



*Office of the Auditor General / Bureau du vérificateur général*

**FOLLOW-UP TO THE 2009 AUDIT OF THE  
BRIDGE MAINTENANCE PROCESS**

**2012**

**SUIVI DE LA VÉRIFICATION DU  
PROCESSUS D'ENTRETIEN DES PONTS DE 2009**

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## EXECUTIVE SUMMARY

### *Introduction*

The Follow-up to the 2009 Audit of the Bridge Maintenance Process was included in the 2011 Auditor General's Audit Plan. It was subsequently delayed as additional audit work was completed. It is now being presented as part of the Auditor General's 2012 Annual Report.

The key findings of the original 2009 audit included:

- The City's bridge maintenance program is generally effective.
- The City's overall bridge maintenance process has the necessary policies and procedures and most aspects are being completed according to Provincial Regulations.
- The City does not follow the Provincial methodology for detailed visual inspections. While this is permitted, the method used by the City does not meet all the requirements of the Regulation.
- Management has agreed with the Auditor General that it should adopt the Provincial process for these inspections.
- Although many of the structure files examined were incomplete, the complete files tend to be the most recent ones and those for more important projects.

### *Summary of the Level of Completion*

The table below outlines our assessment of the level of completion of each recommendation as of July 2013.

CATEGORY	% COMPLETE	RECOMMENDATIONS	NUMBER OF RECOMMENDATIONS	PERCENTAGE OF TOTAL RECOMMENDATIONS
LITTLE OR NO ACTION	0 – 24	-	-	-
ACTION INITIATED	25 – 49	-	-	-
PARTIALLY COMPLETE	50 – 74	-	-	-
SUBSTANTIALLY COMPLETE	75 – 99	-	-	-
COMPLETE	100	1, 2, 3, 4, 5, 6	6	100%
TOTAL			6	100%

### *Conclusion*

The City has made very good progress and has fully implemented all of the recommendations.

In September 2011, a failure of the Highway 174 Jeanne d'Arc 3.6 m diameter pipe occurred. We found that the pipe was classified by the City as part of a storm sewer in the City's asset management database. Consequently, it was not subject to the inspection and maintenance requirements of a structure under Provincial legislation for structures. The City's approach was confirmed by consultation with the Ministry of Transportation of Ontario; the cities of Toronto and Hamilton classify similar situations the same as the City. Based on a review of the characteristics of the 3.6 m diameter pipe, we concur that the pipe is part of the storm sewer system. The City's approach to the inspection of the storm sewer system follows a risk-based approach.

### ***Acknowledgement***

We wish to express our appreciation for the cooperation and assistance afforded the audit team by management.

## RÉSUMÉ

### *Introduction*

Le Suivi de la vérification du processus d'entretien des ponts de 2009 était prévu dans le Plan de vérification du vérificateur général de 2011. Il a été par la suite reporté alors qu'un travail de vérification supplémentaire était effectué. Il est maintenant présenté dans le cadre du Rapport annuel du vérificateur général de 2012.

Les principales constatations de la vérification de 2009 sont les suivantes :

- Le programme d'entretien des ponts de la Ville est en général efficace.
- Le processus global d'entretien des ponts de la Ville est doté des politiques et des procédures nécessaires, et la plupart de celles-ci sont effectuées conformément aux règlements provinciaux.
- La Ville ne suit pas la méthodologie provinciale relativement aux inspections visuelles détaillées. Bien qu'elle soit permise, la méthode utilisée par la Ville ne répond pas à toutes les exigences du règlement.
- La direction convient avec le vérificateur général qu'elle doit adopter la procédure provinciale relative à ces inspections.
- Bien que plusieurs des dossiers de structure examinés aient été incomplets, la vérification a établi que les dossiers plus récents et ceux qui concernent des projets d'importance sont plus complets.

### *Sommaire du degré d'achèvement*

Le tableau ci-dessous présente notre évaluation du degré d'achèvement de chaque recommandation au mois de juillet 2013.

CATÉGORIE	POURCENTAGE COMPLÉTÉ	RECOMMANDATIONS	NOMBRE DE RECOMMANDATIONS	POURCENTAGE DU TOTAL DES RECOMMANDATIONS
PEU OU PAS DE MESURES PRISES	0 – 24	-	-	-
ACTION AMORCÉE	25 – 49	-	-	-
COMPLÉTÉE EN PARTIE	50 – 74	-	-	%
PRATIQUEMENT COMPLÉTÉE	75 – 99	-	-	%
COMPLÉTÉE	100	1, 2, 3, 4, 5, 6	6	100 %
TOTAL			6	100 %

### *Conclusion*

La Ville a réalisé de grands progrès et a entièrement mis en œuvre toutes les recommandations.

L'effondrement de la conduite d'un diamètre de 3,6 m à la hauteur de la sortie Jeanne d'Arc de l'autoroute 174 s'est produit en septembre 2011. Nous avons constaté que la conduite était classée par la Ville, dans la base de données de la gestion des biens, comme étant une partie d'un égout pluvial. Par conséquent, elle n'était pas soumise aux exigences d'inspection et d'entretien de structure conformément à la réglementation provinciale concernant les structures. L'approche de la Ville a été confirmée par consultation avec le ministère des Transports; les villes de Toronto et de Hamilton utilisent la même classification que la Ville dans des cas similaires. En fonction d'un examen des caractéristiques de la conduite d'un diamètre de 3,6 m, nous sommes d'accord que la conduite fait partie du réseau d'égout pluvial. L'approche de la Ville en matière d'inspection du réseau d'égout pluvial suit une approche fondée sur les risques.

### **Remerciements**

Nous tenons à remercier la direction pour la coopération et l'assistance accordées à l'équipe de vérification.

## **1 INTRODUCTION**

The Follow-up to the 2009 Audit of the Bridge Maintenance Process was included in the Auditor General's Audit Plan.

The key findings of the original 2009 audit included:

- The City's bridge maintenance program is generally effective.
- The City's overall bridge maintenance process has the necessary policies and procedures and most aspects are being completed according to Provincial Regulations.
- The City does not follow the Provincial methodology for detailed visual inspections. While this is permitted, the method used by the City does not meet all the requirements of the Regulation.
- Management has agreed with the Auditor General that it should adopt the Provincial process for these inspections.
- Although many of the structure files examined were incomplete, the complete files tend to be the most recent ones and those for more important projects.

## **2 KEY FINDINGS OF THE ORIGINAL 2009 AUDIT OF THE BRIDGE MAINTENANCE PROCESS**

1. The Province of Ontario requires that all bridges be inspected at least every two calendar years, using the procedures in the Ontario Structure Inspection Manual (OSIM). This requirement is defined in the Public Transportation and Highway Improvement Act, R.S.O. 1990, c. P.50 under Standards for Bridges, Ontario Regulation 104/97. The Regulation allows use of procedures that depart from the OSIM procedures, where the procedures are not a marked departure from OSIM.
2. The inspections required every two calendar years are detailed visual inspections. Other inspections are carried out based on the results of the visual inspections and may include detailed condition assessments.
3. The Structure Information Management System was developed based on the former provincial database (Municipal Bridge Assessment Data Entry System or MBADES). SIMS was established for the City as part of the preparations for the Year 2000; the timing also was concurrent with the period during which the responsibility for the bridge inspections and database were transferred to the municipality.
4. SIMS follows the bridge appraisal system used in the MBADES database. Due to limitations in the database system, the data does not reflect the structure inspection system required by the current Ontario Structure Inspection Manual.

5. The City does not follow OSIM for the structure detailed visual inspections that are required at least once in every two calendar years. Instead, the City uses the methodology used for the MBADES system, comprising rankings of the various components of structures. Ranking ranges from 1 for a structure component in critical condition to 6 for a component in excellent condition. A ranking of 0 indicates that the specific item is not applicable.
6. The MBADES methodology provides inspection data and structure appraisal values that rely on subjective ranking assignments, rather than the more objective OSIM system, which provides evaluation of specific structural components, and any defects they may have.
7. The fact that the City does not follow the current OSIM for the bridge detailed visual inspections is allowed by the Regulation; however, the methodology used by the City, based on MBADES does not meet the requirements of the Regulation. Therefore, the system in use by the City does not meet Provincial legislative requirements.
8. We contacted the Ministry of Transportation's office in Kingston and St. Catharines. Discussions revealed that MTO does not consider that the old method of using Condition Ratings for the structure inspections is equivalent to the requirements of the OSIM and Ontario Regulation 104/97 as amended. The MTO indicated that methods which would qualify as alternatives within Ontario Regulation 104/97 are methods that also use detailed visual inspections of structure elements and that give a quantitative indication of the percentage of each element that has defects. The Ministry of Transportation indicated that use of MBADES for structure inspections does not meet the requirements of OSIM and the Regulation.
9. The method used by the City for ranking of structures to set their priority for maintenance and renewal is based on data mining and analysis software external to SIMS.
10. The Senior Engineer responsible for maintenance of SIMS and for the ranking of the structures was the only person fully trained in the overall system. As the system requires professional judgement in the assignment of risk values, the fact that no other person was trained to manage SIMS and the attached processes constituted a concern.
11. During this audit, the Senior Engineer resigned; as a result, for a time thereafter it was necessary for two staff persons to maintain the database. These two staff persons were required to add the database maintenance duties to their regular duties. The Senior Engineer position was filled in late 2008 by promoting a Project Manager in Construction Services.
12. Application of the Guidelines for Renewal Options Analysis and the Project Management Manual have improved the uniformity of the filing and record-

keeping methods used by different project managers. However, the City should improve the controls to ensure consistency between the project managers, as the quality of filing varies substantially.

13. Based on our sample, the studies, processes and methodologies used to manage the bridge assets are not always consistent and compliant with relevant policies, procedures and regulations, as noted below. The following table summarizes the results of our review:

Criteria	Number of Applicable Structures	Number of non-compliant Structures in relation to policies, procedures, and regulations	Percent Non-Compliant (Error Rate)
Inspections Interval	34	0	0.0%
Condition Survey	19	2	10.5%
Renewal Options Report	21	3	14.3%
Detail Design	30	4	13.3%
Contract Tendered	27	2	7.4%
Construction Done	27	0	0.0%
Inspections done by City	26	3	11.5%
Inspections by outside firm	26	4	15.4%
Shop Drawings	23	3	13.0%
Quality Assurance	25	11	44.0%
Records of construction	25	5	20.0%
As-Built Drawing on File	30	9	30.0%
Renewal Info to Database	33	0	0.0%

14. Of the 34 structure files examined, only 3 files could be considered fully complete, in that all the information required to be filed was included in the file. All other files reviewed were missing one or more items that they were expected to contain. The complete files tend to be the most recent ones and those for more important projects (for example, the Laurier Avenue Bridge and the Green Creek bridge).

15. Some as-built record drawings have not been included in the network server, although the copy marked up with red pencil or ink (known as the red-lined copy) is available. A checklist or similar method may help in confirming to the

program manager that all steps have been completed. In this regard, it is noted that the City already has procedures in the Project Manager Procedures Manual, but these are not being followed consistently.

16. Some records of quality assurance procedures have not been filed properly and could not be found. Consistent filing systems, as are now being implemented, should provide improvement of this issue.
17. Two structures had no information at all in their files. Information about the structures was included in the SIMS database, but there was no supporting data in the files. The structures had not had renewal work done since they were built circa 1975. Nevertheless, the City should have as a minimum a set of the original construction drawings on file. If none are available, the City should prepare the drawings from field information.
18. In two of the structures reviewed, the renewal work done in 2007 was resurfacing, completed as part of the road resurfacing contract. No condition survey or renewal options work was done to confirm that resurfacing was the only work required. We noted that the latest inspection sheets indicated a rating of "Very Good" for one of the structures (Structure No. 056060), but some repairs were required for the other (Structure No. 016200). We found no confirmation that the repairs were completed.
19. IM indicated that, although the Structure Inspections do not follow OSIM, the Condition Survey included a detailed survey of the structure using OSIM forms and methodology. Our review of Detailed Condition Survey reports showed that generally this is the case, but we found three cases in which the OSIM forms were not used in the Condition Survey.
20. Replacement of culverts during road reconstruction contracts did not receive as strict review by IM as when the structures are examined independently of the road contract. Three bridge-culvert reconstruction or extension contracts in the sample were part of road reconstruction or widening contracts. We found that in those cases the investigation of renewal options was not done with the same level of detail as when structures are analysed independent of the road work. In addition, the construction inspection, the field inspection records, review of shop drawings, and quality assurance records were not kept as well in those three cases as for other bridges or bridge-culverts.
21. One of the bridge-culverts, the Castlefrank Road culvert in Glen Cairn, was designed as part of the flood control project. In reviewing the reports and options examined, we concluded that the range of options reviewed could have included alternatives that were not examined. Some of the construction difficulties encountered may have been avoided this way. In our opinion, IM should be involved in the assessment of replacement options in similar cases.

22. In the case of the Fortune Street culvert, the design of the culvert replacement was carried out by a firm which did not have the qualifications and experience to complete the work, as evidenced by the fact that they had to retain a specialist firm to undertake a review of their design.
23. In three cases the renewal options report was required by the Request for Quotations (or Request for Service) issued by the City, and was included as a task in the Offer of Services or Proposal by the consultant, but was not produced. In the three cases noted, when we noted that the renewal options reports were not in the files, the City indicated to us that the renewal options report were not required, when in fact it was. Subsequently, the City provided the required reports.
24. In two cases, the files were not provided for our review because they were held by the Legal Services Branch due to the existence of outstanding construction claims. We note that both files were managed by the same Project Manager. The two files noted above were provided for our review upon further request. It was found that these two files are incomplete. Specifically, the files did not include records of quality assurance for concrete and asphalt; the inspector notes indicate that the information was received, but it is not in the files. The City subsequently clarified that only one file was held by Legal Services.
25. In one case (Structure 757210) we found no data at all in the file. The City indicated that this was the result of file retention policies. However, we noted that other two structures of approximately the same age did have part of their files available (these files also were not complete).
26. The City indicated that the File Retention Policies are based on the City's Records Management Policy, 2003. The Records Management Policy refers to the City's records retention and disposition schedule, which indicates that structure records must be kept inactive for 25 years. On this basis, the absence of records is appropriate. However, we note that records that are considered to have archival importance should not be destroyed. Since the structure (Structure 757210) was transferred in 2000, the structure records should have been available.

### **3 STATUS OF IMPLEMENTATION OF 2009 AUDIT RECOMMENDATIONS**

#### **2009 Recommendation 1**

**That the City ensure that the management of the database be fully documented in a manual and that training of the use of the database plus ranking of projects be provided to more than one person in the Infrastructure Management Division.**

**2009 Management Response**

Management agrees with the recommendation.

With the realignment that took place earlier this year in the Infrastructure Services Department (ISD), the former Infrastructure Management Division is now the Asset Management Branch (AMB). AMB has developed documentation on the management of the database. This documentation is expected to evolve as AMB migrates to a new structures management system in Q2 2011.

Within AMB, an intermediate level structural engineer reporting to the senior structural engineer has been created and staffed. This individual continues to be involved in the management of the database and on the prioritization of renewal projects.

**Management Representation of the Status of Implementation of Recommendation 1 as of January 31, 2011**

A manual has been created to document the management of the structures database. All staff in the Structures Section are familiar with this manual. In addition to the Senior Structural Engineer, the Asset Management Branch now has two intermediate structural engineers and both are involved in ranking of structural projects.

*Management: % complete* **100%**

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**OAG's Follow-up Audit Findings regarding Recommendation 1**

Management provided a copy of the "AMB Structures Guide to SIMS". Review of the Manual confirmed that the AMB has documented the management of the structures database. The methodology used for data mining of the database and for ranking of the structures is documented in a Master Spreadsheet used for the purpose.

With the addition of the intermediate structural engineers who are involved in ranking of structures there are now more than one person knowledgeable in the management of the database and ranking of the structures.

*OAG: % complete* **100%**

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**2009 Recommendation 2**

**That the City carry out bridge detailed visual inspections in accordance with current Ontario Structure Inspection Manual procedures to remove subjectivity of appraisals and to meet the requirement of current Provincial regulations.**

**2009 Management Response**

Management agrees with the recommendation.

AMB is working on modifications to its business processes and structures management system to align its visual inspections with the most recent Ontario Structures Inspection Manual (OSIM) requirements. AMB applies the OSIM requirements as part of detailed bridge condition assessments that take place prior to identifying specific renewal requirements.

The City is in the process of implementing a new Integrated Infrastructure Management System (IIMS). The structures management system is being implemented to align with the new IIMS. Funding for the new structure management system has been identified in the 2010 draft capital budget and the new system is expected to be completed by (Q2) 2011, subject to progress on the IIMS.

### **Management Representation of the Status of Implementation of Recommendation 2 as of January 31, 2011**

Staff in the Structures Section of the Asset Management Branch are familiar with the current Ontario Structures Inspection Manual (OSIM) procedures. With completion of the work on the Enterprise Asset Management (EAM) System (previously referred to as the Integrated Infrastructure Management System) and structures management system, in 2011, 80% of the inspections will be done in conformance with OSIM. By 2012, 100% of the inspections will be done in conformance with OSIM.

*Management: % complete* *80%*

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### **OAG's Follow-up Audit Findings regarding Recommendation 2**

The City provided a copy of the list of structures inspected in 2010 and the inspection plan for 2011. Review of the list confirmed that the approximately 89% of the structures scheduled for inspection in 2011 will be inspected using OSIM. As of the end of 2012, all structures are being inspected using OSIM.

In September 2011, a failure of the Highway 174 Jeanne d'Arc 3.6 m diameter pipe occurred. We found that the pipe was classified by the City as part of a storm sewer in the City's asset management database. Consequently, it was not subject to the inspection and maintenance requirements of a structure under Provincial legislation for structures. The City's approach was confirmed by consultation with the Ministry of Transportation of Ontario; the cities of Toronto and Hamilton classify similar situations the same as the City. Based on a review of the characteristics of the 3.6 m diameter pipe, we concur that the pipe is part of the storm sewer system. The City's approach to the inspection of the storm sewer system follows a risk-based approach.

*OAG: % complete* *100%*

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### **2009 Recommendation 3**

**That the City ensure that the updated Structure Asset Management Database currently under development be provided with the capabilities required to remove the need for data mining and analysis using external software.**

### **2009 Management Response**

Management agrees with the recommendation.

The new structures management system will have all the capabilities required for data management and analysis.

The City is in the process of implementing a new Integrated Infrastructure Management System (IIMS). The structures management system is being implemented to align with the new IIMS. Funding for the new structures management system has been identified in the 2010 draft capital budget and the new system is expected to be completed by (Q2) 2011, subject to progress on the IIMS.

### **Management Representation of the Status of Implementation of Recommendation 3 as of January 31, 2011**

The implementation of the new Enterprise Asset Management (EAM) System (previously referred to as the Integrated Infrastructure Management System) is underway and it will be a key component of the structures management system. The EAM is going through the procurement process and is expected to be implemented in Q2 of 2012. In the interim, work is ongoing on the application that will be used to manage the data from the inspection process. This application removes the need for data mining/analysis using external software.

***Management: % complete***

***100%***

### **OAG's Follow-up Audit Findings regarding Recommendation 3**

The City provided a copy of RFP No. 18110-20982-P01 Enterprise Asset Management (EAM) Solution, dated October 12, 2010 and which closed on November 15, 2010. The RFP indicates that it is intended that the EAM project will commence in May 2011 and that the EAM Solution will be operational by May 2012. As part of the RFP, the EAM Solution is intended to include the Infrastructure Management needs, and specifically the Asset Management needs. Review of the RFP indicates that the intention of the EAM Solution is "*to address the business needs of water and wastewater operations and to serve as the foundation for managing other assets such as bridges, roads, drains, etc. in the future.*" The RFP further indicates that "*The initial scope of the EAM Project and EAM Solution is concerned with inventory management and maintenance management specifically for water and waste water networks (water infrastructure and wastewater infrastructure). The City may expand the EAM Solution to include other asset classes.*" The needs of the Bridge Maintenance Process are included by the RFP specification that the EAM Solution must provide the

foundation to enable the City to manage other asset classes such as roads, bridges, trees.

The City has approved the development of a Scope and Approach document for a structures management system. This is building on the requirements identified in the current EAM implementation focused on water and sewer assets. This document, completed in 2012, defines the implementation requirements for a new bridge management system.

In our opinion, the actions taken to date by the City by starting the preparation of the EAM Solution represent an important step in satisfying the intent of Recommendation 3.

*OAG: % complete* **100%**

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**2009 Recommendation 4**

**That the City ensure that bridge-culvert projects undertaken as part of a road reconstruction project be reviewed in detail to confirm that the planning and design of the structure meets the requirements of the *Guidelines for Infrastructure Renewal Options Analysis*.**

**2009 Management Response**

Management agrees with the recommendation. This recommendation is consistent with Infrastructure Services' current procedure.

**Management Representation of the Status of Implementation of Recommendation 4 as of January 31, 2011**

This is consistent with Infrastructure Services' current procedure.

*Management: % complete* **100%**

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**OAG's Follow-up Audit Findings regarding Recommendation 4**

The City provided a copy of the draft sample Project Scoping Report for Integrated Road, Sewer and Watermain Program. The sample project requirements have a section on Structures. The Structures Section in the Project Scoping Report is developed specifically for each project.

*OAG: % complete* **100%**

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**2009 Recommendation 5**

**That the City implement a checklist or other management process to allow the program manager and the project manager to confirm that the inspection process has been completed, including the preparation of the As-Built drawings.**

**2009 Management Response**

Management agrees with the recommendation.

Infrastructure Services Department (ISD) has a Project Management Manual in place which defines project management requirements, communicates expectations and fosters consistency on all projects. The above-referenced requirements will be included in the manual by Q4 2010.

### **Management Representation of the Status of Implementation of Recommendation 5 as of January 31, 2011**

A departmental directive is being drafted that will reference a checklist or other management process to allow the program manager and the project manager to confirm that the inspection process has been completed, including the preparation of the As-Built drawings. This directive will be issued in Q2 2011.

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*Management: % complete* *50%*

### **OAG's Follow-up Audit Findings regarding Recommendation 5**

The City provided a copy of the Final Departmental Directive, which provides for a checklist of items and actions to be completed before closing a project file. The departmental directive was circulated to ISD staff on September 21, 2011.

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*OAG: % complete* *100%*

### **2009 Recommendation 6**

**That the City ensure that the project files are set up, maintained, and complete in accordance with the City's policies and procedures and the Project Management Manual.**

### **2009 Management Response**

Management agrees with the recommendation.

Infrastructure Services continues to improve adherence to proper project filing practices. While the audit concludes that only 3 of 34 structure files examined were complete in all aspects, it is noted that these structures span many decades and that filing practices have evolved over time. The four complete structure files represent projects undertaken since amalgamation and the adoption of the Project Management Manual in early 2006. The other 30 files contained over 85% of the required information.

Project filing requirements will be reviewed and reinforced in the Project Management Manual by Q4 2010.

**Management Representation of the Status of Implementation of Recommendation 6 as of January 31, 2011**

A departmental directive is being drafted that reinforces that project files are to be set up, maintained, and completed in accordance with the City’s policies and procedures and the Project Management Manual. This directive will be issued in Q2 2011.

*Management: % complete* **50%**

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**OAG’s Follow-up Audit Findings regarding Recommendation 6**

A departmental directive that reinforces that project files are to be set up, maintained, and completed in accordance with the City’s policies and procedures and the Project Management Manual was issued in September 21, 2011 to ISD staff.

*OAG: % complete* **100%**

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**4 SUMMARY OF THE LEVEL OF COMPLETION**

The table below outlines our assessment of the level of completion of each recommendation as of July 2013.

CATEGORY	% COMPLETE	RECOMMENDATIONS	NUMBER OF RECOMMENDATIONS	PERCENTAGE OF TOTAL RECOMMENDATIONS
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COMPLETE	100	1, 2, 3, 4, 5, 6	6	100%
TOTAL			6	100%

**5 CONCLUSION**

The City has made very good progress and has fully implemented all of the recommendations.

In September 2011, a failure of the Highway 174 Jeanne d'Arc 3.6 m diameter pipe occurred. We found that the pipe was classified by the City as part of a storm sewer in the City's asset management database. Consequently, it was not subject to the inspection and maintenance requirements of a structure under Provincial legislation for structures. The City's approach was confirmed by consultation with the Ministry of Transportation of Ontario; the cities of Toronto and Hamilton classify similar situations the same as the City. Based on a review of the characteristics of the 3.6 m diameter pipe, we concur that the pipe is part of the storm sewer system. The City's approach to the inspection of the storm sewer system follows a risk-based approach.

## **6 ACKNOWLEDGEMENT**

We wish to express appreciation to the staff and management for their cooperation and assistance throughout the audit process.