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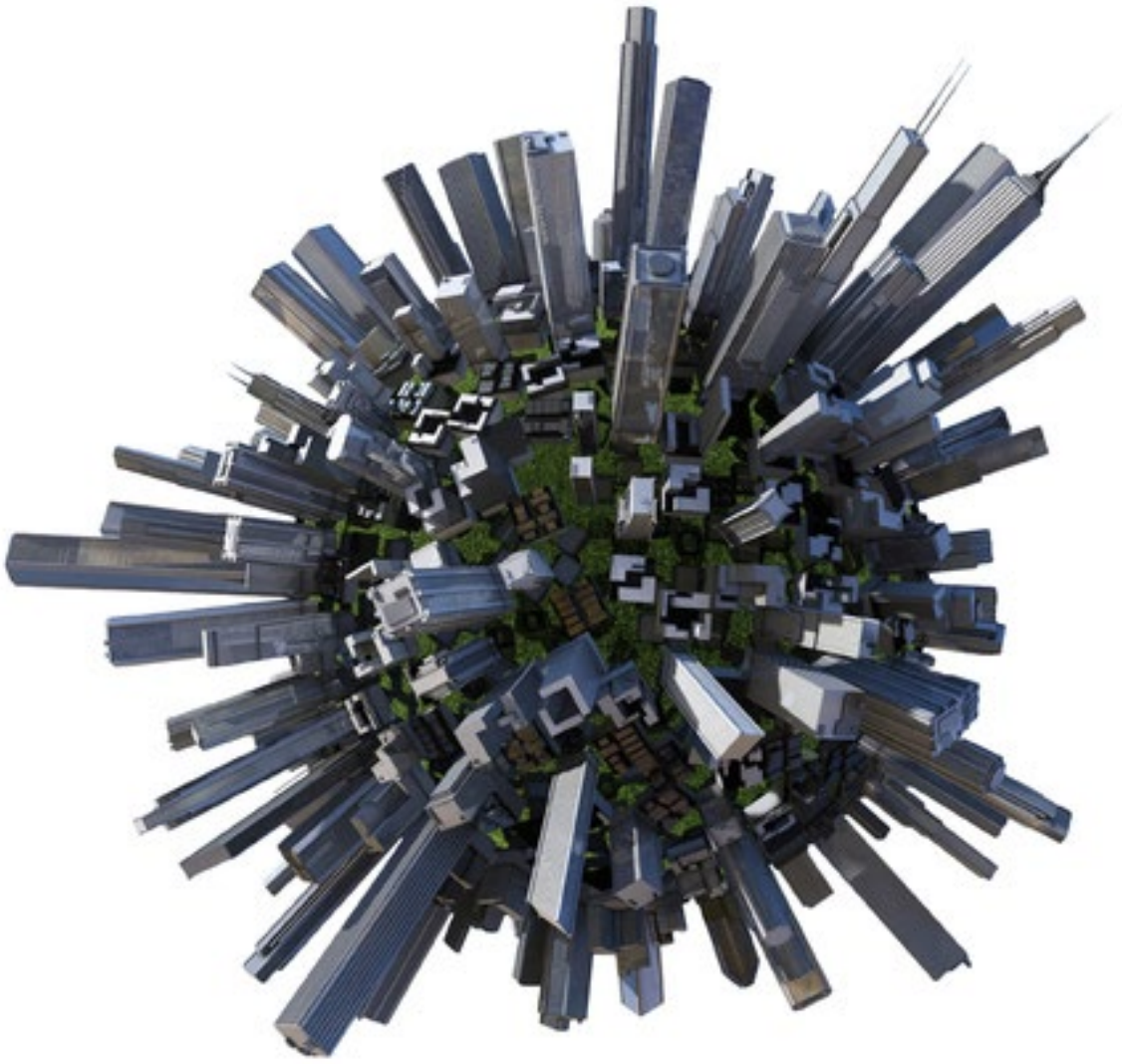

The Corporation of the City of London

Computerized Maintenance Management System (CMMS) Review

Audit Performed: October 2019 – November 2019
Report Issued: January 2020

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Executive summary

Background
The Computerized Maintenance Management System (CMMS) project's objective is to provide Water & Sewer departments a flexible and easy to use solution for staff to plan and schedule work activities and associated resources along with the ability to record and report on the association of these activities and resources to infrastructure assets. To help meet this objective the CMMS project is implementing the Cityworks software solution, purchased from ESRI Canada, who assisted with the Cityworks integration.

Objectives and scope
As part of the 2019 Internal Audit Plan, a pre-implementation review of the Corporation of the City of London's (the 'City') CMMS control framework was conducted. The purpose and objective of this review was to evaluate and assess the City's internal control framework that has been proposed and is currently being established for phase one of the CMMS implementation.

The detailed internal audit scope can be found in *Appendix 1: Internal audit detailed scope* of this report.

The scope of this audit is unchanged from the audit charter of July 31, 2019, however since that date changes have occurred to the scope of the Computerized Maintenance Management System (CMMS) project, and are summarized below.

- The objective of the CMMS project is the implementation of ESRI Canada's Cityworks application for planning, recording and reporting on operations and maintenance work done on City infrastructure.
- A phased implementation by department is planned with the Water and Sewer departments scheduled for Phase 1, Road Operations and Forestry for phase 2, and Parks and Solid Waste for Phase 3. The implementation date for Phase 1 (Water and Sewer) on the Cityworks application was Sept. 30, 2019.
- The Sept. 30 date was postponed, supported by a change request, due to not having defined business processes to support the Finance interfaces. The revised implementation date was Oct. 31. At this time the Finance interfaces were removed from scope, a date for their activation to be determined. In addition, the concept of a "soft launch" was proposed, which reduced the number of field functions to be implemented. The intent was to minimize impact to the field by rolling out field functions over a longer time period. The reduction in implementation scope for Oct. 31 was large, with one of sixteen Water filed functions going live and none of the sixteen Sewer field functions going live on Oct. 31.
- The Oct. 31 date was delayed by one week, supported by a change request, to accommodate additional end user training. The revised implementation date was Nov. 4.
- On Nov. 11 the implementation of Cityworks for Water was stopped, with no further activity to occur in the Cityworks application. Pre-Cityworks processes and tools are to remain in use while the project team re-plans activities and determines a new implementation date for Cityworks, which is not expected to occur in 2019.

While the CMMS scope has changed, the risks related to the project are not mitigated by the degree of functionality being implemented. The observations in this report are applicable regardless of the scope of the functionality being initially implemented.

Strengths
In completion of this assessment, we identified the following areas of strengths.

Areas for continued enhancement
Based on our review of the City's control framework for a Computerized Maintenance Management System (CMMS), we identified six high priority observations, four medium priority observations, one low priority observation and one leading practice recommendation that management should consider going forward. Please refer to *Appendix 2: Internal Audit rating scale* for definitions of the four-point scale.

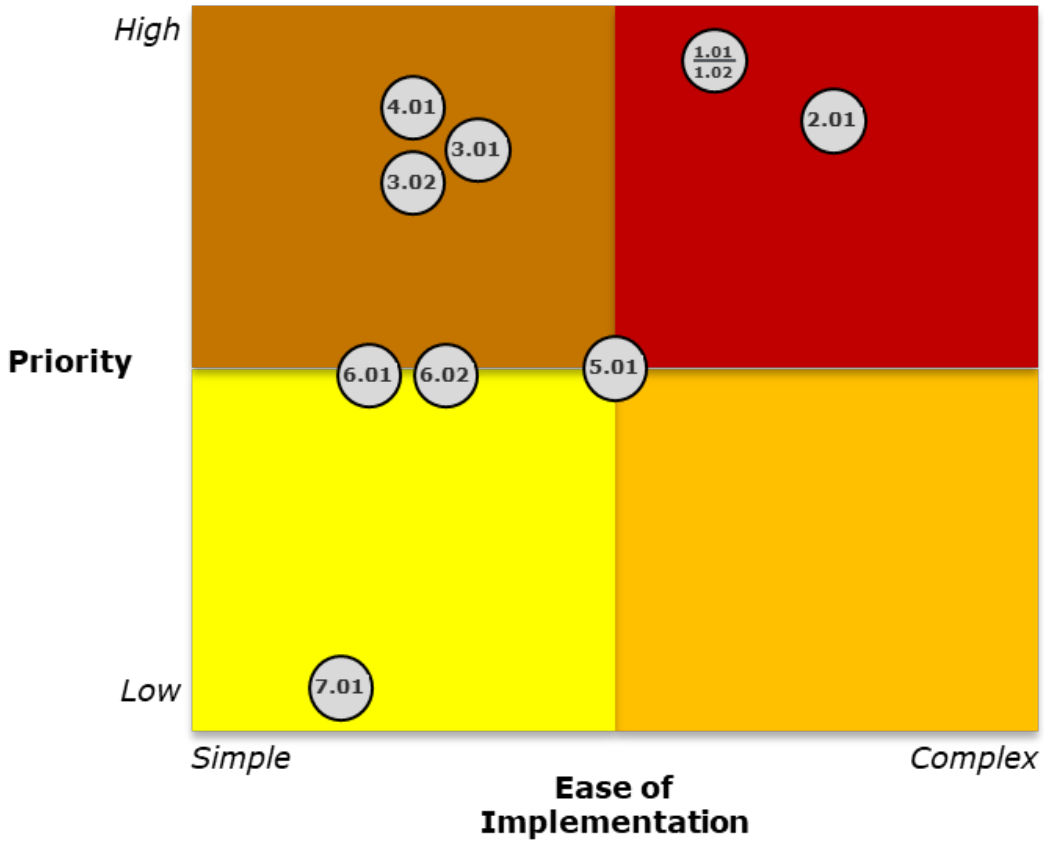
High priority	Medium priority	Low priority	Leading practice
6	3	0	1

Priority	Observation item	Observation description
High	CMMS 1.01	**Communication:** A high-level outline for a communications plan exists, but dates back to the previous project manager's tenure and has not been actioned.
High	CMMS 1.02	**Training:** CMMS project training for Cityworks is ad-hoc, and has been presented re-actively, one week prior to implementation.
High	CMMS 2.01	**Documentation and approval of business process controls**: Business process mapping sessions have not occurred within the various work streams to design the current business processes and associated controls for CMMS. In addition, approval processes and timelines have not been identified.
High	CMMS 3.01	**Interface strategies**: None of the interface strategies have a designated "final" version formally approved by the program leadership (Program Sponsor, Steering Committee).
High	CMMS 3.02	**Report strategy**: The CMMS project does not have a reports strategy as part of the implementation plans for the Cityworks application. Team members have minimal knowledge of the core reports delivered within the Cityworks application.
High	CMMS 4.01	**Segregation of access and change documentation:** There is a lack of segregation of duties in the change management process. In addition, testing and approval of changes prior to moving to production is not documented.
Medium	CMMS 5.01	**Key performance indicators (KPIs) and performance metrics:** Critical KPIs and performance metrics have not been established for CMMS.

Medium	CMMS 6.01	**User access provisioning (de-provisioning):** There is no formalized process for management to approve access and segregate duties prior to provisioning.
Medium	CMMS 6.02	**Password configuration**: The Cityworks application password configuration does not comply with the City's Password Policy.
Leading Practice	CMMS 7.01	**Data conversion requirement:** There is no requirement for the conversion of legacy data into the Cityworks application. No formal documentation of this fact exists.

Priority heat map

Based on our assessment of the City's control framework for a Computerized Maintenance Management System (CMMS), the following image maps areas of continued enhancement based on priority and anticipated ease of implementation of our leading practice recommendations.



Conclusion

Based on our assessment of the City's control framework for a Computerized Maintenance Management System (CMMS), we have identified six high priority observations, four medium priority observations, one low priority observation and one leading practice recommendation that should be addressed to improve internal controls and process efficiency. The identified considerations and observation noted in this report should be addressed in a timely manner to enhance current controls and mitigate relevant risks.

Strengths

In the completion of this assessment, internal audit noted the following areas of strength:

IT Operations: There is a plan in place for the Cityworks application to backup data on a regular basis according to an established schedule and frequency. In addition, batch jobs have been appropriately configured to run as scheduled tasks to support the various interfaces to the system from Dynamics Customer Relationship Management (CRM) and JD Edwards financial system.

Infrastructure Plan: An infrastructure plan has been established by the Cityworks vendor, ESRI, and the City, including system specifications, system architecture review, and capability to maintain infrastructure in a state of good repair as well as cope with growing demand through capacity planning workshop.

Deployment Plan: A plan to deploy CMMS Phase 1 to production has been established and contains the steps for pre-deployment, deployment and post-deployment. Tasks of the plan are tracked and managed through the City's Team Foundation Server (TFS).

Areas for continued enhancement

In completing the procedures noted in *Appendix 4: Audit procedures performed*, internal audit identified the following areas for continued enhancement:

CMMS 1.0 – CMMS project governance		
	High Priority	**CMMS 1.01 – Communication**
Observation		The objective of a communications plan is to communicate project status to all stakeholder groups during the project lifecycle. It is normal for the scope of communications to evolve as the project progresses, from user awareness, to building consensus, to establishing commitment, to facilitating and supporting implementation activities. A key activity conducted early in the communications plan is a stakeholder analysis which identifies stakeholders; groups them according to their levels of participation, interest, and influence in the project; and determines how best to involve and communicate to each of these stakeholder groups throughout. Communications tasks are included in the project plan. At present a one page high level outline for a communications plan exists, however it dates back to the previous project manager's tenure, lacks the detail noted above, and has not been actioned. Formal communications are not occurring.
Implication		Without stakeholder alignment on the project's objectives and how those objectives are to be achieved, there is risk of varying expectations regarding what the project is to achieve, which will result in dissatisfaction with the end product, and the potential for rework leading to increased costs.
Recommendation		Management should perform the following activities: 1. Develop and execute a change management plan as defined above, to align stakeholders on project objectives and how those objectives are being achieve; and 2. Consider appointing a designated resource specializing in communication, for the CMMS program. This part time role would report directly to the CMMS project manager.
Management comments and action plan		*Management agrees and will take the following actions:* *Action Plan* *1. Update the existing Communication Plan.* *2. A resource has been identified to assist the PM with communication duties.* *3. A new CMMS Office has been created at AJ Tyler (site of Phase 1 stakeholders) and the Cityworks Administrator will work from this office full-time and the Project Manager near full-time. This will allow more frequent communication with management as well as field staff.*

Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems*	*February, 2020*
High Priority	**CMMS 1.02 – Training**	
Observation	The objective of a training plan is to educate end users on the use of the new application, as well as any changes in their job function. A training plan identifies trainees, groups them according to role, defines a curriculum for each role, identifies the training methods and courses to be developed. Training tasks are included in the project plan. CMMS project training for Cityworks is ad-hoc, and has been presented re-actively, one week prior to implementation.	
Implication	There is risk of work delays, re-work through correction of errors, the perception of project failure, and poor user adoption of the solution are risks resulting from: • Untrained, or poorly trained end-users who are unable to use the Cityworks application effectively, • Insufficient time to update/correct training materials based on feedback when training is delivered one week prior to implementation.	
Recommendation	Management should perform the following activities: 1. Develop and execute a training plan as defined above, including the creation of training materials (e.g. electronic help functions, "cheat" sheets") to best equip end users for success when using the new Cityworks application. 2. Deliver training in a timely manner, as part of the UAT test cycle, and consider refresher training at implementation based on the roll out schedule of when functionality and impacted users is introduced. 3. Consider appointing a designated resource specializing in training, for the CMMS program. This part time role would report directly to the CMMS project manager. A specialized training resource (or function) adds value through their; independence from the core project team (non-biased approach), ability to leverage a range of training techniques (classroom, video, computer based training), and expertise in the creation of "help" functions. An independent training function would be available to all projects and departments within the City, providing a consistent approach to both materials and delivery methods.	
Management comments and action plan	*Management agrees and will take the following actions:* *1. Develop and execute a training plan that includes sufficient scheduling to ensure staff are comfortable prior to launch.* *2. Create simple training materials such as one-page cheat sheets and presentation materials.*	

	3. Identify a dedicated training coordinator.	
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems*	*April 2020*

CMMS 2.0 – Business process controls	
High Priority	**CMMS 2.01 – Documentation and approval of business process controls**
Observation	Business requirements and workflows for the various work streams have been documented in the CMMS Business Requirements Document (BRD). However, business process mapping sessions have not occurred within the various work streams to design the current business processes and associated controls for CMMS. In addition, approval processes and timelines have not been identified.
Implication	While it is realistic for certain items within the processes to be in flux until go-live, the risk exists that without formal and signed-off documentation being maintained, the City may be unable to affirm with confidence that: • Processes were designed after taking into account relevant considerations; • Feedback from relevant stakeholders was incorporated into the designed business processes; and • Robust controls were designed to mitigate identified risks.
Recommendation	Management should ensure that business processes and controls are designed and formally documented with appropriate signoffs being received by accountable parties at each stage of the CMMS implementation. In addition, the outputs generated from this documentation may be used as an input for training and change management purposes.
Management comments and action plan	*Management agrees and will take the following actions:* *1. Stakeholder workshops will be used to review the Business Processes and update the UAT scripts.* *2. Stakeholders will sign off on the contents of the UAT scripts to ensure business processes are being properly represented. Sign-off will also be sought following successful completion of the UAT phase.*
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems* — *April 2020*

CMMS 3.0 – Data mapping and management	
High Priority	**CMMS 3.01 – Interface strategies**
Observation	Five interfaces from the JD Edwards financial application into Cityworks are defined; Data Broker, Work Orders, Costs, Material, and Employee Master. Each interface has a detailed development strategy, which include; scope, solution overview, use cases, and technical processes and elements - including data mapping. The interface strategies each include a table to track version changes by date, however none of the interface strategies has a designated "approved" version formally approved by the program leadership (Program Sponsor, Steering Committee).
Implication	Without approvals which formalize each interface strategy, there is risk of misinterpreting the interface design and delivering an incomplete solution. Multiple document versions leads to confusion on which version is current and should be tracked to.
Recommendation	Management should formalize the approval of the final interface strategy documents by the Project Manager, Sponsor and the Steering Committee.
Management comments and action plan	*Management agrees with the observation and will take the following actions:* 1. *Interface design documents known to be final (currently stored in a folder called Final) will be pulled and designated as final to avoid confusion going forward in the project.* 2. *Going forward Interface design documents will be presented to the steering committee for approval.*
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems* — *February, 2020*

	High Priority	CMMS 3.02 – Report strategy
Observation		As is typical of 3rd party software, Cityworks includes a series of delivered reports (and queries). Using the Cityworks delivered reports as a baseline, the standard approach to a reporting strategy is to: • Map the City's reporting requirements to the vendor's (Cityworks) delivered core reports. • Identify Cityworks delivered core reports which can be used unchanged. • Identify Cityworks delivered core reports which require modification. Include in project planning the development and testing of core report modifications. • Identify net new reports required not delivered by Cityworks. Include in project planning the development and testing of net new reports. • For all reports, identify recipients, mode of distribution (paper, electronic), and frequency of creation to enable reporting to begin immediately upon system implementation. The CMMS project does not have a reports strategy, and team members have minimal knowledge of the core reports delivered by the Cityworks. The current approach to reporting is to address post-implementation.
Implication		Not having core reports defined for implementation day is a critical gap in the delivery of the Cityworks application and limits the end users in their ability to provide management with meaningful information for informed decision-making.
Recommendation		Management should perform the following activities: 1. Develop and execute a reports strategy as defined above, for core reports, which will enable reporting to begin as part the Cityworks implementation. 2. As noted in prior observations, it is important that approvals surrounding the reports strategy and individual report designs are included in the process.
Management comments and action plan		*Management agrees with the observation and will take the following actions:* *1. Develop a reports strategy for core reports. Strategy will include design elements of individual reports.* *2. Report Strategy to follow appropriate approval process (e.g. user stakeholders → steering Committee)*
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems*	*May, 2020*

CMMS 4.0 – Change management of Cityworks application controls	
High Priority	**CMMS 4.01 – Segregation of access and change documentation**
Observation	There is a lack of segregation of duties in the change management process for Cityworks (e.g. users have access to the development environment and to promote changes to the production environment). Furthermore, it was noted that the Cityworks application does not have the functionality to generate system change listings. Hence, changes are currently only being logged manually and will be captured in the IT Service Portal service requests post go-live.
Implication	There is risk that inappropriate changes are made to application systems or programs that contain relevant controls (i.e., configurable settings, automated algorithms, automated calculations, and automated data extraction) and/or report logic.
Recommendation	Management should perform the following actions: 1. Segregate access to development and access to promote changes to production environment and/or implement management review of changes according to an established frequency (i.e. quarterly) where the following is reviewed by appropriate management: • Complete and accurate population of all application changes; • Whether changes followed the formal change management process (were tested and approved prior to implementation); • Segregation of duties was maintained between the developer and implementer of the changes; and, • Change management process were initiated in a timely manner for changes flagged as exceptions during the review. 2. The IT Service Portal service requests listing, as pertain to changes to Cityworks, should be reviewed by management according to an established frequency (i.e. quarterly) for completeness and accuracy.
Management comments and action plan	*Management agrees with the observation and will take the following actions:* *1. We will create a group called "Cityworks" in the ITS Service Portal application. This will facilitate a single point of contact for users requesting access or application changes The Service Portal workflow with generate an email to the "Cityworks" group to alert the administrator of the request. Application access requests will be reviewed and approved by CityWorks Administrator.* *2. Creation of the CityWorks Working Team consisting of Business and IT stakeholders and led by the Cityworks Project Manager. The CityWorks Working Team will provide updates to the CMMS Steering Committee. The Working Team will review application change requests and enhancements on a regular basis to ensure validity and prioritization for future upgrades/application releases.*

Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems*	*March, 2020*

CMMS 5.0 – Performance metrics	
Medium Priority	**CMMS 5.01 – Key performance indicators (KPIs) and performance metrics**
Observation	It was noted that the designation of critical KPIs and performance metrics has not occurred for the Cityworks application. Hence, no KPI or performance metric reports have been drafted and discussed in meetings. Examples of performance KPI's include: application response times (by function), application availability targets (and actuals).
Implication	Without the designation of critical KPIs and performance metrics, there is the risk that minimum performance standards will not be enforced. Furthermore; performance will not be accurately and consistently tracked and documented.
Recommendation	The CMMS project in conjunction with key stakeholders should designate critical KPIs and performance metrics, approved by management, for the Cityworks application. Once Cityworks is live, management should formally track, discuss and report performance measurements against KPIs according to an established frequency.
Management comments and action plan	*Management agrees with the observation and will take the following actions:* *1. The PM will work with stakeholders to define the KPI and related reporting process.* *2. Resulting KPI report document will outline the KPI, its means of reporting, and frequency.*
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems* — *April, 2020*

CMMS 6.0 – Access security IBusiness controls	
Medium Priority	**CMMS 6.01 – User access provisioning (De-provisioning)**
Observation	The process for user provisioning (de-provisioning) to the Cityworks application consists of an application administrator granting (removing) access to a user after receiving a user provisioning (de-provisioning) request and approval through email. There is no formalized process whereby prior to provisioning (de-provisioning) appropriate management approves access to Cityworks, and confirms segregation of duties is maintained between the approver and the person granting (revoking) the access in the system.
Implication	There is risk that users may have access privileges beyond those necessary to perform their assigned duties.
Recommendation	A formalized process should be established whereby prior to provisioning (de-provisioning) appropriate management approves access to Cityworks and confirms segregation of duties is maintained between the approver and the person granting (revoking) the access in the system. Similar documentation is required when a user changes roles resulting in a change to their security profile.
Management comments and action plan	*Management agrees with the observation and will take the following actions:* 1. *City will start using the IT Service Portal to manage user access to Cityworks application in March 2020. Cityworks Configuration documents will be reviewed and improvements leading to clarification on roles and how they are assigned will be included.* 2. *The Cityworks administrator will maintain this document and consult operations stakeholders when questions arise over a particular user being added or removed.*
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems* — *March, 2020*

Medium Priority	CMMS 6.02 – Password configuration
Observation	The Cityworks application password configuration does not comply with the City's Password Policy, as password parameters are not configured on the Cityworks application layer. It was noted that while desktop users authenticate through the City's Windows Active Directory (AD), field users authenticate through the Cityworks application's internal configuration.
Implication	There is a risk that systems are not adequately configured or updated to restrict system access to properly authorized and appropriate users. In addition, there is also a risk that the system password parameters are not in accordance with City's requirements.
Recommendation	Management should configure the password parameters on the Cityworks application layer to be in accordance with the City's password policy. As for technical system limitations within Cityworks for certain password parameters, management should communicate to field users that they should set their passwords in accordance with the City's password policy.
Management comments and action plan	*Management agrees with the observation and will take the following actions:* *1. Replicating the corporate password policy as closely as Cityworks permits.* *2. Follow the strategy which has already been developed. The Password Management Processes and Activities document.*
Responsible party and timing	*Gary Stronghill, Manager, Geospatial Information Systems* — *March, 2020*

CMMS 7.0 – Data mapping and management	
Leading Practice	**CMMS 7.01 – Data conversion requirement**
Observation	Through discussions with City management, Internal Audit noted that there is no requirement for the conversion of legacy data into the Cityworks application, nor does formal documentation of this fact exist.
Implication	Insufficient documentation of management practices could lead to undesired process activities and may restrict new management from fully understanding relevant processes and controls when undertaking their responsibilities.
Recommendation	Management should formalize documentation, with approvals, to reflect that there is no requirement for the conversion of legacy data.

Appendix 1: Internal Audit detailed scope

Specifically, the internal audit addressed the following areas:

Reviewed and assessed the City's governance structure and change management plans for the new CMMS

- ✓ Reviewed the roles and responsibilities including job descriptions and assessed adequacy of the structure to effectively govern CMMS in production;
- ✓ Reviewed and assessed the City's change management plan and approach to identify and engage (e.g., communicate, coach, train, etc.) relevant management and staff; and
- ✓ Reviewed the CMMS strategy and assess its capability to maintain infrastructure in a state of good repair as well as cope with growing demand.

Reviewed and assessed the design of business processes and relevant controls surrounding the new CMMS

- ✓ Assessed the internal control framework currently designed for related business processes surrounding CMMS including IT general controls and user access controls;
- ✓ Evaluated the internal control framework to ensure an optimum mix of manual and automated controls will be implemented;
- ✓ Assessed related process documentation to demonstrate linkages to applicable laws and regulations as well as City expectations (i.e., City Policy); and
- ✓ Evaluated the design of oversight of operational activities including monitoring activities and criteria for follow-up.

Reviewed and assessed the requirements gathered by the City for the new CMMS

- ✓ Reviewed and assessed the procedure to gather, validate and approve requirements;
- ✓ Reviewed and assessed the mapping of approved requirements to delivered CMMS functionality; and
- ✓ Reviewed and assessed the gap management process.

Assessed the approach for data mapping and data management for the new CMMS

- ✓ Reviewed the planned data mapping and data management controls and assessed its effectiveness to create, maintain, and protect complete and accurate information; and
- ✓ Reviewed plans for CMMS reporting and assured it is effectively designed to provide management with meaningful information for informed decision-making.

Appendix 2: Internal Audit rating scale

Individual observation prioritization
Internal Audit has prioritized each observation and recommendation within this report using a four point rating scale. The four point rating scale is as follows:

Description	Definition
High	Observation is high priority and should be given immediate attention due to the existence of either significant internal control risk or a potential significant operational improvement opportunity.
Medium	Observation is a moderate priority risk or operational improvement opportunity and should be addressed in the near term.
Low	Observation does not present a significant or medium control risk but should be addressed to either improve internal controls or process efficiency.
Leading Practice	Consideration should be given to implementing recommendations in order to improve the maturity of the process and align with leading practices.

Appendix 3: Stakeholder involvement

In conducting this assessment, the following management and staff were interviewed to gain an understanding of the City's Computerized Maintenance Management System (CMMS) processes and practices.

Stakeholder	Position	Division
Scott Mathers	Director	Water and Wastewater
Doug MacRae	Director	Roads and Transportation
Lori Kolodia	Division Manager	Information Technology Services
Gary Stronghill	Manager	Infrastructure Systems
Dean Thompson	Manager	Information Technology Services
Scott Koshowski	Engineer	Environmental Services

Appendix 4: Audit procedures performed

As part of the Computerized Maintenance Management System (CMMS) pre-implementation review, the following procedures were performed:

- ✓ Conducted a planning meeting (June 2019) with the Managing Director of Environmental & Engineering Services and City Engineer, Managing Director of Corporate Services and City Treasurer and Chief Financial Officer, Director of Information Technology Services, Director of Water and Wastewater, and Director of Roads & Transportation.
- ✓ Updated and issued a finalized Project Charter and request for information;
- ✓ Conducted meetings and interviews with City management and staff to obtain an understanding of the project management and control framework for the CMMS implementation;
- ✓ Obtained documentation regarding relevant procedures and controls to perform an inspection of:
  - Cityworks Infrastructure Review
  - Cityworks Deployment Plan
  - Team Foundation Server Requirements
  - IT Controls: Operations, Access Security and Change Management
  - Interface Strategy
  - Project management artefacts pertaining to requirements, interfaces, communications, training, change management, risk management, cutover planning, and status reporting
- ✓ Drafted preliminary observations and verified observations with management;
- ✓ Conducted a closing meeting with key management stakeholders to validate and communicate our findings; and
- ✓ Issued this internal audit report with our detailed observations.

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