Asset Management Plan

Final Report

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EXECUTIVE SUMMARY

Public infrastructure is central to our prosperity and our quality of life. The majority of public infrastructure in Canada is the responsibility of municipal government, and most people take for granted the important role of these assets. Adequate municipal infrastructure such as roads, bridges, and underground water and sewage pipes are essential to economic development, citizen safety, and quality of life. Well maintained infrastructure is critical in sustaining a municipality as an attractive place to live and do business.

The County of Elgin (County) has recognized the requirement for a comprehensive Asset Management Plan (AMP), for optimal decision making regarding infrastructure management. The AMP must meet guidelines for Ministry of Infrastructure's Building Together: Guide for Municipal Asset Management.

Dillon Consulting Limited (Dillon) was retained by the County to develop an Asset Management Plan (AMP), which will contribute to Elgin's eligibility for provincial funding under the Municipal Infrastructure Investment Initiative (MIII) program. Eligibility rules for MIII funding indicate that municipalities must prepare an AMP to ensure that the funds provided by the Province are spent in a cost-effective manner. Municipalities must also prove in their submission that they have acquired suitable asset management tools that will assist staff in managing its infrastructure assets in the future. These tools and systems will ensure that municipalities continue to provide an adequate level of service to their residents and create a solid foundation for economic prosperity.

This AMP meets all the Province's requirements outlined in the "Building Together: Guide for Municipal Asset Management" for an AMP to permit the County to apply for future funding programs. The adopted financial investment in the County's 10 Year Capital Plan will increase annually by $400,000, until year 2020. This funding will be spent on the network, however will not be sufficient to maintain the network at the current high level.

State of Local Infrastructure

The County provided a detailed inventory of the existing infrastructure within the road network. The road network includes 58 roads, which are further divided into a total of over 250 road sections, totaling 698 kilometers. The condition of the road network is important in determining the needs of the overall network. The County maintains a system to determine the condition of the road sections in their network, by means of a Structural Adequacy Rating (SAR) attributed to each road section within the network. The overall network condition was determined through the consideration of the SAR rating attributed to each section in combination with the length of that section as a portion of the entire network. The generally good condition of the majority of the road sections results in an average current condition of the road network of approximately 14.6 out of 20. These high values indicate that the road network currently provides an adequate level of service to the residents.

Bridge and culvert infrastructure in the County considered within the AMP are those three meters in size or larger. This included analysis of 60 bridge structures, and 82 culvert structures. A condition index was determined for each structure using the year of construction or last replacement of the structure and the life expectancy. The average condition index for the bridges was 0.43 on a scale of 0 to 1, with 1 being perfect condition. This value means that on average, the County bridges have approximately 43% of their lifespan remaining.

It is often suggested in literature that 2% to 4% of the value of an asset should be spent yearly to ensure sustainability of the assets. Without asset management tools, it is almost impossible to determine the long term effect of inadequate budget allocations. Yet, it is important for a municipality to determine if the current level of funding is appropriate to continue to provide an adequate level of service to its residents. It is also essential to allocate adequate funding to ensure sustainability of the assets in the future. For the County, the value of the road assets was estimated at over $350 million. The value of the bridge and culvert assets was estimated at just under $130 million for bridges, and just over $40 million for culverts, totaling just under $170 million.

Current Needs Summary

The current needs for the County road network are mostly based on the condition of the road, or where it is deemed practical and cost-effective, in association with needs-based sections or additional requirements. In 2014, it is expected that $7,137,000 will be required for 18 road rehabilitation projects.

The current needs for the bridges were determined using the MS Excel-based asset management tool described in ***Section 2.4***, which took into consideration the rehabilitation and needs recommendations identified within the OSIM report for each structure, in addition to the year of construction or last replacement of each structure and the life expectancy. The results of the current needs analysis determined that bridge and culvert needs for 2014 total $17,634,400. This large amount is mostly for assets that have theoretically reached the end of their service life. The bi-yearly OSIM inspection will likely result in spreading that amount over a number of years based on actual field inspection.

In addition to the analysis results, the County has identified some bridge and culvert projects to be undertaken in 2014, listed in the following table.

Current Needs Projects Identified by the County			
Network	**Project**	**Location**	**Expenditure**
Bridges	Middlemiss Bridge Rehab (1/2 Middlesex County)	Dutton/Dunwich	$200,000
Culverts	Bradley Creek Culvert Replacement - Engineering plus John St. curb repairs	Aylmer	$75,000
Culverts	Culvert Slip Linings	Various	$175,000

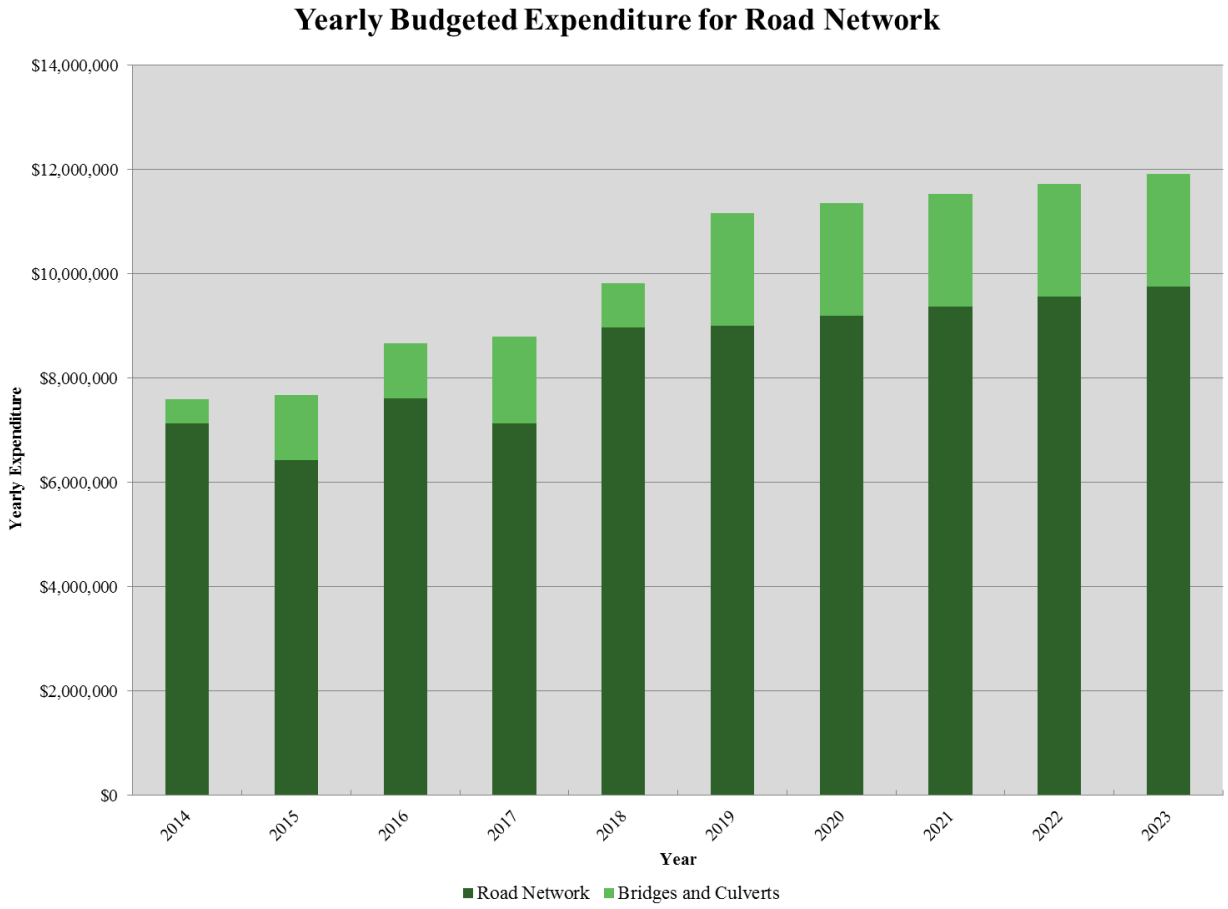
Asset Management Strategy

Road Network

The road network asset management plan was developed using the information and strategies currently in place at the County. The plan provides detailed information regarding the projects planned for the upcoming ten years. The first 5 years of the plan include a breakdown of specific projects attributed to each year.

The sixth to tenth years within the plan do not distinguish between individual project years, instead allotting a lump anticipated expenditure of $45,046,000 for selected projects. The following figure shows the anticipated expenditure anticipated for road rehabilitation for the 10 year scenario, including an assumed even division of the lump expenditure over years 2019-2023, as dark green bars.

The light green bars are representative of the budgeted by the County expenditures for bridge and culvert works. The total allocated budget is based on a summation of the two values.



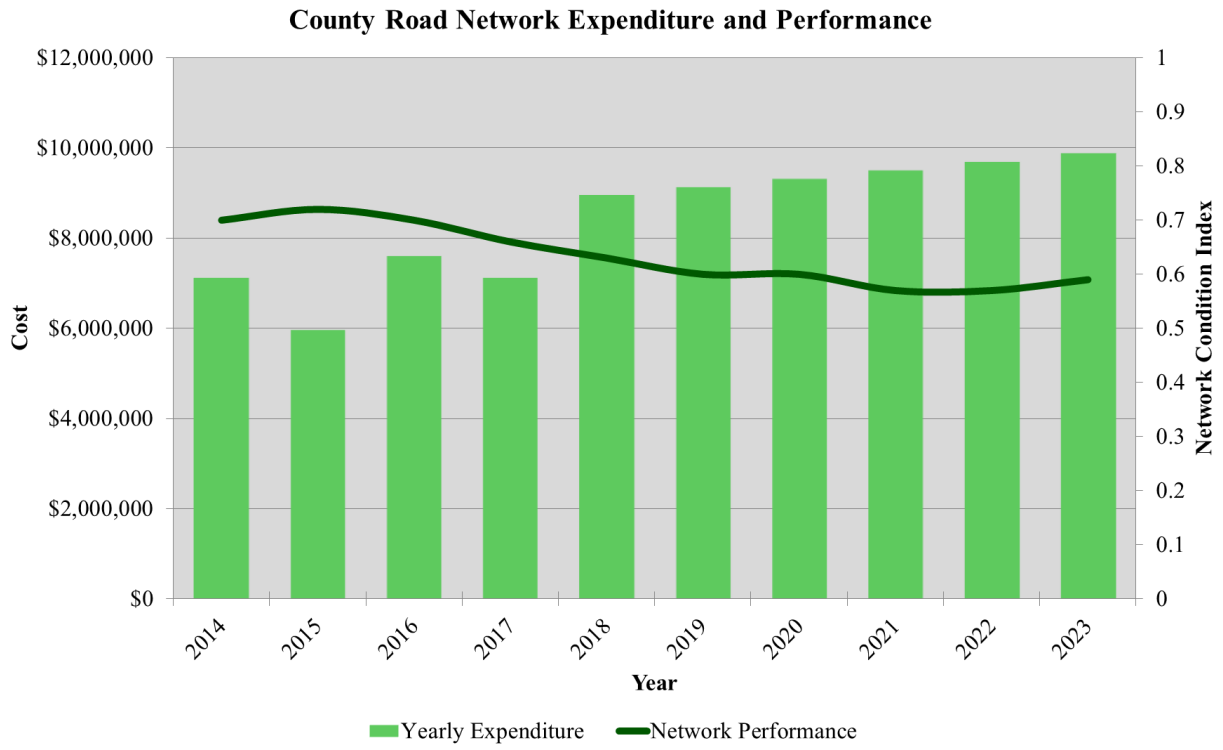
Yearly Estimated Expenditure for Road Network Rehabilitation – 10-Year Plan

The budget allocated for bridges and culverts is shown for visualization of entire budget breakdown. Further detail regarding the usage of the structure portion of this budget is given in **Section 5.2**. It is anticipated that in each of the upcoming ten years of projected infrastructure expenditures that approximately $7 million to $9 million will be spent to address needs on the road network.

In addition to the identified expenditures, the County will undertake a project for the relocation of Dexter Line. This work is anticipated to have an expenditure of $4.5 million, however funding is being sought to address the high expenditure.

Using the DPSS asset management tool described in **Section 2.4**, it is possible to analyze the infrastructure needs into the future, and the impact of allocated funding on the overall network condition. A plan was developed to ascertain a high level understanding of the anticipated expenditures and associated overall road network performance. Assumptions were made to simplify the County planning process to create a reasonable representation.

A scenario was analyzed using the annual budget values consistent with approved County road network capital budgets from 2014-2023. The results of the analysis are presented in the following figure.



County-Allocated Budget Values and Associated Road Network Performance

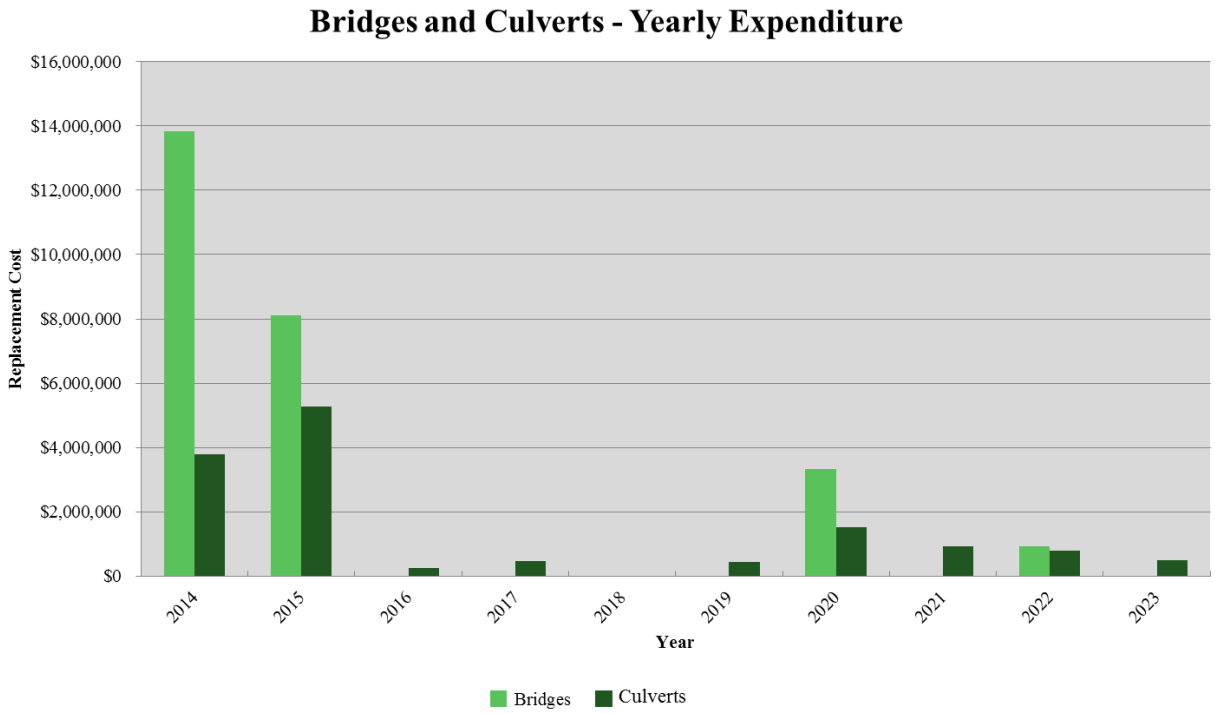
The initial road network condition was determined through condition surveys completed by the County, and represents a good network condition. Through the usage of the allocated budget, the network condition is noted to decrease, as illustrated by the solid line in the figure. The minimum value reached through this scenario remains above 0.5, which is above accepted industry standards. Towards the end of the ten year scenario, the condition index begins to rise, reaching nearly a 0.7 condition index, similar to the initial condition of the network. Because of the relatively consistent nature and high value of the network index throughout this timeframe, the County-defined budget is considered sufficient.

It is noted that going forward, an inflation value of 2% annually of the allocated budget spent on the County network would result in an overall increase in the network condition, which would ultimately reach the initial value of 0.7 in the road network.

Bridges and Culverts

The short-term asset management plan developed for the bridges and culverts was done using the MS Excel-based AMP tool developed by Dillon. The tool was used to consider the remaining life, replacement cost, and recommended rehabilitation actions for each structure; and develop a schedule and anticipated yearly expenditure for a ten-year timeframe.

The figure below shows the capital expenditure anticipated for bridges and culverts based upon the age and life expectancy of the structure. Some lower volume, "town line" structures have exceeded their service life and although replacement of these bridges is identified, the plan proposes to continue to rehabilitate as recommended in the OSIM report to extend their service lives rather than complete replacement at a significantly higher cost.



Yearly Anticipated Expenditure for Bridges and Culverts over 10 Years

In addition to the projects identified through analysis of the structures, the County has previously identified multiple bridge and culvert rehabilitation projects to be undertaken within a 10 year timeframe. It is recommended in the event that a project was selected due to factors additional to those considered in the analysis to retain the prioritization defined by the County.

Financing Strategy

Financing infrastructure needs has become a very serious issue. We need to identify better practices and innovations in infrastructure financing if municipalities and other levels of government want to continue to provide an adequate level of service to tax payers in an affordable manner. It is often thought that municipal infrastructure should be financed, as far as possible, by the residents who benefit from it but, how do you determine who should pay for the rehabilitation of an arterial or collector road going from point A to point B in large cities throughout Canada. In addition, for many years, municipal accounting practices have failed to include replacement costs for depreciating assets, thereby assuring a fiscal shock when replacement time arrives. The Public Sector Accounting Board (PSAB) has changed that practice which has required municipalities to realize the extent and magnitude of the infrastructure deficit. Asset managers need to come up with innovative solutions to address that infrastructure deficit.
Asset management systems are part of the solution but innovative financing and finding alternate revenue sources are an even bigger part of the solution.

In this report we have worked with County staff to develop an Asset Management (AM) Strategy, including funding requirements that would ensure sustainability of the assets to continue to provide an adequate level of service to the residents of the County.

The strategy developed is realistic, but a funding gap has been identified on the bridge and culvert network if the County wants to repair or replace assets based mainly on service lives. The bi-yearly OSIM inspection of all bridges and culverts will likely result in reducing that funding gap. The County has identified revenue sources that will support the Asset Management Plan (AMP) developed through this report. The funding sources include:

- General Tax Revenue
- Federal Gas Tax
- Assessment Growth
- New Tax Base
- Debt Financing

The County, where applicable, will seek Federal and Provincial funding through competitive grant programs, resulting in a potential funding source.

Prior to initiation of this report, the County developed an infrastructure plan identifying road network, bridge and culvert needs within a 10 year timeframe. The anticipated capital budget required to address works over both the road and structure networks is just over $7.5 million in 2014, and increases to an average of over $11 million for 2019-2023. The budget values were derived by the County to achieve a predetermined expenditure level which would adequately maintain the system. The budget allowances increase each year by 2% and $400,000 in accordance with a plan developed to reach an ideal expenditure level by 2020. The inflation of annual budget is reflected in the projected budgets defined by the County.

The County receives funding for its capital budget primarily through tax base and gas tax, which account for $1.5 million annually. In the event that a project must be undertaken where funding is insufficient, the County will borrow from future years of the capital plan.

The results of the analysis conducted on the road network identified that to maintain the good condition of the road network, the County allocated budget is sufficient. The results of the analysis on bridges and culverts identified over $17.5 million in needs in 2014, and over $13M for 2015. Both expenditures exceed budget allotments, which include both structure and road network expenditures, resulting in a shortfall in funding. It may be recommended that the needs identified through analysis be refined continually based on the results of condition surveys undertaken at each structure which will result in an anticipated reduction of current needs.

It is recommended that future iterations of County budget include the diversion of road network budget towards rehabilitation of bridges and culverts. Where the road network is maintained at a sufficient condition index, funding should be allocated to bridges and culverts, as they will take precedence due to the increased risk associated with poor condition.

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1. INTRODUCTION

1.1. Significance of Municipal Infrastructure

Public infrastructure is central to our prosperity and our quality of life. The majority of public infrastructure in Canada is the responsibility of municipal government, and most people take for granted the important role of these assets. Adequate municipal infrastructure such as roads, bridges, and underground water and sewage pipes are essential to economic development, citizen safety, and quality of life. Well maintained infrastructure is critical in sustaining a municipality as an attractive place to live and do business.

The recent *Canadian Infrastructure Report Card* (2012), which addresses municipal roads and water systems, stated that approximately 30% of municipal infrastructure is in "fair" to "very poor" condition across Canada. The replacement value of these assets alone totals over $170 billion. This illustrates the importance of municipalities protecting their investment in infrastructure, and finding creative financial solutions to keep infrastructure in good operating condition. One of the solutions to Canada's infrastructure issues is improved asset management.

The County of Elgin (County) has recognized the requirement for a comprehensive Asset Management Plan (AMP), for optimal decision making regarding infrastructure management. The AMP must meet guidelines for Ministry of Infrastructure's Building Together: Guide for Municipal Asset Management.

The present AMP report, along with the asset management tools delivered to the County, will assist staff in making the most cost-effective decisions with regards to rehabilitation or replacement of their infrastructure. It will also ensure that the limited funds made available for infrastructure renewal are spent wisely, and that staff decisions are supported by sound technical data and analysis.

1.2. Purpose of the AMP

Dillon Consulting Limited (Dillon) was retained by the County to develop an Asset Management Plan (AMP), which will contribute to Elgin's eligibility for provincial funding under the Municipal Infrastructure Investment Initiative (MIII) program. Eligibility rules for MIII funding indicate that municipalities must prepare an AMP to ensure that the funds provided by the Province are spent in a cost-effective manner. Municipalities must also prove in their submission that they have acquired suitable asset management tools that will assist staff in managing its infrastructure assets in the future. These tools and systems will ensure that municipalities continue to provide an adequate level of service to their residents and create a solid foundation for economic prosperity.

The Ministry of Infrastructure of Ontario recognized that public infrastructure is central to prosperity and quality of life, as municipalities deliver many services that are critical to the public. Many of these services rely on well planned and maintained infrastructure. All levels of government understand also that they have an obligation to address the ever increasing infrastructure challenges, to ensure that they can continue providing and adequate level of service to tax payers. In an effort to commence addressing these challenges, the Ministry has initiated a program and plan called *Building Together*: *Guide for Municipal Asset Management Plans* (2012).

This program is meant to assist municipalities in developing a municipal infrastructure strategy. This strategy provides an opportunity for municipalities to address current and emerging infrastructure challenges. One of the main components of the strategy is to improve the current municipal infrastructure asset management practices. The first step for municipalities is to develop an AMP. The province has indicated that any municipalities seeking provincial infrastructure funding must demonstrate that they have or are in the process of developing an AMP and how its proposed project funding requests fit within a detailed AMP. The AMP should not only address the current needs in infrastructure, it should also identify future needs and a financing short and long-term strategy to fund those needs.

The AMP will assist municipalities in making the best possible decisions regarding the building, operating, maintaining, renewing, replacing and disposing of infrastructure assets. The intent of the plan is to make the best use of the funds available while managing risk and continuing to provide adequate levels of service to the public.

1.3. County of Elgin

The County is located in the Province of Ontario. It is an upper-tier municipality, subdivided into seven lower-tier municipalities. The County is located in Southwestern Ontario, south of the City of London, and borders Lake Erie on the south. The County is approximately 1,820 square kilometers in size, and has a population of nearly 50,000. ***Figure 1*** illustrates the location of the County.

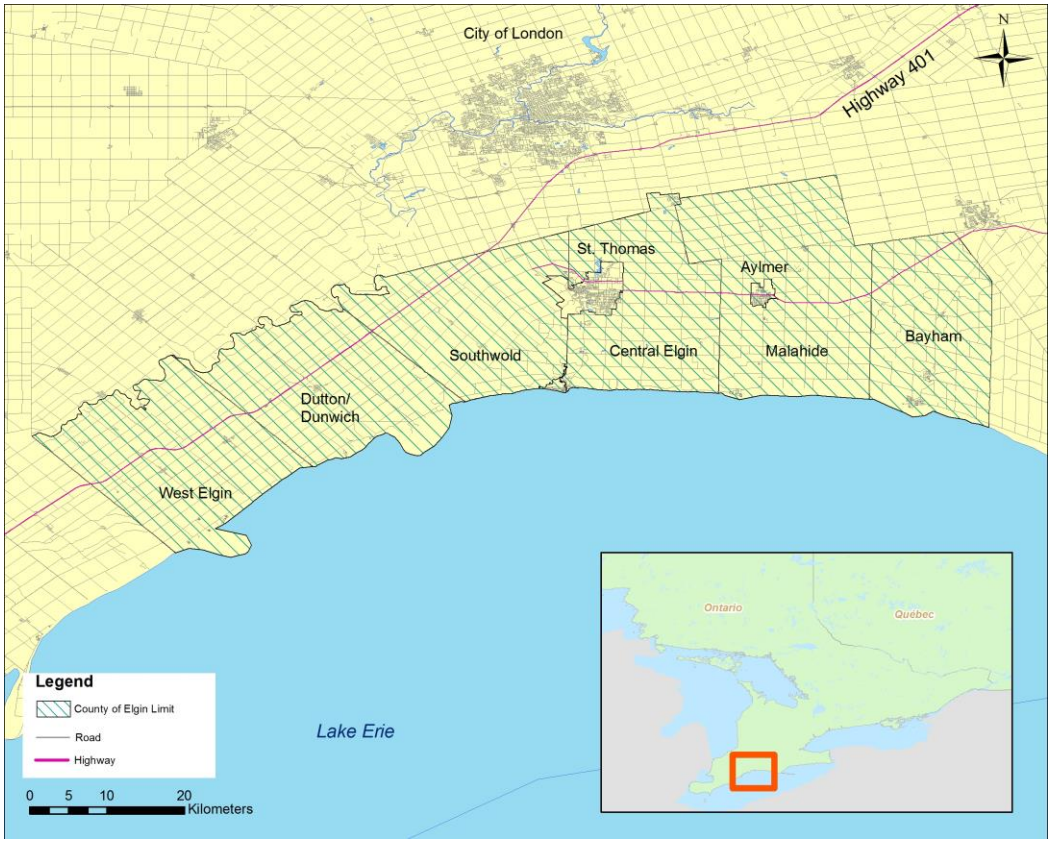

Figure 1: County of Elgin – Location Map

1.4. Project Team

To ensure that all technical and financial aspects of the plan were addressed, the County included representatives from relevant departments in the project. Individuals from the Finance and Engineering Services departments were consulted during the development of the AMP. Their involvement will continue in the future to ensure that the plan remains relevant and useful in properly managing the County's infrastructure assets.

1.5. Assets Included in the AMP

Ideally, municipalities should include all the capital assets owned and maintained by the municipality. However the funds currently made available by the province are mostly for infrastructure assets such as roads, bridges, water and wastewater assets, and social housing. As recommended in the Guide for Municipal Asset Management Plans, the County opted to develop a plan that includes all the primary assets. These infrastructure assets are considered essential to continue to provide an acceptable level of service to the public.

The County is an upper tier municipality, subdivided into seven lower-tier municipalities. Responsibility for maintenance of infrastructure is divided between the upper- and lower-tier municipalities. The subdivided municipalities are responsible for the majority of the infrastructure within the County. It is the responsibility of the County to maintain major arterial and collector road network and bridge infrastructure belonging to the County, which will be the focus of this AMP. Road, bridge and culvert infrastructure within the County includes:

- 700 kilometers of paved roads;
- 60 bridge structures; and
- 82 culvert structures.

Detailed information of the road network can be found in the digital database delivered to the County. The information is included in the asset management tools delivered to the County, to assist them in updating the AMP in the future. However, it is important to note that the AMP is not a static plan, and it will need to be updated as infrastructure is maintained and rehabilitated. The condition of the assets will also need to be reviewed as the assets continue to deteriorate over time.

The information provided to the Dillon Team originated from the County's existing databases and the Ontario Structure Inspection Manual (OSIM) reports.

1.6. AMP Limitations

The AMP is a tool which is meant to be used to inform decision making. Other political, social, and environmental considerations should also be taken into account in planning capital investments. However, the AMP should provide a foundation on which those decisions are made.

In addition, the usefulness of the AMP is directly related to the quality of data used in its analysis. Both the County Staff and Dillon Team involved in the project were committed to data accuracy, yet some assumptions had to be made in extenuating circumstances. Yet as a whole, the AMP provides an accurate approximation of the County's current and future infrastructure needs.

2. PROJECT METHODOLOGY

The general methodology we have adopted has been to follow the best practices from the *National Guide to Sustainable Municipal Infrastructure (2002)*, also known as the *InfraGuide*. The approach is described in five steps and was designed to help asset managers assess the level of service currently provided by their tangible assets. It allows asset managers to make fact-supported infrastructure investments decisions, while maximizing the effectiveness of available funds. In developing an AMP for the County, each of the five steps, and their key elements, as presented below, were addressed. Each step is described in detail in the sections below.

1. **Infrastructure Data Inventory - *What infrastructure do you own?***

- Analysis of existing data and optimization of data sources;
- Transfer of physical characteristic information into databases; and
- Document inventory of all assets.

2. **Replacement Costs - *What is it worth?***

- Define bench-marking unit prices for replacement;
- Calculate replacement costs of all assets; and
- Input information in analytical tools.

3. **Condition Assessment - *What is its condition and remaining service life?***

- Review of condition assessment data;
- Transfer of condition data to analytical tools;
- Computing condition assessment indices where appropriate;
- Statistical analysis of defects to assess life expectancy;
- Determination of service life of all infrastructure assets; and
- Comparison with industry standards and definition of acceptable level of service.

4. **State of Local Infrastructure Analysis- *What needs to be done to rehabilitate, replace, operate and maintain these assets?***

- Upload condition data in asset management tools and process information;
- Review the effect of different repair alternatives;
- Consideration of lifecycle costs and extension of service life; and
- Determine financial requirements to address needs identified.

5. **Asset Management Strategy - *What should be done first and how much will it cost?***

- Consideration of selected "what if" expenditure scenarios; and
- Production of a prioritized short and long term AMP.

The final part of this report which could be incorporated as an additional question to the list above is "How will you finance your plan?" To answer that question we have reviewed a variety of financing strategies which could be implemented to address the needs of all assets while maintaining an acceptable level of service to the residents.

2.1. Infrastructure Data Inventory

The County possesses a large amount of inventory and condition assessment data in a variety of formats; therefore, no field data collection was required on this project. We worked closely with the County staff to make best use of the valuable information they had.

2.1.1. Linear Infrastructure Inventory – Road Network

Prior to project initiation, the County staff had already created a digitized road network database. The Dillon Team reviewed that information and identified data gaps that needed to be addressed before processing data for the development of the AMP. Information such as year of construction, surface type, and pavement widths were some of the attribute information that was required in the development of the AMP. The Project Team worked closely with staff to address missing data or to make educated assumptions where the information was not available.

2.1.2. Point Asset Inventory – Bridge and Culvert Assets

The point assets considered within this AMP include bridge and culvert structures three meters or larger in span. The main source of information for these point assets were reports created to respond to Ontario Structure Inspection Manual (OSIM) requirements. To meet the requirements set out in OSIM, all structures on Ontario highways must be inspected at systemic intervals, based on defined technical and material standards. Full reports were developed for the structures within the County, providing detail on condition, physical attributes and recommendations for future needs and rehabilitation.

As a supplement to this resource, where required, the database created to respond to the requirements of the Public Sector Accounting Board (PSAB) was used. To meet the PSAB requirements, municipalities had to generate an inventory of all their assets, including details such as the year of construction or acquisition, estimations of the acquisition cost, and depreciation of costs to determine current residual value. The OSIM information was used as a primary resource, and was verified or built upon using PSAB data where required.

The Dillon Team, in collaboration with County staff, reviewed all OSIM and PSAB data and made appropriate adjustments to parameters such as service lives and replacement cost of an asset. The goal was to cater the existing information on current infrastructure conditions to the AMP development process.

2.2. Replacement Costs

Calculating the replacement costs of infrastructure assets provides insight on the existing financial investments on municipal infrastructure networks. To calculate overall replacement costs, the road infrastructure was assigned an average unit cost per square meter of construction. Unit construction costs were developed in collaboration with County staff, based on recent construction activities in the area. Detailed cost information was provided by the County. Calculation of replacement costs for point assets involved assigning an average unit cost per square meter of deck area to each bridge, and per meter of length for culverts. The replacement costs were dependent on the construction type and overall size of each structure. The replacement costs were developed from previous project experience, and were reviewed by the County.

2.3. Condition Assessment

The generation of condition indices, using consistent and repeatable techniques, is essential in comparing assets and identifying needs in all types of infrastructure. These indices are used to track improvements to the level of service in the condition of the asset network in the form of financial investment. The County already had performance data on their road network which was summarized using an index called Structural Adequacy Rating (SAR). That index was correlated to a Performance Index (PI) the road network ranging from 0 to 1, with 1 representing an asset in perfect condition. This conversion was required for processing of the data in the asset management tool. Once all assets were assigned a condition rating, knowledge of assets and technical expertise were used to determine rating level which represented the minimal level of service that can be provided to the residents. This was determined in consultation with County staff. Any components of infrastructure rated below the minimal rating are considered in needs of repair to improve the level of service. The minimum rating, or level of service, is called the "Threshold of Acceptability" of an asset.

The following ***Figure 2*** illustrates graphically an example of performance thresholds and deterioration model used for road networks.

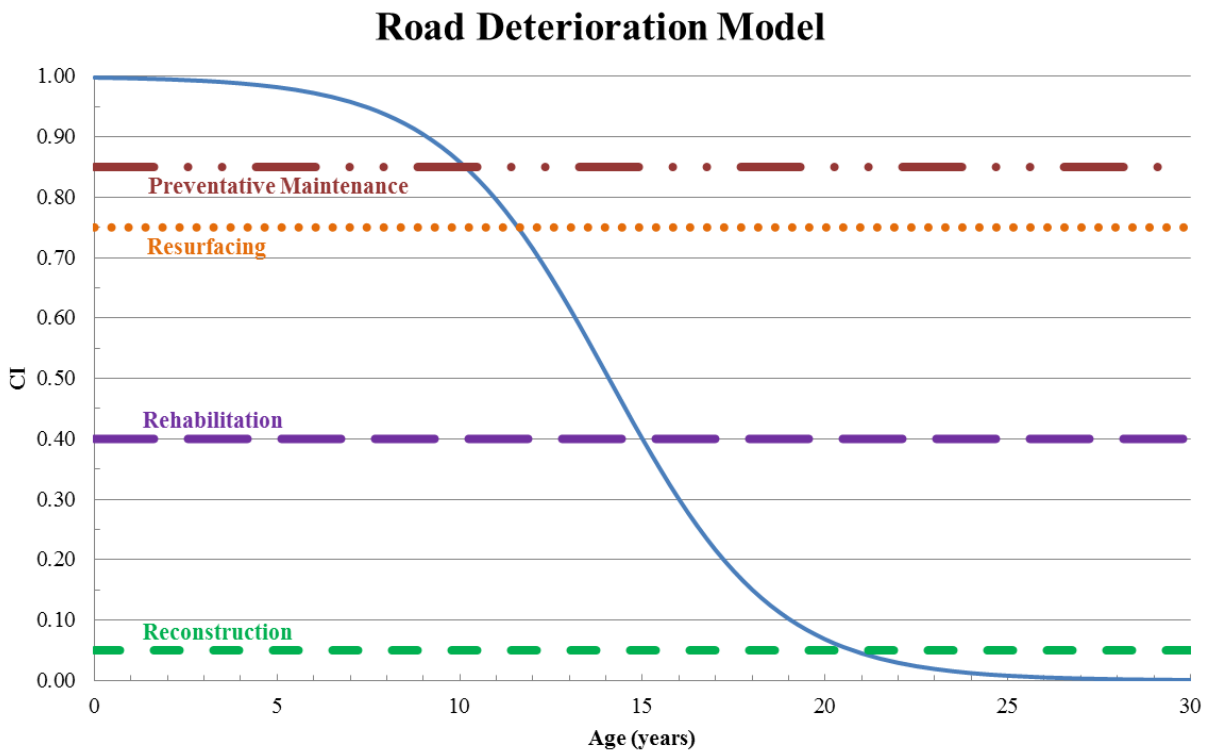

Figure 2: Deterioration Model and Threshold of Acceptability

2.3.1. Road Network Condition Assessment Process

The County has a highly developed Structural Adequacy Rating system which they use to summarize the results of condition assessment surveys carried out on all the roadway sections in the network on a regular basis. This survey provides a more accurate indication of the condition of the road surfaces, and better prediction of roadway deterioration. This information was used to analyze the road network over time.

2.3.2. Bridge and Culvert Condition Assessment Process

Condition assessment surveys had been carried out on the bridge and culvert point assets in 2010 through the OSIM report program. The detailed condition assessment evaluated the condition of the elements of the structure, and identified elements requiring repair, however did not attribute condition indices to the structures. Therefore, it was decided to take an approach based on year of construction and remaining service life in determining condition indices. The OSIM and PSAB databases contained information on year of construction, service lives and replacement costs, which were used to approximate timing for rehabilitation and replacement of those assets. The approximations were reviewed by staff and adjusted in some cases to better reflect actual condition of some assets. The final results were reviewed and endorsed by staff.

2.4. State of Local Infrastructure Analysis

For the road network, the Dillon Predictive Scenario Software (DPSS) was used in preparing the capital investment analysis of the AMP. The tool is a Microsoft Access application that relies on an overall assessment of the infrastructure condition to produce investment scripts based on degradation curves, which are adjusted to the County's particular operations and thresholds of acceptability.

The DPSS tool assesses the condition, and puts the Asset Manager in control of the life cycle of assets. It also allows for planning as to where, when, how and how much to invest in the renewal and replacement of infrastructures for the coming year, or for the next 5, 10, 20 or 50 years.

We used the DPSS application to develop the County's long term prioritized renewal plan. ***Figure 3*** provides a view of a screen capture of the DPSS analytical tool. Based on unit costs for rehabilitation of roadways provided by the County, AMPs were developed using the tool.

Figure 3: Dillon Predictive Scenario Software (DPSS)

For point assets, Dillon also developed a simple and practical tool to manage these types of assets. Point assets are assets such as bridges and culverts. These assets usually behave differently than linear assets because they are composed of many different components that have variable service lives. The service lives of these components can usually be obtained from sources such as:

- The supplier's suggested service life;
- The experience of the technical expert performing condition assessment; and,
- Published industry guides on service life and maintenance requirements.

The AMP tool developed by Dillon has been designed to summarize in tabular and chart forms the maintenance and renewal costs of the components of the assets. In addition to the condition assessment results, the tool considers factors such as year of construction, expected service life, infrastructure needs, maintenance and replacement costs, and year of intervention. It has been successfully implemented in many communities across Canada. ***Figure 4*** illustrates the AMP tool interface.

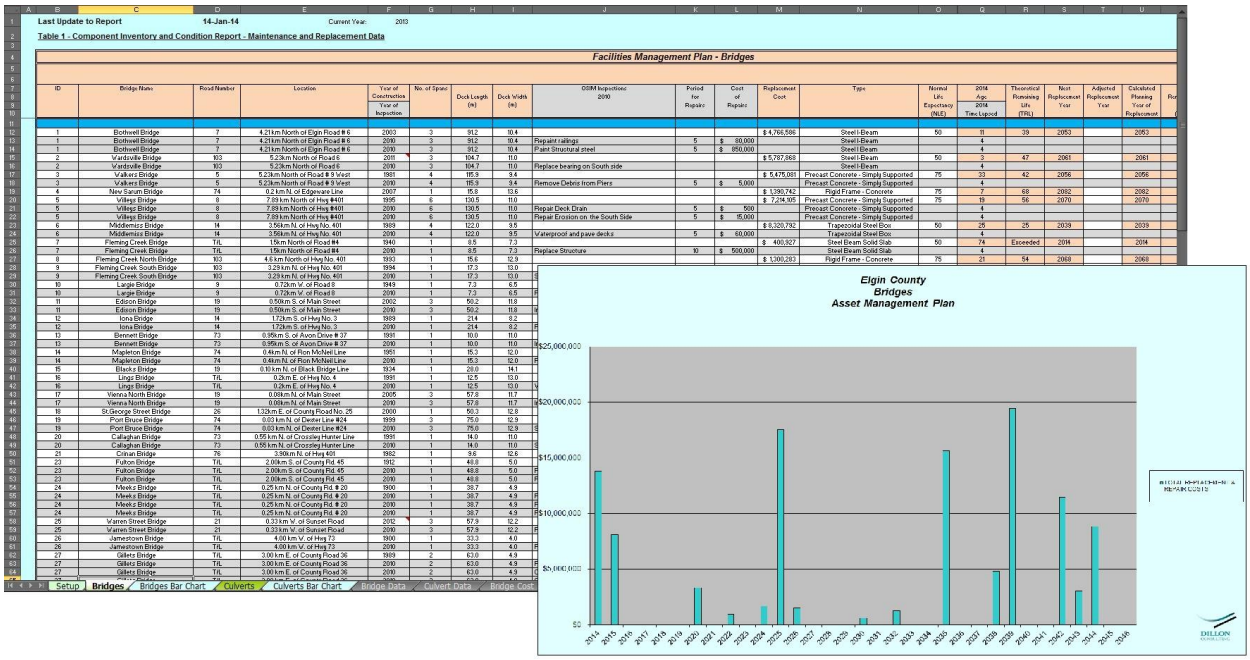

Figure 4: Condition Assessment Tool

This tool was used to develop the multi-year AMP for the point assets included in this project. The results were delivered in digital form in MS Excel format. County staff will continue to use the applications described above to assist them in managing their infrastructure assets.

3. DESIRED LEVELS OF SERVICE

As described in the best practice document in the *National Guide to Sustainable Municipal Infrastructure* (2003), also known as *InfraGuide*, levels of service fall into two broad categories: those that are mandated by regulations (codes, standards, etc.); and those that result from community plans or objectives.

In general, mandated levels of service are very specific in their description of the measures to be used. Community objectives tend to be less defined measurement in terms of schemes. They are future oriented, and focus less on technical measures and more on social, cultural and environmental concerns.

3.1. Mandated Levels of Service

Regulations exist to ensure the safety of the users of public infrastructure. These regulations are enforced through codes, standards, or guidelines adopted government authorities.

The most common regulations that apply to transportation infrastructure include:

- Minimum Maintenance Standards For Municipal Highways;
- Ontario Provincial Standards For Roads And Public Works (OPS); and
- Ontario Structure Inspection Manual (OSIM).

This list is not comprehensive and the owners and managers of infrastructure need to be fully familiar with the regulations that apply to their assets.

3.2. Community Objectives

Every community has developed objectives on the expected quality of life in their community and a vision for the future. These are established either through a structured process (such as a comprehensive community plan) or by other means. The objectives and vision usually include elements of health and safety, social wellbeing, economic and cultural development, and other factors. Community objectives rely heavily on the ability of the existing infrastructure to support such plans. In many instances, the objectives call for new infrastructure that the community will have to operate and maintain for generations.

The *InfraGuide* describes the steps required to successfully establish a community's levels of service. The key elements that relate to the development of levels of service as described in the *InfraGuide* best practice are illustrated in
Figure 5.

Figure 5: Levels of Service (*InfraGuide* 2002)

Asset understanding refers to the knowledge about the inventory, condition and performance of infrastructure that provide the community its services: potable water, wastewater collection and treatment, solid waste management, roads and bridges, community buildings, etc. This information is provided by the AMP and is used to ensure existing and planned infrastructure can support the levels of service established.

Consultation and communication are important elements of developing community levels of service. Key stakeholders must be involved; including community leaders, operators of the assets, education and health professionals, and other levels of government officials. The consultations should be properly managed to avoid creating a "wish list", as consultations have a tendency to raise expectations amongst those involved. Instead, the consultation process should provide adequate background material, and the context and constraints (e.g., financial, environmental, material and human resources, etc.) which face the municipality. This will help generate realistic levels of services that the community can achieve and afford.

Levels of service have to be aligned to the *strategic direction* of the community. Appropriate levels of service must consider the community's ability and willingness to *tolerate risk*. The costs associated with the levels of service need to be established and evaluated in view of the capacity of the community to support them.

Ideally, each community should use this process to define their acceptable level of service. Once determined, all assets would need to be reviewed and compared to the community's expectations. Action plans on remedial measures would have to be developed to close the gap between expectations and reality, if physically and financially possible.

3.3. Determining Appropriate Levels of Service for Elgin County

For this project, due to time constraint and budget limitations, a full community consultation process for establishing levels of service was not conducted. The process followed was mostly based on the *Asset Understanding* component of the process, which considered the physical and functional characteristics of an asset to define a measurable index that can be monitored over time.

Condition indices were determined as described in **Section 2.3: Condition Assessment.** The County's current levels of service, measured in terms of condition index, were determined in consultation with the County's Project Team. By combining that information with staff knowledge, it was possible to determine if the current levels of service provided to the residents were appropriate. Once acceptable levels of service were established, the information was used to identify current and future infrastructure investment requirements. The asset management tools described previously were provided to staff to monitor the levels of service over time, and to assess the effect of different budget scenarios on the current and future levels of service. The results of our analysis are presented in **Section 5: Asset Management Strategy**.

4. STATE OF LOCAL INFRASTRUCTURE

The County has a detailed infrastructure database, which was used to provide detail for the state of the local infrastructure.

4.1 Road Network

4.1.1 Existing Infrastructure

The County provided a detailed inventory of the existing infrastructure within the road network. The road network includes 58 roads, which are further divided into a total of over 250 road sections, totaling 698 kilometers. The information provided by the County included specific data pertaining to each section, which is useful in the development of an asset management plan. Although any information received is pertinent in characterizing the usage and type of road section, it is especially necessary to have the surface dimensions for asset management purposes.

The characteristics of road sections within the network vary, including variations in the age of surface and surface type of each. The age of the surface for each section was determined using the date of last rehabilitation or resurfacing. The following ***Figure 6*** illustrates the distribution of the age of surfaces of the road sections within the network.

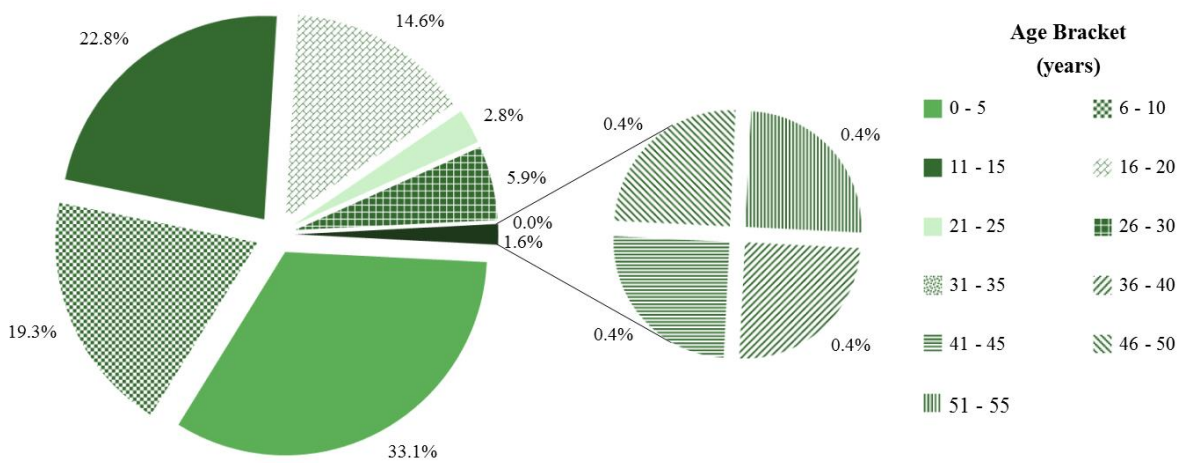

Figure 6: Age Distribution of Road Sections

The road sections which make up the road network are varied in surface type. Some roads remain in their original constructed state, while others have been resurfaced, or entirely reconstructed. Based on the level of distress of the road surface, the County employs one of multiple available methods to rehabilitate the road segment, resulting in a network consisting of various surface types. ***Figure 7*** shows the distribution of surface types within the County network.

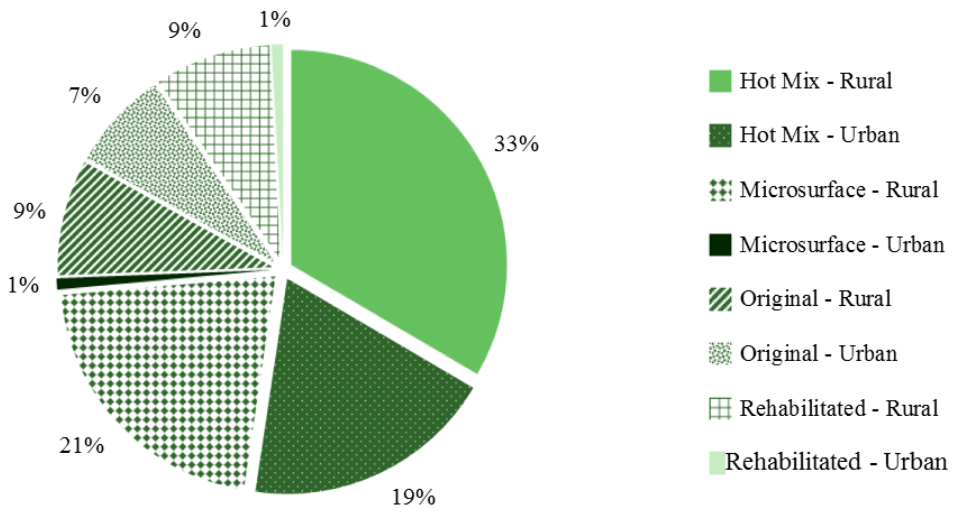

Figure 7: Distribution of Road Surface Types

4.1.2 Infrastructure Condition

The condition of the road network is important in determining the needs of the overall network. The County maintains a system to determine the condition of the road sections in their network, by means of a Structural Adequacy Rating (SAR) attributed to each road section within the network. The SAR is determined through a physical inspection of each road section, and is defined on a scale from 1 to 20, with 1 representing the highest level of distress, and 20 the lowest. The SAR is indicative of the necessity for rehabilitation of the road section and the anticipated remaining lifespan.

The overall network condition was determined through the consideration of the SAR rating attributed to each section in combination with the length of that section as a portion of the entire network. ***Figure 8*** below illustrates the percentage of the network at each SAR, based on the combined section lengths for each rating.

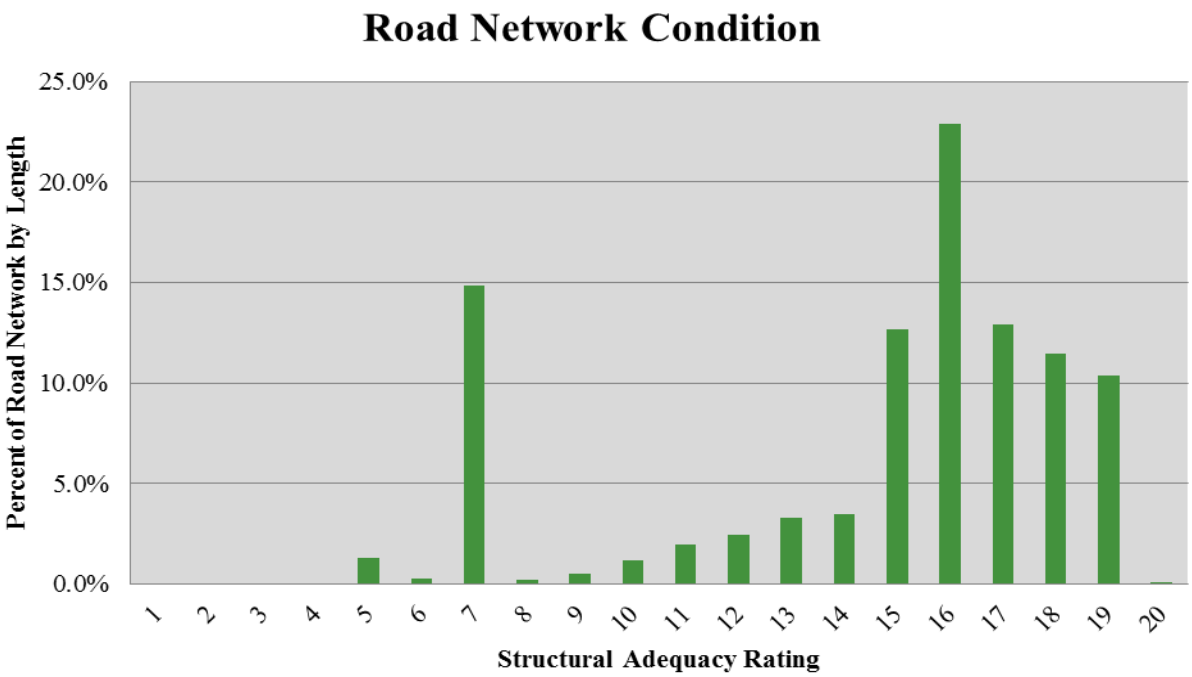

Figure 8: Percentage of Road Network Condition Distribution of Road Section Conditions

The road network is in good condition, having 83% of the network length been rated at a 10 or higher. The generally good condition of the majority of the road sections results in an average current condition of the road network of approximately 14.6 out of 20. These high values indicate that the road network currently provides an adequate level of service to the residents.

4.1.3 Estimated Asset Value

It is often suggested in literature that 2% to 4% of the value of an asset should be spent yearly to ensure sustainability of the assets. Without asset management tools, it is almost impossible to determine the long term effect of inadequate budget allocations. Yet, it is important for a municipality to determine if the current level of funding is appropriate to continue to provide an adequate level of service to its residents. It is also essential to allocate adequate funding to ensure sustainability of the assets in the future. For the County, the value of the road assets was estimated at over $350 million. Based on this result and the recommended 2% to 4% yearly investment in maintenance, theoretically the County should allocate around $7M to $14M per year to ensure future sustainability of its roads.

4.1.4 Current Needs Summary

The current needs for the County road network are mostly based on the condition of the road. In addition, there may be instances where a road section is considered for rehabilitation prior to incurring a needs-based requirement, where it is deemed practical and cost-effective, in association with needs-based sections or additional requirements. In 2014, it is expected that $7,137,000 will be required for 18 road rehabilitation projects. This road network improvement total is further organized into six categories of needs, including microsurfacing, single lift resurfacing (Asphalt R1), recycling then resurfacing (Recycling + R1), full reconstruction (Construction), and others. The distribution of needs for each of these categories is shown in ***Figure 9***.

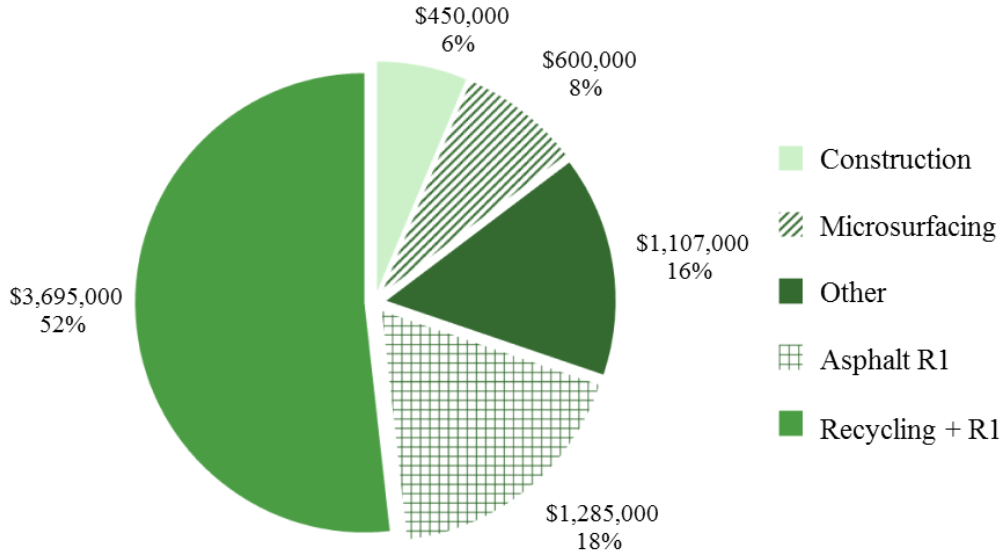

Figure 9: Road Network Project Type Distribution for 2014

The majority of the needs currently incurred by the road network can be remedied through resurfacing. The work required for 2014 consists primarily of recycling then resurfacing the existing pavement surface.

In addition to the current needs identified above, the County has identified a project to be undertaken in 2014 that was selected for reasoning other than physical condition. The project will include relocation of Dexter Line, and will be conducted in conjunction with relocation of a municipal waterline. This project was identified based on safety concerns for both the roadway and water supply. The project will include reconstruction of approximately 3.5 kilometers of road, with an anticipated project expenditure of $4.5M.

4.2 Bridges and Culverts

4.2.1 Existing Infrastructure and Condition

Bridge and culvert infrastructure in the County considered within the AMP are those three meters in size or larger. This included analysis of 60 bridge structures, and 82 culvert structures.

The County's bridge infrastructure varies in construction type, but includes mostly concrete and steel I-beam structures. The average life expectancy for a concrete bridge structure is 75 years, and 50 years for a steel structure. A condition index was determined for each structure using the year of construction or last replacement of the structure and the life expectancy. The average condition index for the bridges was 0.43 on a scale of 0 to 1, with 1 being perfect condition. This value means that on average, the County bridges have only 43% of their lifespan remaining.

The County's culvert infrastructure includes structures typically constructed of steel and/or concrete. The network includes primarily precast box culverts and corrugated plate steel culverts. The average life expectancy for concrete culverts is 75 years, and 50 years for steel. A condition index was determined for each structure using the year of construction or last replacement of the structure and the life expectancy. The average value across the culvert structures was 0.29 on a scale of 0 to 1. This value indicates that on average, the County culverts are older than 2/3 of their service life.

4.2.2 Estimated Asset Value

It is often suggested in literature that 2% to 4% of the value of an asset should be spent yearly to ensure sustainability of the assets. Without asset management tools, it is almost impossible to determine the long term effect of inadequate budget allocations. Yet, it is important for a municipality to determine if the current level of funding is appropriate to continue to provide an adequate level of service to its residents. It is also essential to allocate adequate funding to ensure sustainability of the assets in the future. For the County, the value of the bridge and culvert assets was estimated at just under $130 million for bridges, and just over $40 million for culverts, totaling just under $170 million. Based on this result and the recommended 2% yearly investment in maintenance, theoretically the County should allocate around $3.4 M per year to ensure future sustainability of its bridges and culverts.

4.2.3 Current Needs Summary

The current needs for the bridges were determined using the MS Excel-based asset management tool described in ***Section 2.4***, which took into consideration the rehabilitation and needs recommendations identified within the OSIM report for each structure, in addition to the year of construction or last replacement of each structure and the life expectancy. A full replacement of the structure is typically recommended at the end of the structure's anticipated service life. Additional costs to be incurred prior to full replacement are rehabilitation items identified within the OSIM reports, each of which has a timeline for completion and associated costs.

The results of the current needs analysis determined that bridge and culvert needs for 2014 total $17,634,400, broken down in ***Figure 10***.

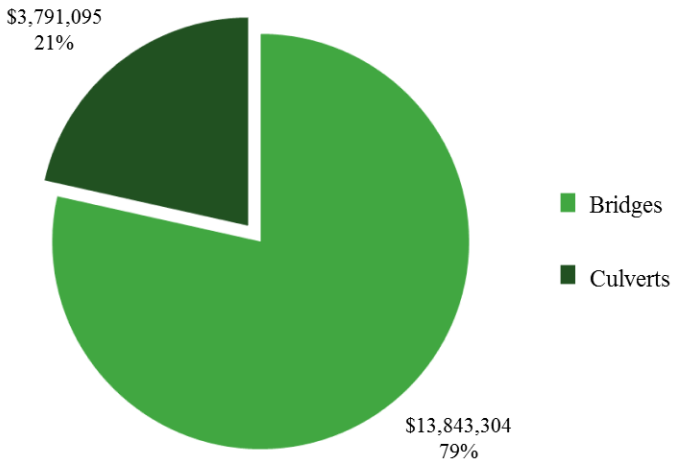

Figure 10: Percentage of Expenditures for 2014 Anticipated for Bridges and Culverts

The large expenditure is mostly for assets that have theoretically reached the end of their service life. The bi-yearly OSIM inspection will likely result in spreading that amount over a number of years based on actual field inspection.

It is evident that the majority of expenditures anticipated for 2014 will be required to rehabilitate or replace the bridge structures, whereas approximately only ¼ of the cost for bridges will be required for culvert replacement and rehabilitation.

The results of the analysis for work required on bridges in 2014 identified 5rehabilitations as per OSIM surveys, and 8 full bridge replacements, totaling $13,843,304. The rehabilitation work identified within the OSIM surveys for 2014 are minor repairs, and do not carry high costs. These repairs account for only 0.04% of the yearly expenditure for bridges.

The total work for culverts involves only two rehabilitations as per OSIM surveys. In addition to structure replacements, the 2014 needs total $3,791,095. Similar to bridges, the rehabilitation work identified within the OSIM surveys for 2014 are minor repairs, and do not carry high expenditures. These repairs account for only 0.07% of the yearly expenditure for culverts.

In addition to the analysis results presented above, the County has identified some bridge and culvert projects to be undertaken in 2014. **Table 1** lists those projects:

Table 1 – Current Needs Projects Identified by the County

Network	Project	Location	Expenditure
Bridges	Middlemiss Bridge Rehab (1/2 Middlesex County)	Dutton/Dunwich	$200,000
Culverts	Bradley Creek Culvert Replacement - Engineering plus John St. curb repairs	Aylmer	$75,000
Culverts	Culvert Slip Linings	Various	$175,000

It is often the case that projects are included in the capital program due to functional deficiencies, or other considerations which cannot be effectively modeled, including organization and logistical requirements. It is recommended that both the results from analysis and County identified needs be considered in conjunction for the current needs. The total anticipated expenditure for both bridges and culverts is detailed in **Table 2**.

Table 2 – Summary of Current Needs for Bridges and Culverts

Network	Analysis Results	County Projects	Total
Bridges	$13,843,304	$200,000	$14,043,304
Culverts	$3,791,095	$250,000	$4,041,095

5. ASSET MANAGEMENT STRATEGY

5.1. Road Network

5.1.1. County of Elgin Asset Management Plan

The County currently maintains a comprehensive MS Excel-based asset database. The database was used, in conjunction with details regarding the processes and requirements, for road network rehabilitation and replacement to develop a system through which road improvements are managed. The processes through which a road segment is selected for rehabilitation take into consideration factors in addition to the condition, including:

- Capacity / growth
- Drainage requirements
- Roadside environment
- Construction history
- Planned work by others

The most reproducible technique for determining which road segment requires rehabilitation is through analysis of the structural adequacy rating (SAR), which corresponds to a level of distress of the road surface, as described in **Section 4.1.2**. The County has defined a prioritized list of actions to be undertaken at varying degrees of distress, as detailed in **Table 3.**

Table 3 – Structural Adequacy Rating

Value	Distress	Actions
20	Distress <5%	None
19 - 15	Distress 5 - 15 %	Crack Sealing, Patching, Microsurfacing, R1, MR1
14 - 12	Distress 16 - 25%	R1, MR1, PR1, CIREAM/R1
11 - 8	Distress 26 - 35%	PR1, CIREAM/R1, MR2, PR2, Reconstruction
7 - 1	Distress > 35%	Reconstruction, Surface Treated Roads

Each SAR bracket is associated with a list of suggested actions. Additional factors, as listed above, are considered when determining the most appropriate action to be undertaken to a road segment, at the discretion of the County. Further details provided by the County regarding SAR ratings can be found in **Appendix A**.

Because of the high level of intricacy in determining the timing and action type for maintenance of each road segment within the system, it is recommended that the short-term asset management planning, within a timeframe of 10 years from the present, continue in this manner. Retaining the County system to characterize the work to be done allows the system to be inter-connected with additional information and reference to rehabilitation guidelines easily feasible.

The County developed cost information associated with each rehabilitation method used. The cost information provides breakdowns of individual components for each rehabilitation method, and costs per kilometer of road being rehabilitated, details for which can be found in **Appendix A**. These values were used to determine the expenditures for road work in the plan.

The short-term asset management plan was developed using the information and strategies currently in place at the County. The plan provides detailed information regarding the projects planned for the upcoming ten years. The first 5 years of the plan include a breakdown of specific projects attributed to each year. The sixth to tenth years within the plan do not distinguish between individual project years, instead allotting a lump anticipated expenditure of $45,046,000 for selected projects. The following ***Figure 11*** shows the anticipated expenditure for road rehabilitation for the 10 year scenario, including an assumed even division of the lump expenditure over years 2019-2023, as dark green bars. The light green bars are representative of the budgeted by the County expenditures for bridge and culvert works. The total allocated budget is based on a summation of the two values.

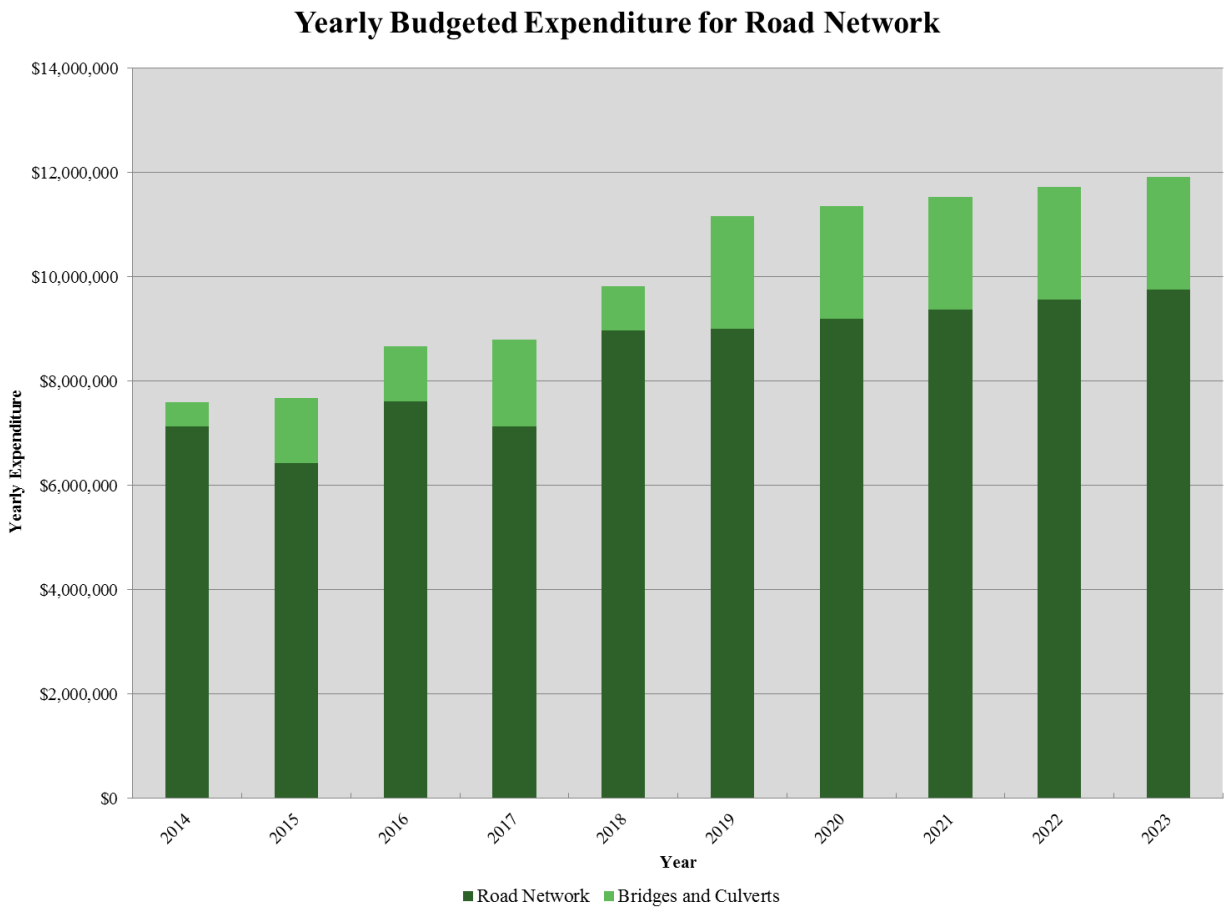

Figure 11: Yearly Estimated Expenditure for Road Network Rehabilitation – 10-Year Plan

The budget allocated for bridges and culverts is shown for visualization of entire budget breakdown. Further detail regarding the usage of the structure portion of this budget is given in **Section 5.2**.

The road network budget allocations for each year within the plan range from approximately $7 million to $9 million, and were determined to address specific needs identified by the County in an effort to maintain the good quality of the road network. Documents supporting the short-term asset management strategy for the road network as used by the County can be found in **Appendix A**. A list of the rehabilitation projects included within the asset management plan is detailed within **Appendix B**.

In addition to the identified expenditures, the County will undertake a project for the relocation of Dexter Line, as identified in **Section 4.1.4**. This work is anticipated to have an expenditure of $4.5 million, however funding is being sought to address the high expenditure.

5.1.2. Network Condition Analysis

Using the DPSS asset management tool described in **Section 2.4**, it is possible to analyze the infrastructure needs into the future, and the impact of allocated funding on the overall network condition. The DPSS tool delivered to the County will assist asset managers in determining what funding levels are required to increase, decrease or maintain the current condition of the network.

As noted in **Section 5.1**, the considerations used in the development of the asset management plan as used by the County are intricate and subjective in nature, and dependent on a range of variables. The typical lifecycle of a road segment within the County is illustrated by the grey solid line in ***Figure 12.***

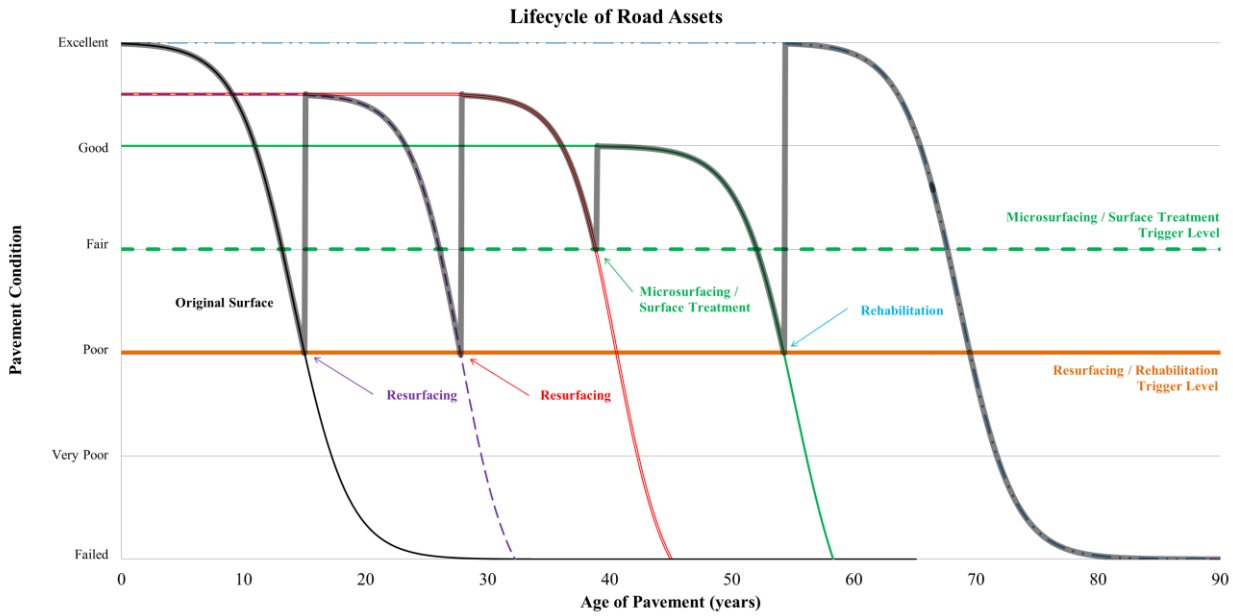

Figure 12: Graphical Representation of Lifecycle of an Asset

The figure demonstrates a typical rehabilitation schedule for a road segment, using different rehabilitation options, and their rate of deterioration. As demonstrated in the figure, road network maintenance can be undertaken using a number of rehabilitation options, which are incurred at different road condition levels. The lifecycle presented is considered typical, and the type of rehabilitation, condition level trigger and sequencing of works are all subject to change at the discretion of the County. These factors render the plan irreproducible using automated asset management tools.

In consideration of the limitations, a plan was developed to ascertain a high level understanding of the anticipated expenditures and associated overall road network performance. Assumptions were made to simplify the planning process to create a reasonable representation. Deterioration curves were developed based on service life values for road surfaces, and a resurfacing trigger value, as determined through County information. The expenditure was determined based on a typical cost of resurfacing. This simplified program applies to one cycle of rehabilitation per road segment, and is not representative of the entire lifecycle as presented above.

A scenario was analyzed using the annual budget values consistent with approved County road network capital budgets from 2014-2023. The results of the analysis are presented in ***Figure 13***.

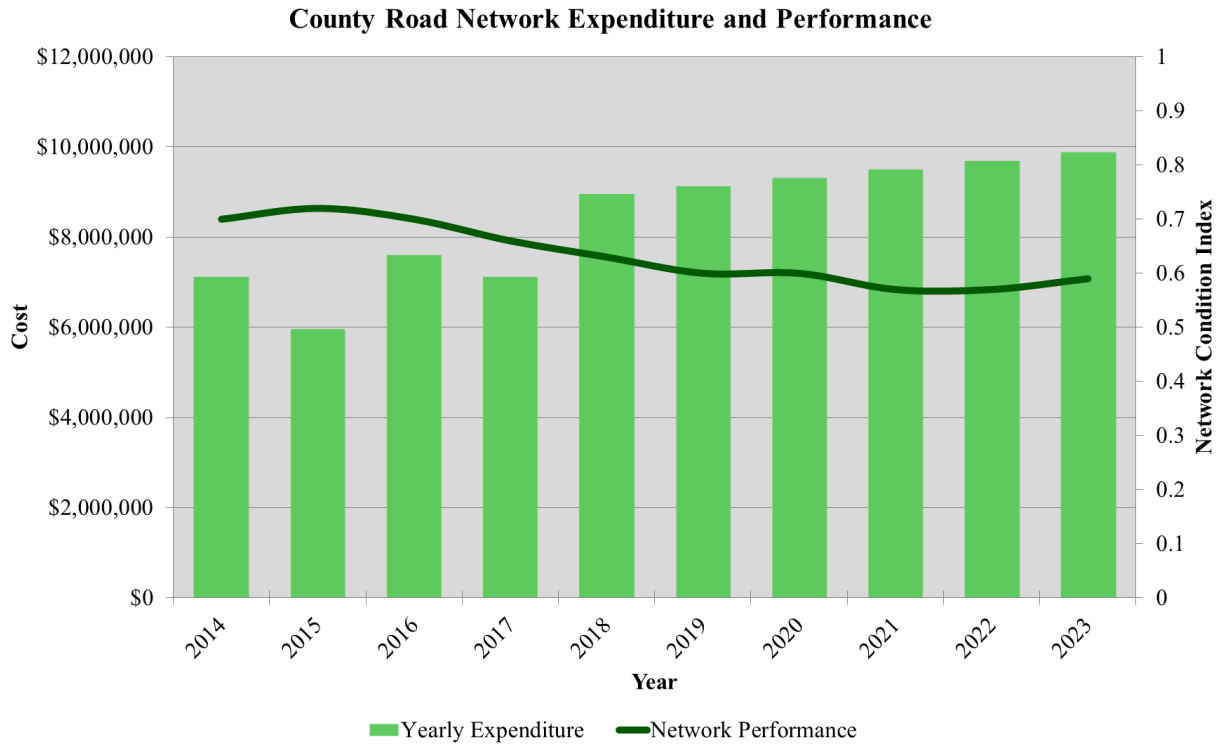

Figure 13: County-Allocated Budget Values and Associated Road Network Performance

The initial road network condition was determined through condition surveys completed by the County, and represents a good network condition. The County currently provides a high level of service to its users of the road network. As a road network in good condition has become the standard for the County, it is recommended that efforts be made to continue to maintain this level of service for its residents. During each year analyzed, the entirety of the allocated budget was spent. Through the usage of the allocated budget, the network condition is noted to decrease, as illustrated by the solid line in the figure. The minimum value reached through this scenario remains above 0.5, which is above accepted industry standards. Towards the end of the ten year scenario, the condition index begins to rise, reaching nearly a 0.7 condition index, similar to the initial condition of the network. Because of the relatively consistent nature and high value of the network index throughout this timeframe, the County-defined budget is considered sufficient.

It is noted that going forward, an inflation value of 2% annually of the allocated budget spent on the County network would result in an overall increase in the network condition, which would ultimately reach the initial value of 0.7 in the road network.

5.2. Bridges and Culverts

The short-term asset management plan developed for the bridges and culverts was done using the MS Excel-based AMP tool developed by Dillon. The tool was used to consider the remaining life, replacement cost, and recommended rehabilitation actions for each structure; and develop a schedule and anticipated yearly expenditure for a ten- year timeframe. The plan was developed in consideration of the rehabilitation requirements defined in the most recent OSIM reports completed for the structures. These recommendations were included in the plan using the anticipated timeline and cost for each.

Network condition indices were not developed for the bridges and culverts. In the case of these structures, a network condition rating is not an accurate way to qualify the condition. An index determined through comparison of lifespan to age of the structure is not necessarily reflective of the actual conditions of the structure. The structure network undergoes periodic inspection, through OSIM, which identifies required rehabilitation and condition of structures. Because there are multiple components to each bridge structure, an overall condition index is difficult to determine.

Figure 14 shows the capital expenditure anticipated for bridges and culverts based upon the age and life expectancy of the structure. Some lower volume, “town line” structures have exceeded their service lives and although replacement of these bridges is identified, the plan proposes to continue to rehabilitate as recommended in the OSIM report to extend their service lives rather than complete replacement at a significantly higher cost.

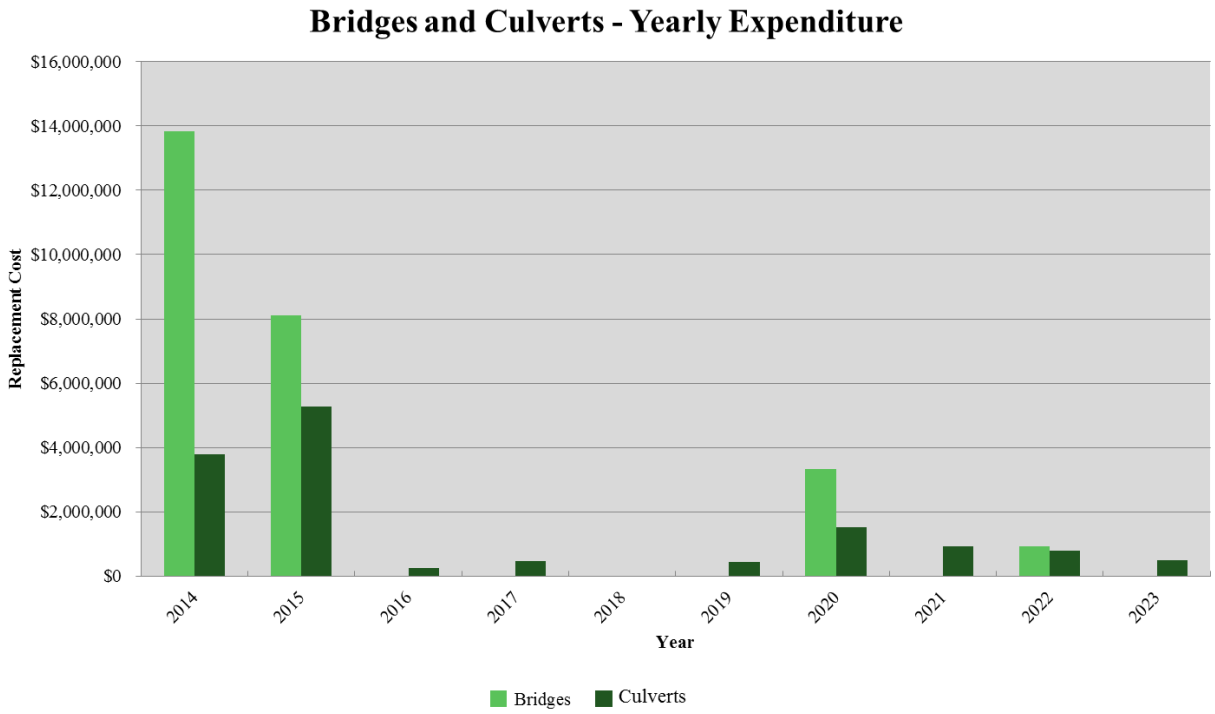

Figure 14: Yearly Anticipated Expenditure for Bridges and Culverts over 10 Years

The initial two years of the asset management plan indicate comparatively large expenditures from the remainder of the plan. These expenditures are as such due to the backlog of repairs which exists, as well as the expiration of the 5 year period for repairs identified to be completed within the 1-5 year period in the OSIM surveys. A detailed list of the rehabilitation and replacement projects triggered within the long-term asset management plan are detailed within Appendix B. It should be noted that the OSIM condition surveys have been legislated by the province and must be carried every 2 years. This is a good process to frequently update the plan and accelerate or delay rehabilitation based on the recommendations of the surveys.

In addition to the projects identified through analysis of the structures, the County has previously identified multiple bridge and culvert rehabilitation projects to be undertaken within a 10 year timeframe. These projects are identified in ***Table 4***.

Table 4 – 10 Year AMP Proposed County Bridge and Culvert Projects

Year	Network	Project	Location	Expenditure
2014	Bridges	Middlemiss Bridge Rehab (1/2 Middlesex County)	Dutton/Dunwich	$200,000
2014	Culverts	Bradley Creek Culvert Replacement - Engineering plus John St. curb repairs	Aylmer	$75,000
2014	Culverts	Culvert Slip Linings	Various	$175,000
2015	Culverts	Duff Line Slope Stabilization (Middlemiss Culvert)	Dutton/Dunwich	$300,000
2015	Culverts	Culvert Slip Linings	Various	$200,000
2015	Bridges	Brooks Bridge Replacement - Engineering	Malahide	$50,000
2015	Culverts	Bradley Creek Culvert Replacement - John Street - Aylmer	Aylmer	$700,000
2016	Bridges	Brooks Bridge Replacement	Malahide	$500,000
2016	Bridges	Bothwell Bridge $1 Million Total Project Cost (Elgin/Middlesex/Chatham)	West Elgin	$350,000
2016	Culverts	Culvert Rehabilitations	Various	$200,000
2017	Bridges	Minor Rehabilitation	Various	$275,000
2017	Bridges	King George Lift Bridge Structural Rehabilitation	Central Elgin	$850,000
2017	Culverts	Newell Culvert Extension	Malahide	$85,000
2017	Culverts	Culvert Rehabilitations	Various	$200,000
2017	Bridges	Iona Bridge Replacement and Road Realignment - EA	Dunwich	$250,000
2018	Bridges	Kimble Bridge Replacement		$855,000
2019-2023	Bridges	Mapleton Bridge Replacement	Central Elgin	$2,000,000
2019-2023	Bridges	Vienna Bridge Minor Rehabilitation	Bayham	$350,000
2019-2023	Bridges	Lewis Bridge Replacement	Southwold	$200,000
2019-2023	Bridges	Sparta Line Bridge Minor Rehabilitation	Central Elgin	$400,000
2019-2023	Bridges	King Bridge Replacement	Malahide	$1,100,000
2019-2023	Bridges	Eden Bridge Structural Painting	Bayham	$1,000,000
2019-2023	Bridges	Philmore Bridge Structural Painting and New Deck	Bayham	$1,000,000
2019-2023	Bridges	Port Burwell Deck Rehab.	Bayham	$750,000
2019-2023	Bridges	Iona Bridge Replacement and Road Realignment	Dunwich	$4,000,000

The above noted projects were identified by the County prior to completion of the AMP, and the selection criteria for these projects may differ from those considered within the AMP program, accounting for the difference in prioritization. It is recommended in the event that a project was selected due to factors additional to those considered in the analysis to retain the prioritization defined by the County.

A long term asset management strategy was not developed for bridges and culverts, as the frequency of structure assessments will provide a more representative profile than comparison of the theoretical lifespan and age of each structure.

5.3. Asset Management Policies

5.3.1. Approach to Data Assembly

The County currently manages a large amount of data and information stored in Excel databases. It is recommended to continue that practice but to incorporate additional information related to all other assets and create what is referred to as an enterprise database. This is critical for ongoing infrastructure management activities within the County's organization. The database used in preparation of the AMP encompasses asset information that can support multiple business functions. ***Figure 15*** and ***Figure 16*** illustrate the concept of going from an ad-hoc data environment to a structured enterprise database.

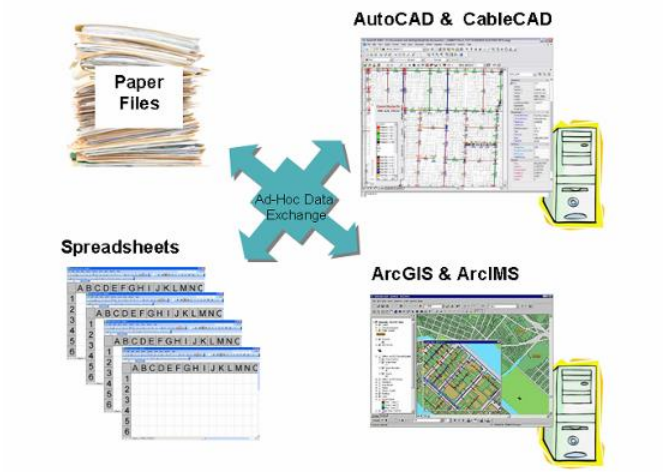

Figure 15: Ad Hoc Environment

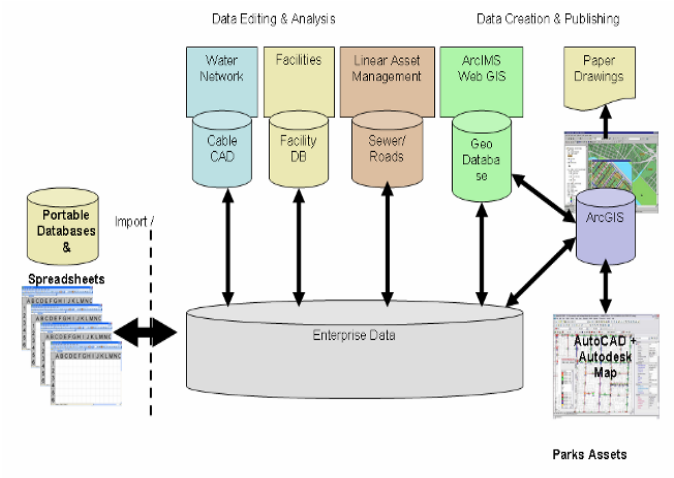

Figure 16: Recommended "Enterprise" Environment

The recommendation to use the Corporate GIS as the enterprise database is common practice in many municipalities across Canada. Data is maintained in one environment, and accessible by many users. Relevant information can be exported in external applications for processing of data. The results can then be imported back in the GIS database and accessed/displayed graphically which add value to the information stored in databases. An enterprise database system reduces data redundancy and increases access to information across the organization. The County does not currently use GIS technology but staff was in agreement to support the implementation of a GIS in the near future.

5.3.2. Condition Assessment Strategy

In continuing to maintain a detailed AMP over time, it is highly recommended that the municipality acquire detailed condition assessment data on all components of their infrastructure assets. It is critical to ensure the data is current and accurate, in order to maintain a useful AMP.

Roads should undergo a full condition assessment every 3-5 years. Given the shorter lifespan of road structures, and high variability in road construction and environment, pavement condition indices are more difficult to estimate over time. Therefore, their condition should be evaluated on a more frequent basis.

The approach for condition assessment of point assets, including bridges and culverts, is to follow the mandated approach of inspection of the assets every 2 years.

5.3.3. Maintenance Activities

It should be understood that most infrastructure assets will usually reach their expected service lives if routine maintenance is carried out on those assets while in service. As specified in the literature, 2% to 4% of the value of an asset should be spent on a yearly basis to ensure it reaches the end of its service life. Most municipalities will spent less than 2% a year of the value of the asset in maintenance. Maintenance activities such as crack sealing or slurry sealing a roadway or flushing and cleaning a sewer pipe should be carried out on a regular basis depending on the condition and age of the assets. There are many very good Computerized Maintenance Management Systems (CMMS) in the market that are very helpful and efficient in ensuring sustainability of infrastructure assets. Some types of CMMS could be very beneficial to the County.

5.4. AMP Update and Evaluation

The present AMP has been designed for a time span of 10 years. However, as previously mentioned it should be treated as a living document, which is regularly updated to reflect changes in infrastructure condition. It is, therefore, recommended that the AMP be updated every year. This will include incorporating rehabilitations and their associated condition changes, adding newly constructed infrastructure, removing decommissioned infrastructure from the analysis, and updating unit prices for rehabilitation or reconstruction.

The AMP should also be continuously evaluated and improved through clearly defined actions. It is recommended that the County generate a short-term action plan every 2 to 3 years including a timetable for implementation. These actions should include measures to insure data quality, and improve the AMP process.

5.5. Criticality of Infrastructure and Risk

The criticality of infrastructure and consequences of failure of that infrastructure were not really addressed in this project. However some general guidelines could be provided to assess criticality and identify high level consequences of failure. The results of this high level assessment should be used to assigned priorities to infrastructure repair and minimize disruption to the general public. Some criteria that should be looked at when assigning priorities could be:

1. Road classification: Arterial and collector roadways carry more traffic than local roads and defects on these roadways should be addressed first.
2. Bridge access to a community: In some cases, a municipality may only have one or two accesses that are serviced by a bridge structure. These should be fixed first when defect are identified.

These are examples of common sense factors that should be used to define criticality and assign a risk factor. If a community decides to conduct a detailed study to identify Critical Assets and Risk associated with them, they should think of using the following framework that was developed by individuals from Australia and New Zealand:

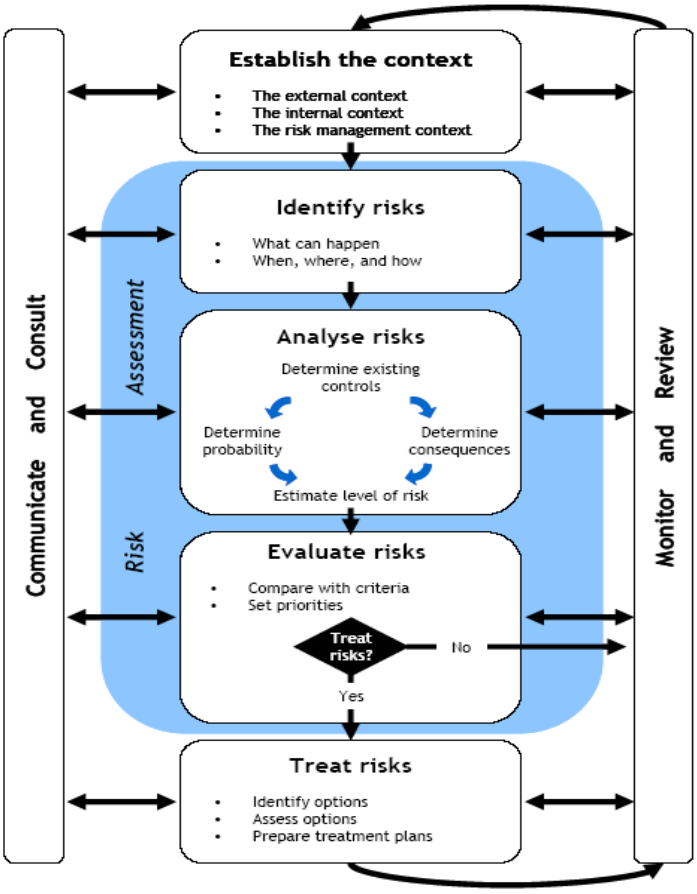

Figure 17: Framework for Identification of Critical Assets

Source: Australian and New Zealand AS/NZS 4360 (1999) '*Risk Management'* and Emergency Management Ontario (2004) '*Emergency Management Doctrine for Ontario*.'

By following this approach, the municipality would have a much better understanding of its infrastructure assets and be in much better position to prioritize repair or replacement of critical assets.

6. FINANCING STRATEGY

Financing infrastructure needs has become a very serious issue. We need to identify better practices and innovations in infrastructure financing if municipalities and other levels of government want to continue to provide an adequate level of service to tax payers in an affordable manner. It is often thought that municipal infrastructure should be financed, as far as possible, by the residents who benefit from it but, how do you determine who should pay for the rehabilitation of an arterial or collector road going from point A to point B in large cities throughout Canada. In addition, for many years, municipal accounting practices have failed to include replacement costs for depreciating assets, thereby assuring a fiscal shock when replacement time arrives. The Public Sector Accounting Board (PSAB) has changed that practice which has required municipalities to realize the extent and magnitude of the infrastructure deficit. Asset managers need to come up with innovative solutions to address that infrastructure deficit. Asset management systems are part of the solution but innovative financing and finding alternate revenue sources are an even bigger part of the solution.

Most municipalities are familiar with a variety of internal and some external revenue sources. The following describes a few of those revenue sources currently being used by municipalities:

- **Internal Revenue Sources:**
  - ***General Operating Revenues***: Rural municipalities, towns and smaller cities tend to rely more on local taxes, user fees and grants than on borrowing, partly because borrowers view them as higher risk than larger cities, thus raising their borrowing costs.
  - ***Reserves:*** Financing capital projects through funds set aside for capital spending is the reverse of financing through borrowing. A "capital levy" — usually a few percentage points of the local property tax — is set aside and accumulates in interest earning accounts segregated from general revenues.
  - ***Special Assessments and Local Improvement Charges***: A special assessment is a specific charge added to the existing property tax to pay for improved capital facilities that border them. The charge is based on a specific capital expenditure in a particular year, but may be spread over a number of years.
  - ***Development Charges*****:** Most large municipalities and many smaller ones impose a specific dollar value per lot on developers to finance the off-site capital costs of new development. Developers are generally responsible for on-site services, such as local roads, sidewalks, and street lighting. Historically, development charges have financed "hard" services, such as water supply, sewage treatment, trunk mains and roads.

- **External Revenue Sources**
  - ***Grants:*** Municipalities sometimes rely on provincial and federal government grants for infrastructure. Program such as the MIII is a good example. In the past capital assistance has also been made available for water, sewer, and transportation projects with all three levels of government participating.
  - ***Borrowing:*** Municipalities engage in both short-term and long-term borrowing. Short-term borrowing may be used to finance capital expenditures or to finance an unexpected deficit in the operating budget. For infrastructure whose benefits accrue to future residents, fairness, efficiency and accountability is enhanced if these projects are financed by borrowing with repayment coming from property tax revenues and user fees paid by future beneficiaries.
- **New Financing Instruments**
  - ***A Dedicated Municipal Fuel Tax***: Many American cities levy fuel taxes, but municipalities in Canada do not. In a few Canadian cities and city-regions (Victoria, Vancouver, Edmonton, Calgary, and Montreal), provincial fuel tax revenues are shared between the province and the city or city-region. The federal government's recent initiative to provide grants to municipalities from federal gas tax revenue is a form of revenue sharing and not a municipal fuel tax because the municipalities do not set fuel tax rates and have no say over the tax base.
  - ***Public-Private Partnerships (P3):*** A P3 involves the direct participation of the private sector in a venture controlled by the public sector. The public sector's role is to facilitate, regulate, and guarantee provision of an asset and the private sector's role is to design, finance, build and operate the asset in a formalized partnership agreement.

6.1. County of Elgin Financing Strategy

In **Section 5.0** of this report we have worked with County staff to develop an Asset Management (AM) Strategy, including funding requirements that would ensure sustainability of the assets to continue to provide an adequate level of service to the residents of the County. The strategy developed is realistic, but a funding gap has been identified on the bridge and culvert network if the County wants to repair or replace assets based mainly on service lives. The bi-yearly OSIM inspection of all bridges and culverts will likely result in reducing that funding gap.The County has identified revenue sources that will support the Asset Management Plan (AMP) developed through this report. The funding sources include:

- General Tax Revenue
- Federal Gas Tax
- Assessment Growth
- New Tax Base
- Debt Financing

The County, where applicable, will seek Federal and Provincial funding through competitive grant programs, resulting in a potential funding source.

Prior to initiation of this report, the County developed an infrastructure plan identifying road network, bridge and culvert needs within a 10 year timeframe. Each of the works identified was attributed an anticipated expenditure. The plans for both the road network and structures were presented in **Section 5.0**. The anticipated capital budget required to address works over both the road and structure networks is just over $7.5 million in 2014, and increases to an average of over $11 million for 2019-2023. The budget values were derived by the County to achieve a predetermined expenditure level which would adequately maintain the system. The budget allowances increase each year by 2% and $400,000 in accordance with a plan developed to reach an ideal expenditure level by 2020. The inflation of annual budget is reflected in the projected budgets defined by the County.

The County receives funding for its capital budget primarily through tax base and gas tax, which account for $1.5 million annually. It is noted that the county does not utilize reserve funds to address expenditures. In the event that a project must be undertaken where funding is insufficient, the County will borrow from future years of the capital plan. The County will seek supplemental federal and provincial government funding where applicable and available.

The results of the analysis conducted on the road network identified that to maintain the good condition of the road network, the County allocated budget is sufficient. With this knowledge, it is recommended that future iterations of County budget include the diversion of road network budget towards rehabilitation of bridges and culverts. Where the road network is maintained at a sufficient condition index, funding should be allocated to bridges and culverts, as they will take precedence due to the increased risk associated with poor condition.

The results of the analysis on bridges and culverts identified over $17.5 million in needs in 2014, and over $13M for 2015. Both expenditures exceed budget allotments, which include both structure and road network expenditures, resulting in a shortfall in funding. It may be recommended, then, that the needs identified through analysis be refined continually based on the results of condition surveys undertaken at each structure which will result in an anticipated reduction of current needs, and that additional funding be diverted to these rehabilitation works from excess in the road network.

REFERENCES

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APPENDIX A

Elgin County Road Network Documents

Structural Adequacy Rating (SAR)		
Value	**Distress*****	**Actions***
20	Distress <5%	None
19 - 15	Distress 5 - 15 %	Crack Sealing, Patching, Microsurfacing, R1, MR1
14 - 12	Distress 16 - 25%	R1, MR1, PR1, CIREAM/R1
11 - 8	Distress 26 - 35%	PR1, CIREAM/R1, MR2, PR2, Reconstruction
7 - 1	Distress > 35%	Reconstruction, Surface Treated Roads**
Notes:	* Actions - are a guide and must also take into account:	
		- Capacity / Growth
		- Drainage Requirements
		- Roadside Environment
		- Construction History
		- Planned work by others
	** Surface Treated Roads are posted at "half load" during spring thaw,	
	and are therefore not "Structurally Adequate" at all times.	
	*** Distresses are deterioration features that affect the pavement's ability	
	to support traffic loads. Surface defects can become "structural distresses"	
	if they are moderate or severe, allowing water to enter the base.	
	Examples of Structural Distresses are:	
		- Moderate to Severe Transverse Cracks
		- Aligator Cracks
		- Moderate to Severe Map/Random Cracks
		- Wheel Track Rutting
		- Moderate to Severe Longituduinal Cracks (CL)
		- Frost Heaving / Boils
		- Surface Ponding
		- Pavement Edge Break up / Creep
	Actions to be scheduled before SAR worsens and changes proposed action.	

		Cost per km	
		(000"s)	
R1	50mm Hot Mix Asphalt ($85/t)	85	
MR1	Granular Shouldering ($25/t)	25	
		110	**110**
R2	Pulverize (milling) / Pack / Water ($3/m2)	25	
MR2/PR2	100mm Hot Mix Asphalt ($85/t)	200	
CIP/R1	Granular Shouldering ($25/t)	25	
		250	**250**
RREC	Granular A (0.15mx13.5mx2.4x$20)	98	
	Granular B (0.45m x 13.5m x 2.4 x $15)	219	
	Drainage (culverts, ditching, drains)	100	
	Eng / Safety	75	
	100mm Hot Mix Asphalt ($85/t)	170	
	Granular Shouldering ($25/t)	25	
		687	**675**
UREC	Granular A	75	
	Milling R2	200	
	Drainage (Storm Sewers, Curb and Gutter)	700	
	Eng. / Restoration / Utilities	100	
		1075	**1100**
CULV	Road Crossing Culvert Replacement/Lining	**100**	**100**
WRREC	Land / Earthworks / Engineering	250	
	Granular A (0.15mx21mx2.4x$20)	151	
	Granular B (0.45m x 21m x 2.4 x $15)	340	
	Drainage (culverts, ditching, drains)	250	
	Safety	15	
	100mm Hot Mix Asphalt ($85/t)	350	
	Granular Shouldering ($25/t)	25	
		1381	**1400**

ROAD DESIGN STANDARDS				
	Class 1	Class 2	Class 3	Class 4
Lane Width (m)	3.75	3.75	3.25	3
Shoulder Width (m)	2.5	2.5	2	1*
* farm entrances 45m wide upon reconstruction				
Horizontal and Vertical				
Curves Design Speed				
Over Posted Speed Limit	20km/h	20km/h	10km/h	0km/h
Safe Stopping Sight Distance				
(speed over posted limit)	20km/h	20km/h	20km/h	0km/h
Drainage - Flood Return	100 year	50 year	50 year	2 year
Collision Rating	1			
(Collisions per million km driven)				
System Wide Condition Rating	80%			
"Roads in Good to Very Good				
Condition" - F.I.R.				
SAR > 15				

APPENDIX B

Infrastructure Needs for Linear and Point Assets

Intervention Year	Project Description	Intervention Type	Location	Estimated Cost
2014	Land Purchase			$ 20,000
2014	Road 44 Rehabilitation (Hwy 3 to Rd 19)	Recycling + R1	Bayham	$ 1,800,000
2014	Road 40 Rehabilitation (Hwy 3 to Glencolin Line)	Recycling + R1	Malahide	$ 600,000
2014	Road 45 Rehabilitation (Rd 4 to Rd 28)	Recycling + R1	Central Elgin	$ 775,000
2014	Road 5 PDST (Hwy 401 to Crinnan Line)	Recycling + R1	West Elgin	$ 520,000
2014	Road 36 Reconstruction (Sparta)	Construction	Central Elgin	$ 450,000
2014	Road 76 West Lorne Resurfacing (MR1)	Asphalt R1	West Elgin	$ 425,000
2014	Road 2 Resurfacing (Rd 8 to Ecker Drain)	Asphalt R1	Dutton/Dunwich	$ 235,000
2014	Road 16 Resurfacing - Fingal, Road 20 east, MR1	Asphalt R1	Southwold	$ 85,000
2014	Road 45 Micro Surfacing (40 to 43) plus ditching	Construction	Malahide	$ 225,000
2014	Road 40 Micro Surfacing (Rd 42 to Road 45)	Construction	Malahide	$ 110,000
2014	Road 14 Micro Surfacing (Iona Bridge to Middlemiss Bridge)	Construction	Dutton/Dunwich	$ 265,000
2014	Chatham Street Slope Drainage	Other	Bayham	$ 65,000
2014	Ferguson Line Slope Stabilization	Other	Malahide	$ 60,000
2014	Bridge Street and Colbourne Traffic Signal Replacement	Other	Central Elgin	$ 325,000
2014	Road Sign Replacements - West Elgin, Dunwich, Southwold	Other	Various	$ 425,000
2014	Guiderail Installations	Other	Various	$ 192,000
2014	Permanent Traffic Counter Stations	Other	Various	$ 20,000
2014	Road 19 Resurfacing (Vienna to Straffordville)	Asphalt R1	Bayham	$ 540,000
2015	Land Purchase			$ 20,000
2015	Road 19 Resurfacing (GEL to Vienna + Straffordville to Eden+ Eden to Carson	Asphalt R1	Bayham	$ 930,000
2015	Road 5 PDST (Carrol Line to Thames River)	Recycling + R1	West Elgin	$ 240,000
2015	Road 45 Rehabilitation (Rd 28 to Rd 35)	Recycling + R1	Central Elgin	$ 2,090,000
2015	Road 43 Rehabilitation (Vienna Line to John Wise -minus Calton)	Recycling + R1	Malahide	$ 475,000
2015	Road 20 Rehabilitaiton (Fingal to Shedden)	Recycling + R1	Southwold	$ 725,000
2015	Road 23 Resurfacing (Sunset to Joseph) + shoulders	Asphalt R1	Central Elgin	$ 300,000
2015	Road 73 Resurfacing (Aylmer to Port Bruce)	Asphalt R1	Malahide	$ 675,000
2015	Road 21 Resurfacing	Asphalt R1	Central Elgin	$ 85,000
2015	Road 37 Resurfacing (74 to east Belmont limits)	Asphalt R1	Central Elgin	$ 150,000
2015	Road 38 Micro Surfacing (Garner Rd to Rd 55)	Construction	Bayham	$ 129,000
2015	Road 22 Microsurfacing (Road 27 to 24)	Construction	Central Elgin	$ 115,000
2015	Road 18 FiberMAT (Rd 14 to RR tracks) - no shoulder gravel	Construction	Southwold	$ 135,000
2015	Road 27 FiberMAT (Meeks Br. To T/L)	Construction	Southwold	$ 75,000
2015	Road 103 Micro Surfacing (Lake to Road 3)	Construction	West Elgin	$ 66,000
2015	Road 52 Microsurfacing (73 to Springfield)	Construction	Malahide	$ 100,000
2015	Road 37 Engineering (Widening)	Other	Malahide	$ 75,000
2015	Miller Road Engineering	Other	Dunwich	$ 40,000
2016	Land Purchase			$ 20,000
2016	Road 103 Rehabilitation (Rodney to Thames River) CIREAM/R1	Recycling + R1	West Elgin	$ 2,420,000
2016	Road 37 Rehabilitation - Helder Rd to 47 (land, hydro, widening)	Recycling + R1	Malahide	$ 1,000,000
2016	Miller Road Reconstruction	Construction	Dunwich	$ 1,500,000
2016	Road 13 Resurfacing (Dutton)	Asphalt R1	Dunwich	$ 125,000
2016	Road 20 Resurfacing (Port Stanley)	Asphalt R1	Central Elgin	$ 276,000
2016	Road 34 Resurfacing	Asphalt R1	Central Elgin	$ 250,000
2016	Road 39 Resurfacing	Asphalt R1	Bayham	$ 150,000
2016	Road 73 (Aylmer)	Asphalt R1	Aylmer	$ 550,000
2016	Road 53 Resurfacing (Hwy 3 to John Street)	Asphalt R1	Aylmer	$ 230,000
2016	Road 20 Micro Surfacing (Shedden to rd 18)	Construction	Southwold	$ 150,000
2016	Road 119 Micro Surfacing (Rd 3 to Rd 18)	Construction	Southwold	$ 160,000
2016	Road 13 Micro Surfacing	Construction	Dutton/Dunwich	$ 280,000
2016	Highbury Ave. Slope Rehabilitation	Other	Central Elgin	$ 200,000
2016	County Road Intersection Sign Replacements - East Half	Other	Various	$ 300,000
2017	Land Purchase			$ 20,000
2017	Road 38 Rehabilitation (Richmond to Sandytown Road)	Recycling + R1	Bayham	$ 2,027,000
2017	Road 6 Rehabilitation (Blacks Rd. to 103)	Recycling + R1	West Elgin	$ 750,000
2017	Sparta Reconstruction (Rd 27 and 36)	Construction	Central Elgin	$ 1,600,000
2017	Road 76 Resurfacing (excluding West Lorne)	Asphalt R1	West Elgin	$ 1,450,000
2017	Road 8 Micro Surfacing (Hwy 401 to Celtic)	Construction	Dutton/Dunwich	$ 165,000
2017	Road 55 Microsurfaing	Construction	Malahide	$ 250,000

Intervention Year	Project Description	Intervention Type	Location	Estimated Cost
2017	Road 32 Microsurfacing	Construction	Malahide	$ 215,000
2017	County Road Intersection Sign Replacements - West Half	Other	Various	$ 350,000
2017	Calton Line Slope Stabilization	Other	Bayham	$ 300,000
2018	Land Purchase			$ 20,000
2018	Road 46 Rehabilitation (Hwy 3 to Pressey Line)	Recycling + R1	Bayham	$ 1,000,000
2018	Road 2 Rehabilitation (103 to WL)	Recycling + R1	West Elgin	$ 1,300,000
2018	Road 27 Rehabilitation - Union to Sparta	Recycling + R1	Central Elgin	$ 2,000,000
2018	Vienna Reconstruction	Construction	Bayham	$ 3,100,000
2018	Road 8 Resurfacing (Rd 16 to Rd 3)	Asphalt R1	Dutton/Dunwich	$ 120,000
2018	Road 18 Microsurfacing (Lawrence to 20)	Construction	Southwold	$ 90,000
2018	Road 18 Microsurfacing (119 to Green Lane)	Construction	Southwold	$ 84,000
2018	Road 46 Microsurfacing (Knotts Mill Br. To Hwy 3)	Construction	Bayham	$ 100,000
2018	Road 48 Microsurfacing plus farm culverts (Rd 25 to Rd 73)	Construction	Central Elgin	$ 1,150,000
2019-2023	Land Purchase			$ 100,000
2019-2023	Rodney Reconstruction (103 and 104)	Construction	West Elgin	$ 2,750,000
2019-2023	Fingal Reconstruction (16 and 20)	Construction	Southwold	$ 3,000,000
2019-2023	Road 4 Rehabilitation (Hwy3/4 to City limits)	Recycling + R1	Southwold	$ 550,000
2019-2023	Road 4 Resurfacing (St. Thomas to Carlow Road)	Asphalt R1	Central Elgin	$ 2,000,000
2019-2023	Road 5 Microsurfacing	Construction	West Elgin	$ 400,000
2019-2023	Road 6 Resurfacing (Rd 7 to Blacks Rd)	Asphalt R1	West Elgin	$ 396,000
2019-2023	Road 7 Resurfacing	Asphalt R1	West Elgin	$ 240,000
2019-2023	Road 8 Microsurfacing (16 to Lake View Line)	Construction	Dunwich	$ 200,000
2019-2023	Road 9 Microsurfacing	Construction	Dunwich	$ 600,000
2019-2023	Road 16 Microsurfacing (8 to Fingal)	Construction	Dunwich	$ 500,000
2019-2023	Road 16 Rehabilitation (Fingal to City)	Recycling + R1	Southwold	$ 2,000,000
2019-2023	Road 19, 50 and 42 Resurfacing - Port Burwell	Asphalt R1	Bayham	$ 450,000
2019-2023	Road 20 Microsurfacing (rd 18 to southdel dr)	Construction	Southwold	$ 105,000
2019-2023	Road 24 Rehabilitation (Yarmouth Centre to Quaker Road)	Recycling + R1	Central Elgin	$ 760,000
2019-2023	Dexter Line Relocation	Construction	Central Elgin	$ 4,500,000
2019-2023	Road 25 Rehabilitation - all	Recycling + R1	Southwold	$ 1,700,000
2019-2023	Road 30 Rehabilitation - all	Recycling + R1	Central Elgin	$ 1,700,000
2019-2023	Road 35 Microsurfacing (Rd 45 to Hwy 3)	Construction	Malahide	$ 167,000
2019-2023	Road 35 Microsurfacing (Hwy 3 to Rd 52)	Construction	Central Elgin	$ 150,000
2019-2023	Road 36 Microsurfacing (Rd 24 to Sparta)	Construction	Central Elgin	$ 105,000
2019-2023	Road 36 Microsurfacing (Sparta to Hwy 3)	Construction	Central Elgin	$ 308,000
2019-2023	Richmond Reconstruction (38 and 43)	Construction	Bayham	$ 1,200,000
2019-2023	Road 38 Reconstruction (Straffordville)	Construction	Bayham	$ 2,300,000
2019-2023	Road 38 Rehabilitation (Garner Road to County Road 55)	Recycling + R1	Bayham	$ 1,000,000
2019-2023	Road 40 Rehabilitation (Rd 45 to Hwy 3)	Recycling + R1	Malahide	$ 1,160,000
2019-2023	Road 42 Microsurfacing (73 to 43)	Construction	Bayham	$ 310,000
2019-2023	Road 43 Microsurfacing (42 to Calton)	Construction	Bayham	$ 150,000
2019-2023	Road 43 Microsurfacing (John Wise Line to Richmond)	Construction	Bayham	$ 150,000
2019-2023	Road 44 Micro Surfacing (Rd 46 to Hwy #3)	Construction	Bayham	$ 40,000
2019-2023	Road 45 Microsurfacing (3 to 16)	Construction	Southwold	$ 123,000
2019-2023	Road 45 Micro Surfacing (Rd 16 to Rd 4)	Construction	Southwold	$ 201,000
2019-2023	Road 47 Rehabilitation (48 to 37)	Recycling + R1	Malahide	$ 1,200,000
2019-2023	Road 48 Rehabilitation (Rd 47 to Rd 54)	Recycling + R1	Malahide	$ 600,000
2019-2023	Road 48 PR1 (Wonderland Road to 600m east of 25)	Construction	Southwold	$ 800,000
2019-2023	Road 49 (all) PDST	Construction	Malahide	$ 650,000
2019-2023	Road 51 Microsurfacing	Construction	Central Elgin	$ 35,000
2019-2023	Road 51 Rehabilitation (4 to Whites Station)	Recycling + R1	Central Elgin	$ 200,000
2019-2023	Road 52 Microsurfacing (30 to 74)	Construction	Malahide	$ 250,000
2019-2023	Road 52 Resurfacing (Springfield plus realignment at rd 47)	Construction	Malahide	$ 900,000
2019-2023	Road 52 Rehabilitation (74 to 73)	Recycling + R1	Malahide	$ 1,750,000
2019-2023	Road 54 Rehabilitation	Recycling + R1	Bayham	$ 1,200,000
2019-2023	Road 56 Resurfacing (28 to 36)	Asphalt R1	Central Elgin	$ 516,000
2019-2023	Road 73 Rehabilitation (Aylmer to Avon Drive)	Recycling + R1	Malahide	$ 3,500,000
2019-2023	Road 104 Microsurfacing (McPherson to Rodney)	Construction	West Elgin	$ 200,000
2019-2023	Road 119 Micro Surfacing (Rd 3 to Rd 18)	Construction	Southwold	$ 200,000
2019-2023	Road Slope Rehabilitations	Other	Various	$ 1,730,000
2019-2023	Roadway Paved Shoulders (2m Wide)	Other	Various	$ 2,000,000

Last Update to Report **27-Jan-14**

Table 1 - Component Inventory and Condition Report - Maintenance and Replacement Data

Facilities Management Plan - Bridges							Replacement Profile									
ID	Bridge Name	Road Number	Location	Year of Construction / Year of Inspection	2010 OSIM Inspections	Period for Repairs (years)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Bothwell Bridge	7	4.21 km North of Elgin Road # 6	2003			---	---	---	---	---	---	---	---	---	---
1	Bothwell Bridge	7	4.21 km North of Elgin Road # 6	2010	Repaint railings	5	---	$81,600	---	---	---	---	---	---	---	---
1	Bothwell Bridge	7	4.21 km North of Elgin Road # 6	2010	Paint Structural steel	5	---	$867,000	---	---	---	---	---	---	---	---
2	Wardsville Bridge	103	5.23km North of Road 6	2011			---	---	---	---	---	---	---	---	---	---
2	Wardsville Bridge	103	5.23km North of Road 6	2010	Replace bearing on South side		---	---	---	---	---	---	---	---	---	---
3	Walkers Bridge	5	5.23km North of Road # 9 West	1981			---	---	---	---	---	---	---	---	---	---
3	Walkers Bridge	5	5.23km North of Road # 9 West	2010	Remove Debris from Piers	5	---	$5,100	---	---	---	---	---	---	---	---
4	New Sarum Bridge	74	0.2 km N. of Edgeware Line	2007			---	---	---	---	---	---	---	---	---	---
5	Willeys Bridge	8	7.89 km North of Hwy #401	1995			---	---	---	---	---	---	---	---	---	---
5	Willeys Bridge	8	7.89 km North of Hwy #401	2010	Repair Deck Drain	5	---	$510	---	---	---	---	---	---	---	---
5	Willeys Bridge	8	7.89 km North of Hwy #401	2010	Repair Erosion on the South Side	5	---	$15,300	---	---	---	---	---	---	---	---
6	Middlemiss Bridge	14	3.56km N. of Hwy No. 401	1989			---	---	---	---	---	---	---	---	---	---
6	Middlemiss Bridge	14	3.56km N. of Hwy No. 401	2010	Waterproof and pave decks	5	---	$61,200	---	---	---	---	---	---	---	---
7	Fleming Creek Bridge	T/L	1.5km North of Road #4	1940			$400,927	---	---	---	---	---	---	---	---	---
7	Fleming Creek Bridge	T/L	1.5km North of Road #4	2010	Replace Structure	10	---	---	---	---	---	---	$563,081	---	---	---
8	Fleming Creek North Bridge	103	4.6 km North of Hwy No. 401	1993			---	---	---	---	---	---	---	---	---	---
9	Fleming Creek South Bridge	103	3.29 km N. of Hwy No. 401	1994			---	---	---	---	---	---	---	---	---	---
9	Fleming Creek South Bridge	103	3.29 km N. of Hwy No. 401	2010	Stream Channelization Required	10	---	---	---	---	---	---	$5,631	---	---	---
10	Largie Bridge	9	0.72km W. of Road 8	1949			---	---	---	---	---	---	---	---	---	---
10	Largie Bridge	9	0.72km W. of Road 8	2010	Replace structure	5	---	$612,000	---	---	---	---	---	---	---	---
11	Edison Bridge	19	0.50km S. of Main Street	2002			---	---	---	---	---	---	---	---	---	---
11	Edison Bridge	19	0.50km S. of Main Street	2010	Install bridge end markers	1	$1,000	---	---	---	---	---	---	---	---	---
12	Iona Bridge	14	1.72km S. of Hwy No. 3	1989			---	---	---	---	---	---	---	---	---	---
12	Iona Bridge	14	1.72km S. of Hwy No. 3	2010	Replace Structure	10	---	---	---	---	---	---	$45,046	---	---	---
13	Bennett Bridge	73	0.95km S. of Avon Drive # 37	1991			---	---	---	---	---	---	---	---	---	---
13	Bennett Bridge	73	0.95km S. of Avon Drive # 37	2010	Install 2 end marker signs	1	$500	---	---	---	---	---	---	---	---	---
14	Mapleton Bridge	74	0.4km N. of Ron McNeil Line	1951			---	---	---	---	---	---	---	---	---	---
14	Mapleton Bridge	74	0.4km N. of Ron McNeil Line	2010	Replace Structure	10	---	---	---	---	---	---	$1,464,011	---	---	---
15	Blacks Bridge	19	0.10 km N. of Black Bridge Line	1934			$2,543,707	---	---	---	---	---	---	---	---	---
16	Lings Bridge	T/L	0.2km E. of Hwy No. 4	1991			---	---	---	---	---	---	---	---	---	---
16	Lings Bridge	T/L	0.2km E. of Hwy No. 4	2010	Waterproof and pave decks	10	---	---	---	---	---	---	$28,154	---	---	---
17	Vienna North Bridge	19	0.08km N. of Main Street	2005			---	---	---	---	---	---	---	---	---	---
17	Vienna North Bridge	19	0.08km N. of Main Street	2010	Install bridge end markers	1	$1,000	---	---	---	---	---	---	---	---	---
18	St.George Street Bridge	26	1.32km E. of County Road No. 25	2000			---	---	---	---	---	---	---	---	---	---
19	Port Bruce Bridge	74	0.03 km N. of Dexter Line #24	1999			---	---	---	---	---	---	---	---	---	---
19	Port Bruce Bridge	74	0.03 km N. of Dexter Line #24	2010	Sidewalk concrete repairs	5	---	$25,500	---	---	---	---	---	---	---	---
20	Callaghan Bridge	73	0.55 km N. of Crossley Hunter Line	1991			---	---	---	---	---	---	---	---	---	---
20	Callaghan Bridge	73	0.55 km N. of Crossley Hunter Line	2010	Signs	5	---	$510	---	---	---	---	---	---	---	---
21	Crinan Bridge	76	3.90km N. of Hwy 401	1982			---	---	---	---	---	---	---	---	---	---
23	Fulton Bridge	T/L	2.00km S. of County Rd. 45	1912			$2,802,793	---	---	---	---	---	---	---	---	---
23	Fulton Bridge	T/L	2.00km S. of County Rd. 45	2010	Replace Structure	15	---	---	---	---	---	---	---	---	---	---
23	Fulton Bridge	T/L	2.00km S. of County Rd. 45	2010	Repair deck	5	---	$15,300	---	---	---	---	---	---	---	---
24	Meeks Bridge	T/L	0.25 km N. of County Rd. # 20	1900			$2,178,253	---	---	---	---	---	---	---	---	---
24	Meeks Bridge	T/L	0.25 km N. of County Rd. # 20	2010	Replace Structure	15	---	---	---	---	---	---	---	---	---	---
24	Meeks Bridge	T/L	0.25 km N. of County Rd. # 20	2010	Repair south joint on decks	1	$2,500	---	---	---	---	---	---	---	---	---
24	Meeks Bridge	T/L	0.25 km N. of County Rd. # 20	2010	Replace bracing	5	---	$204,000	---	---	---	---	---	---	---	---
25	Warren Street Bridge	21	0.33 km W. of Sunset Road	2012			---	---	---	---	---	---	---	---	---	---
25	Warren Street Bridge	21	0.33 km W. of Sunset Road	2010	Replace joints	5	---	$112,200	---	---	---	---	---	---	---	---
26	Jamestown Bridge	T/L	4.00 km W. of Hwy 73	1900			$1,530,049	---	---	---	---	---	---	---	---	---
26	Jamestown Bridge	T/L	4.00 km W. of Hwy 73	2010	Replace Structure	5	---	$2,244,000	---	---	---	---	---	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	1989			---	---	---	---	---	---	---	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	2010	Replace Structure	15	---	---	---	---	---	---	---	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	2010	Concrete repairs to abutments	10	---	---	---	---	---	---	$11,262	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	2010	Concrete repairs to curb on deck	5	---	$12,750	---	---	---	---	---	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	2010	Power wash bridge	5	---	$2,040	---	---	---	---	---	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	2010	Repair southeast corner of second truss	5	---	$3,570	---	---	---	---	---	---	---	---
27	Gillets Bridge	T/L	3.00 km E. of County Road 36	2010	Repaint lower four feet (excluding underside) of trus	10	---	---	---	---	---	---	$33,785	---	---	---
28	Players Bridge	45	1.66 km E. of County Rd. 36	1985			---	---	---	---	---	---	---	---	---	---
28	Players Bridge	45	1.66 km E. of County Rd. 36	2010	Erosion on slopes (embankments)	10	---	---	---	---	---	---	$33,785	---	---	---
29	Patterson Bridge	30	1.52km N. of County Rd. 52	1987			---	---	---	---	---	---	---	---	---	---
29	Patterson Bridge	30	1.52km N. of County Rd. 52	2010	Replace joint seals	5	---	$20,400	---	---	---	---	---	---	---	---
30	McGinnis Bridge	T/L	1.00 km E. of County Road 30	1949			---	---	---	---	---	---	---	---	---	---
30	McGinnis Bridge	T/L	1.00 km E. of County Road 30	2010	Replace barriers	10	---	---	---	---	---	---	$67,570	---	---	---
30	McGinnis Bridge	T/L	1.00 km E. of County Road 30	2010	Concrete repairs to deck and abutments	5	---	$30,600	---	---	---	---	---	---	---	---
31	Harkness Bridge	T/L	2.50 km W. of Belmont Rd.	1949			---	---	---	---	---	---	---	---	---	---
31	Harkness Bridge	T/L	2.50 km W. of Belmont Rd.	2010	Replace barrier walls	5	---	$45,900	---	---	---	---	---	---	---	---
32	Belmont West Bridge	34	1.37km W. of Hwy 74	1935			$780,984	---	---	---	---	---	---	---	---	---
32	Belmont West Bridge	34	1.37km W. of Hwy 74	2010	Replace structure due to longitudinal and vertical cu	5	---	$1,326,000	---	---	---	---	---	---	---	---
33	Belmont East Bridge	37	1.97 km E. of Belmont Road	1997			---	---	---	---	---	---	---	---	---	---
33	Belmont East Bridge	37	1.97 km E. of Belmont Road	2010	Repave and waterproof decks	10	---	---	---	---	---	---	$19,145	---	---	---
33	Belmont East Bridge	37	1.97 km E. of Belmont Road	2010	Concrete repairs to barriers and soffit	10	---	---	---	---	---	---	$10,135	---	---	---
35	Harrietsville Drain Bridge	37	0.96km E. of Imperial Road #73	1992			---	---	---	---	---	---	---	---	---	---
36	Brooks Bridge	52	1.77 km E. of Hwy #73	1955			---	---	---	---	---	---	---	---	---	---
36	Brooks Bridge	52	1.77 km E. of Hwy #73	2010	Replace structure with culvert	5	---	$408,000	---	---	---	---	---	---	---	---

Last Update to Report **27-Jan-14**

Table 1 - Component Inventory and Condition Report - Maintenance and Replacement Data

Facilities Management Plan - Bridges							Replacement Profile									
ID	Bridge Name	Road Number	Location	Year of Construction / Year of Inspection	2010 OSIM Inspections	Period for Repairs (years)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
38	King Bridge	52	2.89 km. W. of Hwy No. 73	1947			---	---	---	---	---	---	---	---	$932,687	---
38	King Bridge	52	2.89 km. W. of Hwy No. 73	2010	Replace Structure	5	---	$907,800	---	---	---	---	---	---	---	---
39	Kingsmill Bridge	35	3.55 km N. of Hwy No. 3	1999			---	---	---	---	---	---	---	---	---	---
40	Orwell Bridge	35	0.40 km N. of Hwy #3	2000			---	---	---	---	---	---	---	---	---	---
41	Elm Street Bridge	53	0.28km N. of Hwy #3	1963			---	---	---	---	---	---	---	---	---	---
41	Elm Street Bridge	53	0.28km N. of Hwy #3	2010	Concrete repairs at soffit	5	---	$20,400	---	---	---	---	---	---	---	---
42	Dingle Street Bridge	T/L	0.05km N. of Hwy No. 3	1998			---	---	---	---	---	---	---	---	---	---
43	Glencolin Bridge	40	3.27 km N. of Hwy No. 3	1939			$1,135,713	---	---	---	---	---	---	---	---	---
43	Glencolin Bridge	40	3.27 km N. of Hwy No. 3	2010	Replace barriers	5	---	$132,600	---	---	---	---	---	---	---	---
43	Glencolin Bridge	40	3.27 km N. of Hwy No. 3	2010	Concrete repairs to soffit	5	---	$173,400	---	---	---	---	---	---	---	---
43	Glencolin Bridge	40	3.27 km N. of Hwy No. 3	2010	Waterproof and pave deck	5	---	$25,500	---	---	---	---	---	---	---	---
45	Port Burwell Bridge	42	0.62 km W. of Cty. Rd. 19	1985			---	---	---	---	---	---	---	---	---	---
45	Port Burwell Bridge	42	0.62 km W. of Cty. Rd. 19	2010	Install bridge end markers	1	$1,000	---	---	---	---	---	---	---	---	---
45	Port Burwell Bridge	42	0.62 km W. of Cty. Rd. 19	2010	Concrete repairs to decks	10	---	---	---	---	---	---	$33,785	---	---	---
46	Vienna Bridge	T/L	1.00 km N. of Hwy. # 19	1961			$2,042,823	---	---	---	---	---	---	---	---	---
46	Vienna Bridge	T/L	1.00 km N. of Hwy. # 19	2010	Remove structure (long term)		---	---	---	---	---	---	---	---	---	---
46	Vienna Bridge	T/L	1.00 km N. of Hwy. # 19	2010	Paint truss	10	---	---	---	---	---	---	$67,570	---	---	---
46	Vienna Bridge	T/L	1.00 km N. of Hwy. # 19	2010	Repair curbs on deck	5	---	$25,500	---	---	---	---	---	---	---	---
47	Calton Line Bridge	45	5.02 km W. of Hwy 19	1997			---	---	---	---	---	---	---	---	---	---
47	Calton Line Bridge	45	5.02 km W. of Hwy 19	2010	Paint Structural steel	15	---	---	---	---	---	---	---	---	---	---
48	Cooks Bridge	43	2.65 km N. of Cty Rd. 45	1994			---	---	---	---	---	---	---	---	---	---
49	Phillmore Bridge	43	5.43 km N. of Cty Rd. 45	1992			---	---	---	---	---	---	---	---	---	---
49	Phillmore Bridge	43	5.43 km N. of Cty Rd. 45	2010	Paint beams and stringers	10	---	---	---	---	---	---	$39,416	---	---	---
49	Phillmore Bridge	43	5.43 km N. of Cty Rd. 45	2010	Repair expansion joints	10	---	---	---	---	---	---	$11,262	---	---	---
49	Phillmore Bridge	43	5.43 km N. of Cty Rd. 45	2010	Repair erosion on south bank	5	---	$2,040	---	---	---	---	---	---	---	---
49	Phillmore Bridge	43	5.43 km N. of Cty Rd. 45	2010	Install steel grating deck	10	---	---	---	---	---	---	$450,465	---	---	---
53	Eden Bridge	44	2.82 km W. of Hwy # 19	1998			---	---	---	---	---	---	---	---	---	---
53	Eden Bridge	44	2.82 km W. of Hwy # 19	2010	Paint beams	15	---	---	---	---	---	---	---	---	---	---
53	Eden Bridge	44	2.82 km W. of Hwy # 19	2010	Replace asphalt at approach	5	---	$3,570	---	---	---	---	---	---	---	---
60	Dodds Creek Bridge	18	3.70km W. of Hwy No. 4	1963			---	---	---	---	---	---	---	---	---	---
60	Dodds Creek Bridge	18	3.70km W. of Hwy No. 4	2010	Replace barriers with concrete	5	---	$153,000	---	---	---	---	---	---	---	---
60	Dodds Creek Bridge	18	3.70km W. of Hwy No. 4	2010	Concrete repairs to deck and soffit	5	---	$20,400	---	---	---	---	---	---	---	---
60	Dodds Creek Bridge	18	3.70km W. of Hwy No. 4	2010	Waterproof and pave decks	5	---	$25,500	---	---	---	---	---	---	---	---
61	Garton Bridge	52	0.24km W. of Hwy No. 74	1967			---	---	---	---	---	---	---	---	---	---
61	Garton Bridge	52	0.24km W. of Hwy No. 74	2010	Concrete repairs to abutments and soffit	5	---	$45,900	---	---	---	---	---	---	---	---
63	Bucks Bridge	48	4.75 km W. of Hwy # 74	1968			---	---	---	---	---	---	---	---	---	---
64	McGreger Bridge	48	1.02km E. of Hwy # 74	1999			---	---	---	---	---	---	---	---	---	---
64	McGreger Bridge	48	1.02km E. of Hwy # 74	2010	Chaulk Joints	5	---	$2,550	---	---	---	---	---	---	---	---
65	Knotts Mill Bridge	46	2.85 km S. of Hwy # 3	1995			---	---	---	---	---	---	---	---	---	---
65	Knotts Mill Bridge	46	2.85 km S. of Hwy # 3	2010	Concrete repairs to decks	5	---	$7,650	---	---	---	---	---	---	---	---
66	Terminal Rail	27	1.24 km W. of Hwy # 4	1998			---	---	---	---	---	---	---	---	---	---
74	Springwater Bridge & Dam	35	3.26km S. of Hwy #3	1967			---	---	---	---	---	---	---	---	---	---
80	Simpsons Bridge	76	County Line between Middlesex and Elgin	2011			---	---	---	---	---	---	---	---	---	---
80	Simpsons Bridge	76	County Line between Middlesex and Elgin	2010	Replace barriers		---	---	---	---	---	---	---	---	---	---
80	Simpsons Bridge	76	County Line between Middlesex and Elgin	2010	Paint beams		---	---	---	---	---	---	---	---	---	---
92	Kimble Bridge	16	3.87km E. of Cty. Rd. 20	1940			---	$466,350	---	---	---	---	---	---	---	---
92	Kimble Bridge	16	3.87km E. of Cty. Rd. 20	2010	Replace Structure	10	---	---	---	---	---	---	$450,465	---	---	---
93	John Street	73	0.1 km N. of Talbot road (Hwy No. 3)	1993			---	---	---	---	---	---	---	---	---	---
93	John Street	73	0.1 km N. of Talbot road (Hwy No. 3)	2010	Repair gabion basket	5	---	$2,040	---	---	---	---	---	---	---	---
94	Glen Erie East Bridge	42	0.40 km E. of Teal Neville Road	1930			$422,056	---	---	---	---	---	---	---	---	---
94	Glen Erie East Bridge	42	0.40 km E. of Teal Neville Road	2010	Replace due to width and vertical curve	15	---	---	---	---	---	---	---	---	---	---
95	Glen Erie West Bridge	42	0.40 km E. of Plank Road	1980			---	---	---	---	---	---	---	---	---	---
96	Belmont Bridge	74		1992			---	---	---	---	---	---	---	---	---	---
97	King George IV Bridge	4		1992			---	---	---	---	---	---	---	---	---	---
						TOTAL REPLACEMENT & REPAIR COSTS	**$13,843,304**	**$8,107,680**	**$0**	**$0**	**$0**	**$0**	**$3,334,567**	**$0**	**$932,687**	**$0**

Note:
"Period for Repairs" Column - Timeline for repairs was given in OSIM reports as a multi-year window. For simplification in the spreadsheet, the high end of these windows generally were used, as follows:

10 + years	15
6-10 years	10
1-5 years	5
Within 1 year	1

Last Update to Report **27-Jan-14**

Table 1 - Component Inventory and Condition Report - Maintenance and Replacement Data

Facilities Management Plan - Culverts							Replacement Profile									
ID	Culvert Name	Road Number	Location	Year of Construction / Year of Inspection	2010 OSIM Inspections	Period for Repairs (years)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Middlemiss Culvert	9	0.36 km W. of County Road #14	1957			$546,774	---	---	---	---	---	---	---	---	---
1	Middlemiss Culvert	9	0.36 km W. of County Road #14	2010	Remove debris in front of inlet	5	---	$2,040	---	---	---	---	---	---	---	---
1	Middlemiss Culvert	9	0.36 km W. of County Road #14	2010	Repair slope failure on embankments	5	---	$2,040	---	---	---	---	---	---	---	---
2	Orchard Culvert	52	1.43km W. of Belmont Rd. #74	1967			---	---	---	$460,780	---	---	---	---	---	---
3	Silver Creek Culvert	42	2.65 km E. of Imperial Rd. # 73	1983			---	---	---	---	---	---	---	---	---	---
4	Springfield North (Simpson Drain)	49	0.16 km N. of Cty. Rd. # 52	1969			---	---	---	---	---	$443,885	---	---	---	---
5	Springfield South (Simpson Drain)	40	0.7km S. of County Rd. # 52	1970			---	---	---	---	---	---	$457,937	---	---	---
6	Beecroft Culvert	40	1.99 km S. of County Rd. # 52	1970			---	---	---	---	---	---	$417,835	---	---	---
7	Shaw Culvert	45	1.74 km W. of Sunset Road # 4	1970			---	---	---	---	---	---	---	---	---	---
8	Campbell East Culvert	9	3.60 km W. of County Rd. No. 14	1971			---	---	---	---	---	---	---	$386,607	---	---
9	Airport Culvert	36	1.34 km S. of Hwy No. 3	1972			---	---	---	---	---	---	---	---	$590,836	---
9	Airport Culvert	36	1.34 km S. of Hwy No. 3	2010	Brushing at inlet	5	---	$1,530	---	---	---	---	---	---	---	---
10	Port Talbot Culvert	16	2.51 km W. of Cty Rd. # 14	1988			---	---	---	---	---	---	---	---	---	---
11	Newell Culvert	32	0.94 km S. of County Rd. No. 52	1973			---	---	---	---	---	---	---	---	---	$251,220
11	Newell Culvert	32	0.94 km S. of County Rd. No. 52	2010	Extend culvert	5	---	$45,900	---	---	---	---	---	---	---	---
12	Salt Creek Culvert	30	0.97 km N. of County Rd. No. 52	1976			---	---	---	---	---	---	---	---	---	---
13	Kettle Creek Culvert	52	3.12 km E. of Cty. Rd. No. 25	1976			---	---	---	---	---	---	---	---	---	---
14	Rolson Culvert	42	2.51 km W. of Hwy. No. 19	1980			---	---	---	---	---	---	---	---	---	---
15	Golf Course Road Culvert	27	0.83 km W. of Sunset Road	1971			---	---	---	---	---	---	---	$527,792	---	---
15	Golf Course Road Culvert	27	0.83 km W. of Sunset Road	2010	Remove debris on upstream side	5	---	$2,550	---	---	---	---	---	---	---	---
16	Government Drain No.3 Culvert	18	4.33 km W. of Hwy # 4	1963			---	---	---	---	---	---	---	---	---	---
16	Government Drain No.3 Culvert	18	4.33 km W. of Hwy # 4	2010	Concrete repairs to culvert	5	---	$12,750	---	---	---	---	---	---	---	---
16	Government Drain No.3 Culvert	18	4.33 km W. of Hwy # 4	2010	Install 4 end marker signs	5	---	$1,020	---	---	---	---	---	---	---	---
18	Tansley Drain Culvert	56	0.25 km W. of County Rd. No. 36	1996			---	---	---	---	---	---	---	---	---	---
19	Government Drain No.1 Culvert	18	2.87 km W. of Hwy No. 4	1963			---	---	---	---	---	---	---	---	---	---
20	Spring Creek Culvert	37	3.17 km W. of Road. 73	1968			---	---	---	---	---	---	---	---	---	---
21	Grant Drain Culvert	48	2.99 km W. of Belmont Rd. # 74	1966			---	---	$255,750	---	---	---	---	---	---	---
22	Little Otter Creek Culvert	55	2.70 km S. of County Road No. 45	1982			---	---	---	---	---	---	---	---	---	---
23	Morden Culvert	104	4.53 km W. of Furnival Road # 103	1991			---	---	---	---	---	---	---	---	---	---
24	McGill Drain Culvert	5	3.13 km N. of Hwy No. 401	1947			---	---	---	---	---	---	---	---	$211,032	---
24	McGill Drain Culvert	5	3.13 km N. of Hwy No. 401	2010	Concrete repairs to headwall	15	---	---	---	---	---	---	---	---	---	---
25	Government Drain No.1 Culvert	5	0.61 km N. of Hwy No. 401	1999			---	---	---	---	---	---	---	---	---	---
26	Giles Outlet Drain Culvert	9	1.9 km E. of Graham Road	1964			---	---	---	---	---	---	---	---	---	---
27	Cambleton Culvert	9	0.6 km E. of Coyne Road	1962			---	---	---	---	---	---	---	---	---	---
27	Cambleton Culvert	9	0.6 km E. of Coyne Road	2010	Concrete repairs to culvert	10	---	---	---	---	---	---	$5,068	---	---	---
28	McMillian Culvert	8	1.1km South of Road No.9	1958			---	---	---	---	---	---	---	---	---	---
28	McMillian Culvert	8	1.1km South of Road No.9	2010	Concrete repairs to culvert	5	---	$25,500	---	---	---	---	---	---	---	---
29	Emerson East Culvert	9	5.77 km W. of Iona Road # 14	1930			$169,087	---	---	---	---	---	---	---	---	---
29	Emerson East Culvert	9	5.77 km W. of Iona Road # 14	2010	Concrete repairs to culvert	5	---	$18,360	---	---	---	---	---	---	---	---
30	Furnival Road Culvert	103	0.53 km N. fo County Rd. #2	1935			$505,422	---	---	---	---	---	---	---	---	---
31	Emerson West Culvert	9	2.8 km E. of County Rd. No. 8	1940			---	$341,187	---	---	---	---	---	---	---	---
32	Lake Road Culvert	16	1.29 km E. of County Rd. No. 8	1945			---	---	---	---	---	---	$476,047	---	---	---
33	Bell Mill Culvert	20	0.30 km N. of County Rd. No. 21	1957			---	---	---	---	---	---	---	---	---	---
34	Weir Culvert	24	0.53 km E. of Cty Rd. No. 23	1943			$1,133,982	---	---	---	---	---	---	---	---	---
35	Hill Culvert	24	0.34 km West of County Rd. No. 36	1960			---	---	---	---	---	---	---	---	---	---
36	McBain Culvert	25	0.58 km S. of Highway No. 3	1986			---	---	---	---	---	---	---	---	---	---
37	Lynhurst Culvert	25	0.23km S. of Hwy. No. 3	1986			---	---	---	---	---	---	---	---	---	---
38	Chute Culvert	42	2.09 km E. of County Rd. No. 40	1963			---	---	---	---	---	---	---	---	---	---
39	Teeple Culvert	32	Intersection of Hacienda and Glencolin Line	1982			---	---	---	---	---	---	---	---	---	---
40	Argyle Culvert	32	0.87 km E. of Imperial Road # 73	1982			---	---	---	---	---	---	---	---	---	---
41	Fowler East	16	0.99 km E. of County Rd. No. 20	1987			---	---	---	---	---	---	---	---	---	---
42	Glanworth Culvert	30	0.35 km S. of Elgin London Line	1988			---	---	---	---	---	---	---	---	---	---
43	Gold Seal Culvert	18	0.69 km W. of Sunset Rd	1958			---	---	---	---	---	---	---	---	---	---
43	Gold Seal Culvert	18	0.69 km W. of Sunset Rd	2010	Repair erosion at North East corner	1	$1,500	---	---	---	---	---	---	---	---	---
43	Gold Seal Culvert	18	0.69 km W. of Sunset Rd	2010	Remove debris	1	$1,000	---	---	---	---	---	---	---	---	---
44	Silver Creek North	40	0.36 km S. of Cty. Rd. No. 45	1990			---	---	---	---	---	---	---	---	---	---
46	Lake Store Culvert	42	0.76 km W. of Cty. Rd. No. 43	1991			---	---	---	---	---	---	---	---	---	---
47	Aarts Culvert	30	0.41 km N. of Hwy No. 3	1992			---	---	---	---	---	---	---	---	---	---
48	Talbot Creek Culvert	20	1.22 km S. of Talbot Line # 3	1961			---	---	---	---	---	---	---	---	---	---
49	Hoover Culvert	52	3.49km E. of Belmont Road # 74	1962			---	---	---	---	---	---	---	---	---	---
50	Richmond Hill Culvert	38	2.50 km E. of Highway No. 3	1959			---	---	---	---	---	---	---	---	---	---
51	Stimers Culvert	46		1996	N/A		---	---	---	---	---	---	---	---	---	---
52	Mac Pherson Drain Culvert	9	1.19 km E. of Graham Road # 76	1965			---	---	---	---	---	---	---	---	---	---
53	Brown Drain Culvert	8	1.87 km S. of Hwy. 401	1985			---	---	---	---	---	---	---	---	---	---
54	Baird Drain Culvert	18	2.67 km W. of Road 119	1929			$218,710	---	---	---	---	---	---	---	---	---
55	Lewis Culvert	18	1.24 km W. of Road 119	1930			$147,032	---	---	---	---	---	---	---	---	---
55	Lewis Culvert	18	1.24 km W. of Road 119	2010	Replace structure	10	---	---	---	---	---	---	$168,924	---	---	---
57	Hunt Culvert	119	1.79 km N. of Hwy 401	1958			---	---	---	---	---	---	---	---	---	---
58	Shively-Neff Culvert	52	1.54 km W. of Cty Line	1993			---	---	---	---	---	---	---	---	---	---
59	Pettman-Moore Culvert	52	0.2 km W. of Cty Line	1993			---	---	---	---	---	---	---	---	---	---
60	Springfield Culvert	52	3.99 km E. of Cty Rd. 73	1966			---	---	---	---	---	---	---	---	---	---
61	Clapton Farrow Culvert	27	1.43 km N. of Road 48	1948			---	---	---	---	---	---	---	---	---	$254,789
61	Clapton Farrow Culvert	27	1.43 km N. of Road 48	2010	Concrete repairs to culvert	5	---	$35,700	---	---	---	---	---	---	---	---
61	Clapton Farrow Culvert	27	1.43 km N. of Road 48	2010	Extend culvert	15	---	---	---	---	---	---	---	---	---	---
62	Kettle Creek No.2	37	4.3 km E. of Hwy No. 73	1959			---	---	---	---	---	---	---	---	---	---
63	Mapleton Culvert	74	0.20 km S. of Mapleton Line	*2010*			---	---	---	---	---	---	---	---	---	---
63	Mapleton Culvert	74	0.20 km S. of Mapleton Line	2010	Concrete repairs to culvert		---	---	---	---	---	---	---	---	---	---

Last Update to Report **27-Jan-14**

Table 1 - Component Inventory and Condition Report - Maintenance and Replacement Data

Facilities Management Plan - Culverts							Replacement Profile									
ID	Culvert Name	Road Number	Location	Year of Construction / Year of Inspection	2010 OSIM Inspections	Period for Repairs (years)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
64	Truman Culvert	74	0.50 km N. of Truman Line	*2010*			---	---	---	---	---	---	---	---	---	---
64	Truman Culvert	74	0.50 km N. of Truman Line	2010	Concrete repairs to barrel		---	---	---	---	---	---	---	---	---	---
65	Thompson Culvert	74	0.50 km N. of Thomson Line	*2010*			---	---	---	---	---	---	---	---	---	---
65	Thompson Culvert	74	0.50 km N. of Thomson Line	2010	Concrete repairs to barrel		---	---	---	---	---	---	---	---	---	---
66	York Culvert	74	0.30 km S. of Yorke Line	*2010*			---	---	---	---	---	---	---	---	---	---
66	York Culvert	74	0.30 km S. of Yorke Line	2010	Concrete repairs to culvert		---	---	---	---	---	---	---	---	---	---
67	Tunnel Culvert	19	0.05 km N. of Tunnel Line	1940			---	$706,745	---	---	---	---	---	---	---	---
67	Tunnel Culvert	19	0.05 km N. of Tunnel Line	2010	Brushing of stream	5	---	$1,020	---	---	---	---	---	---	---	---
67	Tunnel Culvert	19	0.05 km N. of Tunnel Line	2010	Repair slope failure on embankments	5	---	$2,040	---	---	---	---	---	---	---	---
68	Talbotville Culvert	3	0.3 km. W. of Sunset Road #4	1940			---	$562,397	---	---	---	---	---	---	---	---
69	Ford Culvert	3	1.40 km E. of County Line	1940			---	$890,461	---	---	---	---	---	---	---	---
70	Blacks Culvert	3	0.40 km E. of Blacks Road	1940			---	$1,023,562	---	---	---	---	---	---	---	---
71	New Glasgow Culvert	3	0.85 km W. of Furnival Road	1950			---	---	---	---	---	---	---	---	---	---
72	Mistele Culvert	3	0.10 km W. of Mistele Sideroad	1950			---	---	---	---	---	---	---	---	---	---
72	Mistele Culvert	3	0.10 km W. of Mistele Sideroad	2010	Brushing required	5	---	$2,040	---	---	---	---	---	---	---	---
73	Dunborough Culvert	3	0.85 km W. of Dunborough Road	1950			---	---	---	---	---	---	---	---	---	---
73	Dunborough Culvert	3	0.85 km W. of Dunborough Road	2010	Brushing required	5	---	$2,040	---	---	---	---	---	---	---	---
74	Coyne Culvert	3	0.25 km W. of Coyne Road	1950			---	---	---	---	---	---	---	---	---	---
74	Coyne Culvert	3	0.25 km W. of Coyne Road	2010	Concrete repairs to barrel	10	---	---	---	---	---	---	$5,631	---	---	---
75	Big Tree Culvert	3	1.30 km E. of Coyne Road	1940			---	$1,188,531	---	---	---	---	---	---	---	---
76	Willey Culvert	3	0.25 km E. of Willey Road	1950			---	---	---	---	---	---	---	---	---	---
77	Houghton Culvert	3	0.40 km W. of Houghton Raod	1990			---	---	---	---	---	---	---	---	---	---
78	Carter Culvert	3	0.98 km W. of Onedia Road	1950			---	---	---	---	---	---	---	---	---	---
79	Smoke Culvert	3	0.12 km E. of John Wise Line	1950			---	---	---	---	---	---	---	---	---	---
79	Smoke Culvert	3	0.12 km E. of John Wise Line	2010	Install erosion protection on embankments	5	---	$3,570	---	---	---	---	---	---	---	---
80	Paynes Mills Culvert	3	0.15 km E. of Paynes Mills Rd.	1960			---	---	---	---	---	---	---	---	---	---
81	Catherwood Culvert	73	0.30 km N. of Glencolin Line	1985			---	---	---	---	---	---	---	---	---	---
82	Faulds Culvert	73	0.20 km S. of Lyons Line	1950			$371,025	---	---	---	---	---	---	---	---	---
83	Bradley Creek Culvert	73	1.0 km South of Highway No. 3	1900			$312,443	---	---	---	---	---	---	---	---	---
83	Bradley Creek Culvert	73	1.0 km South of Highway No. 3	2010	Replace culvert	5	---	$408,000	---	---	---	---	---	---	---	---
84	Brock Culvert	3	1.7km West of Graham Road	1950			---	---	---	---	---	---	---	---	---	---
85	Putnam Road Culvert	Putnam	0.50 km S. of Century Line	1930			$384,120	---	---	---	---	---	---	---	---	---
						TOTAL REPLACEMENT & REPAIR COSTS	**$3,791,095**	**$5,278,983**	**$255,750**	**$460,780**	**$0**	**$443,885**	**$1,531,442**	**$914,399**	**$801,868**	**$506,009**

Note:

"Period for Repairs" Column - Timeline for repairs was given in OSIM reports as a multi-year window. For simplification in the spreadsheet, the high end of these windows generally were used, as follows:

10 + years	15	with note
6-10 years	10	with note
1-5 years	5	
Within 1 year	1	