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## 2020 OSIM BRIDGE INSPECTIONS & NEEDS STUDY: SUMMARY REPORT



TSI PROJECT NO: 20065

February 2021  
(Final)



**Submitted To:**

The Township of North Dundas  
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Director of Public Works

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## 1.0 Introduction

TSI Inc. was retained by the Township of North Dundas to perform detailed visual inspection of the Municipality's structural culverts and bridges in accordance with the MTO Ontario Structure Inspection Manual (OSIM-2018). The scope of work included carrying out biennial OSIM inspection for eighteen (18) structural bridges, and thirty-one (31) structural culverts in accordance with the requirements of the most recent edition (2018) of MTO OSIM manual. This summary report contains the individual OSIM inspection forms, as well as the Maintenance Needs Plan, and the 10-year (Rehabilitation/Replacement) Capital Plan for all structures inspected.

## 2.0 Scope of Work

The assignment involved the following:

- A detailed visual inspection of each structure under direct supervision of a Professional Engineer, licensed in the Province of Ontario, and trained by the Ministry of Transportation to do OSIM inspection;
- Generating OSIM inspection reports including representative pictures, observation notes, and comments from the field inspection for each structure;
- Completion of a prioritized list of maintenance needs for each structure and associated cost estimate (in current year dollars);
- Completion of a prioritized list of repairs and/or replacement needs for each structure, and its corresponding capital cost estimate, (in current year dollars);
- A detailed Summary Report presented herein.

## 3.0 Purpose

It is intended that the results of the assignment will be used by the Municipality to ensure that the following items are properly administrated:

- Ensure that the Municipality's structures remain at an acceptable level of safety;
- Ensure that the useful service life of the structures is prolonged;
- Ensure that maintenance and rehabilitation needs are identified and recorded for future planning;

- Ensure that the Municipality has adequate economic and technical information to effectively plan for additional studies and investigations, repair, and/ or replacement of the structure.

## **4.0 Structure Inspection**

### **4.1 Methodology**

The structures were visually inspected in accordance with the MTO Ontario Structure Inspection Manual (OSIM). To achieve the goals and objectives of this assignment, an element-by-element visual assessment of each structure was completed to identify material defects, performance deficiencies, and maintenance needs. The “severity and extent” approach, as outlined in the Preface of the OSIM, was used to simplify the process of using inspection information to estimate bridge rehabilitation needs and costs.

Prior to undertaking visual field inspections, previous OSIM reports were reviewed. A copy of the original drawings, where available, was requested from the Municipality and/or the Ministry of Transportation, Ontario and reviewed prior to the field inspections. The inspection work was completed by four (4) qualified inspectors including an experienced Professional Engineer, licensed in the Province of Ontario. Field inspections were conducted from October 8 to October 10, and November 2 to November 6, 2020. The work was carried out in accordance with the Occupational Health and Safety Act and the requirements of the Ontario Traffic Control Manual Book 7 – Temporary Conditions, where applicable.

Binoculars, camera, tape measures, steel chain, chest waders, flotation vest, hammers, paint markers and other items as listed in Clause 1.4 of Section 1 under Part 2 of OSIM were used to complete the inspections.

During an OSIM inspection, elements of a bridge or culvert are inspected for visual signs of deterioration. Additionally, tactile inspections of accessible concrete elements, such as concrete sounding, are undertaken during an inspection. The tactile inspection uncovers deterioration that is not visually noticeable. The inspection manual provides guidelines for the calculation of the overall quantity of an element. Element quantities are based on the element type and are in units for area (m<sup>2</sup>), linear distance (m), units (each), etc.

Upon completion of the field inspections the structures were reviewed with regards to their individual maintenance and rehabilitation needs. A thorough review of each structure was completed for the purpose of prioritizing and making recommendations appropriate for current

and future use requirements. Two 10-year Capital Plans (bridges and culverts) have been prepared to outline all replacement and/or rehabilitation recommendations, associated costs, and corresponding recommended timelines for each structure.

All reports and evaluation works have been internally reviewed to ensure accuracy and completeness. Report forms have been completed as per section 7 under Part 2 of OSIM. Budget estimates for recommended work have been based on recent project costs for similar work as well as industry benchmark costs.

#### **4.2 Bridge Index Condition (BCI)**

The BCI is calculated using asset management principals based on the remaining economic worth of the bridge. It is based on the premise that a bridge starts at a new condition and deteriorates to a lower condition with time. It uses actual inspection data from the various bridge elements and as the elements deteriorate, they have a lower economic value. Essentially, the BCI is a weighted average of all elements (since all elements are not of equal value to the bridge) and all Condition States (since each condition state represents a certain degree of loss of value of the element). The BCI begins at 100 when the bridge is in new condition and theoretically becomes 0 as all elements become fully in Poor condition. Practically, it is impossible for the BCI to fall to 0 since the entire bridge does not become poor before rehabilitation work is performed.

The BCI is based on the current value and replacement value of all elements in a bridge. The current value of the element is determined based on the depreciated value of the portions of the element that are in each of the four Condition States (Excellent, Good, Fair, and Poor). The following table provides weight factor used for condition states:

Condition State	Weight Factor
Excellent	1
Good	0.75
Fair	0.5
Poor	0.0

The BCI is used to plan repair and maintenance and does not imply for safety of a structure.



## **5.0 Determination of Costs**

Given the cursory information obtained during the visual inspections and without having access to detailed design information, it is unrealistic to develop detailed cost estimates for each structure. For these reasons, benchmark budget costs were developed for categories of repair, rehabilitation and replacement. Usually, benchmark costs do not necessarily provide accurate costs for individual repairs/replacement but have proven to provide adequate accuracy for global budgeting purposes when dealing with a large number of structures.

For the purpose of this study, benchmark costs for the rehabilitation and replacement of structures are based on maintaining the existing width, length and alignment of each structure. However, the costs to replace the existing structures with structures meeting current geometric standards are included for comparison. For this purpose, an overall roadway width of 10 meters was used for both bridges and culverts. More accurate costs for each structure would be provided upon further engineering study and preliminary design based on exact repair, rehabilitation and replacement needs (including change in geometry). The following benchmark costs have been established for this report following the requirements of the inspection forms.

### **5.1 Bridge and Culvert replacement costs**

Budget costs for the replacement of bridges are usually based on the deck surface area of individual structures ( $m^2$ ). Therefore, benchmark replacement costs for this study were determined using the following unit costs based on the spans of individual bridges. The proposed unit costs are in general conformance with the recommendations of MTO Structural Financial Manual and our recent experience in the field. These unit costs include approach roadway costs (which do not vary with bridge span). In addition, the varying widths of bridges were considered to provide more realistic unit costs and to avoid large discrepancies in the replacement cost between bridges of different lengths, but similar surface areas.

Total Bridge Replacement Unit Costs		
Bridge Length (m)	Width (m)	Unit Replacement Cost (\$/m <sup>2</sup> )
3-10	<10m	\$10,000.00
	≥10 m	\$9,500.00
10-20	<10m	\$9,500.00
	≥10 m	\$8,500.00
20-30	<10m	\$8,500.00
	≥10 m	\$7,500.00

In the case of culverts, the plan area (or deck surface area) used in the calculation was ('total span' + 1 m) x ('length of culvert'). The purpose of using the Total Bridge Replacement Unit Costs table for culverts is to normalize the replacement cost figures. Although culverts are generally less expensive to construct than bridges, it is generally accepted that the expected service life span of a culvert is typically less than a bridge. It is valid, therefore, on a life cycle cost basis, to utilize the total Bridge Replacement Unit Costs table for all structures, whether they are bridge or culvert type.

## 5.2 Bridge Repair / Rehabilitation Costs

For budgeting purposes, costs for the rehabilitation of bridges are typically expressed as a percentage of the total replacement costs. Rehabilitation costs for this study are separated into four categories as presented in the table below.

Bridge Rehabilitation Costs	
Category	% of Replacement Cost
Major Bridge Rehabilitation	40-60
Minor Bridge Rehabilitation	20-40
Major Item Repair	10-20
Minor Item Repair	5 or less



### 5.3 Culvert Repair / Rehabilitation Costs

It is generally not practical to undertake major rehabilitation work to culvert crossings where significant material/performance deficiencies (e.g. metal liner (barrel) perforation or severe erosion of concrete) exist. Culvert replacement is normally planned in these circumstances. Repair work identified generally included repairs to the inlet and outlet structures such as headwalls, cut-off walls, retaining walls, restoration of backfill, slope protection at the culvert ends and installation / upgrading of guiderail. In the case of concrete barrels, some repair work to the barrels may be included if the opening is large enough to permit construction.

### 5.4 Approach Roadway Repair / Rehabilitation Costs

For this study, approaches are considered to be 30m of roadway from the center of each individual culvert (60 m total per culvert) and 6m of roadway from the end of the deck for each individual bridge (12m total per bridge). Repair / rehabilitation costs for approach roadways have been separated into three categories as presented in the table below.

Separate costs for Approach Roadway Repair / Rehabilitation have been included for Bridge Rehabilitation. For structure replacement costs and repairs, the approach roadway repair / rehabilitation costs have been included in the recommended work costs if applicable.

Approach Roadway Repair/Rehabilitation Costs	
Category	Cost
Capital Projects (Partial / Complete Paving, Guiderail)	\$60,000.00
Minor Repairs / Maintenance (Crack Sealing, Surface Sealing, Guiderail Repairs)	\$20,000.00
Crack Sealing Only	\$10,000.00

### 5.5 Construction Detour Costs

Several alternatives exist to maintain the flow of traffic when a bridge or culvert undergoes major rehabilitation or replacement. These include construction of a detour structure adjacent to the existing structure, a detour route around (avoiding) the structure, and the staging of the construction to allow traffic on the structure during construction. The construction of a detour structure is the costliest option and is usually recommended only when the other options are not

possible. The detour route is the least expensive option but is often not practical due to the length of the detour route and the inconvenience to residents near the structure. The most frequently recommended option is the staging of rehabilitation work to allow the passage of traffic.

Since most bridge projects would consist of rehabilitation and not replacement, the staging of work would be the most frequently used option to maintain traffic during construction. Therefore, the benchmark costs for detours are based on “staging” of the work as per the following. These costs are based on additional costs incurred from staging of the work during construction (extra effort, time). Traffic control costs would be separate from detour costs and are presented later in this section

Detour During Construction Costs	
Category	Cost
Detour (Minor Rehabilitation / Major Rehabilitation of Bridges Less than 10m Long / Culvert Replacement)	\$40,000.00
Detour (Major Rehabilitation / Bridge Replacement)	\$70,000.00

## 5.6 Traffic Control Costs

In addition to performing the work in stages to accommodate traffic, the safety of traffic passing on the bridge or over the culvert during construction must also be ensured. The costs of traffic control during staged projects would be as follows:

Traffic Control Costs	
Category	Cost
Traffic Control – Minor Rehabilitation	\$40,000.00
Traffic Control Major Rehabilitation	\$80,000.00

### 5.7 Utilities / Right of Way Costs

Most bridge or culvert rehabilitation / replacement projects do not require substantial expenses for the installation or modification of existing utilities. Similarly, most of these projects do not require an increase in right of way (ROW). Therefore, specific benchmark budget costs for these items were not developed.

### 5.8 Environmental Study Cost

Since bridge or culvert replacements / rehabilitations typically do not involve a change in alignment or a reduction in clearances under the structure, these projects usually fall under the Municipal Class Environmental Assessment (MCEA)-Schedule A or A+ for Ontario Municipal Highways. The specific requirement of these two schedules of MCEA do not include detailed environmental and mitigation plans, but typically requires written application with, and permission from, the appropriate environmental agencies (Ontario Ministry of Natural Resources, Ontario Ministry of the Environment, Local Conservation Authorities (Permit to Take Water), etc.). Therefore, the benchmark budget cost for environmental study would be as follows (based on the requirement of Schedule A or A+ Environmental Assessment):

Environmental study Costs	
Category	Cost
Bridge / Culvert Replacement, Minor and Major Rehabilitation	\$15,000.00

### 5.9 Engineering Investigation

Further engineering investigation is recommended for several of the bridges and culverts as indicated on individual OSIM inspection forms. Benchmark budget costs for these additional engineering investigation works are presented in the table below:

Engineering Investigation		
Category	Type of Structure	Cost
Detailed Inspection / Rehabilitation Study – Full Bridge	Truss	\$50,000.00
	Other Structures	\$40,000.00
	Traffic Barrier Only*	\$10,000.00
Detailed Deck Condition Survey	Exposed Deck	\$30,000.00
	Asphalt Paved Deck	\$40,000.00
	Concrete Culvert with Height of Fill Less than 500mm**	\$20,000.00
Structure Evaluation	Truss	\$20,000.00
	Other Structures	\$15,000.00
Underwater Investigation	All Bridges	\$15,000.00
Monitoring of Deformation	All Bridges	\$5,000.00

\* Requirements for traffic barriers on bridges and culverts were determined using the Canadian Highway Bridge Design Code, MTO Standards and best engineering standard practice. The evaluation of existing traffic barriers was based on assumed values of AADT and good engineering practice. For structures with existing approach guiderail, a review of the required approach / leaving end length of guiderail and end treatments (as per the MTO's Roadside Safety Manual) was not carried out.

\*\* Deck condition survey on concrete culvert includes cores with no corrosion potential survey. Deck condition surveys on concrete culverts with a height of fill greater than 500 mm are not practical.

The benchmark budget costs for a Structure Evaluation and Detailed Deck Condition Survey would be reduced to 50% of that shown in the table above when any one of these are performed simultaneously with a Detailed Inspection / Rehabilitation Study.

Other investigations such as fatigue and seismic investigations would be included with the Detailed Inspection and Structure Evaluation (respectively), if deemed necessary by the engineer. Detailed coating condition surveys are typically only required where a failure of coating systems

have occurred other than normal deterioration. A DART (Deck Assessment by Radar Technology) survey is not a commonly used investigation method. Detailed deck condition surveys are the most commonly used method of deck inspection. Therefore, individual costs for the various types of investigation described above are not provided.

#### **5.10 Engineering Design Cost**

For the purpose of this report, the “engineering design” associated with each bridge is estimated at 10% of the estimated rehabilitation/replacement cost.

#### **5.11 Contract Administration, Construction Field Inspection and other design Services during Construction**

For the purpose of this study, the total cost associated with “Contract Administration, Construction Field Inspection and other Design Services during Construction” is estimated at 15% of the estimated rehabilitation/replacement cost.

#### **5.12 Other Costs**

Any other costs not specified in the above (site specific requirements) are deemed to be covered in the total benchmark costs. Therefore, no specific amount for other work is specified in this report.

#### **5.13 Contingency Costs**

The benchmark costs used for budgeting purposes are based only on information obtained from visual OSIM inspections; hence, contingency allowances are already built into the benchmark costs. Therefore, specific amounts for contingencies will not be included in this report.

#### **5.14 Total Capital Work Estimate**

The total capital work estimate cost will be the sum of all above-noted costs identified under sub-sections 5.1 to 5.13 (where applicable).

### **6.0 Routine Maintenance**

As part of the Municipality’s overall bridge management program, a program of routine maintenance should be implemented and upkeep for all structures. Maintaining this program will assist in minimizing the potential for premature deterioration of structural elements; and, when combined with a program of bridge rehabilitation, will assist in maximizing the useful service life of the Municipality’s structure inventory.

Overall routine maintenance needs will vary depending on the type of structure, location, traffic volumes, winter maintenance procedures (sanding vs. salting, etc.), size of the structure, vintage and previous maintenance / rehabilitation carried out on the structure in the past. The following presents a general summary of routine maintenance operations that are considered applicable for the structures present within the Municipality's inventory:

### **6.1 Periodic bridge cleaning**

This would include power-washing of all components exposed to roadway traffic and areas where debris accumulation is prevalent. This would include asphalt wearing surfaces, expansion joint gaps, edges of roadway, bearing seats, truss bottom chords, etc. Typically, this operation would be carried out on an annual basis, most likely each spring after winter sanding / salting operations have ceased; however, in some cases (i.e. gravel approach roadways, etc.), an increase in the number of cleanings per year may be required.

### **6.2 Concrete spot repairs**

This would generally include localized patching of small concrete spalls and delamination located in areas within the roadway splash zones (top of deck, curbs, expansion joint block-outs, etc.). Completing these repairs will assist in preventing accelerated deterioration of concrete in these areas by reducing the ingress of chlorides, etc. There is no specific timing for these types of repairs, and they are generally performed on an as-needed basis.

### **6.3 Steel spot repairs / spot coating**

This would generally include localized touch-ups to steel coatings located in areas within the roadway splash zones (truss bottom chords, exterior floor beams / stringers, etc.) as well as localized spot repairs in areas of appreciable section loss / corrosion. There is no specific timing for these types of repairs, and they are generally performed on an as-needed basis.

### **6.4 Clearing of debris in waterway**

This would include clearing of trapped debris in the vicinity of the structure (upstream / downstream). This operation would typically be carried out on an annual basis, after the spring run-off period.

### **6.5 Asphalt surface repairs / rout and seal**

This would include cold patch asphalt repairs, routing and sealing of wide cracks in asphalt. This operation would typically be carried out on an annual basis, after winter clearing operations have ceased.

### **6.6 Regrading of Approach Roadways (Gravel Roadway Surfaces)**

This would include placing and grading fresh granular material on roadway surfaces. The timing of this work would depend on the overall volume and type of traffic typically traversing the roadway (truck haul route, summer cottage traffic route, etc.). Typically, this work would be carried out on an annual or bi-annual basis.

### **6.7 Bridge deck drainage**

This would include maintaining existing deck drains free of debris and maintaining them in an unplugged condition. This operation would typically be carried out on an annual basis, after winter clearing operations have ceased.

### **6.8 Clearing of debris / vegetation from approach guiderail**

This would involve removing debris and vegetation from in front of approach guiderail. Although this is mainly a safety measure (to ensure proper performance of the guiderail), it also assists in prolonging the lifespan of the guiderail (accumulation of debris can accelerate rot on wooden posts, corrosion on steel guiderail, etc.).

### **6.9 Surface sealing of exposed concrete surfaces**

This would include cleaning and applying a concrete sealer on concrete surfaces exposed within the splash zone (exposed concrete decks, curbs, sidewalks and barrier walls); this operation is not typically required on an annual basis and would typically be completed in 3 to 5 year intervals. Sealing concrete surfaces periodically assists in minimizing the migration of chlorides into the concrete.

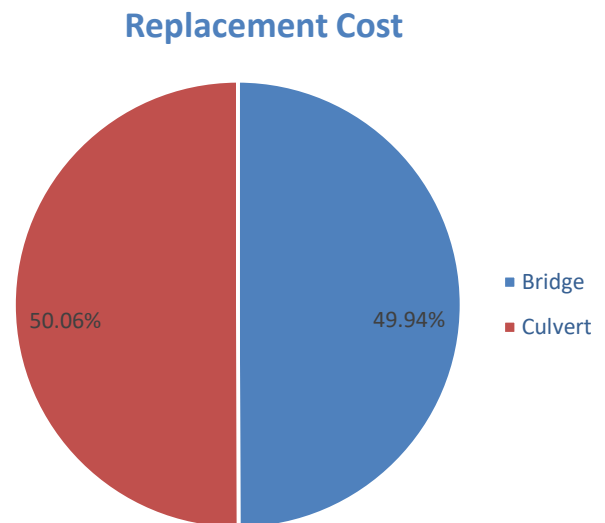


## 7.0 Structure Inventory Overview

TSI Inc. completed the OSIM inspection for forty-nine (49) bridge and culverts identified by the Township of North Dundas in 2020. The structures are split between eighteen (18) bridges and thirty-one (31) culverts.

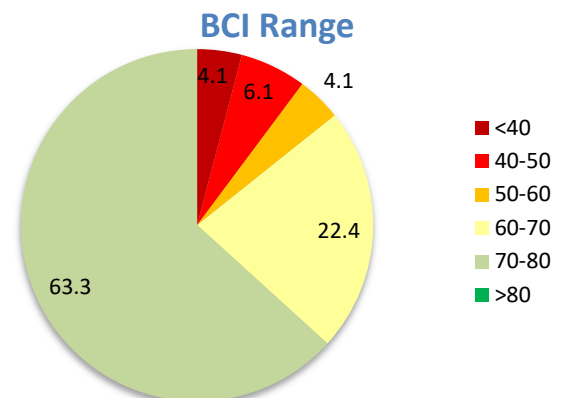
Structure replacement costs were calculated according to the guidelines in Section 5 of this report. The replacement cost of the bridge and large culvert structures inspected is included in **Appendix A**. The total replacement cost is approximately **\$60,164,440.0** broken down as follows for the **49** structures inspected:

Structure	Cost	Percentage
Bridge	\$30,048,690.0	49.94
Culvert	\$30,115,750.0	50.06
<b>Total</b>	<b><u>\$60,164,440.0</u></b>	<b>100.0</b>



In order to determine the overall condition of the structures in the transportation system, the number of bridges in each Bridge Condition Index (BCI) Range was determined. This measure is more preferable than computing the average BCI value of all structure, which can be highly affected by the very new or very poor structure ratings. Based on the OSIM inspections, the following table provides a breakdown of the BCI values in each range:

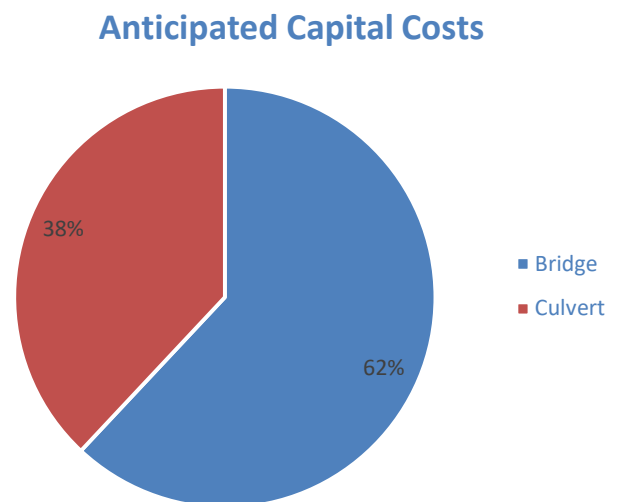
BCI Range	Number	Percentage
<40	2	4.1
40-50	3	6.1
50-60	2	4.1
60-70	11	22.4
70-80	31	63.3
>80	0	0



The results indicate that approximately **15%** of the total structures are in **poor** condition with an additional **22%** of the inventory list in **fair** condition. The results clearly highlight the importance of proper planning and immediate action to be taken by the Township in addressing the identified needs of the structures and to prolong the service life of its bridges and culverts.

The total anticipated capital costs of structures inspected is approximately **\$14,493,633.0** broken down into two 10-year asset management plan (separate plans for bridges and culverts- **Appendix C**). Direct rehabilitation/replacement costs totaled approximately **\$9,495,271.5** The rehabilitation/replacement costs will then be supplemented by additional costs associated with implementing detour, traffic control, environmental study, engineering design, etc. to comprise the total capital work costs. These costs are tabulated separately in **Appendix B**, while maintenance needs are included in **Appendix E**. A detailed list of additional investigations is brought in **Appendix D**. OSIM reports for bridge and large culvert structures are included in **Appendix G**.

Anticipated Capital Costs		
Structure	Cost	Percentage
Bridge	\$8,981,811.25	62
Culvert	\$5,511,822.13	38
<b>Total</b>	<b>\$14,493,633.38</b>	<b>100</b>



## 8.0 General Recommendations

Based on the inspection information, we recommend the following courses of action:

1. Act on all recommendations noted in this report and in individual OSIM reports.
2. Implement all maintenance needs as outlined in **Appendix E**.
3. Conduct follow-up OSIM inspections in two (2) years' time, or on a more frequent intervals as recommended.
4. Establish an infrastructure plan identifying priorities and budgets to guide annual Municipality budgeting processes for the repair and maintenance of bridges and culverts.
5. Continue project development to have "construction ready" (ready for tender) projects to take advantage of funding opportunities.

## 9.0 Limitations

The structural reviews were carried out to address the intent of applicable provincial Regulations, Guidelines, Policies, Standards, Protocols and Objectives administered by the Province of Ontario. No visual review can eliminate the possibility of obtaining partially imprecise or incomplete information. It can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the limited information obtained and in the formulation of remedial measures. Like all professional persons/entities rendering advice, we do not act as absolute insurers of the condition of the structures, but we commit ourselves to care and competence in reviewing the information and reaching those conclusions based on the limited data and information available.

Our undertaking at TSI Inc., therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession. It is intended that the outcome of the structural reviews is to assist in reducing the client's risk associated with structural impairment. No other warranty or representation, either expressed or implied, is included or intended in this report.

This report was prepared for the exclusive use of the Township of North Dundas and may not be reproduced in whole or in part, without the prior written consent of TSI Inc., or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. TSI Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

## 10.0 Closure

We trust that this report with its comments and recommendations provides you with sufficient information to develop your municipal structure Capital Plan. However, should you have any questions, please do not hesitate to contact our office.

Respectfully submitted,

**TSI Inc.**

A handwritten signature in blue ink, appearing to read "S. Teimoori".

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**Saber Teimoori, EIT**



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## **Appendix A:**

### *Structure Inventory*

Structure Inventory																	
Structure ID	PSAB ID	Structure Name	Structure Location	Latitude	Longitude	Year Built	Structure Type	Type	BCI	No. of Spans	Length (m)	Width (m)	Road Width (m)	Replacement Cost	Current Structure Value	Identified Capital Work Needs	Anticipated Capital Cost
BRH001	BR056	Belmeade Rd & South Castor Creek Bridge	5.0km West of County Rd 31	45.12539480	-75.49906610	1981	Slab on Concrete Box Girders	Bridge	74.63	1	12.20	10.50	7.00	\$1,088,850.00	\$812,608.76	Major Rehabilitation	\$754,425.00
BRH002	BR060	Belmeade Rd & South Castor River Bridge	2.1km West of County Rd 31	45.13669020	-75.46572420	1981	Slab on Concrete Box Girders	Bridge	73.36	1	17.40	10.50	7.30	\$1,552,950.00	\$1,139,244.12	Minor Rehabilitation	\$488,237.50
BRH003	BR001	Ormond Bridge	0.2km East of Bisson Rd	45.16535840	-75.35563030	1979	Reinforced Concrete Solid Slab	Bridge	72.99	3	32.30	9.10	7.50	\$2,204,475.00	\$1,609,046.30	Minor Rehabilitation	\$651,118.75
BRH004	BR024	Cayer Rd & Annable Creek MD Bridge	0.5km North of Country Rd 3	45.11122000	-75.35826000	Unknown	Concrete Rigid Frame	Bridge	36.24	1	5.70	6.40	6.00	\$802,560.00	\$290,847.74	Replacement	\$1,173,200.00
BRH005	BR058	Liscumb Rd & Annable MD Bridge	0.35km West of County Rd 3	45.10424000	-75.36220000	Unknown	Concrete Rigid Frame	Bridge	68.57	1	5.30	6.40	4.60	\$746,240.00	\$511,696.77	Major Rehabilitation	\$623,120.00
BRH006	BR003	Development Rd & North Branch of South Nation River MD Bridge	1.2 km North of Van Camp Road	45.04468500	-75.44981100	Unknown	Slab on Steel I - Girders	Bridge	71.53	1	25.90	9.60	8.00	\$2,113,440.00	\$1,511,743.63	Minor Rehabilitation	\$628,360.00
BRH007	BR004	Levere Rd & North Branch South Nation River Bridge	0.40km East of Development Rd	45.04566260	-75.44479560	Unknown	Slab on Concrete Box Girders	Bridge	73.14	1	14.70	8.50	7.00	\$1,187,025.00	\$868,190.09	Minor Rehabilitation	\$396,756.25
BRH008	BR005	Van Camp Road & North Branch South Nation River Bridge	0.5km east of Development Rd	45.03686000	-75.43610000	1979	Slab on Concrete Box Girders	Bridge	73.94	1	14.70	9.00	6.00	\$1,256,850.00	\$929,314.89	Minor Rehabilitation	\$454,212.50
BRH009	BR017	Cameron Rd & Near Boundary Rd Bridge	50m East of Boundary Rd	44.99500000	-75.51611000	Unknown	Slab on Steel I - Girders	Bridge	61.23	1	11.50	6.00	6.00	\$966,000.00	\$591,481.80	Major Rehabilitation	\$748,000.00
BRH010	BR009	Cameron Rd & North Branch of South Nation River MD Bridge	1.5km West of County Rd 3	45.03032000	-75.41273000	Unknown	Slab on CPCI Girders	Bridge	74.95	1	18.30	9.00	7.30	\$1,564,650.00	\$1,172,705.18	Minor Rehabilitation	\$100,000.00
BRH011	BR012	Nation Valley Rd & South Nation River Bridge	70m South of River Rd	45.06817620	-75.28060690	1980	Slab on CPCI Girders	Bridge	74.44	3	69.10	9.20	7.30	\$4,767,900.00	\$3,549,224.76	Minor Rehabilitation	\$397,993.75
BRH012	BR013	Nation Valley Rd & Barkley Creek Bridge	5km West of County Rd 43	45.06663250	-75.28407060	Unknown	T Beam	Bridge	44.32	1	7.00	6.00	4.80	\$840,000.00	\$372,288.00	Replacement	\$1,150,000.00
BRH013	BR008	Timmins Rd & North Branch South Nation River Bridge	0.8km South of County Rd 3	45.02092000	-75.38608000	1987	Slab on Concrete Box Girders	Bridge	72.44	1	20.80	10.10	9.00	\$1,575,600.00	\$1,141,364.64	Minor Rehabilitation	\$592,375.00
BRH014	BR007	Bridge St & South Nation River Bridge	0.3 km North of Sandy Road	44.98924000	-75.45054000	1977	Slab on CPCI Girders	Bridge	72.75	1	30.20	7.00	4.90	\$1,585,500.00	\$1,153,451.25	Minor Rehabilitation	\$357,281.25
BRH015	BR014	Limerick Rd & McMillan Rd Bridge	0.8km East of County Rd 8	45.07987070	-75.20279870	Unknown	Concrete Rigid Frame - Arch	Bridge	71.01	1	12.80	8.50	7.00	\$1,033,600.00	\$733,959.36	Minor Rehabilitation	\$169,200.00
BRH016	BR006	West Bridge	0.1 km South of Nation River Road	44.95978000	-75.47725000	1981	Slab on CPCI Girders	Bridge	74.90	1	32.20	9.70	8.50	\$2,342,550.00	\$1,754,569.95	None	\$0.00
BRH017	BR010	Bigford Bridge	0.2km North of County Rd 5	45.00415000	-75.36276000	1983	Solid Slab (3 - Span Continuous Beam)	Bridge	73.23	3	43.00	9.80	7.50	\$3,160,500.00	\$2,314,434.15	Minor Rehabilitation	\$297,531.25
BRT001	BR057	Chesterville Dam Structure Pedestrian Bridge	30m South of Water St	45.10126490	-75.22599910	Unknown	Pedestrian Bridge (Solid Slab)	Bridge	74.81	6	42.00	4.00	4.00	\$1,260,000.00	\$942,606.00	None	\$0.00
CUC001	BR016	Cayer Rd & McLean MD Culvert	0.5km South of County Rd 13	45.13701400	-75.37806700	Unknown	Precast Concrete Box Culvert	Culvert	73.65	1	11.70	3.00	6.40	\$795,600.00	\$585,959.40	Minor Rehabilitation	\$201,494.00
CUC002	BR023	Cayer Rd & Cinnamon MD Culvert	1.3km South of County Rd 13	45.12935000	-75.37231000	Unknown	Concrete Rigid Frame (Open Footing)	Culvert	74.85	1	19.50	6.10	6.00	\$1,315,275.00	\$984,483.34	Minor Rehabilitation	\$60,000.00
CUC003	BR026	Thompson Rd & Black Creek MD Culvert	Intersection of the Thompson Rd and Steen Rd	45.15021000	-75.31702000	Unknown	Precast Concrete Box Culvert	Culvert	75.00	1	15.90	3.60	6.00	\$877,680.00	\$658,260.00	None	\$0.00
CUC004	BR015	Cayer Rd & Castor Extension MD Culvert	2.4km South of County Rd 13	45.12110000	-75.36599000	Unknown	2-Cell Concrete Box Culvert	Culvert	73.99	2	18.00	8.50	6.00	\$1,453,500.00	\$1,075,444.65	Minor Rehabilitation	\$70,000.00
CUC005	BR018	Kerrs Ridge Rd & Castor Extension MD Culvert	0.6km North of Spruit Rd	45.08720720	-75.42939370	Unknown	Concrete Box Culvert	Culvert	74.40	1	14.50	3.00	4.50	\$754,000.00	\$560,976.00	Minor Rehabilitation	\$60,000.00
CUC006	BR059	Winchester Main St & Henderson Creek MD Culvert	0.3km East of Ottawa St.	45.09536860	-75.34715750	Unknown	Concrete Rigid Frame (Open Footing)	Culvert	63.17	1	15.30	3.10	9.80	\$815,490.00	\$515,145.03	Minor Rehabilitation	\$192,904.38
CUC007	BR019	Guy Rd & East Justus MD Culvert	2.5km West of County Rd 31	45.05028860	-75.35644000	Unknown	Cast-in-Place Concrete Box Culvert	Culvert	75.00	1	12.80	4.20	6.00	\$865,280.00	\$648,960.00	None	\$0.00
Sub-Total:														\$36,925,515.00	\$26,428,005.80		\$9,566,209.63



Structure Inventory																	
Structure ID	PSAB ID	Structure Name	Structure Location	Latitude	Longitude	Year Built	Structure Type	Type	BCI	o. of Spar	Length (m)	Width (m)	Road Width (m)	Replacement Cost	Current Structure Value	Identified Capital Work Needs	Anticipated Capital Cost
CUC008	BR028	Nation Valley Rd & Searge MD Culvert	60m West of Forward Rd	45.07586000	-75.26137000	Unknown	Concrete Rigid Frame (Open Footing)	Culvert	43.50	1	7.50	3.50	4.60	\$607,500.00	\$264,262.50	Replacement	\$859,375.00
CUC009	BR030	Nation River Rd & Eager MD Culvert	1.0km East of Wallace Rd	44.96921000	-75.47351000	Unknown	Concrete Box Culvert	Culvert	74.96	1	17.40	3.00	5.80	\$904,800.00	\$678,238.08	None	\$0.00
CUS001	BR035	Marionville Rd & Lough MD Culvert	0.4km East of Rodney Ln	45.16385610	-75.39694200	Unknown	CSP Arch Culvert	Culvert	74.67	1	28.70	3.20	6.00	\$1,024,590.00	\$765,061.35	Minor Rehabilitation	\$80,000.00
CUS002	BR052	Carruthers Rd & Muffat Creek MD Culvert	0.85km East of County Rd 7	45.19173350	-75.28364350	Unknown	SPCSP Arch Culvert	Culvert	74.57	1	15.30	3.70	5.80	\$934,830.00	\$697,102.73	None	\$0.00
CUS003	BR045	Allen Rd & Allen Creek MD Culvert	0.5km South of French Settlement Rd	45.08615000	-75.55013000	Unknown	CSP Arch Culvert	Culvert	74.75	1	18.30	3.10	5.50	\$975,390.00	\$729,104.03	None	\$0.00
CUS004	BR046	Jennings Rd & Castor Extension MD Culvert	2.2 to Walker Extension MD	45.10040000	-75.42241000	Unknown	SPCSP Arch Culvert	Culvert	66.10	1	13.70	4.60	5.70	\$997,360.00	\$659,254.96	None	\$0.00
CUS005	BR048	Kerrs Ridge Rd Allowance & Castor Extension MD Culvert	0.6km West of Jennings Rd	45.09437000	-75.42706000	Unknown	SPCSP Arch Culvert	Culvert	63.50	1	15.00	4.00	5.00	\$975,000.00	\$619,125.00	None	\$0.00
CUS006	BR047	Spruit Rd & Castor Extension MD Culvert	0.45km West of Riddell Rd	45.07951680	-75.43133560	Unknown	SPCSP Round Culvert	Culvert	63.37	1	13.70	3.00	4.00	\$822,000.00	\$520,901.40	None	\$0.00
CUS007	BR050	Spruit Rd Culvert	0.43km East of Riddel Rd	45.08279020	-75.42104870	Unknown	SPCSP Vertical Oval	Culvert	53.77	1	15.30	2.50	5.30	\$696,150.00	\$374,319.86	Replacement	\$970,187.50
CUS008	BR022	Liscumb Rd & Tighe MD Culvert	0.6km West of County Rd 3	45.10355240	-75.36342680	Unknown	SPCSP Arch Culvert	Culvert	70.33	1	15.30	4.50	10.00	\$841,500.00	\$591,826.95	None	\$0.00
CUS009	BR054	Boyne Rd & Kittle Creek MD Culvert	1.2km East of Kittle Rd	45.12667290	-75.26198900	Unknown	2-Cell CSP Round Culvert	Culvert	74.71	2	18.30	3.00	8.40	\$951,600.00	\$710,940.36	None	\$0.00
CUS010	BR049	Development Rd & CPR Railway Culvert	1.0km South of County Rd 43	45.08616490	-75.55009500	Unknown	3-Cell CSP Culvert	Culvert	48.75	3	20.40	4.50	6.40	\$953,700.00	\$464,928.75	Replacement	\$1,332,125.00
CUS011	BR032	Kittle Rd & Kittle Creek MD Culvert	1.3km West of County Rd 7	45.11716000	-75.25508000	Unknown	2-Cell CSP Round Culvert	Culvert	74.67	2	12.20	3.00	6.00	\$829,600.00	\$619,462.32	None	\$0.00
CUS012	BR044	Finch Winchester Boundary Rd & Soney Creek MD Culvert	0.4km South of County Rd 9	45.13692000	-75.19492000	Unknown	CSP Round	Culvert	65.11	1	18.30	3.00	4.60	\$951,600.00	\$619,586.76	None	\$0.00
CUS013	BR002	Van Camp Rd & North Branch South Nation River MD Culvert	0.25km West of County Rd 1	45.01981000	-75.48735000	Unknown	2-Cell SPCSP Culvert	Culvert	73.59	2	23.50	12.60	6.40	\$2,397,000.00	\$1,763,952.30	None	\$0.00
CUS014	BR033	River Rd & Kittle Creek MD Culvert	0.2km South of County Rd 43	45.10071500	-75.25082700	Unknown	CSP Horizontal Ellipse Culvert	Culvert	61.93	1	25.30	3.90	6.00	\$1,053,745.00	\$652,584.28	Major Rehabilitation	\$408,436.25
CUS015	BR051	Guy Rd & Mullin MD Culvert	0.5km East of Browns Ln	45.04361940	-75.37332880	Unknown	SPCSP Arch Culvert	Culvert	73.32	1	16.80	3.30	5.80	\$939,120.00	\$688,562.78	None	\$0.00
CUS016	BR020	Pemberton Rd & Mulin MD Culvert	0.45km South of Hogaboam Rd	45.04404000	-75.34220000	Unknown	SPCSP Arch Culvert	Culvert	62.97	1	17.50	3.00	5.80	\$910,000.00	\$573,027.00	None	\$0.00
CUS017	BR029	Nation Valley Rd & Dillabough Creek MD Culvert	2.4km West of County Rd 43	45.08186830	-75.24645470	Unknown	SPCSP Arch Culvert	Culvert	28.13	1	17.40	3.30	6.40	\$897,840.00	\$252,562.39	Replacement	\$1,277,300.00
CUS018	BR040	Webb Rd & Whittaker MD Culvert	1.10km North of Nesbitt Rd	45.05621000	-75.29790000	Unknown	4-Cell CSP	Culvert	74.66	4	7.00	3.20	5.50	\$352,800.00	\$263,400.48	None	\$0.00
CUS019	BR053	Hollister Rd & Moffat Creek MD Culvert	0.5km South of River Rd	45.04742700	-75.31713000	Unknown	2-Cell CSP Round Culvert	Culvert	61.04	2	26.50	3.00	10.70	\$901,000.00	\$549,970.40	None	\$0.00
CUS020	BR055	Hollister Rd Equalizer Culvert	0.9km South of River Rd	45.04564180	-75.31373180	Unknown	2-Cell CSP Round Culvert	Culvert	59.57	2	26.50	3.20	10.70	\$946,050.00	\$563,561.99	None	\$0.00
CUS021	BR011	Nesbitt Rd & Whittaker MD Culvert	0.6km East of County Rd 31	45.04451000	-75.29870000	Unknown	Super Cor Culvert	Culvert	74.98	1	13.00	10.00	8.50	\$1,215,500.00	\$911,381.90	None	\$0.00
CUS022	BR025	Nesbitt Rd & Barkley Creek MD Culvert	0.3km West of Shay Rd	45.05131000	-75.28076000	Unknown	SPCSP Arch Culvert	Culvert	65.91	1	21.00	5.50	7.00	\$1,160,250.00	\$764,720.78	None	\$0.00
Sub-Total:														\$23,238,925.00	\$15,297,839.34		\$4,927,423.75
Total:														\$60,164,440.00	\$41,725,845.14		\$14,493,633.38

## **Appendix B:**

### *Anticipated Capital Costs*

Anticipated Capital Costs											
Structure ID	PSAB ID	Structure Name	BCI	Rehabilitation/Replacement Cost	Approach Repair/Rehabilitation Costs	Detour Construction Cost	Traffic Control	Engineering Investigations	Design	Contract Administration	Total
CUS017	BR029	Nation Valley Rd & Dillabough Creek MD Culvert	28.13	\$897,840.00	\$60,000.00	\$40,000.00	\$40,000.00	\$15,000.00	\$89,784.00	\$134,676.00	\$1,277,300.00
BRH004	BR024	Cayer Rd & Annable Creek MD Bridge	36.24	\$802,560.00	\$60,000.00	\$70,000.00	\$40,000.00	\$0.00	\$80,256.00	\$120,384.00	\$1,173,200.00
CUC008	BR028	Nation Valley Rd & Servage MD Culvert	43.50	\$607,500.00	\$20,000.00	\$40,000.00	\$40,000.00	\$0.00	\$60,750.00	\$91,125.00	\$859,375.00
BRH012	BR013	Nation Valley Rd & Barkley Creek Bridge	44.32	\$840,000.00	\$20,000.00	\$40,000.00	\$40,000.00	\$0.00	\$84,000.00	\$126,000.00	\$1,150,000.00
CUS010	BR049	Development Rd & CPR Railway Culvert	48.75	\$953,700.00	\$60,000.00	\$40,000.00	\$40,000.00	\$0.00	\$95,370.00	\$143,055.00	\$1,332,125.00
CUS007	BR050	Spruit Rd Culvert	53.77	\$696,150.00	\$20,000.00	\$40,000.00	\$40,000.00	\$0.00	\$69,615.00	\$104,422.50	\$970,187.50
BRH009	BR017	Cameron Rd & Near Boundary Rd Bridge	61.23	\$386,400.00	\$60,000.00	\$70,000.00	\$80,000.00	\$55,000.00	\$38,640.00	\$57,960.00	\$748,000.00
CUS014	BR033	River Rd & Kittle Creek MD Culvert	61.93	\$210,749.00	\$60,000.00	\$40,000.00	\$40,000.00	\$5,000.00	\$21,074.90	\$31,612.35	\$408,436.25
CUC006	BR059	Winchester Main St & Henderson Creek MD Culvert	63.17	\$122,323.50	\$0.00	\$0.00	\$40,000.00	\$0.00	\$12,232.35	\$18,348.53	\$192,904.38
BRH005	BR058	Liscumb Rd & Annable MD Bridge	68.57	\$298,496.00	\$60,000.00	\$70,000.00	\$80,000.00	\$40,000.00	\$29,849.60	\$44,774.40	\$623,120.00
BRH015	BR014	Limerick Rd & McMillan Rd Bridge	71.01	\$103,360.00	\$0.00	\$0.00	\$40,000.00	\$0.00	\$10,336.00	\$15,504.00	\$169,200.00
BRH006	BR003	Development Rd & North Branch of South Nation River MD Bridge	71.53	\$422,688.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$42,268.80	\$63,403.20	\$628,360.00
BRH013	BR008	Timmins Rd & North Branch South Nation River Bridge	72.44	\$393,900.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$39,390.00	\$59,085.00	\$592,375.00
BRH014	BR007	Bridge St & South Nation River Bridge	72.75	\$237,825.00	\$20,000.00	\$0.00	\$40,000.00	\$0.00	\$23,782.50	\$35,673.75	\$357,281.25
BRH003	BR001	Ormond Bridge	72.99	\$440,895.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$44,089.50	\$66,134.25	\$651,118.75
BRH007	BR004	Levere Rd & North Branch South Nation River Bridge	73.14	\$237,405.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$23,740.50	\$35,610.75	\$396,756.25
BRH017	BR010	Bigford Bridge	73.23	\$158,025.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$15,802.50	\$23,703.75	\$297,531.25
BRH002	BR060	Belmeade Rd & South Castor River Bridge	73.36	\$310,590.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$31,059.00	\$46,588.50	\$488,237.50
CUC001	BR016	Cayer Rd & McLean MD Culvert	73.65	\$79,560.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$10,000.00	\$11,934.00	\$201,494.00
BRH008	BR005	Van Camp Road & North Branch South Nation River Bridge	73.94	\$251,370.00	\$60,000.00	\$40,000.00	\$40,000.00	\$0.00	\$25,137.00	\$37,705.50	\$454,212.50
BRH011	BR012	Nation Valley Rd & South Nation River Bridge	74.44	\$238,395.00	\$60,000.00	\$0.00	\$40,000.00	\$0.00	\$23,839.50	\$35,759.25	\$397,993.75
BRH001	BR056	Belmeade Rd & South Castor Creek Bridge	74.63	\$435,540.00	\$60,000.00	\$70,000.00	\$80,000.00	\$0.00	\$43,554.00	\$65,331.00	\$754,425.00
Total:				\$9,125,271.50						Total:	\$14,123,633.38

## **Appendix C:**

### *Capital Work 10-Year Plan*

Bridges Capital Work 10-Year Plan (in \$1000's)																		
Structure ID	PSAB ID	Structure Name	BCI	Repair Needs	Recommended Timing		Description	2021 (\$000)	2022 (\$000)	2023 (\$000)	2024 (\$000)	2025 (\$000)	2026 (\$000)	2027 (\$000)	2028 (\$000)	2029 (\$000)	2030 (\$000)	10-Year Plan (\$000)
					1 to 5 Years	6 to 10 Years												
		Structures with Approach Rehabilitation BRH010	N/A	Minor Rehabilitation	✓		Design Construction & CA	\$100.000										\$100.000
BRH004	BR024	Cayer Rd & Annable Creek MD Bridge	36.24	Replacement	✓		Design Construction & CA	\$80.256	\$1,092.944									\$1,173.200
BRH012	BR013	Nation Valley Rd & Barkley Creek Bridge	44.32	Replacement	✓		Design Construction & CA		\$84.000	\$1,066.000								\$1,150.000
BRH009	BR017	Cameron Rd & Near Boundary Rd Bridge	61.23	Major Rehabilitation	✓		Design Construction & CA		\$93.640	\$654.360								\$748.000
BRH005	BR058	Liscumb Rd & Annable MD Bridge	68.57	Major Rehabilitation	✓		Design Construction & CA				\$69.849	\$553.270						\$623.119
BRH015	BR014	Limerick Rd & McMillan Rd Bridge	71.01	Minor Rehabilitation		✓	Design Construction & CA					\$10.336	\$158.864					\$169.200
BRH006	BR003	Development Rd & North Branch of South Nation River MD Bridge	71.53	Minor Rehabilitation		✓	Design Construction & CA					\$42.268	\$586.091					\$628.359
BRH013	BR008	Timmins Rd & North Branch South Nation River Bridge	72.44	Minor Rehabilitation		✓	Design Construction & CA					\$39.390	\$552.985					\$592.375
BRH014	BR007	Bridge St & South Nation River Bridge	72.75	Minor Rehabilitation		✓	Design Construction & CA							\$23.782		\$333.498		\$357.280
BRH003	BR001	Ormond Bridge	72.99	Minor Rehabilitation	✓		Design Construction & CA							\$44.089		\$607.029		\$651.118
BRH007	BR004	Levere Rd & North Branch South Nation River Bridge	73.14	Minor Rehabilitation	✓		Design Construction & CA							\$23.740		\$373.015		\$396.755
BRH017	BR010	Bigford Bridge	73.23	Minor Rehabilitation	✓		Design Construction & CA								\$15.802		\$281.728	\$297.530
BRH002	BR060	Belmeade Rd & South Castor River Bridge	73.36	Minor Rehabilitation	✓		Design Construction & CA								\$31.059		\$457.178	\$488.237
BRH008	BR005	Van Camp Road & North Branch South Nation River Bridge	73.94	Minor Rehabilitation		✓	Design Construction & CA								\$25.137		\$429.075	\$454.212
BRH011	BR012	Nation Valley Rd & South Nation River Bridge	74.44	Minor Rehabilitation		✓	Design Construction & CA									\$23.839	\$374.154	\$397.993
BRH001	BR056	Belmeade Rd & South Castor Creek Bridge	74.63	Major Rehabilitation		✓	Design Construction & CA									\$43.554	\$710.871	\$754.425

Total:	\$180.256	\$1,270.584	\$1,720.360	\$69.849	\$645.264	\$1,297.940	\$91.611	\$1,385.540	\$1,235.374	\$1,085.025	\$8,981.803
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Culverts Capital Work 10-Year Plan (in \$1000's)																		
Structure ID		Structure Name	BCI	Repair Needs	Recommended Timing		Description	2021 (\$000)	2022 (\$000)	2023 (\$000)	2024 (\$000)	2025 (\$000)	2026 (\$000)	2027 (\$000)	2028 (\$000)	2029 (\$000)	2030 (\$000)	10-Year Plan (\$000)
					1 to 5 Years	6 to 10 Years												
-		Structures with Approach Rehabilitation CUC002, CUC004, CUC005, CUS001	N/A	Minor Rehabilitation	✓		Design Construction & CA	\$270.000										\$270.000
CUS017	BR029	Nation Valley Rd & Dillabough Creek MD Culvert	28.13	Replacement	✓		Design Construction & CA	\$104.784	\$1,172.516									\$1,277.300
CUC008	BR028	Nation Valley Rd & Servage MD Culvert	43.50	Replacement	✓		Design Construction & CA		\$60.750	\$798.625								\$859.375
CUS010	BR049	Development Rd & CPR Railway Culvert	48.75	Replacement	✓		Design Construction & CA			\$93.370	\$1,236.755							\$1,330.125
CUS007	BR050	Spruit Rd Culvert	53.77	Replacement	✓		Design Construction & CA				\$69.615	\$900.573						\$970.188
CUS014	BR033	River Rd & Kittle Creek MD Culvert	61.93	Major Rehabilitation	✓		Design Construction & CA					\$26.075	\$382.361					\$408.436
CUC006	BR059	Winchester Main St & Henderson Creek MD Culvert	63.17	Minor Rehabilitation	✓		Design Construction & CA					\$12.232	\$180.672					\$192.904
CUC001	BR016	Cayer Rd & McLean MD Culvert	73.65	Minor Rehabilitation	✓		Design Construction & CA					\$10.000	\$191.494					\$201.494
Total:								\$374.784	\$1,233.266	\$891.995	\$1,306.370	\$948.879	\$754.527	\$0.000	\$0.000	\$0.000	\$0.000	\$5,509.821

## **Appendix D:**

### *Capital 10-Year Plan Key Map*





TOWNSHIP OF  
**North Dundas**

## 10 Year Capital Plan Bridges

### Legend

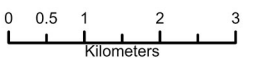
#### Construction Year (Second Year Listed)

- 2021
- 2022
- 2023
- 2025
- 2026
- 2028
- 2029
- 2030

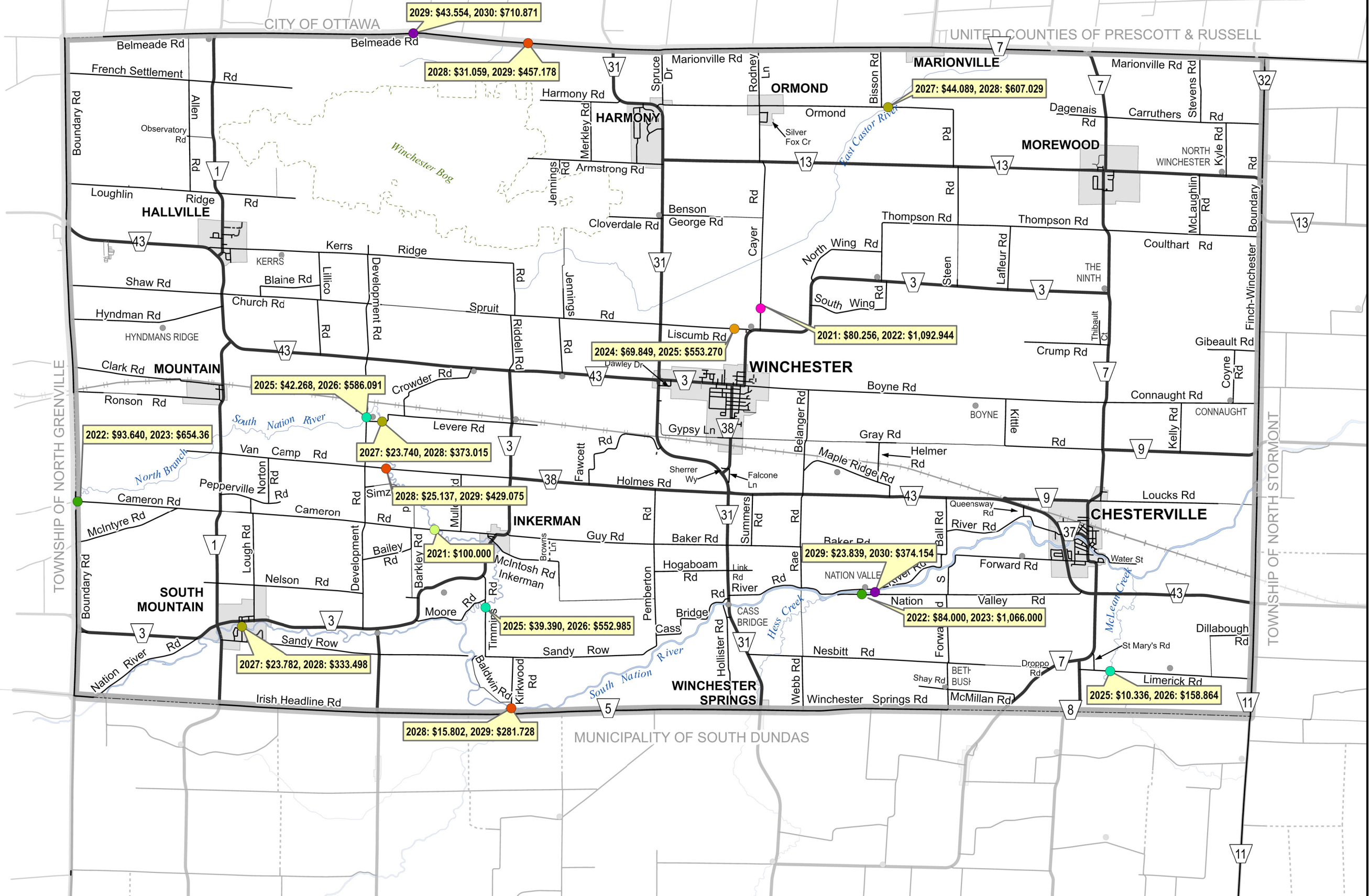
- County Road
- Township Road
- Private/Other Road
- Road Allowance / Seasonal Road
- Under Construction
- Railroad
- Settlement Area
- Township Boundary



1:100,000












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Transportation and Planning Services  
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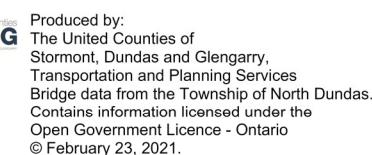
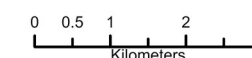
### Legend

	2021
	2022
	2023
	2024
	2025
	2026
	2028
	2029
	2030

— Township Road  
 — Private/Other Road

----- Under Construction

 Settlement Area

 Township Boundary

## **Appendix E:**

### *Additional Investigations*

Additional Investigations											
Structure ID	PSAB ID	Structure Name	Type	BCI	Length (m)	Width (m)	Road Width (m)	Additional Investigations	Priority		
									Urgent	1 Year	2 Year
CUS017	BR029	Nation Valley Rd & Dillabough Creek MD Culvert	SPCSP Arch Culvert	28.13	17.40	3.30	6.40	Structure Evaluation	\$15,000		
BRH009	BR017	Cameron Rd & Near Boundary Rd Bridge	Slab on Steel I - Girders	61.23	11.5	6	6	Detailed Deck Condition Survey		\$40,000	
								Structure Evaluation		\$15,000	
CUS014	BR033	River Rd & Kittle Creek MD Culvert	CSP Horizontal Ellipse Culvert	61.93	25.30	3.90	6.00	Monitoring of Deformations, Settlements and Movements		\$5,000	
CUS016	BR020	Pemberton Rd & Mulin MD Culvert	SPCSP Arch Culvert	62.97	17.50	3.00	5.80	Monitoring of Crack Widths		\$5,000	
CUS005	BR048	Kerrs Ridge Rd Culvert & Castor Extension MD Culvert	SPCSP Arch Culvert	63.50	15.00	4.00	5.00	Monitoring of Crack Widths		\$5,000	
CUS001	BR035	Marionville Rd & Lough MD Culvert	CSP Arch Culvert	74.67	28.70	3.20	6.00	Monitoring of Deformations, Settlements and Movements		\$5,000	
Total Costs:									\$15,000	\$75,000	\$0

## **Appendix F:**

### *Maintenance Needs*

Maintenance Needs										
Structure ID	PSAB ID	Structure Type	BCI	Length (m)	Width (m)	Road Width (m)	Maintenance Needs	Priority		
								Ongoing	1 Year	2 Year
CUC008	BR028	Nation Valley Rd & Servage MD Culvert	43.50	7.50	3.50	4.60	To repair rotated hazard markers.		\$2,000.0	
CUS007	BR050	Spruit Rd Culvert	53.77	15.30	2.50	5.30	To implement erosion control on southeast embankment.		\$4,000.0	
CUS019	BR053	Hollister Rd & Moffat Creek MD Culvert	61.04	26.50	3.00	10.70	To remove overgrown vegetation from stream.		\$2,000.0	
CUS014	BR033	River Rd & Kittle Creek MD Culvert	61.93	25.30	3.90	6.00	Erosion control measures on stream.		\$4,000.0	
CUC006	BR059	Winchester Main St & Henderson Creek MD Culvert	63.17	15.30	3.10	9.80	Rout & seal asphalt wearing surface.		\$10,000.0	
CUS005	BR048	Kerrs Ridge Rd Allowance & Castor Extension MD Culvert	63.50	15.00	4.00	5.00	To regrade approach gravel wearing surface.		\$3,000.0	
CUS012	BR044	Finch Winchester Boundary Rd & Stoney Creek MD Culvert	65.11	18.3	3	4.6	Erosion control measures on stream.		\$8,000.0	
							To remove heavy vegetation from embankments.		\$2,000.0	
BRH005	BR058	Liscumb Rd & Annable MD Bridge	68.57	5.30	6.40	4.60	To repair bridge railing.		\$8,000.0	
BRH015	BR014	Limerick Rd & McMillan Rd Bridge	71.01	12.8	8.5	7	Concrete repairs to end posts.		\$10,000.0	
							Repair to bridge railing coating.		\$6,000.0	
							To remove debris from deck.		\$2,000.0	
BRH006	BR003	Development Rd & North Branch of South Nation River MD Bridge	71.53	25.90	9.60	8.00	To remove debris from deck drains.		\$2,000.0	
BRH013	BR008	Timmins Rd & North Branch South Nation River Bridge	72.44	20.8	10.1	9	To regrade approach wearing surface.		\$3,000.0	
							To remove debris from deck.		\$2,000.0	
BRH014	BR007	Bridge St & South Nation River Bridge	72.75	30.2	7	4.9	Erosion control at stream banks.		\$4,000.0	
							Repair of bridge concrete (abutment)		\$8,000.0	
							Rout and seal asphalt wearing surface.		\$10,000.0	
							To install missing end cap.		\$3,000.0	
							To repair damaged SBGR & install hazard markers.		\$8,000.0	
BRH003	BR001	Ormond Bridge	72.99	32.30	9.10	7.50	To remove debris from expansion joints.		\$2,000.0	
BRH007	BR004	Levere Rd & North Branch South Nation River Bridge	73.14	14.7	8.5	7	To regrade approach gravel wearing surface on both sides and to install hazard markers on 4 quadrants.		\$6,000.0	
							To remove debris from expansion joints.		\$2,000.0	
BRH017	BR010	Bigford Bridge	73.23	43	9.8	7.5	To regrade approach gravel wearing surface on both sides of structure.		\$5,000.0	
							To remove debris from expansion joints.		\$2,000.0	
							Sub-Total:	\$0	\$118,000	\$0

Maintenance Needs										
Structure ID		Structure Type	BCI	Length (m)	Width (m)	Road Width (m)	Maintenance Needs	Priority		
								Ongoing	1 Year	2 Year
CUS015	BR051	Guy Rd & Mullin MD Culvert	73.32	16.80	3.30	5.80	Rout and seal asphalt wearing surface.		\$10,000.0	
BRH002	BR060	Belmeade Rd & South Castor River Bridge	73.36	17.40	10.50	7.30	To repair asphalt surface treatment on approaches.		\$5,000.0	
CUC001	BR016	Cayer Rd & McLean MD Culvert	73.65	11.7	3	6.4	Concrete repairs to inlet components. Rout and seal asphalt wearing surface.		\$5,000.0 \$10,000.0	
CUC004	BR015	Cayer Rd & McLean MD Culvert	73.99	18	8.5	6	Concrete repairs to barrel. Rout and seal asphalt wearing surface.			\$8,000.0 \$10,000.0
CUC005	BR018	Kerrs Ridge Rd & Castor Extension MD Culvert	74.4	14.5	3	4.5	To regrade approach gravel wearing surface. To stabilize outlet components.		\$5,000.0 \$8,000.0	
BRH011	BR012	Nation Valley Rd & South Nation River Bridge	74.44	69.1	9.2	7.3	To remove debris from deck & expansion joints. Animal control. Concrete repairs to girder end.		\$2,000.0  \$6,000.0	\$2,000.0
CUS002	BR052	Carruthers Rd & Muffat Creek MD Culvert	74.57	15.30	3.70	5.80	Rout and seal asphalt wearing surface.			\$10,000.0
BRH001	BR056	Belmeade Rd & South Castor Creek Bridge	74.63	12.2	10.5	7	To install hazard markers on all 4 quadrants. To repair asphalt surface treatment on approaches.		\$4,000.0	\$5,000.0
CUS011	BR032	Kittle Rd & Kittle Creek MD Culvert	74.67	12.20	3.00	6.00	Rout and seal asphalt wearing surface.			\$10,000.0
CUS001	BR035	Marionville Rd & Lough MD Culvert	74.67	28.70	3.20	6.00	Rout and seal asphalt wearing surface.			\$10,000.0
CUC002	BR023	Cayer Rd & Cinnamon MD Culvert	74.85	19.50	6.10	6.00	Animal/pest control		\$2,000.0	
BRH016	BR006	West Bridge	74.9	32.2	9.7	8.5	To install hazard markers. Rout and seal asphalt wearing surface on approaches and deck.		\$8,000.0	\$10,000.0
BRH010	BR009	Cameron Rd & North Branch of South Nation River MD Bridge	74.95	18.3	9	7.3	To implement erosion control measures at bridge corners. To remove heavy vegetation from embankments. To remove debris from deck drains.		\$8,000.0 \$2,000.0 \$2,000.0	
CUC009	BR030	Nation River Rd & Eager MD Culvert	74.96	17.4	3	5.8	Rout and seal approach asphalt wearing surface. To waterproof and seal joints between precast segments.			\$10,000.0 \$6,000.0
CUS021	BR011	Nesbitt Rd & Whittaker MD Culvert	74.98	13	10	8.5	To remove sediments from stream bed. To implement erosion control measures at stream banks.			\$3,000.0 \$8,000.0
Sub-Total:								\$0	\$77,000	\$92,000
Total Costs:								\$0	\$195,000	\$92,000



## **Appendix G:**

### *Approach Rehabilitation Structures*

Approach Rehabilitation Structures					
Structure ID	PASB ID	Structure Name	BCI	Description	Cost
CUC004	BR015	Cayer Rd & Castor Extension MD Culvert	73.99	To replace SBGR end treatments and repair collision damage on steel flex beam.	\$70,000.00
CUC005	BR018	Kerrs Ridge Rd Allowance & Castor Extension MD Culvert	74.40	To replace SBGRs buried end treatment	\$60,000.00
CUS001	BR035	Marionville Rd & Lough MD Culvert	74.67	To install SBGR at the north side of the roadway.	\$80,000.00
CUC002	BR023	Cayer Rd & Cinnamon MD Culvert	74.85	To replace SBGRs buried end treatment	\$60,000.00
BRH010	BR009	Cameron Rd & North Branch of South Nation River MD Bridge	74.95	To conduct length of need study and install hazard markers.	\$100,000.00
Total:					\$370,000.00

## **Appendix H:**

### *OSIM Reports*