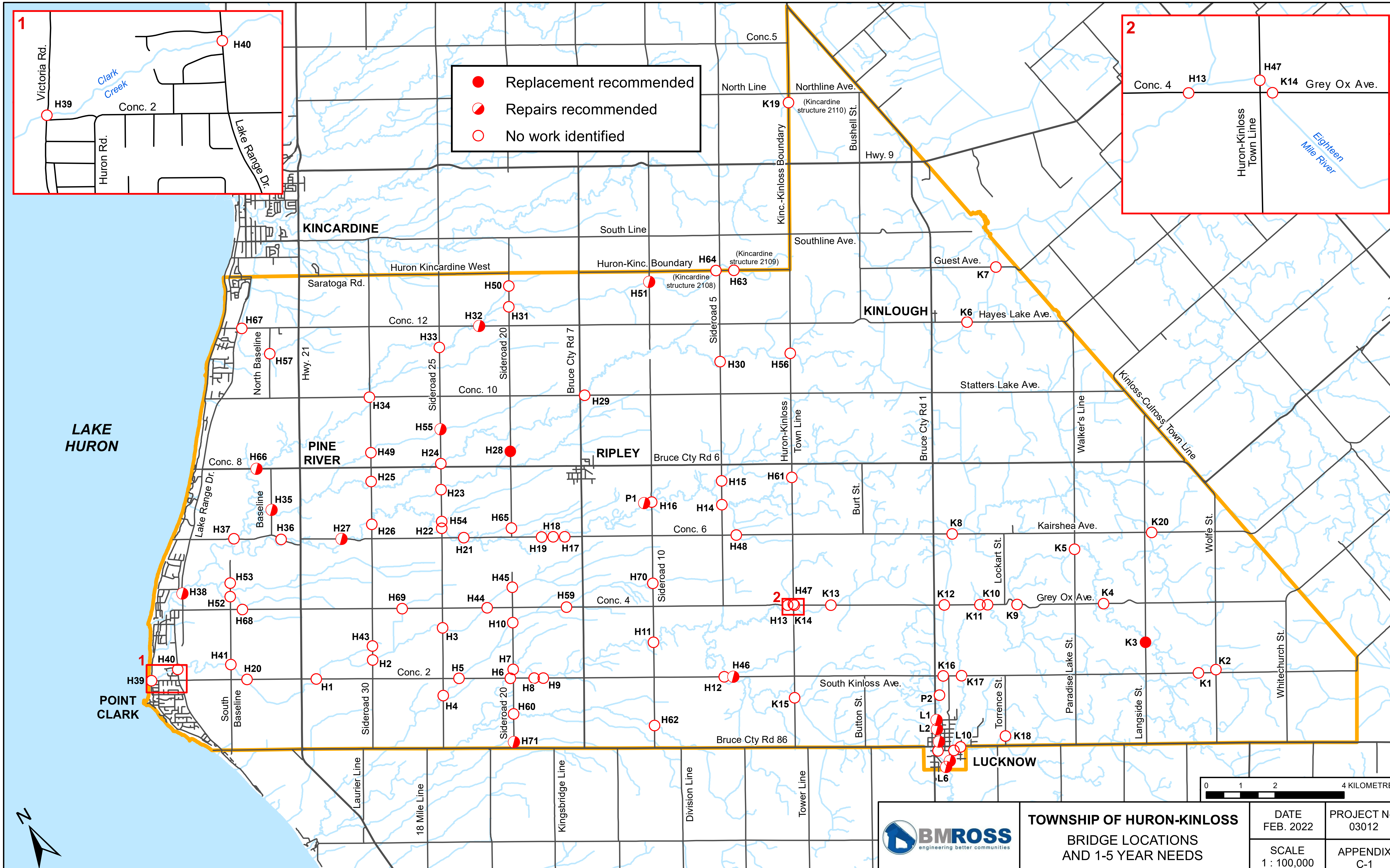
BRIDGE INVENTORY SUMMARY BY BCI NUMBER

Bridge Inventory Summary by Bridge Condition Index									
Site Number	BMROSS Number	Structure Type	Structure Name	Road Name	Structure Location	Span Length (m)	Assumed Year Built	BCI	Probable Cost of 1-5 Year Recommended Work
H28		T-Beam		Sideroad 20	Lot 20-21, Concession 9, Huron Township	10.7	1930	30	$ 720,000.00
K19		Rectangular Culvert		Kincardine-Kinloss Rd	0.25 km South of North Line	3.55	1960	31	-
K7	BR413	CSP Arch Culvert		Guest Avenue	Lot 15, Concession 12	5.4	1980	40	-
P1	BR437	Box Beams of Girders		West side of Sideroad 10	West of Sideroad 10 along old railway line over the South Pine River	28.1	1920	44	$ 218,000.00
K3	BR591	T-Beam		Langside Street	Lot 25-26, Concession 2	7.7	1930	50	$ 590,000.00
H54	BR473	CSP Arch Culvert		Sideroad 25	Lot 25-26, Concession 6, Huron Township	3.2	1984	54	-
H55	BR475	CSP Arch Culvert		Sideroad 25	Lot 25-26, Concession 9, Huron Township	3.8	1984	54	$ 40,000.00
H70		CSP Arch Culvert		Sideroad 10	0.65km North of Concession road 4	2.7	1980	54	-
K10		CSP Arch Culvert		Grey Ox Avenue	Lot 14, Concession 3-4	4.8	1970	54	-
K11		CSP Arch Culvert		Grey Ox Avenue	Lot 13, Concession 3-4	4.8	1965	54	-
K5	BR414	CSP Arch Culvert		Paradise Lake Street	Lot 20-21, Concession 5	7.2	1982	54	-
H41	BR598	I-beam or Girders	Smeltzer Bridge, Lot 13	South Baseline	Lot 13, Lake Range Concession, Huron Township	10.6	1955	57	-
H45	BR221	CSP Arch Culvert	Wylds Culvert	Sideroad 20	Lot 20-21, Concession 4, Huron Township	3.8	1968	57	-
H46	BR307	CSP Arch Culvert		Concession 2	Lot 4, Huron Township	3.9	1973	57	$ 40,000.00
H68		Arch Culvert		Concession 4	0.35km East of South Baseline	2.4	1980	57	-
H71		CSP Round Culvert		Sideroad 20	0.2kmk North of Bruce Road 86	2.4	1990	57	$ 90,000.00
K4		CSP Arch Culvert		Grey Ox Ave	Lot 21, Concession 3-4	3.2	1960	57	-
K8		CSP Arch Culvert		Kairshea Ave	Lot 12, Concession 5-6	8.8	1975	57	-
P2		Box Beams of Girders		East of County Road 1	East of County Road 1, North of Lucknow along old railway line over the Ackert Drain	30.6	1920	57	-
H35	BR1123	I-beam or Girders		Baseline	Lot 34, Huron Township	15.1	1930	59	$ 45,000.00
H26	BR668	I-beam or Girders		Sideroad 30	Lot 30-31, Concession 6, Huron Township	15.1	1935	63	-
H44	BR042	Rectangular Culvert		Concession 4	Lot 22, Huron Township	5.5	1960	63	-
H5		Arch Culvert		Concession 2	Lot 24, Huron Township	6	1970	64	-
H66	BR1441	Rigid Frame, Vertical Legs	Pine River West	Concession 8	1.3 km West of Highway 21	12.3	1960	64	$ 341,000.00
H69		Rectangular Culvert		Concession 4	0.9 km East of Side road 30	2.4	1970	64	-
K12		CSP Arch Culvert		Grey Ox Avenue	Lot 11, Concession 3-4	9.2	1970	64	-
K6		CSP Arch Culvert		Hayes Lake Ave	Lot 13, Concession 11-12	3.4	1970	64	-
H49	BR437	CSP Arch Culvert		Sideroad 30	Lot 30-31, Huron Township	4.4	1981	66	-
H56	BR240	CSP Arch Culvert		Huron-Kinloss Boundary	Lot 1, Concession 11, Huron Township	3.8	1968	66	-
H19		Rigid Frame, Vertical Legs	Murray Bridge	Concession 6	Lot 19, Huron Township	13.3	1964	68	-
H47		Rectangular Culvert		Huron-Kinloss Boundary	Lot 1, Huron Township	6.2	1960	68	-
H53		CSP Arch Culvert		South Baseline	Lot 40, Concession 5, Huron Township	4.3	1965	68	-
K2		CSP Round Culvert		Wolfe Street	Lot 30-31, Concession 2	3	1965	68	-
L10		CSP Arch Culvert		Bob Street		6.6	1976	68	-
H67		CSP Round Culvert		Concession 12	0.15km East of Lake Range Drive	2.7	1990	69	-
L1		Rigid Frame, Vertical Legs		Ludgard Street	Ludgard Street over the Lucknow River	9.1	1967	69	$ 203,000.00
L3	BR036	Rigid Frame, Vertical Legs		Wheeler Street	Wheeler Street over the Lucknow River	9.1	1960	69	$ 191,000.00
L6	BR318	Rigid Frame, Vertical Legs		Canning Street	Canning Street over the Lucknow River	16.8	1974	69	$ 81,000.00
L2	BR174	Rigid Frame, Vertical Legs		Gough Street	Gough Street, over the Lucknow River	9.1	1967	70	$ 203,000.00
H14	BR453	Rectangular Culvert		Sideroad 5	Lot 5-6, Concession 7, Huron Township	6.2	1982	72	-
H29	BR050	Rigid Frame, Vertical Legs		Concession 10	Lot 15, Huron Township	10.7	1965	72	-
K15	BR717	CSP Round Culvert		Huron-Kinloss Boundary	Lot 80, Concession 2, Kinloss Township	6.6	2001	72	-
H18	BR109	Rigid Frame, Vertical Legs		Concession 6	Lot 18, Huron Township	12.3	1964	73	-
H59	BR049	Rectangular Culvert		Concession 4	Lot 16-17, Huron Township	6.4	1962	73	-
H11	BR461	Rigid Frame, Vertical Legs		Sideroad 10	Lot 10-11, Concession 2, Huron Township	10.5	1983	74	$ 85,000.00
H17	BR048B	Rigid Frame, Vertical Legs		Concession 6	Lot 17, Huron Township	12.2	1961	74	-
H27	BR068	Rigid Frame, Vertical Legs	Hunter Bridge	Concession 6	Lot 33, Huron Township	15.2	1962	74	$ 40,000.00
H32	BR204	Rigid Frame, Vertical Legs	McDonald Bridge	Concession 12	Lot 23, Huron Township	10.7	1967	74	$ 40,000.00
H34	BR241	Rigid Frame, Vertical Legs		Concession 10	Lot 31, Concession 9-10, Huron Township	12.2	1969	74	-
H36	BR327	Rigid Frame, Vertical Legs		Concession 6 West	Lot 37, Huron Township	15.2	1980	74	-
H39	BR386	I-beam or Girders		Victoria Road	Lot 10, Huron Township	11.65	1930	74	-
H40	BR247	Rigid Frame, Vertical Legs	Smeltzer Bridge, Lot 12	Lake Range Drive	Lot 12, Huron Township	12.2	1969	74	-

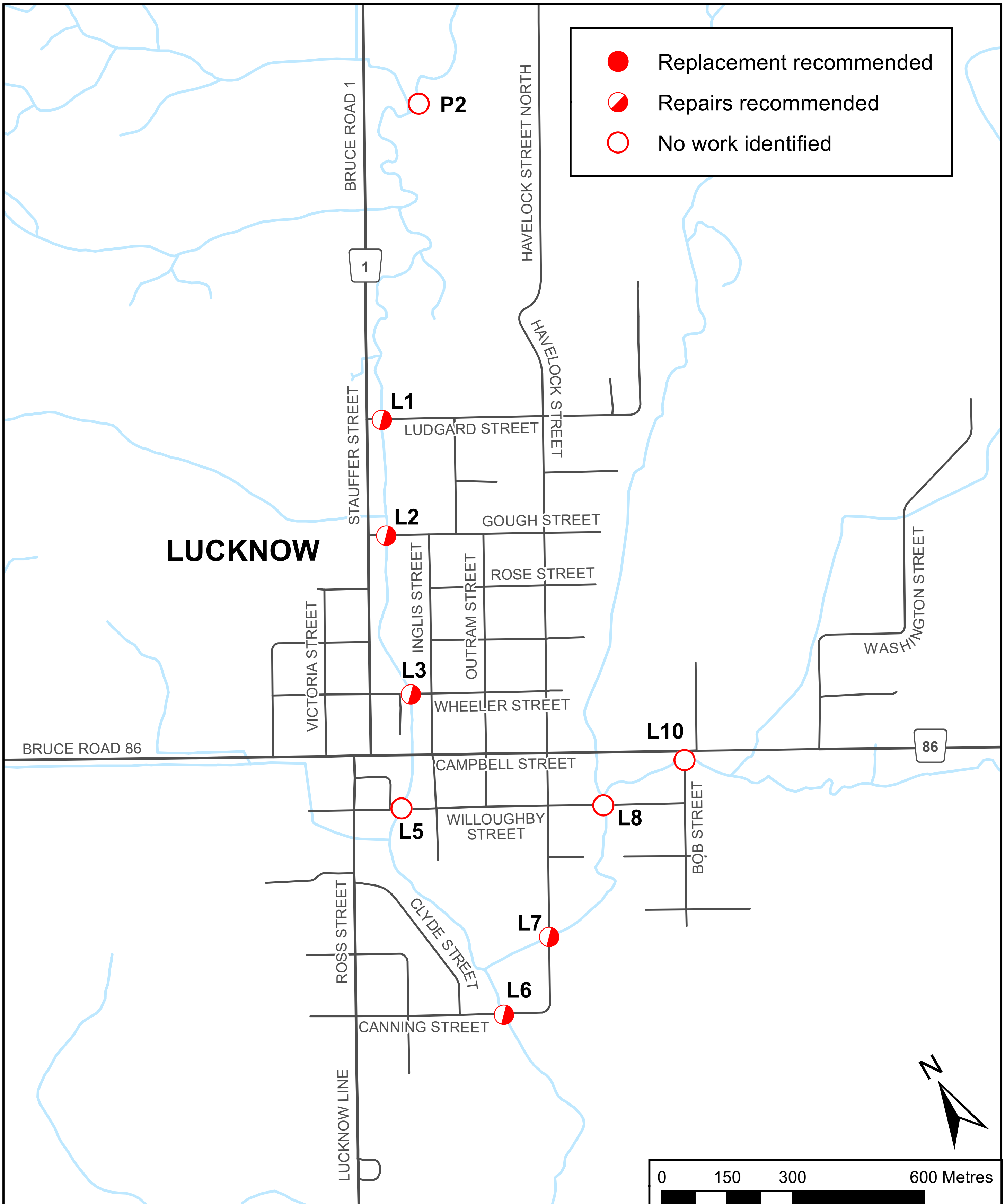
H1	BR270	Rigid Frame, Vertical Legs		Concession 2	Lot 35, Huron Township	9.1	1971	75	-
H12	BR992	Rigid Frame, Vertical Legs		Concession 2	Lot 5, Huron Township	9.3	1950	75	-
H13	BR035	Rectangular Culvert		Concession 4	Lot 1, Huron Township	7	1960	75	-
H15	BR430	Rectangular Culvert		Sideroad 5	Lot 5-6, Concession 7, Huron Township	6.2	1993	75	-
H16	BR336A	Rigid Frame, Vertical Legs		Sideroad 10	Lot 10-11, Concession 6, Huron Township	10.7	1974	75	-
H21	BR269	Rigid Frame, Vertical Legs		Concession 6	Lot 24, Huron Township	12.8	1970	75	-
H22	BR498	Rigid Frame, Vertical Legs		Sideroad 25	Lot 25-26, Concession 6, Huron Township	13.2	1987	75	-
H23	BR472	Rectangular Culvert		Sideroad 25	Lot 25-26, Concession 7, Huron Township	6.1	1984	75	-
H24	BR525	Rectangular Culvert		Sideroad 25	Lot 25-26, Concession 8, Huron Township	7.9	1991	75	-
H33	BR353	Rigid Frame, Vertical Legs		Sideroad 25	Lot 25-26, Concession 11, Huron Township	10.7	1978	75	-
H37	BR490	Rigid Frame, Vertical Legs		Concession 6	Lot 40, Huron Township	18.3	1986	75	-
H50	BR518	Rectangular Culvert		Sideroad 20	Lot 20-21, Concession 13, Huron Township	6.1	1987	75	-
H60		CSP Arch Culvert		Sideroad 20	Lot 40-41, Concession 1, Huron Township	5.3	1965	75	-
H62	BR494	Rectangular Culvert		Sideroad 10	Lot 20-21, Concession 1, Huron Township	3.1	1986	75	-
H8	BR181A	Rigid Frame, Vertical Legs		Concession 2	Lot 18, Huron Township	14.2	1968	75	-
H9	BR181B	Rigid Frame, Vertical Legs	McTavish Bridge East	Concession 2	Lot 36, Huron Township	15.2	1968	75	-
K17	BR718	Rigid Frame, Vertical Legs		South Kinloss Avenue	Lot 57, Concession 11, Kinloss Township	9.2	1960	75	-
K18		Rectangular Culvert		Terrace Street	Lot 50-51, Concession 1, Kinloss Township	3.8	1980	75	-
K9	BR466	CSP Round Culvert		Grey Ox Ave	Lot 16, Concession 3-4	5.4	1980	75	-
L5	BR123	Rigid Frame, Vertical Legs		Willoughby Street	Willoughby Street over the Lucknow River	10.7	1965	75	-
L8	BR070	Rigid Frame, Vertical Legs	Willoughby Street Bridge	Willoughby Street	Willoughby Street over Dickies Creek	12.2	1963	75	-
H2	BR390	Rigid Frame, Vertical Legs		Sideroad 30	Lot 30-31, Concession 2, Huron Township	7.3	1978	76	-
K14		Rectangular Culvert		Grey Ox Avenue	Lot 1, Kinloss Township	4.9	1950	76	-
L7	BR342	Rigid Frame, Vertical Legs		Havelock Street	Havelock Street over Dickies Creek	13.7	1976	76	$ 56,000.00
H30	BR916	I-beam or Girders	Purple Grove Bridge	Sideroad 5	Lot 5-6, Concession 10, Huron Township	8.4	1935	77	-
H31	BR041	Rigid Frame, Vertical Legs		Sideroad 20	Lot 20-21, Concession 12, Huron Township	10.7	1961	77	-
K1	BR581	Rectangular Culvert		South Kinloss Avenue	Lot 22, Concession 1	3.9	1980	79	-
K16	BR1049	Rigid Frame, Vertical Legs		South Kinloss Avenue	Lot 11, Concession 2, Kinloss Township	9.1	1962	81	-
H38		I-beam or Girders	Bell Bridge	Lake Range Drive	Lot 27, Huron Township	47	1963	73	$ 545,000.00
H51		CSP Arch Culvert		Sideroad 10	Lot 10-11, Concession 13, Huron Township	4.3	1980	80	$ 40,000.00
H20	BR038	Rigid Frame, Vertical Legs		Concession 2	Lot 38, Huron Township	9.1	1964	81	-
H25	BR484	Rigid Frame, Vertical Legs		Sideroad 30	Lot 30-31, Concession 7, Huron Township	9	1985	80	-
H7	BR142	Rigid Frame, Vertical Legs		Sideroad 20	Lot 20-21, Concession 2, Huron Township	14	1975	75	-
H6	BR142	Rigid Frame, Vertical Legs	McTavish Bridge	Concession 2	Lot 21, Huron Township	15.2	1966	74	-
H10	BR436	Rectangular Culvert		Sideroad 20	Lot 20-21, Concession 3, Huron Township	6.1	1981	88	-
H48	BR283	CSP Arch Culvert		Concession 6	Lot 5, Huron Township	2.6	2013	95	-
H64	BR1055	CSP Round Culvert		Kincardine-Huron East	Lot 6, Concession 14, Huron Township	3.3	2016	95	-
H61	BR503	Rectangular Culvert		Huron-Kinloss Boundary	Lot 1, Concession 7, Huron Township	5.2	1986	87	-
K13	BR101	CSP Round Culvert		Grey Ox Avenue	Lot 3, Concession 3-4	3.3	1964	97	-
H3	BR452	Rectangular Culvert		Sideroad 25	Lot 25-26, Concession 3, Huron Township	6	1985	90	-
H4	BR624	Rectangular Culvert		Sideroad 25	Lot 50-51, Concession 1, Huron Township	6.66	2007	98	-
H52	BR1212	Arch Culvert		South Baseline	Lot 40, Concession 5, Huron Township	3.5	2016	98	-
H57	BR1223	Arch Culvert		North Baseline	Lot 57, Huron Township	5.6	1930	98	-
H65	BR1211	CSP Arch Culvert		Sideroad 20	0.25 km North of Concession 6	2.7	2016	98	-
K20		CSP Arch Culvert		Kairshea Ave	0.17km East of Langside Street	2.4	2020	98	-
H43	BR1210	Arch Culvert		Sideroad 30	Lot 30-31, Concession 2, Huron Township	3.1	2016	100	-
H63		CSP Round Culvert		Huron-Kincardine East	Lot 4, Concession 14, Huron Township	3.3	2015	100	-

APPENDIX C

MAP



Replacement recommended
Repairs recommended
No work identified
LAKE HURON
KINCARDINE
PINE RIVER
RIPLEY
KINLOUGH
POINT CLARK
LUCKNOW
Conc. 5
North Line
Northline Ave.
Hwy. 9
South Line
Southline Ave.
Huron Kincardine West
Huron-Kinc. Boundary
Saratoga Rd.
Guest Ave.
Hayes Lake Ave.
Conc. 12
Conc. 10
Statters Lake Ave.
Conc. 8
Bruce Cty Rd 6
Conc. 6
Kairshea Ave.
Conc. 4
Grey Ox Ave.
Conc. 2
South Kinloss Ave.
Bruce Cty Rd 86
Kinc.-Kinloss Boundary
Bushell St.
North Baseline
Hwy. 21
Sideroad 25
Sideroad 20
Bruce Cty Rd 7
Sideroad 5
Huron-Kinloss Town Line
Bruce Cty Rd 1
Walker's Line
Kinloss-Culross Town Line
Lake Range Dr.
Baseline
Burt St.
Lockart St.
Wolfe St.
Sideroad 10
Whitechurch St.
South Baseline
Sideroad 30
Button St.
Torrence St.
Paradise Lake St.
Langside St.
Laurier Line
18 Mile Line
Kingsbridge Line
Division Line
Tower Line
(Kincardine structure 2110)
(Kincardine structure 2109)
(Kincardine structure 2108)
1
Victoria Rd.
Clark Creek
Conc. 2
Huron Rd.
Lake Range Dr.
H39
H40
2
Conc. 4
H13
H47
K14
Grey Ox Ave.
Huron-Kinloss Town Line
Eighteen Mile River
H1 H2 H3 H4 H5 H6 H7 H8 H9 H10 H11 H12 H13 H14 H15 H16 H17 H18 H19 H20 H21 H22 H23 H24 H25 H26 H27 H28 H30 H31 H32 H33 H34 H35 H36 H37 H38 H39 H40 H41 H43 H44 H45 H46 H47 H48 H49 H50 H51 H52 H53 H54 H55 H56 H57 H59 H60 H61 H62 H63 H64 H65 H66 H67 H68 H69 H70 H71 H29
K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 K17 K18 K19 K20
P1 P2 L1 L2 L6 L10
0 1 2 4 KILOMETRES
N
BMROSS engineering better communities
TOWNSHIP OF HURON-KINLOSS
BRIDGE LOCATIONS AND 1-5 YEAR NEEDS
DATE FEB. 2022
PROJECT No. 03012
SCALE 1 : 100,000
APPENDIX C-1



BMROSS engineering better communities

TOWNSHIP OF HURON-KINLOSS BRIDGE LOCATIONS AND 1-5 YEAR NEEDS - LUCKNOW	DATE FEB. 2022	PROJECT No. 03012
	SCALE 1 : 12,000	APPENDIX C-2

APPENDIX D

PRIORITY SCORES TABLE

Priority Score Calculation Factors for Bridges

Consequence of Failure:

Average Annual Daily Traffic (AADT)

Traffic Volume	Value
0-49	1
50-199	2
200-499	3
500-999	4
>1000	5

Performance Grade: (Load limit + Struture Type Width Value) / 2

When Traffic is Greater than 200 AADT

Load Limit

Posted	Value
No	1
Yes	5

Width Value if Bridge

Roadway Width (m)	Value
>= 7	1
6-6.9	3
< 6	5

OR

Width Value if Culvert

Overall Structure Width Criteria	Value
If the overall structure width > (10 m + (2 x Fill))	1
If the overall structure width < (10 m + (2 x Fill))	3
If the overall structure width > (7 m + (2 x Fill))	3
If the overall structure width < (7 m + (2 x Fill))	5

* Fill = Fill on structure (slope to road)

When Traffic is Less than 200 AADT

Load Limit

Posted	Value
No	1
Yes, >12	3
Yes, <12	5

Single Axle load limit assessed

Width Value if Bridge

Roadway Width (m)	Value
>= 7	1
6-6.9	1
< 6	3

OR

Width Value if Culvert

Overall Structure Width Criteria	Value
If the overall structure width > (10 m + (2 x Fill))	1
If the overall structure width < (10 m + (2 x Fill))	1
If the overall structure width > (7 m + (2 x Fill))	1
If the overall structure width < (7 m + (2 x Fill))	3

* Fill = Fill on structure (slope to road)

Probability of Failure:

BCI (Bridge Condition Index)

BCI	Value
85-100	1
70-84	2
55-69	3
40-54	4
< 40	5

Risk = Consequence of Failure + Probability of Failure

Priority Score = Risk + Level of Service

Level of Service = Performance Grade + Probability of Failure

APPENDIX E

PROJECTED FUTURE COSTS

Huron-Kinloss Projected Future Costs

03012
February, 11, 2022

Bridge Descriptions, Year Built and BCI Scores							Probable Costs in Future Year in 2022 Construction Dollars								
						2021-2026	2027-2032	2032-2042	2042-2052	2052-2062	2062-2072	2072-2082	2082-2092	2092-2102	2102-2112
Site Number	**BMROSS Number**	**Structure Type**	**Span Length (m)**	**Assumed Year Built**	**BCI**	**1-5**	**6-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**	**90-100**
H1	BR270	Rigid Frame, Vertical Legs	9.1	1971	75	-		$ 193,564.80				$586,560			
H10	BR436	Rectangular Culvert	6.1	1981	95	-				$ 132,912.00					$664,560
H11	BR461	Rigid Frame, Vertical Legs	10.5	1983	74	-	$ 85,000.00			$ 154,752.00			$773,760		
H12	BR992	Rigid Frame, Vertical Legs	9.3	1950	75	-		$ 170,913.60				$517,920			
H13	BR035	Rectangular Culvert	7	1960	75	-		$ 119,808.00			$599,040				
H14	BR453	Rectangular Culvert	6.2	1982	72	-		$ 163,800.00			$819,000				
H15	BR430	Rectangular Culvert	6.2	1993	75	-			$ 146,952.00			$734,760			
H16	BR336A	Rigid Frame, Vertical Legs	10.7	1974	75	-			$ 203,860.80				$617,760		
H17	BR048B	Rigid Frame, Vertical Legs	12.2	1961	74	-				$1,129,440					
H18	BR109	Rigid Frame, Vertical Legs	12.3	1964	73	-				$698,880					
H19		Rigid Frame, Vertical Legs	13.3	1964	68	-				$829,920					
H2	BR390	Rigid Frame, Vertical Legs	7.3	1978	76	-		$ 152,380.80				$461,760			
H20	BR038	Rigid Frame, Vertical Legs	9.1	1964	85	-					$524,160				
H21	BR269	Rigid Frame, Vertical Legs	12.8	1970	75	-			$ 267,696.00			$811,200			
H22	BR498	Rigid Frame, Vertical Legs	13.2	1987	75	-			$ 286,228.80				$867,360		
H23	BR472	Rectangular Culvert	6.1	1984	75	-			$ 162,864.00			$814,320			
H24	BR525	Rectangular Culvert	7.9	1991	75	-				$ 121,680.00			$608,400		
H25	BR484	Rigid Frame, Vertical Legs	9	1985	86	-			$ 195,624.00				$592,800		
H26	BR668	I-beam or Girders	15.1	1935	63	-			$524,160						
H27	BR068	Rigid Frame, Vertical Legs	15.2	1962	74	$ 40,000.00		$ 352,123.20			$1,067,040				
H28		T-Beam	10.7	1930	30	$ 720,000.00									
H29	BR050	Rigid Frame, Vertical Legs	10.7	1965	72	-	$ 259,000.00								
H3	BR452	Rectangular Culvert	6	1985	98	-				$ 127,296.00			$636,480		
H30	BR916	I-beam or Girders	8.4	1935	77	-				$324,480					
H31	BR041	Rigid Frame, Vertical Legs	10.7	1961	77	-					$667,680				
H32	BR204	Rigid Frame, Vertical Legs	10.7	1967	74	$ 40,000.00					$736,320				
H33	BR353	Rigid Frame, Vertical Legs	10.7	1978	75	-						$717,600			
H34	BR241	Rigid Frame, Vertical Legs	12.2	1969	74	-					$867,360				
H35	BR1123	I-beam or Girders	15.1	1930	59	$ 45,000.00			$505,440						
H36	BR327	Rigid Frame, Vertical Legs	15.2	1980	74	-			$ 310,939.20				$942,240		
H37	BR490	Rigid Frame, Vertical Legs	18.3	1986	75	-				$ 418,017.60				$1,266,720	
H38		I-beam or Girders	47	1963	83	$ 545,000.00						$3,020,160			
H39	BR386	I-beam or Girders	11.65	1930	74	-				$486,720					
H4	BR624	Rectangular Culvert	6.66	2007	98	-					$ 122,616.00				$613,080
H40	BR247	Rigid Frame, Vertical Legs	12.2	1969	74	-					$755,040				
H41	BR598	I-beam or Girders	10.6	1955	57	-			$624,000						
H43	BR1210	Arch Culvert	3.1	2016	100	-							$210,600		
H44	BR042	Rectangular Culvert	5.5	1960	63		$ 472,000.00								
K7	BR413	CSP Arch Culvert	5.4	1980	40	-				$218,400					
H54	BR473	CSP Arch Culvert	3.2	1984	54	-					$369,600				
H47		Rectangular Culvert	6.2	1960	68	-		$ 73,008.00			$365,040				
H55	BR475	CSP Arch Culvert	3.8	1984	54	$ 40,000.00					$285,600				
H70		CSP Arch Culvert	2.7	1980	54	-				$193,200					
K10		CSP Arch Culvert	4.8	1970	54	-		$226,800							

Huron-Kinloss Projected Future Costs

03012
February, 11, 2022

Bridge Descriptions, Year Built and BCI Scores							Probable Costs in Future Year in 2022 Construction Dollars								
						2021-2026	2027-2032	2032-2042	2042-2052	2052-2062	2062-2072	2072-2082	2082-2092	2092-2102	2102-2112
Site Number	**BMROSS Number**	**Structure Type**	**Span Length (m)**	**Assumed Year Built**	**BCI**	**1-5**	**6-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**	**90-100**
H50	BR518	Rectangular Culvert	6.1	1987	75	-							$833,040		
K11		CSP Arch Culvert	4.8	1965	54	-			$113,400						
K5	BR414	CSP Arch Culvert	7.2	1982	54	-					$281,400				
H45	BR221	CSP Arch Culvert	3.8	1968	57	-	$ 342,000.00							$285,600	
H46	BR307	CSP Arch Culvert	3.9	1973	57	$ 40,000.00			$394,800						$394,800
H68		Arch Culvert	2.4	1980	57	-				$262,080					
K4		CSP Arch Culvert	3.2	1960	57	-			$184,800						
K8		CSP Arch Culvert	8.8	1975	57	-	$ 497,000.00							$361,200	
H59	BR049	Rectangular Culvert	6.4	1962	73	-					$570,960				
H6	BR142	Rigid Frame, Vertical Legs	15.2	1966	87	-			$ 308,880.00			$936,000			
H5		Arch Culvert	6	1970	64	-				$570,960					
H61	BR503	Rectangular Culvert	5.2	1986	97	-							$528,840		
H62	BR494	Rectangular Culvert	3.1	1986	75	-							$322,920		
H63		CSP Round Culvert	3.3	2015	100	-						$256,200			
H64	BR1055	CSP Round Culvert	3.3	2016	95	-						$281,400			
K12		CSP Arch Culvert	9.2	1970	64	-			$201,600						
H66	BR1441	Rigid Frame, Vertical Legs	12.3	1960	64	$ 341,000.00									
H67		CSP Round Culvert	2.7	1990	69	-					$189,000				
K6		CSP Arch Culvert	3.4	1970	64	-				$197,400					
H69		Rectangular Culvert	2.4	1970	64	-				$163,800					
H7	BR142	Rigid Frame, Vertical Legs	14	1975	86	-	$ 47,000.00			$ 273,873.60			$829,920		
H49	BR437	CSP Arch Culvert	4.4	1981	66	-				$382,200					
H71		CSP Round Culvert	2.4	1990	57	$ 90,000.00					$151,200				
H8	BR181A	Rigid Frame, Vertical Legs	14.2	1968	75	-		$ 337,708.80				$1,023,360			
H9	BR181B	Rigid Frame, Vertical Legs	15.2	1968	75	-			$ 339,768.00				$1,029,600		
K1	BR581	Rectangular Culvert	3.9	1980	79	-						$430,560			
H56	BR240	CSP Arch Culvert	3.8	1968	66	-	$ 352,000.00							$390,600	
H53		CSP Arch Culvert	4.3	1965	68	-			$336,000						
L10		CSP Arch Culvert	6.6	1976	68	-				$273,000					
K13	BR101a	CSP Round Culvert	3.3	2018	97	-						$252,000			
K14		Rectangular Culvert	4.9	1950	76	-			$224,640						
K15	BR717	CSP Round Culvert	6.6	2001	72	-					$260,400				
K16	BR1049	Rigid Frame, Vertical Legs	9.1	1962	81	-				$561,600					
K17	BR718	Rigid Frame, Vertical Legs	9.2	1960	75	-				$549,120					
K18		Rectangular Culvert	3.8	1980	75	-						$421,200			
K19		Rectangular Culvert	3.55	1960	31	-	$ 490,000.00								
K2		CSP Round Culvert	3	1965	68	-				$235,200					
H60		CSP Arch Culvert	5.3	1965	75	-		$424,200							$424,200
K3	BR591	T-Beam	7.7	1930	50	$ 590,000.00									
H51		CSP Arch Culvert	4.3	1980	84	$ 40,000.00					$319,200				
H48	BR283	CSP Arch Culvert	2.6	2013	95	-						$218,400			
H52	BR1212	Arch Culvert	3.5	2016	98	-							$229,320		
H57	BR1223	Arch Culvert	5.6	2018	98	-							$397,800		
H65	BR1211	CSP Arch Culvert	2.7	2016	98	-							$100,800		

Huron-Kinloss Projected Future Costs

03012
February, 11, 2022

Bridge Descriptions, Year Built and BCI Scores						2021-2026	Probable Costs in Future Year in 2022 Construction Dollars								
							2027-2032	2032-2042	2042-2052	2052-2062	2062-2072	2072-2082	2082-2092	2092-2102	2102-2112
Site Number	**BMROSS Number**	**Structure Type**	**Span Length (m)**	**Assumed Year Built**	**BCI**	**1-5**	**6-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70-80**	**90-100**
K9	BR466	CSP Round Culvert	5.4	1980	75	-				$218,400					
L1		Rigid Frame, Vertical Legs	9.1	1967	69	$ 203,000.00					$667,680				
K20	BR1345	CSP Arch Culvert	2.4	2020	98	-							$243,600		
L2	BR174	Rigid Frame, Vertical Legs	9.1	1967	70	$ 203,000.00					$711,360				
L3	BR036	Rigid Frame, Vertical Legs	9.1	1960	69	$ 191,000.00					$630,240				
L5	BR123	Rigid Frame, Vertical Legs	10.7	1965	75	-			$ 228,571.20			$692,640			
L6	BR318	Rigid Frame, Vertical Legs	16.8	1974	69	$ 81,000.00			$ 395,366.40			$1,198,080			
L7	BR342	Rigid Frame, Vertical Legs	13.7	1976	76	$ 56,000.00			$ 317,116.80				$960,960		
L8	BR070	Rigid Frame, Vertical Legs	12.2	1963	75	-				$748,800					
P1	BR437	Box Beams of Girders	28.1	1920	44	$ 218,000.00									
P2		Box Beams of Girders	30.6	1920	57	-			$ 195,624.00						
					Totals	**3,483,000**	**2,544,000**	**2,214,307**	**6,468,331**	**9,272,131**	**10,959,936**	**13,374,120**	**10,726,200**	**2,304,120**	**2,096,640**
		Average Annual	**$ 694,698**		**Annual Totals**	**696,600**	**508,800**	**221,431**	**646,833**	**927,213**	**1,095,994**	**1,337,412**	**1,072,620**	**230,412**	**209,664**

Legend

- Culvert Rehab
- Bridge Rehab
- Replacement