

Report Number: FIN 25-19

Date: December 16, 2019

From: Stan Karwowski
Director, Finance & Treasurer

Subject: Audit and Accountability – Service Review Report

Recommendation:

1. That Council receive report FIN 25-19 for information in regards to service review report for Public Wi-Fi; Building Permits & Fleet Management Solutions;
 2. That staff be directed to include in the 2020 draft capital budget submission a new fleet management system and where applicable, apply for Provincial grant funding; and
 3. That the appropriate City of Pickering officials be authorized to take the necessary actions as indicated in this report.
-

Executive Summary: On May 21, 2019, the Premier announced the creation of the Audit and Accountability Fund with funding of \$7.35 million for large urban municipalities interested in conducting service delivery and administrative expenditure review with the goal of finding efficiencies while protecting front line City services. Council approved staff applying for this grant under report FIN 14-19 (Attachment 1).

The City was successful in obtaining grant funding (\$100,000) and hired Deloitte LLP to conduct a review of the following three items: provision of Public Wi-Fi; building permit process and fleet management system. Deloitte's report is attached for information and as a condition of the grant funding will be posted on the City's website.

The public Wi-Fi section of the report examined the City's current state of Wi-Fi deployment, took into consideration the provision or availability of free public Wi-Fi provided by the private sector and provided options for the City to consider. The building permitting process examined current processes (that is heavily paper based) and identified opportunities and possible efficiencies with a more interconnected (24/7 electronic application system) and its benefits. The City's existing fleet management system and vehicle tracking are "old systems" that need to be replaced in order to

approve efficiencies and cost savings. In addition, a new system may also lead to increased worker safety and possible insurance premium savings.

Based on Deloitte's recommendation and recognizing the need to prioritize the City's investment of critical resources including staffing, recommendation two directs staff to prioritize the delivery of a new fleet management system. In addition, the Province has announced possible future grant funding opportunities under the "Audit and Accountability" umbrella through a Municipal Modernization Program and the fleet management software system would be an excellent candidate due to fact it was increase staff efficiencies that translates into cost savings to the taxpayer.

Financial Implications: The Audit and Accountability Fund covered 100 per cent of the City's costs for delivery of the consultants' report. The fleet management system represents for the City, the "best bang for the buck" due to the fact it can deliver possible cost savings up to \$308,000 (page 106) per year. The Province under the Municipal Modernization Program has announced grant funding in the amount of \$125 million through 2022-23 and City staff will be pursuing this opportunity to help support the cost and implementation of the fleet management system.

Discussion: The Audit and Accountability exercise was a beneficial to the City due to the fact it identified "low hanging fruit" from an efficiency and cost savings perspective. With the possibility of further grant announcements related to "Audit and Accountability", the City is well positioned to take advantage of these opportunities due to the fact the background work and justification has been completed through this exercise.

Attachments:

1. Report FIN 14-19 regarding Provincial Audit & Accountability Fund
2. Service Review Report on Public Wi-Fi, Building Permits & Fleet Management Solutions

Prepared / Approved By:

Original Signed By:

Paul Bigioni
Director, Corporate Services & City Solicitor

Prepared /Approved By:

Original Signed By:

Stan Karwowski
Director, Finance & Treasurer

Recommended for the consideration
of Pickering City Council



Dec. 10, 2019

Tony Prevedel, P.Eng.
Chief Administrative Officer

REVISED**Report to
Council****Report Number:** FIN 14-19**Date:** June 24, 2019

From: Stan Karwowski
Director, Finance & Treasurer

Subject: Provincial Audit and Accountability Fund

Recommendation:

1. That Report FIN 14-19 of the Director, Finance & Treasurer be received;
2. That staff be directed to submit an Audit and Accountability Fund: Expression of Interest for grant funding to the Ministry of Municipal Affairs and Housing Central Region by June 30, 2019 deadline;
3. That Council grant the Chief Administrative Officer and the Director, Finance & Treasurer the authority to single source a third party consulting engagement in accordance with the City's Purchasing Policy Item 10.03 and not to exceed \$100,000 should the City of Pickering's request for funding be approved by the Ministry of Municipal Affairs and Housing; and
4. That the appropriate City of Pickering officials be authorized to take the necessary actions as indicated in this report.

Executive Summary: On May 21, 2019, the Premier announced the creation of the Audit and Accountability Fund with funding of \$7.35 million for large urban municipalities and district school boards interested in conducting service delivery and administrative expenditure review with the goal of finding efficiencies while protecting front line services.

Projects that are eligible can take the following forms:

- A line-by-line review of the municipality's entire budget.
- A review of service delivery and modernization opportunities.
- A review of administrative processes to reduce costs.

As part of the annual budget process, the City conducts a line-by-line review of the operating budget and detailed scrutiny of the capital budget to find savings. Staff are recommending that the review focus on assessing the implementation of free WIFI in all public property and study implementation of new technology to better serve Pickering residents.

Financial Implications: The Audit and Accountability Fund covers 100 per cent of the eligible costs, that includes the costs associated with a third-party consultant. The estimated eligible costs for this project is estimated to be up to \$100,000. This cost reflects the total cost of the third-party consultant including non-recoverable HST.

In the event the City receives confirmation written or otherwise of the Grant funding being awarded, Recommendation 3 provides staff the authority to proceed with the award of the sole source contract and hence expediting the commencement of the work required.

Discussion: In a May 21st news release Premier Ford announced that “the Ontario government is offering to help large urban municipalities protect core public services for future generations by finding savings of four cents on every dollar spent. He announced that the government is providing \$7.35 million for large urban municipalities interested in conducting municipal service delivery expenditure reviews to identify potential savings, while maintaining vital front-line services, through the “Audit and Accountability Fund.”

Through the Audit and Accountability Fund, the Ontario government is offering large municipalities funding to undertake a third-party expenditure review of their service delivery and administrative expenditures with the goal of funding efficiencies and to modernize service delivery while protecting front-line jobs.

On May 29th, Pickering was notified that the Expression of Interest (EOI) forms were being accepted for funding until June 28th. EOI submissions will be reviewed on a case-by-case basis. Funding amounts may depend on the available appropriation. This funding covers 100 per cent of the cost of a consultant/third party. **Internal municipal costs are considered ineligible.**

The grant was released May 29th and the application process consists of two steps: June 14, 2019 – notify Ministry of intention to apply followed by a submission of an Expression of Interest (EOI) to the Province by Friday, June 28, 2019. The City notified the Province before June 14th that the City would be putting forward an EOI. By completing this step, staff kept the “Door Open” for the grant funding process, however, the City is not legally bound to complete Step Two. If Recommendation 2 is approved, staff will complete the EOI for submission on or before June 28, 2019. **If Council does not approve Recommendation 2 – no application will be submitted.**

EOI forms will be reviewed and approved by the Province as they are received. Our understanding is that notification of the approval, or denial, of our EOI will be in July. It is our understanding that the eligible cost to date to commence expenditures will coincide with the receipt of verbal or written approval for the grant and that a formal Transfer Payment Agreement will follow for execution later this summer.

As part of the funding agreement requirement, Pickering is required to “**Publicly post the study results**”, no later than November 30, 2019. The third-party report needs to be approved by City Council at the November 22, 2019 Council meeting.

The consultant's final report will need to outline the analysis, findings and include any identified specific and actionable recommendations for cost savings and improved efficiencies. The focus is on savings of about 4 per cent of every \$1, however, if the study does not yield the desired savings we have been advised that this would not jeopardize our funding. Conversely, if savings and efficiencies are found there is an expectation that they be implemented.

If staff's EOI is successful and if the City receives notification by the end of July, the project would basically have three months to complete all project tasks including:

- Award of contract to a consultant
- Consultant performing the review, completing and delivering the final report to the City
- Administration presenting final report to City Council on November 22nd, the last City Council meeting in November
- Approved report posted publicly by November 30, 2019

Recommendation Three (Single Source) is required to facilitate completing all tasks within the timelines outlined in the Audit and Accountability grant funding guidelines.

Given the very tight timelines provided by the Province under this grant funding program, staff have identified the following services (Preliminary Priority Sequence) to be reviewed:

1. Review implementation of free WIFI in all City owned public property and also review the provision of free WIFI by other municipalities (excluding single tier municipalities.) Single tier municipalities are being excluded from the study to facilitate a more "apples to apples" comparison as it relates to population size and economic capacity.
2. Review and study the implementation of new technology to better serve Pickering residents. The anticipated outcome from this review would be to provide a roadmap or high level plan.

As stated above with the tight timeframe and taking into consideration of available staffing resources, the above priority sequence may change. As Members of Council are aware, Finance Department staff is heavily involved in the implementation of a new financial system with a Go-Live date of January 2, 2020 and therefore, Finance staff's availability for this project is constrained.

Attachments:

1. Audit and Accountability Fund: Expression of Interest

Prepared By:

Approved / Endorsed By:



Stan Karwowski
Director, Finance & Treasurer



Stan Karwowski
Director, Finance & Treasurer

Recommended for the consideration
of Pickering City Council



Tony Prevedel, P.Eng.
Chief Administrative Officer



Audit and Accountability Fund: Expression of Interest

To apply to the Audit and Accountability Fund:

- 1.) Complete all required fields of this Expression of Interest.
- 2.) Ensure that the completed Expression of Interest has been attested to by the appropriate municipal staff.
- 3.) Include an outline of your project timeline and costs (procurement documents, a project charter, a project work plan, or any other document as appropriate).
- 4.) Email this Expression of Interest and any additional supporting materials to municipal.programs@ontario.ca by **June 30, 2019**.

Attestation

I have reviewed this expression of interest and the supporting material and can verify that it is accurate to the best of my knowledge and understanding.

Signature

Date (DD/MM/YYYY)

Legal Name of Municipality	
Name of Signatory	Position Title

Applicant Information

Mailing Address	
Name of Primary Contact	Position Title
Email Address	Telephone Number

- I acknowledge that it is a program requirement that the proposed third-party review project result in a publicly posted report by November 30, 2019.

What is the anticipated cost of your proposed third-party review project? **Note:** only the cost of a third-party service provider should be included. Attach a document to support the timeline and costs of your project.

Have you included a resolution of council demonstrating support for the proposed third-party review project?
Note: this is not a program eligibility requirement.

- Yes (If yes, please attach a copy to this Expression of Interest form)
- No

Review Project Description

1.) Provide a brief description of your proposed third-party review project.

2.) Provide a summary of the objectives of your proposed third-party review project.

3.) Provide a summary of expected outcomes of your proposed third-party review project.



City of Pickering

Service Review Report on Public Wi-Fi, Building Permits &
Fleet Management Solutions

November 2019

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Executive summary

The City of Pickering engaged Deloitte to conduct a review of three functions which the City hopes to continue to develop over the next several years. The review included analysis and discussion on the provision of a free public Wi-Fi deployment, the building permitting system and the fleet management system. This report is written to inform the reader on the current state of these functions, to provide analysis on solutions which are available to enhance current functionality, as well as to provide potential options and considerations for a path forward. Each of the three assessment topics has a section within the report which presents the detailed analysis around that topic. In order to successfully implement the options mentioned in each section of the report, the City will need to assign internal resources with the appropriate skillset to perform the work required as part of those initiatives, as well provide ongoing maintenance of the new capabilities deployed.

Public Wi-Fi

The City of Pickering's tax payer funded free public Wi-Fi deployment has been expanded over the past several years and has received positive feedback for the value and quality access to the internet that it provides to citizens. There is a need to ensure that their Wi-Fi deployment covers both the requirements of the City, as well as those of citizens using City buildings and parks. Currently, the private sector provides access to 25% of the free Wi-Fi available within the City of Pickering with the Pickering Town Centre being the largest of the deployments. A list of these locations is provided within this report.

There are several factors which may have an impact on the City's strategy moving forward, including new wireless technologies, locations and reach of a potential deployment, level of service to be provided and needs of the City's potential new Internet of Things (IoT) technologies.

The public Wi-Fi section of this report is written to:

1. Provide information on the current state of the Wi-Fi deployment at the City of Pickering, including usage at the various City locations and investment over the past 5 years.
2. Show what similar size municipalities in Eastern Ontario have accomplished with their Wi-Fi deployment.
3. Define benefits and consideration points when managing a public Wi-Fi deployment.
4. Introduce insights on new technologies available in the market today as well as technologies which will impact Wi-Fi deployments of the future.
5. Present potential options for the City to consider when planning for the future, including costs and benefits of each option.

Building Permitting

The City's current building permitting process is heavily reliant on paper and lacks the ability to automate key permitting tasks such as application submission, permit review, online payment processing, and automatic inspection assignment. The lack of integration and functionality required in order to realize efficiencies and reduce costs is resulting in the following challenges experienced by the City staff:

- Added delays in issuing permits as staff is manually inputting data, processing payments, along with reviewing, and stamping plans for compliance on paper.
- The current system lacks the ability of applicants to review their permit status in real-time, which results in delays as the City informs residents of additional information requests, outstanding payments, or status inquiries in person, or on the phone.
- The current manual scheduling process for inspections is inefficient and it has resulted in scheduling errors, along with inspector task lists for inspections not being generated correctly.

- Increased costs associated with paper consumption and clerical data entry.

In efforts of achieving the City's expected outcome of 24/7 electronic application submission, built-in tracking functionalities, reduction in staff and paper expenditures, along with faster issuance of building permits, it is recommended that a formal system selection be conducted. A system selection will include formal scoring and detailed solution demonstrations.

Based on the initial cost-benefit analysis in this report, the potential annual savings of deploying an e-permitting system would be \$56,550 (CAD expressed throughout report), along with an acceleration of permit revenue of \$645,000, as a result of faster issuance of building permits. The assumptions used to calculate these figures are estimates, and actual cost savings, along with revenue increases will vary depending on the level of permit volumes. It should be noted that many of the vendors highlighted in the report support an e-portal for citizens who wish to submit an application for a variety of reasons, meaning that the solution may be able to support other lines of business beyond building permits, including the online portal, inspections booking and payment processing for Fire, Parks, Tax for example. When conducting a deeper analysis, considerations should be given to these other areas to ensure that a potential investment is maximized.

Additional benefits of implementing an e-permitting system include enhancing client service and staff productivity from automating key permitting tasks. The high-level benefits include, but are not limited to, electronic applicant submission, electronic review, and automatic assigning as well as routing of inspections to inspectors. This will result in faster issuance of permits as the City will not only increase permit revenue, but also increase municipal tax revenue as a result of an adjustment to the tax roll from the betterments added under the work permits.

Fleet Management

The City's existing fleet management and vehicle tracking solutions are legacy applications that have limited integration and functionality required in order to realize efficiencies, save costs and improve day-to-day activities. Based on interviews with the City staff, the main challenges around fleet management and vehicle tracking are:

- The current solution does not provide fleet maintenance functionalities such as schedule maintenance appointments, does not record the frequency or cost of maintenance, and does not provide long-term asset utilization analysis of vehicles.
- The current solution does not promote routing and dispatching optimization, which could improve the service reaction time and citizen's satisfaction rate.
- The current solution does not provide part management functionalities that would record part usage and enable cost analysis on individual vehicles.
- The current solution does not support the City's reporting needs due to disparate data housed outside of the system in paper format, and limited ad-hoc custom reporting functionality.

In the efforts of achieving the City's expected outcome of lower risks associated with fleet investments, lower operating cost, higher volume of work output, increased worker safety, higher integration level across different departments and improved resident satisfaction, it is recommended that a formal system selection be conducted. A system selection will include formal scoring and detailed solution demonstrations.

Currently, the City is spending \$72,775 annually (the average of 2016 – 2019 total spending) on fleet management and vehicle tracking software solutions. A potential annual incremental cost savings of \$308,667 could be achieved by upgrading Pickering's fleet management and vehicle tracking systems to ensure the City's requirements for Vehicle Maintenance, Dispatching and Routing, and Inventory Management are met. For additional information on how these potential cost savings may be realized, please see the full analysis within the fleet management section of this report.

In an environment of scarce resources, including both staff and funding, the City will need to prioritize in order to best allocate the available resources to public Wi-Fi, building permit system, and fleet management system. Based on the facts pointed out by the research described in this report, priority should be given to fleet management project given it is the area where the highest potential savings have been identified. Upgrading the fleet management software would also improve the City's public service delivery, and increase the overall resident satisfaction on this subject.

Public Wi-Fi business case

Executive summary

Analysis on Public Wi-Fi

The City of Pickering is considering expanding their tax-payer funded public free Wi-Fi to all City owned public property (buildings and parks) and has engaged Deloitte to assist in developing a business case with options and considerations regarding free Wi-Fi services to be provided by the City. This study has investigated what other similar size municipalities are doing regarding the provision of free W-Fi in order to provide a comparable scenario for the City of Pickering to consider.



The objectives of the Public Wi-Fi analysis as determined by the City were to answer the following questions:

1. Identify what buildings and/or facilities that currently have free public Wi-Fi.
2. What is the current cost of providing these services both externally and internally?
3. What is the current usage of the provided public Wi-Fi (volume) and type of usage (i.e., emails, web-searches and video streaming)?
4. What would be the cost of implementing and/or providing free public Wi-Fi in City buildings and parks? Define the phased rollout implementation strategy for equal level of service among the three wards over several years.
5. What are the “definable and measurable” benefits of offering free public Wi-Fi? If the benefits of free public Wi-Fi cannot be quantified, then what are the “evidence based” qualitative analysis factors?
6. What are the liability and reputational risks associated with the provision of free public Wi-Fi?

The Intelligent Community Forum (ICF) has recognized Pickering as a Smart21 Communities of 2017 and 2018. The award program recognizes the world's leading municipalities that are successfully leveraging the power of technology to develop inclusive and prosperous communities.

The following reports aims to answer these questions and provides additional information by informing the reader of the topic and its intricacies, provides details on internal and external factors and trends which may have an impact on a potential decision, and provides options and a recommendation based on a cost-benefit analysis for potential paths forward.

Background and context



Background

Municipal public Wi-Fi is playing a growing role in enabling people to stay connected to the internet. There is a strong global trend towards increased access to free public Wi-Fi provided by carriers and municipalities, enabling people to be connected to the internet and other devices everywhere.¹ In Eastern Ontario (region where Pickering is located), the trend is similar with significant and growing access to free public Wi-Fi in municipal facilities, town centres and private businesses.

According to a Pickering Library study performed in 2016, 18% of Pickering residents do not currently have access to the Internet, either due to financial situations or lack of broadband availability in rural Pickering. This creates a digital divide and creates barriers in accessing online content relating to education, social inclusion, healthcare, government services and employment.

In Eastern Ontario communities, there is a full range of municipal Wi-Fi offerings, from no service at all, to public Wi-Fi in all municipal facilities and town centres. As in other parts of the world, public Wi-Fi is established first in public libraries and cafés, before expanding to other public venues. Many communities have plans to expand public Wi-Fi service to additional recreational facilities, private locations, municipal offices and town centres.

The most significant trends in public Wi-Fi are the growing demand for connectivity 'everywhere, all the time', the growth in carrier class Wi-Fi services, and the proliferation of venues where Wi-Fi is offered.²

There is an emergence of Smart Cities that use information and communications technology (ICT) to manage their operations and assets, including IT functions, transportation systems, power plants, law enforcement,

¹ Municipal Public Wi-Fi a Sound Investment? https://www.eorn.ca/en/resources/Municipal-Wi-Fi/EORN_WP_WiFi_FINAL.pdf

² <https://cira.ca/resources/corporate/factbook/canadas-internet-factbook-2019>

community services, schools and libraries. The internet of things (IoT) is an important and growing part of this initiative. These cities use Wi-Fi for operations and for public access to the internet, and the more people are connected, the more relevant connectivity becomes to them. They access more and more information over the internet and become dissatisfied when disconnected. In response to the increased demand for connectivity, many municipalities are providing public Wi-Fi.

The following analysis includes a sample of findings from other Eastern Ontario municipalities of similar size to Pickering, and provides an overview of their current public Wi-Fi deployment.

Municipal Wi-Fi Networks including overview of deployment locations

There are many municipalities, in Canada and around the world, that own and operate Wi-Fi zones to serve their downtown areas and Wi-Fi hotspots to serve more limited areas such as libraries, recreational facilities and other municipal facilities. These systems operate increasingly on municipally owned fibre networks, but also on public networks where the municipality pays for service.

Municipal Wi-Fi systems can support a variety of applications for the City's operations including fleet services, smart lighting to reduce energy usage, traffic management to improve mobility, parking meters and security video management that help make cities safer and greener. This constitutes the Smart City model. The same infrastructure can support free public Wi-Fi hotspots or zones. Fredericton, New Brunswick's Fred-eZone, Stratford, Ontario's Stratford Free and Olds, Alberta's O-NET are notably successful Wi-Fi networks hosted on municipally owned fibre networks. Because these communities own their fibre backhaul facilities, there is no incremental backhaul cost to their public Wi-Fi services on top of the infra-structure they already have in place.

Many municipalities have public Wi-Fi in their municipal offices, which might be used by employees and the public. Often this service is provided in council chambers and meeting rooms as well as common areas. If the municipal office is in a central location, people may stop by to use the internet. If it is more remote, the service is used mainly by people visiting the office for service or meetings. In the older stone municipal buildings, Wi-Fi signal does not extend beyond the room in which the access point is located.

Often recreational facilities, including indoor recreation centres, arenas, community centres and outdoor facilities like parks, baseball fields and soccer pitches would have municipal public Wi-Fi, as this type of service is expected by the clients of these facilities. If they are used in sporting tournaments, results or scores are communicated. Sometimes video or live data from the game is posted, however this requires significant backhaul capacity and could be costly. If the facility is rented out, the venue may have more appeal and value if there is public Wi-Fi, which could lead to increased revenue.

Current Wi-Fi deployment details

Buildings which currently have free public Wi-Fi in the City of Pickering

The following table outlines all city buildings by ward, including details of Wi-Fi deployment per building.

Location	Access Points*	Annual Usage
Westshore Community Centre	1	280 GB
George Ashe Community Centre	1	404 GB
Delaney and O'Brian Arena	1	282 GB
Fire Station 2	1	1040 GB
Fire Station 5	2	1240 GB
Fire Station 6	1	1130 GB
Don Beer Arena	5	2535 GB
Don Beer Meeting Rooms	0	None currently
East Shore Community Centre	1	771 GB
Pickering Operations Centre	4	854 GB
Kinsmen Park	1	Unknown
Millennium Park	1	295 GB
Esplanade Park	1	369 GB
Civic Centre	16	5210 GB
Whitevale Community Centre	1	169 GB
Pickering Village Museum	1	Unknown
Brougham Hall	0	None currently
Animal Shelter	1	128 GB
Fire Station 4	2	675 GB
CHD Recreation Centre	15	7920 GB
Dr. Nelson F Tomlinson Community Centre	1	114 GB
Greenwood Community Centre	0	None currently
Mt Zion Community Centre	0	None currently

*The number of access points listed above is indicative of a location having an area where public Wi-Fi is available but does not include details on how much Wi-Fi coverage is implemented, for example some facilities only have Wi-Fi coverage in the reception area. The analysis could be taken further to understand what would be required for full coverage by analyzing current usage with a heat map. Locations with 0 access points will be discussed further in the options analysis section later in this report.

Current cost of providing free Wi-Fi internally and externally (inclusive of staffing costs)

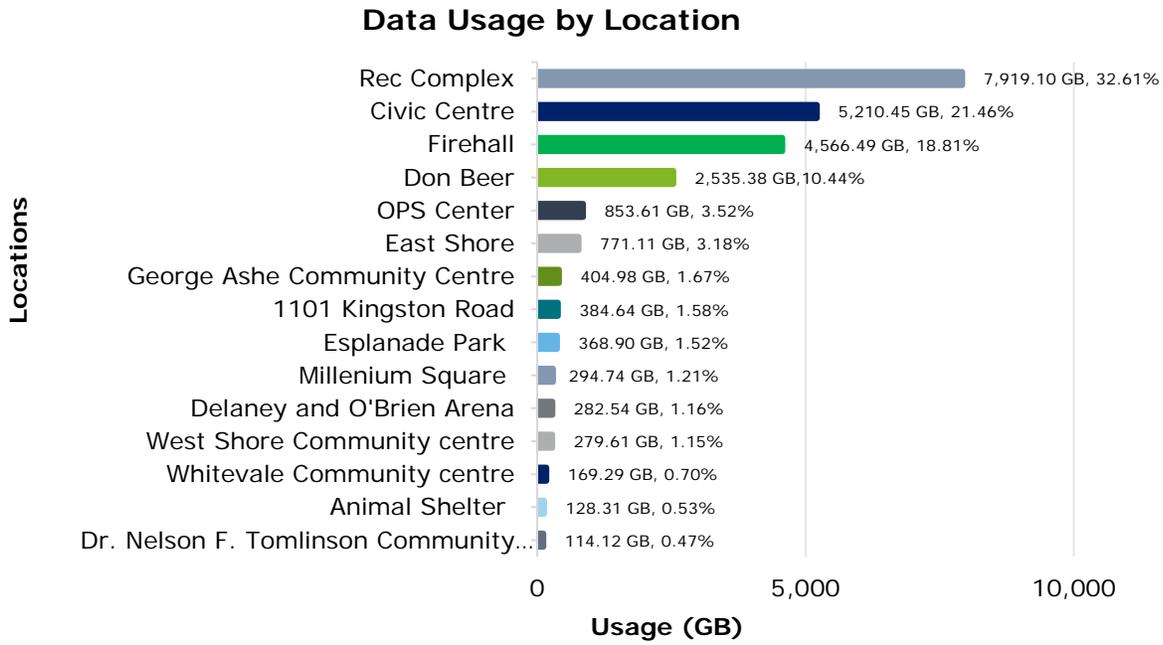
The following table outlines the known costs that have been spent to maintain and expand the Wi-Fi network at the City of Pickering for the past 5 years. The cost for the City to extend the use of the internal Wi-Fi network to the public is nominal, as the amount of data used is the only incremental cost because hardware can be used for both City use and public use. Note that many of the costs below are for hardware needing to be replaced due to damage or compatibility issues with new devices.

Type	Cost Item	Amount (CAD)	Year Incurred	Cost Occurrence
Service Fee	Access Point Maintenance for 67 APs	\$7,870	2019	Recurring
Licensing	System Management	\$220	2019	Recurring
Data Usage	Additional data for Wi-Fi	\$1,780	2019	Recurring
Hardware	Wi-Fi upgrades for arenas, squash courts, west shore, fire stations	\$13,240	2019	One-time
Hardware	Wi-Fi upgrades for museum, west shore, fire station #5, and recreation complex	\$7,850	2018	One-time
Hardware	Wi-Fi for facilities and public spaces	\$10,050	2017	One-time
Hardware	Wi-Fi for facilities and public spaces (Esplanade Park, Kinsmen Park, Millennium Square)	\$18,830	2016	One-time
Hardware	Wi-Fi for recreation complex and meeting rooms	\$7,790	2015	One-time
Hardware	Wi-Fi for city parks	\$2,850	2015	One-time
Hardware	Wi-Fi for civic complex	\$16,770	2014	One-time
Hardware	Wi-Fi for arenas	\$5,530	2014	One-time
Total Annual Recurring		\$9,870	n/a	
Total One-time Hardware		\$84,690	2014-2019	
Total 5 Year Cost		\$134,0400	2014-2019	

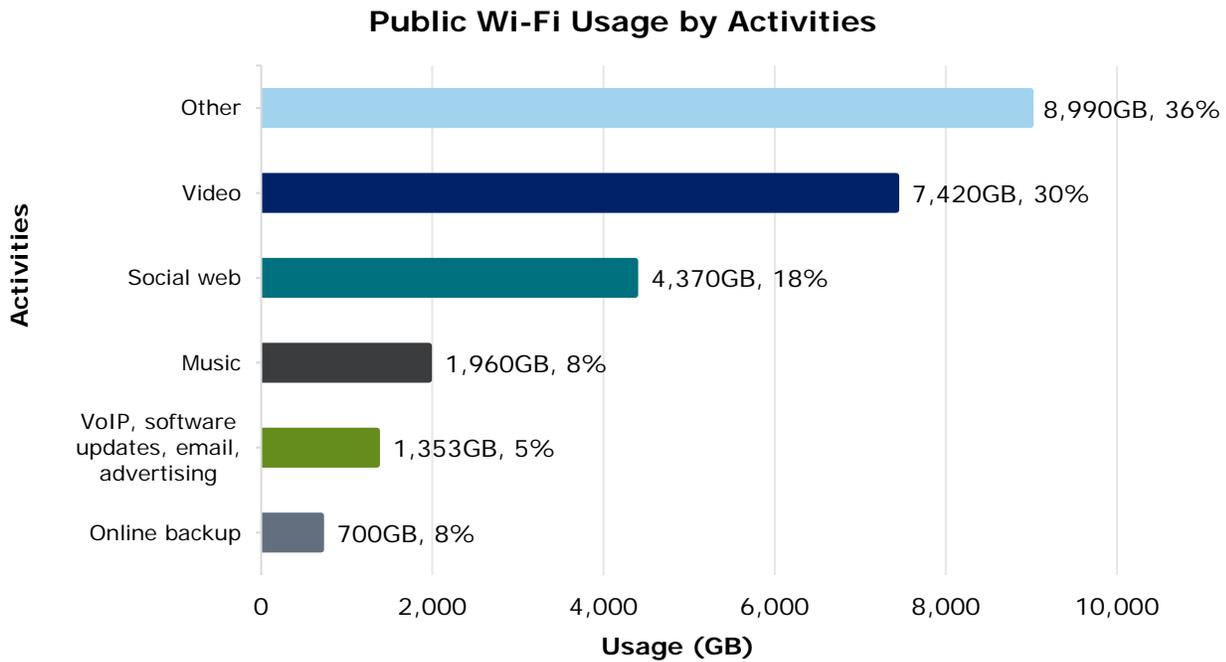
The information above shows what the City needs to pay on an annual basis to maintain the current Wi-Fi service and infra-structure as well as a baseline for estimating additional expansion costs. It helps provide a baseline for assumed expansion costs when discussing options for the future of the free public Wi-Fi network, depending on how much hardware and access points are required.

Analysis on current usage of public Wi-Fi and type of usage

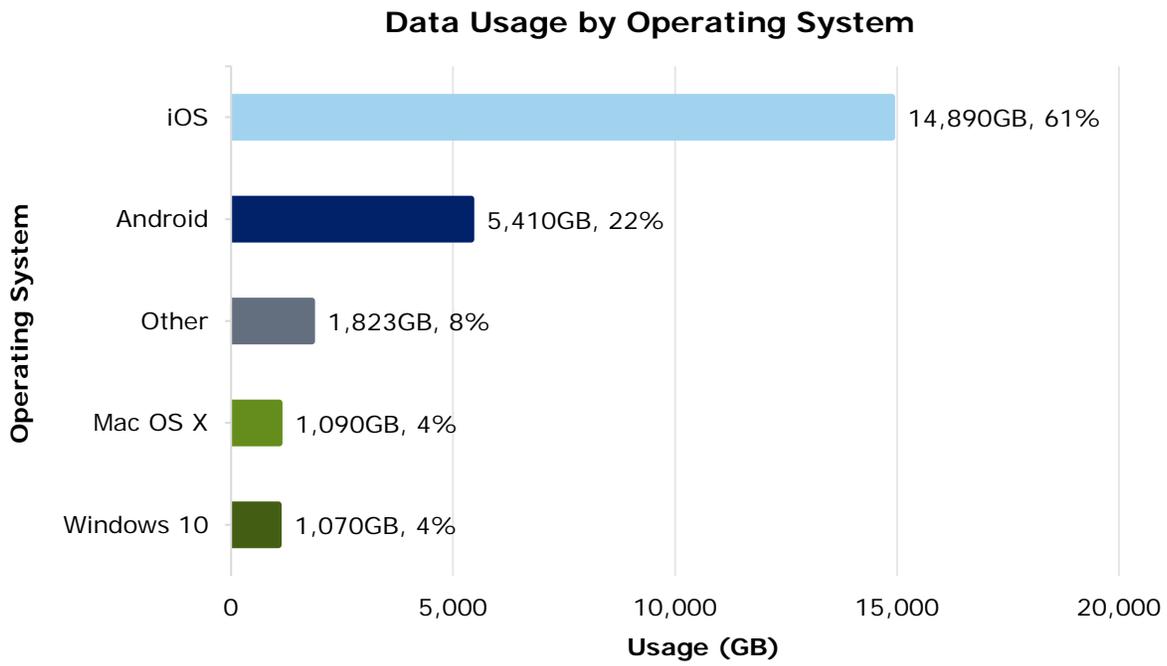
The following chart shows the amount of data that has been consumed at the various City's locations from January 2019 to June 2019. It provides an understanding of the scale of use and which types of locations should be emphasized in future development efforts given historical usage. Based on the results, it is apparent that community centres provide the most value as visitors typically spend their time waiting and passing time via connected devices.



The following chart shows the amount of data used for particular activities, which indicates where value is being delivered to users of the Wi-Fi service. It is clear that the “other” category is the main use, which encompasses general web browsing, with video streaming following in second place.



The following chart shows the amount of data used by various devices operating systems. It provides a rough understanding of the type of devices that are being used to consume the Wi-Fi service. iOS (Apple) is the main user as many mobile Apple devices are found in the technology ecosystem today (e.g., iPad, iPhone, Apple Watch).



Jurisdictional scan

As part of the analysis of free public Wi-Fi, a jurisdictional scan was conducted in order to understand what other municipalities in Southern Ontario of equal size to the City of Pickering have implemented regarding Wi-Fi services. Based on this, the cities of Niagara Falls, Waterloo, Cambridge, St Catharines, Oshawa and Burlington were selected as they have released some information on their public Wi-Fi deployments publically. This chart below shows their population size, number of facilities, how the Wi-Fi service is funded, how much it costs and whether ads are used to generate revenue. The latter is done by launching advertisements on the login page of the Wi-Fi network as a means to recoup a portion of the costs of offering the service. For larger Wi-Fi deployments in cities not listed here, this is sometimes used as an avenue to support a much more robust rollout of free public Wi-Fi with more access points and further reach.

City	Population	Public Wi-Fi	Facilities with Wi-Fi	Funding	Cost (CAD)	Use of Ads
Niagara Falls	88,071	Yes	6 Facilities incl.: City Hall City Parks Community Centres Libraries	100% funded by City	Not available	No
Waterloo	104,986	Yes	18 Facilities incl.: City Hall Public Square	100% funded by City	\$6,552/year ongoing	No
Cambridge	129,920	Yes	12 Facilities incl.: Civic Square Community Centres Recreation Arenas Gardens	100% funded by City	Not available	Yes
St. Catharines	133,113	Yes	2 Facilities incl.: City Hall Public Libraries	Partnership with Bell Smart Kiosk	Not available	Yes
Oshawa	159,458	Yes	2 Facilities incl.: Council Chambers Public Libraries	100% funded by City	Not available	No
Burlington	183,314	Yes	17 Facilities incl.: City Hall Libraries Community Centres	100% funded by City	Not available	No

This table shows that most of the deployments are managed and paid for fully by the lower tier municipality, which is the current case at Pickering. Only one municipality (St Catharines) has partnered with a service provider (Bell) in order to provision free public Wi-Fi. This may be an option for the City of Pickering in the future if it plans to have more access points per square foot to enhance the public Wi-Fi offering (Note: details of such an arrangement have been outlined in the options analysis).

The following table outlines additional details from the jurisdictional scan which relate to the operation and characteristics of the public Wi-Fi deployment. Filtering factors are ways in which a City could choose to filter content consumption but is not being done at this time. Filtering systems are described in more detail later in this report but at a high-level are ways in which the City controls what the internet is being used for. The City asks users to “agree” to basic terms of use and runs software which monitors usage (sample terms and conditions provided in the Appendix section). The chart also highlights plans and efforts underway to improve or change the public Wi-Fi deployment.

City	Filtering System	Filtering Factors	Other program details
Niagara Falls	Basic terms & conditions	None	<p>According to Niagara Falls Wi-Fi deployment overview:</p> <ul style="list-style-type: none"> Public Wi-Fi improves citizen's sense of belonging, economic vibrancy, health behaviors and civic engagement and this will be accomplished by creating a digital ecosystem that makes 'invisible' members of society visible and by developing reimagined connectivity hubs that enable participation by all; and Plans to expand free Wi-Fi programs to include existing community gathering places (i.e., churches, school, social halls, etc.) through partnerships with local broadband providers.
Waterloo	Basic terms & conditions Filtered & unfiltered workstations at Library	Inappropriate content	Not available
Cambridge	Basic terms & conditions	None	Not available
St. Catharines	Basic terms & conditions	None	Not available
Oshawa	Basic terms & conditions	None	<p>According to Oshawa Wi-Fi deployment overview:</p> <ul style="list-style-type: none"> The City implemented an extensive consultation process to undertake an evidence based approach to assessing the needs of the community, possible challenge areas and deciding on a priority issue. Activities conducted including: commissioned the Oshawa Needs Assessment Study, which analyzed and summarized existing community focused studies conducted over the last five years, commissioned an Intelligent Communities Forum Report Card, Participated in the CIRA (Canadian Internet Registration Authority) Broadband Speed Test Study, Registered to become ISO 37120 certified with World Council on City Data (WCCD) in 2018; Residents who do not have access to the internet at home can now check out a mobile hot spot from their local library, which provides them with unlimited internet access for a week. Currently, the program has a waiting list of over 100 families.
Burlington	Basic terms & conditions	None	Not available

Wireless local-area networking components

The following section outlines the components of a Wi-Fi deployment, including an overview of the hardware and software required to effectively operate a large public network. It is important for the City to have an understanding of what is included in a physical network so that the options can be better understood.³

Wireless Access Points:

A simple Wi-Fi hotspot requires an access point (AP) and an internet connection. The AP enables multiple devices to be connected to the internet using a single connection.

There is a large offering of networking equipment on the market. Currently, the City has 67 APs and the fee paid was roughly \$150 for each AP (*Note: based on average cost over the past 5 years*). Installation costs for each AP has varied over the years and accounts for a significant portion of overall costs.

Network management and monitoring

Monitoring and maintaining a single router takes little time. However, as the number of Wi-Fi hotspots a municipality operates increases, it becomes more onerous. Municipalities that have centrally managed Wi-Fi networks, have said that the cost and effort required to upgrade their systems have paid off in terms of their ability to manage them well. Several municipalities that have distributed systems stated that they are planning to move to a single controller for central management of their Wi-Fi networks.

Performance management system

Performance management is the collective techniques that enable, manage and ensure optimal performance levels of a computer network. Network performance management generally requires the performance and quality service level of each network device and component to be routinely monitored. These tasks are typically managed within a management system which the City licenses.

Guest access

Wireless "open" (unauthenticated) access is the easiest connectivity strategy for users. Users/guests have historically struggled with how to physically get password credentials for networks where there is no help desk and as such, will have a system where a login page is used to "apply" to the Wi-Fi network by inputting personal information. This should be the continued strategy for the City of Pickering as there is no helpdesk at any of the locations for external use.

Intrusion detection systems/wireless intrusion detection systems

A network device that monitors the radio spectrum for the presence of unauthorized access points (intrusion detection), and can automatically take countermeasures (intrusion prevention). This is

The estimated cost of Wi-Fi deployment is made up of the capital cost to deploy the equipment and the operating cost to manage and maintain the system. Understanding the cost element is the first step for the city to tailor a service offering that fits within the budget.

³ <https://meraki.cisco.com/solutions/government>

needed for the City to ensure that there are no attempts to enter into the internal side of the network available from the access points.

Location services

Devices that have both GPS and Wi-Fi can be used to send information about a network back to a GPS company so that they can determine where the network is. These location services can help with City with applying additional details to logins to the network, just making the information on the logins more relevant for analysis. The City may want to explore the details of this factor in the future as it could aid in making data consumed on the network more valuable for potential commercialization.

Bandwidth Requirements

The type of activity users perform on the internet drives the bandwidth required for the network. Although this information is not available for lower-tier municipalities, in town centres or sports venue of higher-tier municipalities, the typical on-the-go internet activities are not data intensive. In the case of the City's free Wi-Fi, the usage breakdown is as follows: 30.55% of video streaming, followed by 17.98% of social media viewing and 8.07% of music hearing. It is clear that much of the use is for personal reasons like keeping users entertained during their visits to the various locations.

In a public Wi-Fi, the connection to the internet requires sufficient bandwidth to support the expected traffic. Public Wi-Fi is provided on a best effort basis, but if there is truly not enough backhaul capacity to support users, they will be dissatisfied, causing a negative reaction to the service.⁴

A potential problem with public Wi-Fi is that a few people may attempt to use too much data. While most guests will engage in low bandwidth on-the-go activities, some may want to download large files, such as video files and will slow down the service for everyone else. To ensure that a few prolific file downloads do not disrupt the service for others, limits can be set for download and upload speeds. These limits should be established based on the expected use of the service and the total available bandwidth. The City can also establish limits on the daily data transfer per user. The town of Perth in eastern Ontario imposes a limit of 50 Mbps per user per day as an example. A municipality offering free public Wi-Fi is a provider but is not an ISP and provides service on a best effort basis.

⁴ <https://meraki.cisco.com/solutions/government>

The case for public Wi-Fi

Defining the case for the City's public Wi-Fi

Developing a business case for public Wi-Fi provides details on internal and external facts which may have an impact on the City's decision, and provides options and recommendations based on a cost-benefit analysis. As municipal public Wi-Fi is typically provided at no direct cost to the user, the benefits are in the form of value to the municipality, its residents and businesses. While it is difficult to quantify the benefits of public Wi-Fi, they can be identified in qualitative terms. However, all costs currently are born by the tax payer.

This report provides details on costs and benefits based on assumptions and feedback from the City of Pickering's IT staff, legal counsel and industry reports.

High-level qualitative benefits of free public Wi-Fi

Before deploying or expanding municipal Wi-Fi, a community should assess the value the service can bring. Typical benefits to municipal public Wi-Fi are presented below. Wi-Fi provided by private enterprise can offer many of the same benefits to a municipality. Encouraging businesses to offer free public Wi-Fi can be a good way to get some of the desired benefits without spending tax payers' money to provide it.

The areas where public Wi-Fi tends to have the most impact are: business activity, community branding, support for municipal programs and services, and internet service to low income residents and residents without broadband access at home. Public Wi-Fi can enhance the vibrancy and attractiveness of communities, retaining and attracting young people and business and tourists⁵. For the purpose of this analysis, the benefits of public Wi-Fi service are presented in qualitative terms. The following are elements a municipality should consider when weighing the value of Wi-Fi service in their community against the costs of installing and maintaining the Wi-Fi infrastructure.

Business activity benefits

Providing Wi-Fi in public places, whether downtown zones, recreational facilities or private businesses, encourages people to spend time and money in the community⁶. Social media users love to share photos of themselves and their friends. People sharing photos of themselves having a wonderful time is great promotion for the City.

People will prefer free Wi-Fi over cell service if there is no cellular signal, if they have no mobile data plan, or if they are trying to stay within the usage allowance of their mobile data plan⁷.

Splash screens, the screen users see when they log onto Wi-Fi, can suggest things to do in Pickering or be routed to the City's homepage. They may suggest a local market or festival, a municipal service or activity or they can direct users to a business, perhaps for an advertising fee. Splash pages can also be used to conduct short focused surveys on relevant community issues and demographics. Answering a short survey can be included as part of the acceptance of the terms and conditions for using and signing into the free Wi-Fi.

⁵ Municipal Public Wi-Fi a Sound Investment? https://www.eorn.ca/en/resources/Municipal-Wi-Fi/EORN_WP_WiFi_FINAL.pdf

⁶ <https://www.alepo.com/solutions/carrier-wifi/>

⁷ <https://www.symantec.com/content/dam/symantec/docs/reports/2017-norton-wifi-risk-report-global-results-summary-en.pdf>

Public Wi-Fi adds value to facility rental, attracting sporting events, fairs, festivals and meetings. Often, event organizers simply cannot hold events in venues that do not have public Wi-Fi. They need it for operations and their customers demand it. Presentations often include web links. Many sporting events require Wi-Fi to post results and to satisfy the fans' need for constant access. For example, Wi-Fi in arenas will attract more and bigger tournaments. The City of Ottawa confirmed that when they rent conference rooms, they charge an additional fee to activate Wi-Fi. The meeting room Wi-Fi service draws more meetings to their facilities and is profitable.

Retaining young residents in areas is important to the continuity and vitality of communities, especially since only 10% of the population is aged 20-29⁸. Another key metric for City of Pickering is that around 25% of its population had immigrant status at a point in time⁹, in order to appeal to immigrants, City services like free public Wi-Fi may help in early connectivity. Connectivity is extremely important to these demographics as they would like to stay connected to their peers and access key public resources available online. Public Wi-Fi makes connectivity cheaper and more available to them and signals that the community is right for them.

Service to Low-income residents

Rural family income levels are 15 per cent lower than levels in metropolitan Ontario¹⁰ and the high cost of access to internet and mobile data can be a hindrance to equality in access to education, employment, health and social connection. There are certainly opportunities to support low income residents¹¹:

- Affordability of internet service: Rural service can be limited and expensive.
- Affordability of mobile data plans: Residents who have cell phone plans may choose small data plans or no data plans, knowing that they can rely on public Wi-Fi in certain places. It is very expensive to supply a family with multiple children with data plans (defined further in unlimited data plan analysis).
- According to a Pickering Library study performed in 2016, 18% of Pickering residents do not currently have access to the Internet, either due to financial situations or lack of broadband availability in rural Pickering. This creates a digital divide and creates barriers in accessing online content relating to education, social inclusion, healthcare, government services and employment.

Through public Wi-Fi, low income residents can gain access to the benefits of internet connectivity, including:

- Social connection (e.g., Social media, advertising, researching events, local outreach etc.).
- Improved public access to government services and information.
- Business potential: The ability to search for jobs online, to apply online, to operate home based businesses, to telecommute, to do online banking and investing.
- Educational: The ability to take online courses, to do coursework at a bricks and mortar institution from home, to submit assignments from home, to do online research, to read online material.
- Health care: To access health services (eHealth Ontario, online lab results, online consultations with medical professionals in another community), to use eHealth monitoring services (alarms, glucose monitors, etc.), remote diagnostics, to research health related topics, to find appropriate health services.

Meet The Increased Demand for Data On The Go

As more people carry mobile devices, especially smartphones, but also tablets and laptops, there will be more demand for data on the go. This will have an impact on the demand for data service.¹² As the City creates more public spaces that cater to the various wants and needs of the population, there will be a growing demand to use the internet at these facilities. Beyond the benefit that a Wi-Fi deployment will give to citizens, it will also provide wider access for City staff. As the City continues to implement new systems,

⁸ <https://www.pickering.ca/en/business/Demographics.aspx>

⁹ <https://www.pickering.ca/en/business/Demographics.aspx>

¹⁰ Focus on Rural Ontario Fact Sheet, <http://www.farms.com/news/focus-on-rural-ontario-fact-sheets-show-rural-incomelevels-and-trends-101871.aspx>

¹¹ Municipal Public Wi-Fi a Sound Investment? https://www.eorn.ca/en/resources/Municipal-Wi-Fi/EORN_WP_WiFi_FINAL.pdf

¹² Economics of Public WiFi (Potts 2014)

there will be a growing demand for data to access critical business information and conduct day-to-day tasks.

Improve Business Activity

Public Wi-Fi provides cities a way to improve business activity by means such as increasing sales of local businesses and through social media promotion of the region and its events supported by the community. Providing Wi-Fi in public places, such as downtown zones, recreational facilities or private businesses can connect people with the services they want, encourage them to spend time and money in the community.¹³

In some cases, the Wi-Fi network can generate revenue, including but not limited to:

- Facilities can be rented at a higher price, and more frequently if they have public Wi-Fi.
- Splash screen advertising and other ad-based revenue programs.
- Exclusive rights to places where Wi-Fi hotspots are located and can be sold.
- Add value to the renting properties that are near a location which provides Wi-Fi.

Wi-Fi Zoning Analytics

Data usage on the public Wi-Fi network is considerable at this time but in the future it is set to rise. Data on user traffic can be sold, used by the municipality, or made available to community members for a variety of purposes, similar to how it is done today by applications and service providers. The type of data available is aggregated in real-time data based on the number of users by area or by type of device, but could be captured with additional details so that additional analysis and mining tasks could be performed.

Support Applications for Municipal Operations

The municipal Wi-Fi network can support a variety of applications for municipal operations that could help make Pickering safer and better connected, such as¹⁴:

- Fleet services
 - Access points around the City could be used for updating key information on fleet vehicles as they make stops at specific locations
- Smart lighting
 - Devices are available at an additional cost in the marketplace which turn City lighting in Wi-Fi enabled lights, providing citizens with light for seeing at night and access to view the content which they desire
 - Connected smart lighting systems also allow for more active management to respond to daily changes in light conditions
- Traffic management
 - Connected traffic management devices help Cities provide quicker responses to traffic and road use, potentially supporting development efforts
- Information kiosks
 - Connected kiosk devices currently found in many major municipalities help citizens with staying informed on events around them, weather conditions and public service announcements
 - Connected kiosks also help with expanding public Wi-Fi in locations that may otherwise not have Wi-Fi (outdoor public spaces)
- Cloud-based business software
 - Access to cloud applications will increase as the City implements the newest tools on the market
 - Many of these tools require an internet connections to conduct day-to-day tasks and information monitoring, furthering the need for expanded connection options

¹³ Municipal Wireless Broadband: Policy and Business Implications of Emerging Access Technologies (Lehr, Sirbu and Gillet, 2014)

¹⁴ <https://www.alepo.com/solutions/carrier-wifi/>

Technological change impact

Innovation Technology Insight – State of Unlimited Data Plans and rollout of Wi-Fi 6 and 5G

To optimize city's planning and deployment decisions, infrastructure and operations leaders responsible for managing network infrastructure need to understand the technological advantages that can potentially be utilized for a longer term. This section outlines two topics which should be understood before moving forward with any potential investments, namely Wi-Fi 6 (802.11ax) and 5G cellular.

Building on the progress made by 802.11 technologies over the past 20 years, 5G represents a shift in focus to go beyond consumer handsets, to address the networking needs of a much broader group of wireless devices with very divergent requirements.¹⁵

Market reports show that people want either all of the data or none at all¹⁶. Wanting unlimited data plans could be the result of clever advertising campaigns by the major carriers, or of all the extra perks that now come with these plans. On the other hand, consumers who are looking for plans with little to no data could be trying to save money by opting to utilize Wi-Fi as much as possible.

In the past year there has been an extra push in an ongoing effort by the Canadian Radio-Television and Telecommunications Commission (CRTC) to review mobile wireless services. This has been brought on for many factors, however there are two that are noteworthy for the purposes of this report.

1. Affordability of data plans for all Canadians
2. Planning for implementation of 5G across Canada and the impact this will have on competitiveness

The City of Pickering will likely be involved in the move to implementation of 5G infrastructure in the region as service providers will need to work with the City to develop appropriate implementation locations for the new network and assess the demographics to provide plans which meet the needs of the population. For a detailed explanation of the results of the review on wireless services in Canada by the CRTC, see the Appendix section.

Mobile Data Trends

Over the past 3 years, there has been a trend when it comes to mobile data. There has been a clear steady rise in preferences for both zero data plans and unlimited data plans.¹⁷ Note: 'Unlimited' in many cases refers to more data than customers can typically use with soft data caps on unlimited plans ranging from 20-50GB, while searches for plans with 1-5GB of data have decreased at almost the same rate.

It seems that there are two main groups of people—those who use a lot of data and those who just want the minimum amount. As described within this report, the regulators and market in Canada are still attempting to formulate an official standpoint and strategy on how to create right-size products for various groups of consumers. Many reports highlight 2020 as a year where many of these conclusions will be defined as 5G begins implementation across Canada and products will be rolled out to service the new paradigm.¹⁸

¹⁵ Innovation Tech Insight for Wi-Fi 6, Gartner, Inc.

¹⁶ <https://cira.ca/resources/corporate/factbook/canadas-internet-factbook-2019>

¹⁷ <https://www.whistleout.ca/CellPhones/Guides/comparing-rogers-infinite-unlimited-data>

¹⁸ Predicts 2019: 5 CSP Technology Trends to Plan for 5G, Open Source, Virtualization and Private Networks (Gartner 2018)

There is a significant number of people who need very little data (less than 6GB), potentially utilizing public Wi-Fi to access the internet. In fact, people are using Wi-Fi from their cell phones 3.75 times more than their cellular data, which may be an attempt to save money on their phone bills.¹⁹

There a number of reasons for these trends over the past few years, the following are some of the causes:

- The availability of Wi-Fi has increased dramatically resulting in consumers needing little to no mobile data.
- Unlimited plans have become more available and affordable resulting in consumers opting for unlimited data vs a small data allowance (e.g., 5GB).
- Unlimited plans may also seem to provide more value for money but benefits are difficult to calculate at this time. Typical unlimited data plans start at roughly ~\$60 CAD for data only plans and from ~\$100 CAD for voice, text and data. As 5G begins rollout in 2020 it will become more apparent how unlimited data plans are priced and delivered to the consumer.
- Carriers tend to promote their unlimited plan more than their other plans, which is set to continue as bandwidth continues its growth.

Benefits and Uses of Wi-Fi 6

Benefits of Wi-Fi 6²⁰

Wi-Fi 6 or 802.11ax has many benefits compared to the current Wi-Fi 5 which is in use at the City today. These benefits may be beneficial to the City due to the nature of use at their locations. A full description of the benefits are available in the appendix section however at a high-level these benefits are:

1. Backward Compatibility
2. Higher Data Rates
3. Device Battery Life Improvements
4. Connection for more devices
5. Data use balancing based on needs of the phone
6. Newer technology to increase lifespan of deployment

Use Cases for Wi-Fi 6 and impact of IoT

Public Connectivity

Public areas are a combination of lower inter-device interference and high-density user environments. The ability to scale up easily and support higher bandwidth makes 802.11ax an improved Wi-Fi standard to support high-density user environments. For sport venues, shopping malls, convention centres and other more heavy usage environments, Wi-Fi 6 improves the ability to support and enhance faster Wi-Fi networks discovery and authentication processes.

Public Wi-Fi provided by Private Sector Companies

The biggest private providers of public Wi-Fi in Ontario are Bell Mobility and Cogeco (service providers or carriers). Hotspots are also provided by many coffee shops, restaurants, inns, hotels, marinas and smaller internet service providers (ISPs). Cogeco Free Wi-Fi is available mostly in the Kingston area, where there are 90 hotspots. There are also hotspots in Peterborough, Belleville, Kemptville and Smiths Falls. This service is a variant of the public free Wi-Fi model, as service is available only to Cogeco internet subscribers at no additional cost. It is nominally free, as the service is paid for as part of subscribers' internet service fee. The Cogeco hotspots are located in restaurants, cafes, stores, inns, medical clinics and other customer facing outlets.

¹⁹ <https://cira.ca/resources/corporate/factbook/canadas-internet-factbook-2019>

²⁰ Municipal Wireless Broadband: Policy and Business Implications of Emerging Access Technologies (Lehr, Sirbu and Gillet, 2014)

Bell Mobility provides unlimited access to free public Wi-Fi in participating Tim Horton's, McDonald's and Chapters Indigo locations. There are over 1000 participating locations in Ontario. There are more of these locations in high density areas, but they are also present in small towns²¹.

The following restaurants offer free WI-FI within the City of Pickering: Tim Horton's (9); Starbucks (3), McDonalds (2), Burger King (1); Swiss Chalet (2); Wendy's (1); Mary Brown's (1); Kentucky Fried Chicken (1) and St. Louis Bar and Grill (1). It appears that every food chain restaurant big or small now offers free Wi-Fi. At a minimum, there are at least 25 locations in Pickering that provide free Wi-Fi, of which the Pickering Town Centre is the largest.

As mentioned above, many business owners, including coffee shops, restaurants, retailers, hotels, clinics and others offer public Wi-Fi to their customers. Normally, businesses expect and appreciate it when Wi-Fi users buy something but it is usually not mandatory in order to have access to their WI-FI. Most retailers who offer public Wi-Fi service find that it keeps customers in their facilities longer and see a correlation between having public Wi-Fi and increased sales. In Central Frontenac, North Frontenac Telephone Company is providing public Wi-Fi service to visitors at Sharbot Lake beach. The original plan was to fund the service by selling advertising on splash page, however the population was not large enough for this model to be successful.

There are several examples of successful free public Wi-Fi services across the world. Many of these deployments are in cities with populations over 1 million and as such have not been included in this report. If the reader would like to get a flavour of one of these examples, Link NYC is a success story of a Public-Private partnership which has made free public Wi-Fi accessible across New York City. Link NYC is powered by CIVIQ Smartscapes solutions. These solutions have started being tested within the City of Toronto in recent years.

One of the key elements of these carrier supported free Wi-Fi deployments are the monetization methods. Direct monetization, that is charging for Wi-Fi access, is a valid but declining revenue channel. Other monetization opportunities play an increasingly important role. These include advertising, analytics, SME solutions, IoT, and others, as well as using Wi-Fi as a differentiator or last mile for mobile broadband. The combination that makes the most sense depends on the operator's context but regardless, it is likely that more than one monetization channel will be needed for cost recovery.

Drivers for carrier Wi-Fi include²²:

1. Cater to the demands from newly evolving smart cities
2. Compensate for gaps in network coverage
3. Expand services and complimentary infrastructure
4. Keep pace with competitors and market trends
5. Create compelling B2B (Business to Busienss) products
6. Protect and increase market share
7. Stopgap and augment 5G services

²¹ <https://www.bell.ca/Mobility/Bell-Wifi-Internet-Locations>

²² https://www.alepo.com/wp-content/uploads/2019/09/Alepo_Solution-Brief_Carrier-WiFi-in-the-5G-Era.pdf

Risk assessment and legal liability strategy

There are manageable risks associated with providing public Wi-Fi, particularly in the area of security and liability. Using proper security practices and policies will help mitigate security risks. Liability factors for Wi-Fi network issues should be understood by the City and any organization that provides the service to the public. The following section aims to highlight these factors and provide an overview of why these are relevant to the City. The City of Pickering's legal counsel was consulted when developing this section and were instrumental in assessing any legal liabilities.

Filtering System and Best Practices for Wi-Fi

Zones

Different zones should be established in the network to support users with different privileges. Establish a guest (or public) zone that is a subset of the zones for employees. Zones can be implemented with Virtual Local Area Networks (VLANs) with access restrictions enforced by an upstream device such as a gateway, AP controller or firewall. This will allow for City staff to have a secure connection in areas where they are required to conduct their day-to-day operations and will allow the public to access the network in areas where they choose to consume the internet.

Public Access

Public internet access via Wi-Fi can either be secured or accessed without a password. The choice to provide security might hinge on the expected use. A public Wi-Fi zone on a street, where users are likely to engage in popular on-the-go activities (get directions, look for a restaurant, check the weather, use Twitter, check sports scores) might be suitable for no password required access. A meeting room or library, where users do work, would be a candidate for better security. If the network is secured, a password is required, along with agreement to a Terms and Conditions of Use Statement. Both appear on a splash page to log-on. If the network is not secured (no password) the Terms and Conditions of Use Statement should be agreed to at log-on. Use of a password provides protection for the network operator and other Wi-Fi users.

The survey of upper-tier municipalities in Eastern Ontario revealed that of those communities that provide public Wi-Fi, 33% require a log-in with password, 42% leave their Wi-Fi network completely open and 25% have a combination of some open hotspots and some protected by password. The City has elected to provide access in an no password needed fashion, with users having to agree to Terms and Conditions on appropriate use upon access. This method is suitable going forward as it ensures that everyone who would like to access the network is in agreement of the guidelines and City of Pickering reputational risk is mitigated.

Access Points

The default SSID name on access points should be changed to something unique and that will help people identify the right network to join. Do not use the default name. The City should ensure that all access points across all locations follow the same naming convention so as to ensure consistency for users accessing the network from different locations.

Web Filtering System (or secure web gateway)

Secure web gateway (SWG, also known as web filtering) is the technology and market category for tools that filter users web browsing content to enforce acceptable use and protect against malicious content and reputational risk of the provider. SWGs have become key protection technologies for enterprises as the web evolves. The various types of malicious content can be detected using distributed filters on endpoints or gateways as well as cloud-based facilities by combining Uniform Resource Locator (URL) lists, reputation systems, real-time content detection, and blended techniques. An effective web filtering system can protect users from malware and online phishing exploits, filter inappropriate content, filter applications such as instant messaging (IM), multiplayer games, Web storage, wikis, peer-to-peer (P2P), public voice over IP (VoIP), blogs, data-sharing portals, Web backup, remote PC access, Web conferencing, chat, streaming media, blogging activity, and micro-blogging activity. As the City is currently using a management tool with some level of web filtering available, and no issues have been raised on improper use, there is no apparent need to make any changes going forward.

It can also protect users from web-based exploits. Web-based attacks are implemented in many places, and may use blended techniques. Attacks are quite diverse, but tend to fall into a few basic categories²³:

- User-dependent: Social engineering using deceptive content that induces the user to take inappropriate action, such as download a Trojan horse malware file or give up personal information, perhaps simply by logging into the fake site.
- Vulnerability dependent: Web code or scripts that trigger a flaw in the browser or browser plug-in code, thereby enabling a buffer overflow or some other remote code-execution exploit that takes control of the running process and ultimately the computer.
- Protocol or content dependent: Attacks that take advantage of multi-site interactions, such as cross-site scripting attacks that inject code from one site to the other, or iFrames used to hide clickjacking attacks.

Wi-Fi Deployment Components and Use Cases

In order to understand a Wi-Fi deployment, it is critical to understand what comprises a Wi-Fi system. The following are the mandatory and optional components needed in order to have a successful deployment of Wi-Fi. The City currently has access to and uses all of the Wi-Fi deployment components in day-to-day operation of the network. Market leading cloud-based tools are being used, which ensures that the City is running the network on the latest versions of the software.

Mandatory SWG components

- Web filter, or gateway (enforcement point)
- URL lists or reputation database
- Management console (may be web-based)
- Security research center

Optional SWG components

- Additional analysis engines in the cloud
- Centralized management system, with optional separate policy database and/or reporting database

²³Assessing secure web gateway, Gartner, Inc

Other Considerations

Endpoints physically located in sites that are directly connected to the Internet, or mobile endpoints travelling outside the firewall, do not get filtered by the SWG unless the organization:

- Backhauls all network traffic from the site to the data center via virtual private network (VPN) for filtering
- Backhauls all network traffic from the mobile endpoint to the data center via VPN for filtering.
- Configure the endpoint to direct web traffic to specific SWGs along with mobility, demand for computationally intensive real-time content inspection and larger URL lists is also driving need for more distributed gateway topologies, or cloud-based topologies that can throw more horsepower at the problem than premise-based ones. Increased complexity of policy requirements and protection objectives demands integration with related security infrastructures such as anti-spam and data leakage protection (DLP). Throughout it all rides the imperative to maintain performance and may result in slower internet.

The City must ensure that all locations are managed in a centralized manner. For some of the locations which are remote, cellular Wi-Fi deployments are being used with additional monitoring licenses. The City should review these deployments and have them all managed within the same monitoring system network.

Liability

Neither the Canadian Radio-television and Telecommunications Commission (CRTC) nor Industry, Science and Economic Development Canada have made statements about liability for activity conducted over a public Wi-Fi network or requirements relating to logon records, browser history or router logs. The information presented is based on common practices described in a research paper on public Wi-Fi.²⁴

Public Wi-Fi network operators can protect themselves from liability for illegal activity on their networks by:

- Securing their network
- Terms and Conditions of Use Policies

At a minimum, organizations should consider implementing URL lists or reputation databases to prevent users from unknowingly visiting sites with high malware or phishing risk. Beyond reducing malware and phishing, AUP enforcement can reduce risks to productivity and liability.

In most cases, users are required to review and agree with the Terms and Conditions which specify that users can not use the Wi-Fi service or allow anyone to use the service on mobile device, for any unacceptable use. An example for Terms and Conditions:

- Invading another person's privacy; misrepresenting yourself by posing as someone else; unlawfully promoting or inciting hatred; unlawfully using, possessing, posting, transmitting or disseminating obscene, profane, hate, terrorist or child pornographic material;
- Posting, transmitting, distributing, disseminating, uploading or downloading content that is unlawful, threatening, harassing, abusive, libellous, slanderous, defamatory or otherwise offensive or objectionable; or encouraging conduct that would constitute a criminal offence, give rise to civil liability, or otherwise violate any municipal, provincial, federal or international law, order, rule or regulation;
- Accessing any computer systems, software, data, or confidential, copyright-protected, patent-protected material or personal information of any other person without the person's knowledge and consent; making unauthorized attempts to gain access to any account or computer resource not belonging to you, or otherwise gain unauthorized access to, alter or destroy information of another person by any means or device;

²⁴ Municipal Public Wi-Fi a Sound Investment? https://www.eorn.ca/en/resources/Municipal-Wi-Fi/EORN_WP_WiFi_FINAL.pdf

- Uploading, posting, publishing, defacing, modifying, transmitting, reproducing or distributing information, software or other material that is confidential, protected by copyright or other intellectual, property or proprietary right, or related derivative works, without obtaining permission of the copyright owner or right holder;
- Disrupting our network, directly or indirectly; use the service to restrict, inhibit or interfere with the ability of any other person to use or enjoy use of our products or services or the Internet, including, without limitation, knowingly posting or transmitting information or software that contains a virus, lock, key, bomb, worm, Trojan horse or other harmful, debilitating or disruptive feature;
- Sending unsolicited email ("spamming"), large quantities of unwanted or unsolicited email messages ("mail bombing") or VoIP messages ("voice casting"); attempting to overload a system ("flooding"); participating in broadcast attacks; interfering with service to or by any user host or network; engaging in counterfeit, subterfuge or malicious activities; making inappropriate postings to news groups; sending false commercial messages; or engaging in any other abuse of email or news group servers;
- Violating any system or network security measures, including engaging in unauthorized access or use of our network, data or information;
- Using, intending or attempting to use, or allowing the use of our service in a way that violates any municipal, provincial, federal or international law, order, rule or regulation;
- Using the service in a way that violates the decisions, orders, policies or other requirements of the Canadian Radio-television and Telecommunication Commission or any other regulatory body with jurisdiction over the service or the city;
- Engaging in any activity which we advise you, in our sole and unfettered discretion, is an unacceptable use of telecommunications services, or is otherwise deemed an unacceptable use of our service will result in suspension of use of the Wi-Fi network.

After reviewing the City's terms and conditions, it is evident that there is full coverage of these industry suggested features. The City should review their terms and conditions on a periodic basis and make adjustments as required. Issues and breaches should be escalated to the necessary City staff in order to conduct any investigation and propose recommendations for the issue resolution.

Privacy Considerations²⁵

Despite many of the positive benefits mentioned in this report regarding access to the internet, there are also considerations regarding privacy of data transmitted through an open network. These are risks which users should be aware of when accessing a public Wi-Fi network, regardless of who the operator is. The following are examples of such considerations:

Man in the middle attacks

One of the most common threats on these public Wi-Fi networks is called a Man-in-the-Middle (MitM) attack. Essentially, a MitM attack is a form of eavesdropping. When a computer makes a connection to the Internet, data is sent from point A (computer) to point B (service/website), and vulnerabilities can allow an attacker to get in between these transmissions and "read" them. So what the individual thought was a private interaction with the network, no longer is.

Unencrypted Networks

Encryption means that the information that is sent between the computer and the wireless router is in the form of a "secret code," so that it cannot be read by anyone who does not have the key to decipher the code. Most routers are shipped from the factory with encryption turned off by default, and it must be turned on when the network is set up. If an IT professional sets up the network, this should be verified to ensure the encryption feature is enabled.

²⁵ <https://us.norton.com/internetsecurity-privacy-risks-of-public-wi-fi.html>

Malware Distribution

A software vulnerability is a security weakness found in an operating system or software program. Hackers can exploit this weakness by writing code to target a specific vulnerability, and then inject the malware (computer virus) onto your device.

Snooping and sniffing

Cybercriminals can buy special software kits and even devices to help assist them with eavesdropping on Wi-Fi signals. This technique can allow the attackers to access everything that a person might be doing online — from viewing whole webpages visited (including any information filled out while visiting that webpage) to being able to capture login credentials, and even hijacking the corresponding accounts.

Reputational and Brand Protection Considerations

The City should continue to monitor any attacks on its reputation and brand, particularly when offering a public service such as Wi-Fi. Systems and tools are already in use at the City to restrict access to dangerous content and these should remain in the future. The City should also continue to monitor web links, URLs, domain names and page content that may contain potential threats to its brand and should investigate concerns related to misuse as soon as a potential issue is discovered.

Some consideration should be given on what to do in the event of a crises including:

- Identifying and preparing a response and mitigation for reputational risks
- Using tools and techniques such as crisis simulations
- Monitoring potential risks, risk sensing (early risk detection) and defining rapid response communication teams²⁶

²⁶ Risk Angles – Reputational Risk (Deloitte 2019)

Options analysis

The City has made significant progress over the past several years in providing tax-payer funded free Wi-Fi at many of its public facilities. Moving forward, the City must determine a strategy for how they will keep supporting and potentially expanding this service to citizens, visitors and businesses and enable them to remain connected to the Internet while within Pickering's city limits. The following section outlines 3 options which the City should consider when developing its strategy for the public Wi-Fi deployment moving forward. The options have been developed based on the information provided within this report. On one hand, the options are unique, on the other hand the options could be assessed and combined as a path forward depending on the City's appetite for expanding the network and adopting new technology which is set to become widely available over the next 12-24 months.

Based on the information gathered through the research around free public Wi-Fi, including what other municipalities are doing, the costs and risks involved as well as the benefits, three potential options are presented below for the City's consideration in the decision whether to offer free Wi-Fi in all public areas. It should be noted that these options are not in any particular order and the City may which to choose one option, two options or all options going forward.

1. Expand coverage of free Wi-Fi services provided into all City managed facilities using present day technology
2. Offer public Wi-Fi in all public areas via a public-private partnership in order to reduce the cost to provide the service
3. Keep current Wi-Fi coverage and wait for next generation technologies to prove their models in 2020-2021 before expanding

Option 1 – Expand City Wi-Fi to managed facilities

Option 1 – Expand	Description	Next Steps	Costs and Benefits
Expand free Wi-Fi into all City managed facilities	<p>Opportunity To have access points available at all City managed facilities.</p> <p>Current Operations There are already access points at many City managed facilities which enables staff and the public to use the internet. City is continuing to develop the network on an ongoing basis.</p> <p>Benefit Staff and the public will be able to use the internet for work or leisure wherever they choose to go, although speed might be limited in some areas due to the connection strategies used (i.e., cellular Wi-Fi or hardwired).</p>	<p>Confirm if access point estimate provided here (Cost and Benefits column on the right) is accurate and would ensure full coverage.</p> <p>Identify if additional access points are required for facilities with aging equipment or limited reach.</p> <p>Contact preferred vendors to obtain cost quotes for additional access points and associated licenses (if required).</p>	<p>One-Time Costs Assuming a cost of \$650 per access point router and 2 access points required = \$1300.</p> <p>Assuming a cost of \$150 per access point antennas and 2 access points required = \$300.</p> <p>Recurring Costs Assuming a cost of \$250 per management cloud controller license and 2 licenses required = \$250 recurring.</p> <p>Benefits City of Pickering would be able to claim that there is public Wi-Fi available at all City managed facilities. Access for residents in all 3 wards, further solidifying the</p>

Option 1 – Expand	Description	Next Steps	Costs and Benefits
			balanced implementation approach. City would continue to fulfill the benefits described in the early sections of this report.
	Risks/Pitfalls		
	<ul style="list-style-type: none"> This approach does not assess the reach of the access points in the current locations, potentially missing an opportunity to expand internet access into more square feet of buildings with some level of access. 		
	Ease of Implementation – Low		
	<ul style="list-style-type: none"> Deployment of Wi-Fi access points has been rather straightforward for the City in the past several years as the technology options in use (i.e., Cisco Meraki and Dell/EMC) are plug-and-play. The City has several individuals trained on the maintenance and management of these access points and could deploy the additional access points with its own staff. 		

The following outlines the recommended implementation locations for Option 1 including the amount of access points suggested for each location. The City will need to determine whether additional hardware is required to support the new and expanded locations identified.

Historical one-time costs for access points have been between about \$600-\$700 for an installed router and \$100-\$200 for an installed antenna. Recurring costs are for the controller management licenses which have ranged between \$200-\$300 annually.

Operating cost will include backhaul and maintenance. Backhaul costs will depend on the type of internet service available and the bandwidth amount allocated to public Wi-Fi. Pricing will be different for different carriers and services if an additional cellular connection is needed. A municipality that has excess capacity in their connection to the internet will not incur additional cost for Wi-Fi backhaul.

Option 2 – Offer Public Wi-Fi in all public areas via partnership with a carrier

Option 2 – Private Partnership	Description	Next Steps	Costs
Expand free Wi-Fi into all public locations	<p>Opportunity</p> <p>Expand Wi-Fi into all public locations across the City, with an emphasis on outdoor locations and commercial locations (i.e. malls).</p> <p>Partner with service provider(s) (carriers) to implement free public Wi-Fi across applicable City locations.</p> <p>Use advertisements on the access screen to help with a monetization strategy.</p> <p>Current Operations</p> <p>Currently there are no partnerships with internet service providers to provide</p>	<p>Research potential solutions providers (e.g., Alepo, CIVIQ Smartscapes, Bell Canada etc.) and community partners who may be able to support the development of the project.</p> <p>Attempt to meet with other jurisdictions who have deployed an expanded free Wi-Fi systems to gain additional insights.</p> <p>Document detailed requirements (e.g., functional, technical, level of service, geographic reach) for a broader free public Wi-Fi deployment.</p>	<p>Costs</p> <p>Several cost models available including: City owned, service provider owned or Public-Private partnership. Detailed cost breakdown is unavailable at this time given each model is affected by a number of factors.</p> <p>Benefits</p> <p>Several monetization models exist in order to recover costs and continue providing free Wi-Fi. Some examples of this include: advertisements (video and static), capturing data using social logins, verification of SMS to connect to capture user data, filling of survey.</p>

Option 2 – Private Partnership	Description	Next Steps	Costs
	free public Wi-Fi in any of the locations.	<p>Consider starting with a pilot of the initiative in key locations that feedback can easily be gathered, and analyze results in order to refine strategy before expanding.</p> <p>Discuss public Wi-Fi partnering agreements with local businesses who are interested in being a part of a larger deployment.</p>	<p>General benefits of using a service provider to expand free Wi-Fi at all locations include: lowering operational costs, elimination of coverage gaps, reduction in network congestion, improvement in customer experience, increased ability to drive revenue²⁷.</p>
	<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> • Server down-time or inability to manage the level of service provided • Reliant on the provider to offer the service, which could result in a loss of control over certain aspects of the deployment • Lack of choice over locations chosen due to provider participating in the choice of areas and venues covered • Potential concerns regarding ownership of data and user privacy related to the monetization of user information. The City will need to ensure that these concerns are included as considerations when discussing potential solutions with private companies and consult with experts for guidance on policies. <p>Ease of Implementation – High</p> <ul style="list-style-type: none"> • Longer deployment timeline as the City would need to investigate the option(s) in more detail, meet with potential vendors (service providers) to discuss the options and plan for the implementation • Implementation of the deployment would likely require managing a relationship with a vendor, which would add a degree of complexity • Expanding free Wi-Fi into a wider region would require significant investment (of time, money or a combination of both depending on the type of deployment chosen) and would likely be a multi-year effort to operationalize 		

Option 3 – No immediate action and wait for next generation technologies

Option 3 – Wait	Description	Next Steps	Costs and Benefits
Wait for next generation technologies to be proven in the next 1-2 years before making an investment	<p>Opportunity</p> <p>Allow other organizations to try to the new Wi-Fi 6 technologies and share their results before becoming an early adopter.</p> <p>Work with ISPs to plan for the implementation of 5G across the community.</p> <p>Collect information and proposals from companies who are interested in developing the City’s</p>	<p>Identify existing deployments which may benefit from enhanced Wi-Fi capabilities available through the potential implementation of Wi-Fi 6.</p> <p>Monitor vendor solutions to assess which have the best combinations of hardware and software to deploy in a larger area at a lower cost.</p> <p>Work with ISPs and other interested parties to plan how 5G will be implemented</p>	<p>Costs</p> <p>Time investments by IT and City development team to monitor progress of technologies and work with ISPs.</p> <p>Benefits</p> <p>Allow market to prove next generation technologies allowing the City to learn from other jurisdictions mistakes or wins.</p>

²⁷ <https://www.alepo.com/monetize-your-wifi-using-captive-portal/>

Option 3 – Wait	Description	Next Steps	Costs and Benefits
	<p>infrastructure and enabling IoT technologies</p> <p>Current Operations Continue ongoing management of existing Wi-Fi network and make adjustments where required without upgrading technology.</p> <p>Benefit Staff can focus on assessing other high priority initiatives which may have a larger impact for the community.</p> <hr/> <p>Risks/Pitfalls</p> <ul style="list-style-type: none"> Public perception that the City is not making continued investments in order to expand Wi-Fi access to the residents despite scheduled upgrades and implementation of new hardware happening on an ongoing basis <p>Ease of Implementation – Low</p> <ul style="list-style-type: none"> As there is no actual implementation, the effort is generally low at this time as staff will be focused on research and planning of next-gen technologies, installing planned hardware maintenance upgrades, as well as liaising with interested development groups 	<p>across the City. Discuss whether the City can support in the development of cellular towers and where the initial deployments should be located in order to reach the most citizens.</p>	<p>Showcase to the public that the City is committed to long-term growth, following a structured path.</p>

Conclusion

In Closing

Public Wi-Fi (currently funded by tax-payer dollars) brings opportunities for municipalities to provide communications services to their residents, businesses and visitors. It can support the vibrancy of a community through business growth and community branding, by supporting and enhancing other municipal services and by providing internet connectivity for those who do not have access at home for reasons of income or lack of service availability. The City of Pickering already provides public Wi-Fi access in 19 facilities including almost all of their libraries and most of their other municipal facilities and parks. The City also makes a concerted effort to replace aging hardware and implement new access points on an as needed basis to improve the network coverage.

Based on the facts collected as part of this research, particularly the minimal number of additional facilities requiring deployment and the state of next generation technologies, our analysis indicates that any of the options described in the previous section is suitable for the City's public W-Fi strategy. Option 1 allows the City to make a small investment today and wait for next generation technologies to be proven in the coming years before purchasing them now, as described in Option 3. The City may decide to change its strategy on Option 2, if 5G data plans become cost prohibitive for some residents, however as mentioned, the CRTC is in the midst of an investigation and there is some likelihood that pricing for plans will change due to the ongoing scrutiny. If these plans are affordable and the 5G coverage is robust, the City may not need to focus on Wi-Fi as the way of getting access to internet to its citizens.

As for ensuring security and legal coverage, proper security practices and policies mentioned in this report can be used to mitigate security risks to the City providing the Wi-Fi service and network users. Liability risks can be mitigated by providing Terms and Conditions of Use Policies. The City may elect to review their Terms of Use to ensure coverage addresses aspects like privacy and reputation.

As stated in the opening section, free public Wi-Fi can provide business and social support to the City of Pickering in many ways for many people and should continue to be offered if costs can continue to be controlled and minimized. Like any purchase made by the City, the investment should be weighed against other priorities to ensure that tax payer dollars are spent in areas that will bring most value and reach more residents.

As part of next steps, the City should consider implementing an additional or internal consultation process to undertake an evidence based approach to assessing the broader internet needs of the community. Activities could include: commission a needs assessment study to analyze and summarize existing community studies conducted over the last five years, commission an Intelligent Communities (Smart City) Forum Report Card, and begin to request feedback on the current free Wi-Fi deployment to understand levels of satisfaction.

Appendix – Public Wi-Fi

Review Results from CRTC on Wireless Services in Canada

The results of the review on wireless services in Canada, including the following:

1. Affordability of data plans for all Canadians²⁸

From a technological perspective, wireless networks in Canada have also evolved, as carriers continue to roll out long-term evolution (LTE) and LTE-advanced (LTE-A) networks, contribute to the growth of the Internet of Things (IoT) market, and transition away from third-generation (3G) networks. Currently, the mobile wireless service market is on the verge of a major transformation, since wireless carriers are poised to begin introducing 5G wireless technology into their networks. This technology upgrade will mean that wireless networks will become exponentially faster, more pervasive, and more versatile. With a predicted maximum throughput of 10 gigabits per second (Gbps), this technology will support innovative and bandwidth-intensive new services, including self-driving cars, smart cities, and a multitude of interconnected devices that form the IoT.

In order to begin introducing 5G technology, wireless carriers will be required to make significant investments in network infrastructure, and to negotiate with a variety of stakeholders to secure adequate access to fibre facilities, rights of way, and small-cell sites. It is therefore important to assess whether there are barriers to the introduction of new technologies by carriers, and the extent to which regulatory intervention by the Commission may be required to support investment and competition in the evolving marketplace.

The mobile wireless service industry has evolved since the Commission's last review of these services, due to, among other things, technological and market changes, and it will continue to evolve as carriers begin to introduce 5G networks.

The Commission is concerned that the fact that (i) retail market concentration remains high (due in part to a series of acquisitions), and (ii) the Commission has been repeatedly required to intervene in the retail market, suggests that certain aspects of this market are not, in fact, sufficiently competitive in their current state to properly protect the interests of users. As a result, the Commission will include a review of the state of competition in the retail market. As part of this review, there will be a definition of the retail market and whether the retail mobile wireless services currently offered by wireless carriers, including prepaid services and lower-cost data-only plans, are meeting the needs of Canadians.

Depending on the results of the review, the Commission will evaluate whether any changes to its mobile wireless service regulatory framework are required, which could include, for example, establishing new retail policies and imposing conditions of service. The review may also result in the Commission considering whether to reassert any previously forborne powers in order to apply any regulatory measures that are deemed appropriate. These could be in addition to any wholesale measures that may be required as a result of this proceeding.

²⁸ <https://crtc.gc.ca/eng/archive/2019/2019-57.htm>

2. Planning for implementation of 5G ²⁹

- In the coming years, wireless carriers will begin to deploy 5G technology in their networks across the country. One of the first steps toward the introduction of 5G technology is the construction of the cellular network infrastructure that the technology requires. Going forward, carriers will continue to need to acquire and develop high-power cell sites where they can install radio equipment on ground-based masts, towers, rooftops, and other existing structures. Small cell deployment will require a change from the standard model of large macrocell sites delivering wireless signals over relatively long distances to also include numerous small-cell sites packed more densely together. Because small cells will be used in conjunction with high-frequency spectrum, which has limited propagation, a large number of small cells will be required to properly cover any given area.
- Given the role that small cells will have in supporting next-generation services, it is clear that investment in these cells by wireless carriers will be of increasing importance in the coming years.

In order to successfully deploy small cells, a wireless carrier must, among other things, (i) negotiate with owners (e.g., municipalities) for access to passive infrastructure, (ii) negotiate with carriers (in the absence of a tariff) and hydro companies for access to poles, and (iii) build or acquire access to fibre-based transport sufficient to support the service.

Detailed Benefits of WiFi 6³⁰

Wi-Fi 6

Wi-Fi 6 is the last iteration of 802.11 standards developed through ratification in the past 20 years, starting with the original standard 802.11a (1997) and 802.11b (1999), 802.11g (2003), 802.11n (2009) and 802.11ac (2013). While pre-standard Wi-Fi 6 wireless LAN (WLAN) access points (APs) are available in the market, the 802.11ax standard won't be officially ratified until late 2019.

Backward Compatibility

- Backward compatibility is an important aspect when a new Wi-Fi standard comes out. Historically the wireless local access network (WLAN) access points offerings included a separate “legacy” radio to support “legacy” devices, namely wireless clients that did not support the “new” technology.
- Backward compatibility allows integration with legacy 802.11ac and 802.11n infrastructure. This provides the option for enterprises to gradually upgrade to Wi-Fi 6.
- While it is backward compatible with 802.11a/g/n/ac, the full benefits of deploying it will only come into play when wireless clients also support Wi-Fi 6. Compared to the overall global installed base of wireless clients, a rather limited percentage of devices supporting Wi-Fi 6 will be available over the next three years.

Higher Data Rates

- Wi-Fi 6 promises better user experience and a higher number of users supported per access points. Wi-Fi 6 can provide up to 10 Gbps of wireless throughput operating in the 5GHz frequency band, which is an apparent upgrade from the previous 75 Mbps and 2.4GHz. Today the theoretical data rates of 802.11n at 2.4GHz are 75 Mbps per radio
- The potential to deliver theoretical throughput close to 10 Gbps will struggle to find real-life implementation for the city public Wi-Fi due to limitations related to the data subcarrier (signal) modulation scheme.

²⁹ <https://crtc.gc.ca/eng/archive/2019/2019-57.htm>

³⁰ Magic Quadrant for the wired and wireless LAN access infrastructure (Gartner 2018)

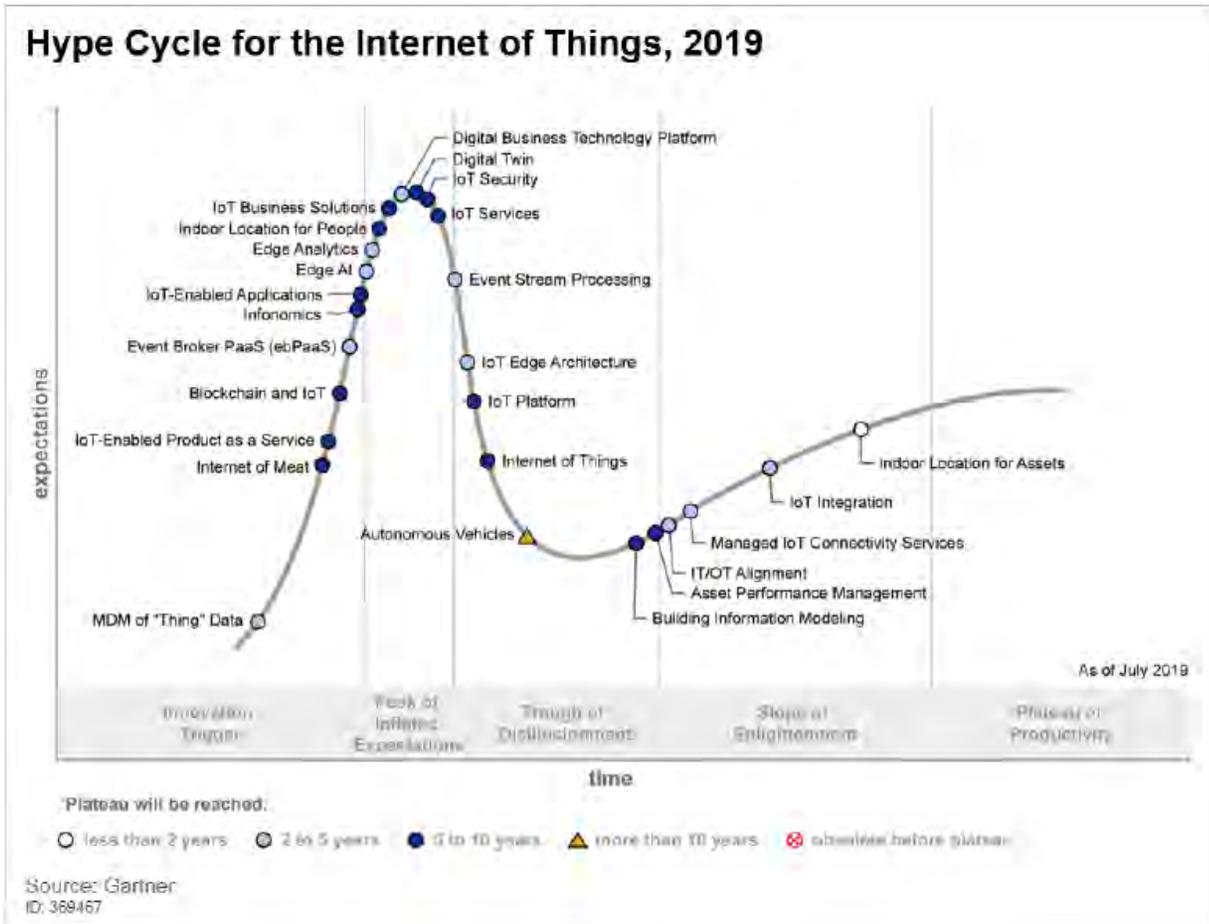
Internet of Things (IoT)

There have been many reports in the past several years around the IoT which highlight how IoT is changing our world as we know it through the rollout of connected devices. The City has been approached by several companies who would like to implement technologies which will support the development of a connected community and enable the City to use IoT connected devices for many of their operations. These proposals are being assessed on an ongoing basis for appropriateness and viability. Some examples of potential outcomes would include: smart internet enabled light-posts, environmental sensors, additional cameras, and advanced tracking on fleet vehicles, to name a few. Broader access to free public Wi-Fi has been proposed by many companies, however the City must ensure that the business interest and privacy of the public is taken into consideration when reviewing these proposals, as ownership of user data is a key factor to consider.

As a primer, key IoT technologies include:

- Digital business technology platforms such as wireless payment processing, or corporate systems run on devices
- Edge AI, which means that AI algorithms are processed locally on a hardware device. The algorithms are using data (sensor data or signals) that are created on the device. A device using Edge AI does not need to be connected in order to work properly, it can process data and take decisions independently without a connection.
- Event stream processing
- IoT edge architecture to ensure devices are running on latest code
- IoT integration so that devices can be connected to management systems
- Information technology/operational technology (IT/OT)

Key use cases for IoT include autonomous vehicles, building information modeling, indoor location for assets, and IoT enabled product as a service, which could all be applicable to municipalities. The following image shows where key IoT technology are in their development and rollout. It is taken from Gartner’s hype cycle which shows the trend line for each of the pieces of the technology and where they are in their general development and roll-out.



(Hype Cycle for the Internet of Things, 2019, Gartner, Inc.)

Sample Wi-Fi Terms of Use

Standard terms of use

You must agree to the following text before using our wireless hotspot.

Policy Statement

Use of this network contrary to the operational and management objectives is unacceptable and prohibited.

Scope

This Policy applies to all customers and to all other users of this hotspot.

Prohibited Uses

Examples of prohibited uses of this hotspot are described below. The examples are guidelines and are not intended to be exhaustive.

Illegal/Criminal Activity

This network may not be used in connection with criminal or civil violations of laws, regulations, or other government requirements of any jurisdiction. Such violations include theft or infringement of copyrights, patents, trademarks, trade secrets, or other intellectual property, export control violations, fraud, forgery, pyramid or other prohibited business schemes; and theft, misappropriation, or unauthorized transmission or storage of funds, credit card information, personal information, or online services.

Security Violations

This hotspot may not be used to violate the security of a network, service or other system. Examples of this may include hacking, cracking, monitoring, or using systems without authorization; port scanning; conducting denial of service attacks; distributing viruses or other harmful software; smurf attacks; and unauthorized alteration or destruction of websites or other information.

Threats

This hotspot may not be used to transmit or store material of a threatening nature, including threats of death or physical harm, harassment, libel, and defamation.

Offensive materials

This hotspot may not be used to transmit or store material of an offensive nature, including obscene, pornographic, indecent, abusive and harmful materials, or to transmit to recipients material which is inappropriate for them, including obscene or offensive materials to children.

Spam

This hotspot may not be used to spam. Spam includes any of the following activities:

- Sending any unsolicited email that could be expected to provoke complaints.
- Sending email that does not accurately identify the sender, the sender's return address, and the email address of origin.
- Sending unsolicited email without identifying in the email a clear and easy means to be excluded from receiving additional email from the originator of the email.
- Collecting the responses of unsolicited email. Sending email with charity requests, petitions for signatures, or any chain mail related materials.
- Posting a single message, or messages similar in content to more than five online forums or newsgroups.
- Posting messages to an online forum or newsgroup that violate the rules of the forum or newsgroup.

Security System

This hotspot may not be used, directly or indirectly, with systems that are not configured and maintained in a manner which prevents their use by others in violation of this Policy. Examples include improperly securing a server so that it may be used by others to conduct a denial of service attack, improperly securing a mail server so that it may be used by others to distribute spam, and improperly securing an FTP server so that it may be used by others to illegally distribute licensed software.

Application visibility

Application Visibility and Control (AVC) classifies applications using deep packet inspection techniques with the Network-Based Application Recognition (NBAR) engine, and provides application-level visibility and control (QoS) in wireless networks.³¹ This is relevant for the City as it will be needed for using enterprise applications at the various facilities where Wi-Fi is present. For example, accessing the ERP to make a request would need application visibility.

Factors that will impact equipment selection include:

³¹ https://www.cisco.com/c/en/us/td/docs/wireless/controller/7-4/configuration/guides/consolidated/b_cg74_CONSOLIDATED/b_cg74_CONSOLIDATED_chapter_01111.html

- Size of area to be served, which determines the number of access points required and the range of each access point;
- Number of devices to be supported;
- Mobility, such as if users need transparent handoff from one AP to the next;
- Type of activity supported;
- Network Control, per AP or centralized;
- Spectrum and standards;
- Content filtering; and
- Indoor vs. outdoor deployment.

Other

This hotspot may not be used in a manner that damages the owner's reputation or goodwill; violates another ISP's acceptable use policy and/or terms of service; or interferes with another's use of the network.

Attempts

This hotspot may not be used to attempt an activity prohibited by this Policy – whether or not successful.

General

Under no circumstances, including, but not limited to, negligence, shall the owner of this hotspot, its subsidiary and parent companies or affiliates be liable for any direct, indirect, incidental, special or consequential damages that result from the use of, or the inability to use this hotspot. You specifically acknowledge and agree that the owner of this hotspot is not liable for any defamatory, offensive or illegal conduct of any user.

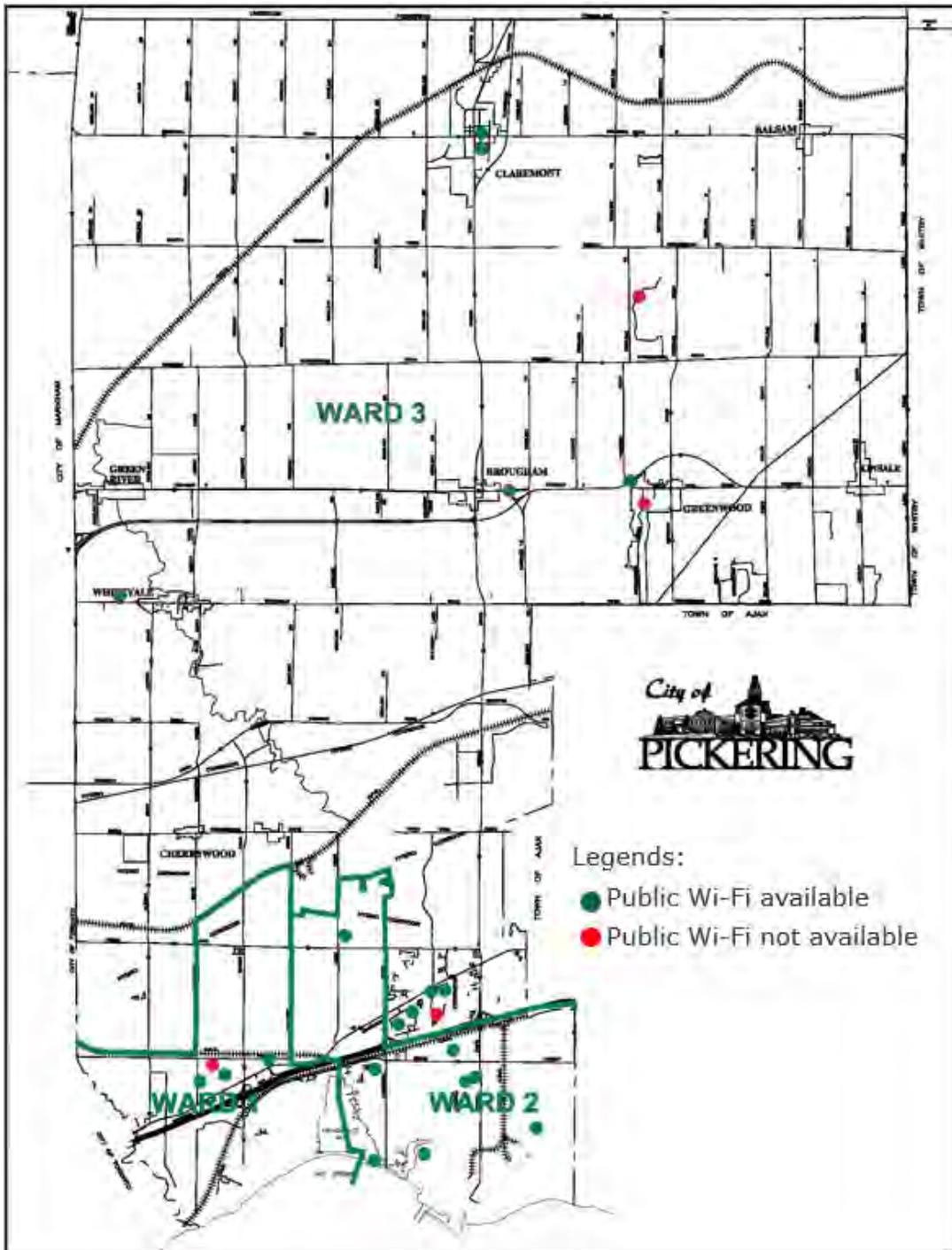
If you are dissatisfied with these terms and conditions, your sole and exclusive remedy is to discontinue using this service

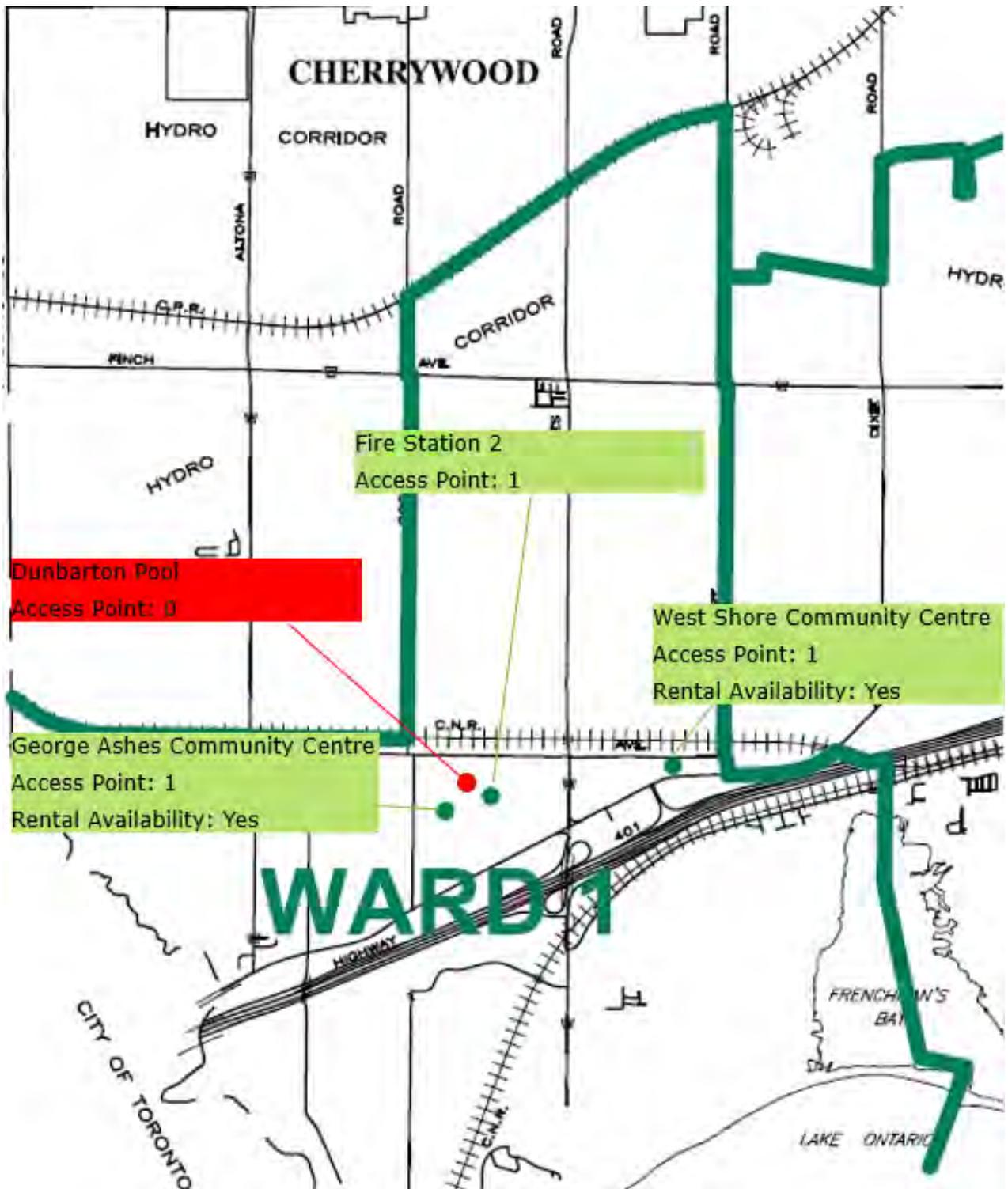
Notable Definitions

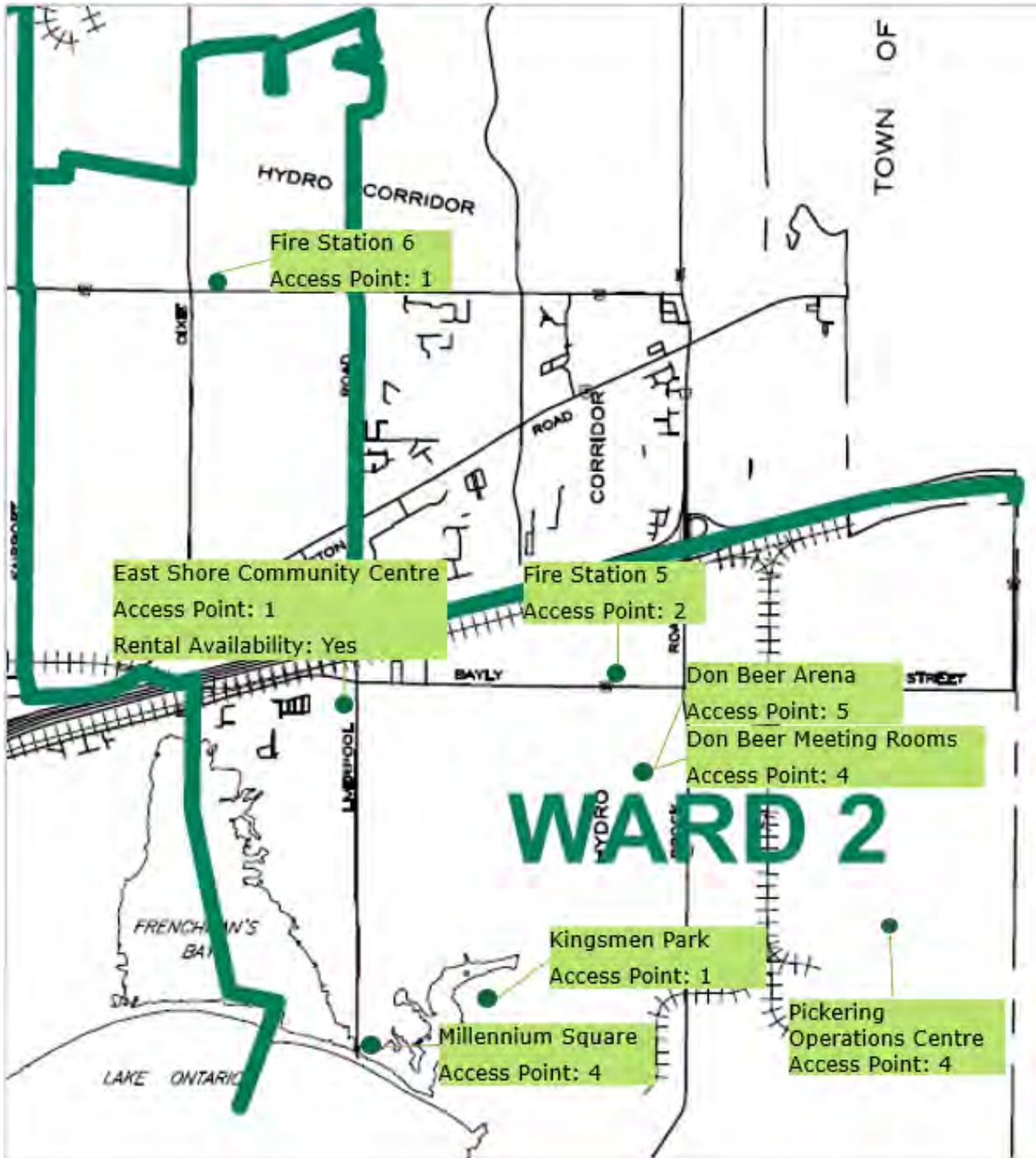
1. Gigahertz is a measure of speed vibration
2. Gbps, short for Gigabits per second, a data transfer speed measurement for high-speed networks
3. Orthogonal frequency-division multiple access (OFDMA) is a method of encoding data on multiple carrier frequencies. Multiple access is achieved by assigning subsets of subcarriers to multiple users.
4. Basic Service Set (BSS) Coloring: "BSS Coloring" assigns a numerical identifier (color) based on the channel used by the basic service set (BSS, also known as the AP radio with the associated connected clients). This method is used to identify and mitigate overlapping BSSs, decreasing channel contention problems.
5. Backhaul technology: In a hierarchical telecommunications network, the backhaul portion of the network comprises the intermediate links between the core network, or backbone network, and the small subnetworks at the edge of the network. Visualizing the entire hierarchical network as a human skeleton, the core network would represent the spine, the backhaul links would be the limbs, the edge networks would be the hands and feet, and the individual links within those edge networks would be the fingers and toes.
6. Network topology: Network topology is the arrangement of the elements (links, nodes, etc.) of a communication network. Network topology can be used to define or describe the arrangement of various types of telecommunication networks, including command and control radio networks, industrial field busses and computer networks)

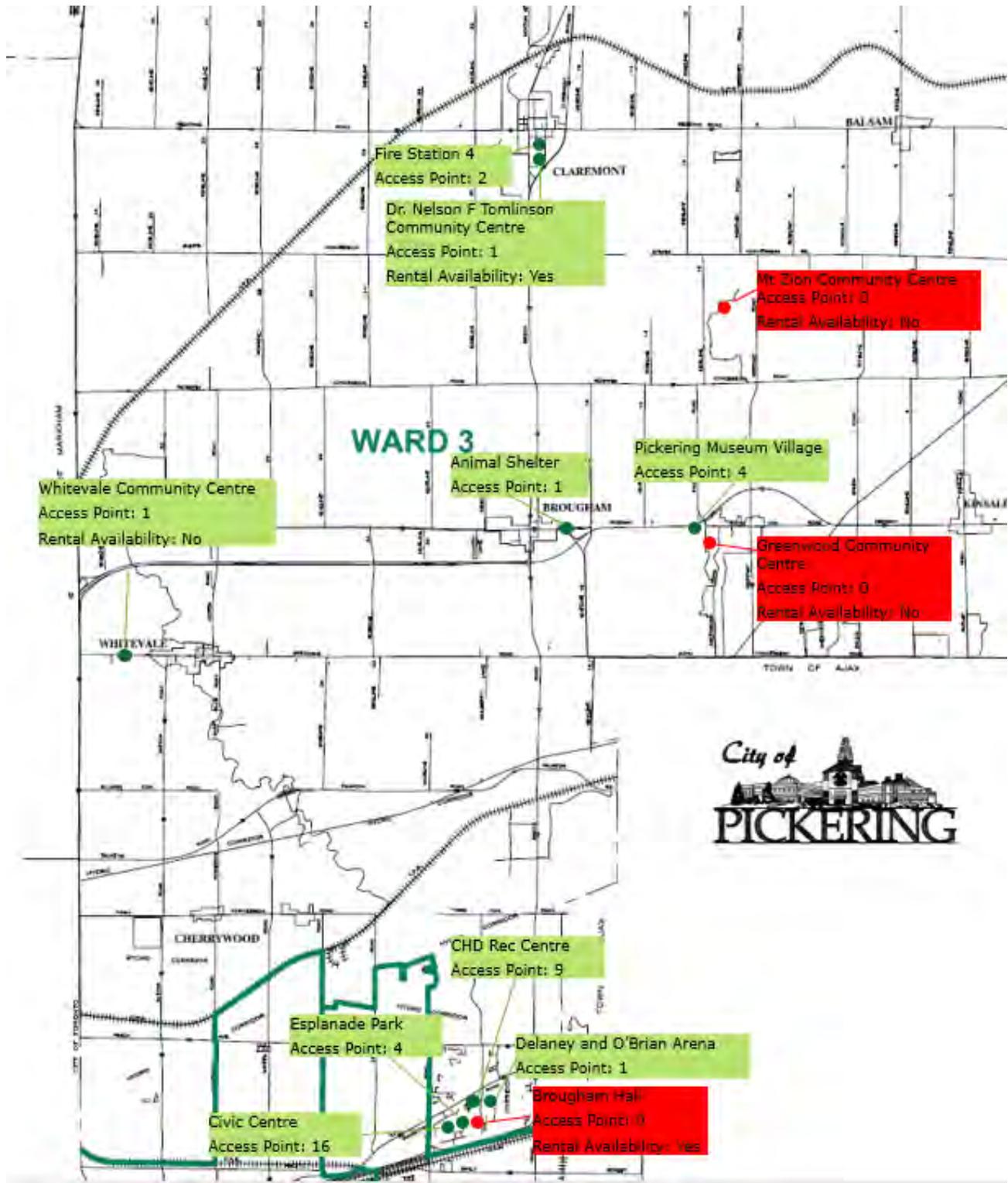
Current Deployment Maps

The following pages are visual representations of where there is currently free public Wi-Fi at the City. The representations are based on information received by the City and provide a more detailed view of the current Wi-Fi deployment by Ward. A green label indicates current Wi-Fi access, while a red label indicates no current Wi-Fi access. The maps also include the amount of access points at each location.









Building permitting system report

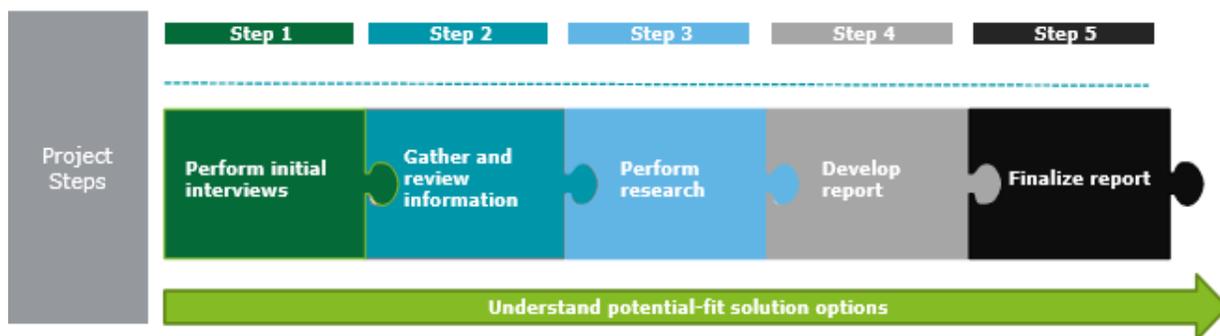
Introduction

Service Review Objective

The objective of the building permit report was to identify technology options that can expedite the time to issue building permits, thus increasing productivity in the building permit division, and identify other areas which could realize cost savings, as well as understand the investment in an electronic permitting system.

Figure 1: Project Steps

Summary: The project steps diagram below illustrates the steps taken as part of this investigation beginning with initial interviews, information gathering, research analysis, followed by development, and finalization of report.



Research Methodology

The research methodology for the building permit report was to first conduct a preliminary analysis of the current building permitting process at the City of Pickering. This consisted of engaging with key members of the building permitting team in order to understand the City's current operational deficiencies, along with researching technological advances in the permitting sector in order to identify current state gaps. Once the current state gaps were identified in terms of functional deficiencies of the current system and industry best practices, follow-up inquiries were made with the permitting team in order to better understand the department's functional requirements for a new system.

Scope

The scope of the research conducted as determined by the City of Pickering is described below:

- Understand the current paper-based building permit application process at the City of Pickering in order to identify deficiencies experienced by users in the current process.
- Work with the City's personnel to determine critical requirements for an electronic building permit system.
- Perform research on available building permit systems that could assist the City of Pickering in improving its efficiency and productivity in the issuance of building permits. In particular, examining potential solutions that could provide benefits in areas including but not limited to permit intake, review and document management, system integration, payment processing, inspections, and built-in tracking functions.

Approach

In order to conduct the research for the report, the following approach was used:

- Research and understand the building permit industry in order to ensure the City of Pickering is in alignment with industry standards in terms of client service, productivity, and cost savings.
- Analyze the City's current operational state and identify current state gaps preventing the City from performing at optimal efficiency.
- Use functional requirements derived from the City's current state gap analysis developed in the previous step to identify and assess potential-fit building permit technology options.
- Provide a cost-benefit analysis in order to quantify the benefits of purchasing and implementing an electronic permitting solution that would meet the City's requirements.

Background

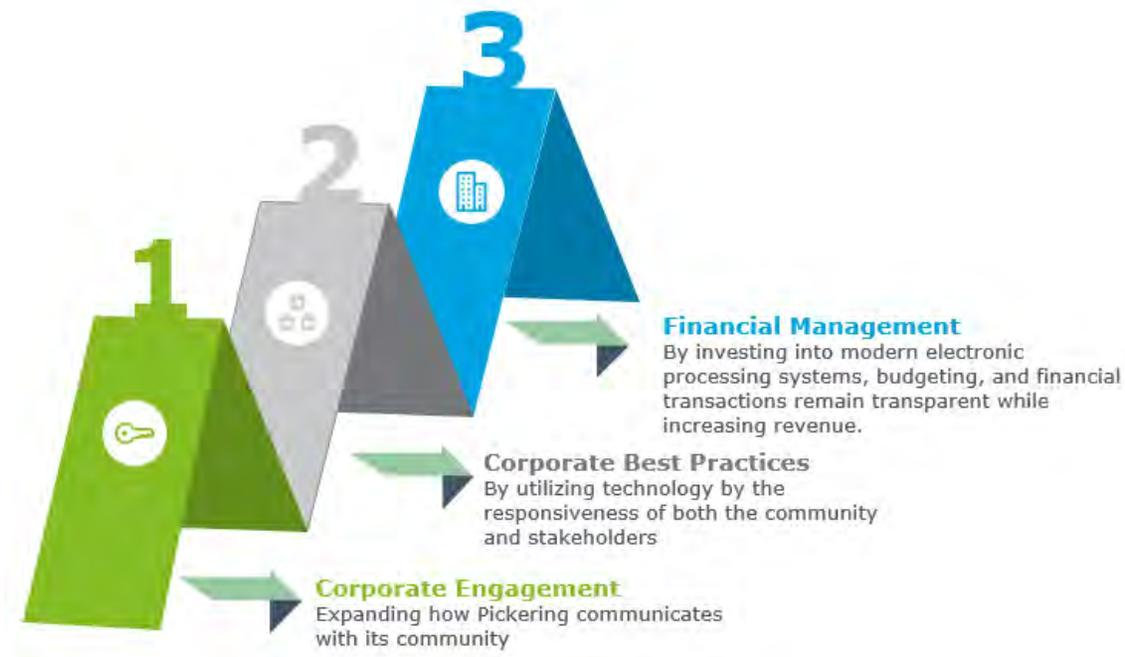
Industry Background

Municipalities across Ontario and Canada are falling behind their international counterparts in adapting to emerging permitting technologies which is resulting in delays in permit approval time, along with increased construction costs. According to RESCON, "...many developers and builders alike believe that the time it takes to submit all of the required paperwork and receive the applicable approvals, and the building permit itself, is often longer than the actual physical construction of the project."³² Likewise, adhering to Ontario building code requirements takes time, and having a paper-based application system only delays the process. Therefore, it is essential for the City of Pickering to optimize their permitting process through electronic submission and review in order to meet the following corporate priorities as discussed in figure 2 below.³³



Figure 2: City of Pickering Corporate Priorities

Summary: The City of Pickering’s corporate priorities are corporate engagement, corporate best practices, and financial management. The corporate priorities are described in the illustration below as follows:



³² Modernizing Building Approvals in Ontario Report, Rescon Residential Construction and Ryerson University, https://www.ryerson.ca/content/dam/cur/pdfs/RESCON/CUR_RESCON_Modernizing%20Building%20Approvals%20in%20Ontario%20Report_2017.07.05.pdf

³³ Corporate priorities derived from Business Case for Electronic Permit Solution

City of Pickering Background

Currently, the City's permitting application process is conducted by a paper-based system., and is confined to the City's hours of operations as applicants have to physically visit the City to submit permit applications, and pay permit fees. The submission package is made up of application forms, construction drawings, approvals from other parties, and supporting documentation. This process is inefficient and is resulting in late tax revenue for the City and increased operational costs as a result of storing paper and stationary costs, along with staff performing clerical tasks such as data entry for application submission, and communicating status of application.

The building permit department is responsible for the following:

- Managing the City's permit submission process
- Communicating permit status to stakeholders
- Scheduling residential and commercial inspections, and
- Issuing permits and resolving permit disputes.

The current building permitting software provider Calytera, formally known as CSDC, is a US-based company providing building permitting solutions with options of web-based, cloud, and on-premises data storage. The City has adopted the Amanda system as a back office tool to record permit intakes, schedule inspection requests, and process payments. The City currently pays \$25,000 annually in licensing fees for the permitting software.

Upon inquiries and meetings with the City, the team learned that the City is currently in the process of transitioning to a system upgrade next year as the existing system is not user-friendly. The City will upgrade to the Amanda 7 system next year as the current version of the software will no longer be supported after January 2021. The Amanda 7 upgrade will cost approximately \$190,000 and will enhance greater efficiencies in the permitting process. These improvements include but are not limited to an upgraded user interface with the ability to make user level changes to enhance inter-department workflow, along with advanced search and analytical tools for graphical review and analysis. Therefore it's essential for the new e-permitting system to integrate with the City's existing Amanda system.

Based on the above analysis, adopting an e-permitting solution would expedite the timely issuance of permits and will help rectify the critical issues identified in the current process. An e-permitting solution will electronically accept, review, schedule, and assign inspections, while communicating status updates in real-time to both applicants and staff.

Key findings

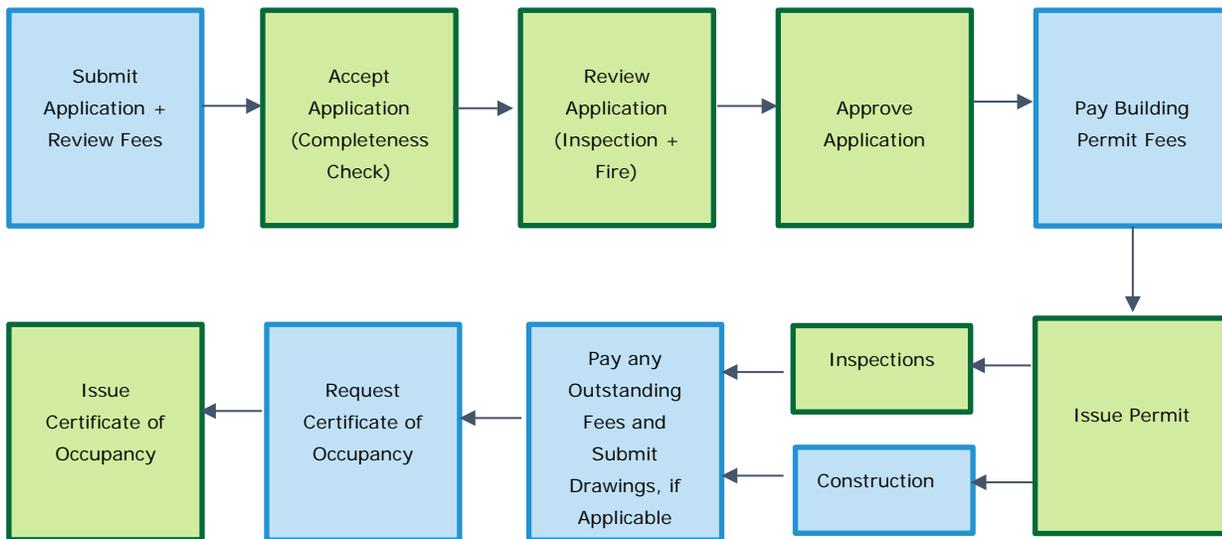
The following are the key findings uncovered during interviews with the City of Pickering as part of this service review. These findings were used when determining potential solution providers to include in the assessment described in the Functional and Non-Functional Requirement section of this report.

1. The City's current permitting process is heavily reliant on paper and lacks the ability to automate key permitting tasks such as application submission, permit review, and payment processing. The lack of integration and functionality required in order to realize efficiencies, reduce costs, and improve day-to-day functions is resulting in the following challenges experienced by the City staff:
 - Added delays in issuing permits as staff is manually inputting data, processing payments, along with reviewing and stamping plans for compliance on paper. The legacy paper-based application system currently takes 3 weeks to review and issue a permit for a detached dwelling home permit, far below the industry standard of a few days under an e-permitting solution.
 - Increased costs associated with paper, office supplies, and stationary.
 - Increased clerical costs associated with data entry.
2. The current system does not calculate permit fees correctly and does not notify the City of any overcharges. The overcharges have resulted in \$70,000 being returned to residents in 2018 based on the City's internal review. There could be additional miscalculations that the City has still not uncovered, and it is recommended that the City performs an in-depth analysis to further uncover miscalculations in permit fees, and potentially hire external independent consultants to support the assessment. To rectify any future errors in overcharges, the new system needs to integrate with the City's existing ERP system.
3. The current system lacks the ability of applicants to review their permit status in real-time, which results in delays as the City informs residents of additional information requests, outstanding payments, or status inquiries in person, or on the phone. To reduce the paper footprint and call volume of residents visiting or calling in to the City regarding their application status, the new system needs to provide users with the ability to review their application status online in real-time, and show which phase their application process is in (initial review or inspection). A built-in tracking function with active dashboards will enable the City to notify applicants of any pending application tasks such as outstanding payments, submission of plans, or missing application information, which further enhances efficiencies in the permitting process.
4. The current manual scheduling process for inspections is inefficient and it has resulted in scheduling errors, along with inspector task-lists for inspections not being generated correctly which is currently conducted by the scheduler. To reduce errors in scheduling, the new system should provide applicants with the ability to book inspections online, and the system should have the ability to automatically assign, route, and schedule inspections. The system should provide the City with the opportunity to configure the process of automatic scheduling based on custom defined rules and inspector availability. In addition, the new system will need to provide inspectors with the ability to generate and view task lists on mobile devices.
5. As mentioned above, inspectors currently do not have mobile capabilities to make field changes to plans regardless of geographic location. Instead, inspectors are currently logging in through VPN Citrix on their laptops to make changes. Thus, the new system must allow inspectors to view field data in real-time through GIS technology, enabling inspectors to see exactly what changes on the field will look like in real-time. The key features of GIS technology are discussed on page 47 of this report.

A new enhanced building permitting system will bring more automation to the current process, and convert documents to electronic format, which will result in improved citizen service, and reduced costs. The flow chart in figure 3 depicts the flow of an e-permitting process enabled by a system.

Figure 3: E-Permitting System Process Flow

Summary: An e-permitting system can automate a number of functions including submission of applications, payment processing, electronic review of permits, and issuance of permits. The illustration below depicts the process flow of a permitting application. The process flow steps in blue represent responsibilities of the applicants and green represents the responsibilities of the City that can be performed electronically through an e-permitting system.



Legend:



Current State Gaps

The next section looks into current state gaps which were derived during meetings with key members of the building permitting team. During the meeting it was uncovered that the gaps the City is facing with the current building permit system revolve around:

- Permit Intake
- Review and Document Management
- System Integration
- Payment Processing
- Inspections, and
- Built-In Tracking Functions.

The table in the next section depicts the current state gaps identified in the existing system.

Current State Gaps

Permit Intake	Review and Document Management	System Integration	Payment Processing
Current System	Current System	Current System	Current System
Paper-based application submission in Amanda.	The review process is currently conducted manually on paper.	Amanda and the current SAP ERP system are not integrated, resulting in fees not being calculated correctly.	Payments are currently made in-person at the City Hall.
Current State Gaps	Current State Gaps	Current State Gaps	Current State Gaps
<p>Applications are submitted on paper and entered into the system by staff which is taking up both time and cost associated with staff performing clerical tasks such as redundant data entry which can be automated.</p> <p>Additional functions required:</p> <ul style="list-style-type: none"> • Automatic 24/7 electronic application submission. 	<p>The current review process consists of staff manually reviewing applications for errors and stamping each permit plan for compliance by hand. This is a highly time consuming process and electronic review can help automate this process.</p> <p>Additional functions required:</p> <ul style="list-style-type: none"> • Staff have the ability to mark-up and stamp applications online through e-review. • Automatic routing of permit workflow to appropriate division (examination or zoning). 	<p>The Amanda system does not integrate with the City's current SAP accounting system. This has resulted in multiple errors in staff reconciling accounts incorrectly as the Amanda system only showcases sub-totals without illustrating the accounts receivables outstanding.</p> <p>Additional functions required:</p> <ul style="list-style-type: none"> • Ability to provide daily AR reconciliation summaries in order to avoid overcharges. • Ability to integrate with SAP to enable effective processing of financial data in order to ensure data integrity and avoid overcharges. 	<p>Payments are currently made by applicants in person. This leads to delay in the building permit process as applicants need to visit the City's offices during business hours to make changes.</p> <p>Additional functions required:</p> <ul style="list-style-type: none"> • Notify applicants of outstanding payments in real-time. • Ability to mandate fee payments both at the time of application and at the time of permit pick up.

Current State Gaps

Inspections	Built-In Tracking Function
<p>Current System</p> <ul style="list-style-type: none"> • Calytera's Amanda System is used for scheduling. • Inspectors call into VPN Citrix to make changes. 	<p>Current System</p> <ul style="list-style-type: none"> • Calytera Amanda System.
<p>Current State Gaps</p> <p>The scheduler books inspections in Amanda based on user requests (done by phone or online form). This has resulted in multiple scheduling errors. Similarly, inspectors have to login into Citrix VPN on their computer to make changes from the field as they currently do not have mobile capabilities.</p> <p>Additional functions required:</p> <ul style="list-style-type: none"> • Users schedule inspections through e-portal. • GIS map integration allowing inspector to access data in real-time regardless of geographic location and device used (mobile or laptop). 	<p>Current State Gaps</p> <p>The current system is not user-friendly and it is only accessed by internal staff. Applicants currently do not have any ability to view the status of their application online, instead the back office staff provides status updates by phone or answer questions when residents visit the City office.</p> <p>Additional function is required for:</p> <ul style="list-style-type: none"> • Dashboards that enable residents to see status of application in real-time.

Key Features of E-Permitting System

In addition to the current state gaps identified above, further research was conducted to identify other aspects of e-permitting systems deemed as critical capabilities within the permitting industry. These capabilities include but are not limited to payment processing tools, review and document management, built-in tracking functions, data analytics, as well as GIS integration and mobile capabilities.

Payment Processing Tools

Electronic payment processing tools are becoming a norm in the permitting industry as providers are going beyond normal security standards, while adhering to municipal financial and tax rules. Certain providers are offering financial tracking capabilities that can be audited, along with solutions that support fee creation, payments, waivers, refunds, chargebacks, NSF tracking for cheques, and deposits for prepayments. Given the current deficiencies in the payment processing system at the City, implementing a payment processing tool will enhance efficiencies at the City. As providers are beginning to offer applications that not only integrate with a municipalities existing ERP system, but also provide their own financial systems that can provide daily reconciliation summaries, this further heightens the benefits of implementing an e-permitting solution.



Review and Document Management

According to RESCON, the industry is moving towards electronic review and document management as a way for the future.³⁴ Reviewing applications, construction blueprints, and subsequent review documents in paper is leading to an increase in both paper and storage costs. As a result, the City of Pickering's review of building permit applications is highly time consuming, as staff are manually reviewing and stamping documents in order to ensure compliance. Additionally, multiple case studies have demonstrated the inefficiencies experienced by municipalities across the globe. For instance "...Salt Lake City, Utah, reduced paper consumption by approximately 512,000 lbs, recognizing a cost savings of nearly \$1.5M (CAD) per year and Miami Florida reduced plans review time from 322 days to 2 months."³⁵ The municipality's process entailed of processing and reviewing applications 100% on paper.



The operational efficiencies experienced by municipalities is a result of certain systems ability to effectively route workflow to appropriate divisions, providing reviewers with the ability to electronically mark-up, approve plans, and request subsequent plans from applicants, while securely managing documents on the e-portal.

Given the building department spent just under \$6,500 last year in costs associated with photocopying permitting documents, this shows the cost savings opportunity to implement an e-permit review solution, hence leading to a more sustainable environment.³⁶

³⁴ Modernizing Building Approvals in Ontario Report, Rescon Residential Construction and Ryerson University, https://www.ryerson.ca/content/dam/cur/pdfs/RESCON/CUR_RESCON_Modernizing%20Building%20Approvals%20in%20Ontario%20Report_2017.07.05.pdf.

³⁵ Derived from Business Case for Electronic Permit Solution, provided by City staff.

³⁶ Derived from Information derived from Total Activity Maps, provided by City staff.

Built-in Tracking Function

Dashboards create user specific reports in real-time which is currently not available in the existing system. Through interactive dashboards, both clients and staff can see exactly what stage of the permitting process their application is at. This further improves cross-functional communication channels between staff members, as users can derive, update, and upload documents, while communicating with clients in real-time.

Data Analytics

Through data visualization tools, certain systems provide management with the ability to improve service delivery to citizens by generating performance reports catered specifically to divisional results. This allows management to identify areas of critical weaknesses and to implement mitigating measures in a timely manner.

GIS Integration and Mobile Capabilities



“The use of mobile technology and interactive mapping capabilities allows our inspectors to accomplish their daily tasks more efficiently.”

City of Washington, DC

Through geospatial data from satellite imaging, aerial photography and remote sensors, GIS technology can show exactly what changes on the ground will look like in real-time for effective decision making.³⁷ Considering there is an industry wide trend in performing inspections through mobile-based applications, this will further enhance the City's ability to deliver service excellence to the residents of Pickering as inspectors can view site data via mobile capabilities at any time regardless of geographic location.

Similarly, certain providers are offering mobile-based applications or systems that configure with mobile apps, allowing inspectors to derive and update data in real-time, thus reducing the time spent by inspectors on reviews. According to Accela, GIS technologies helps inspectors maximize their time in the field and complete more inspections scheduled for the day.

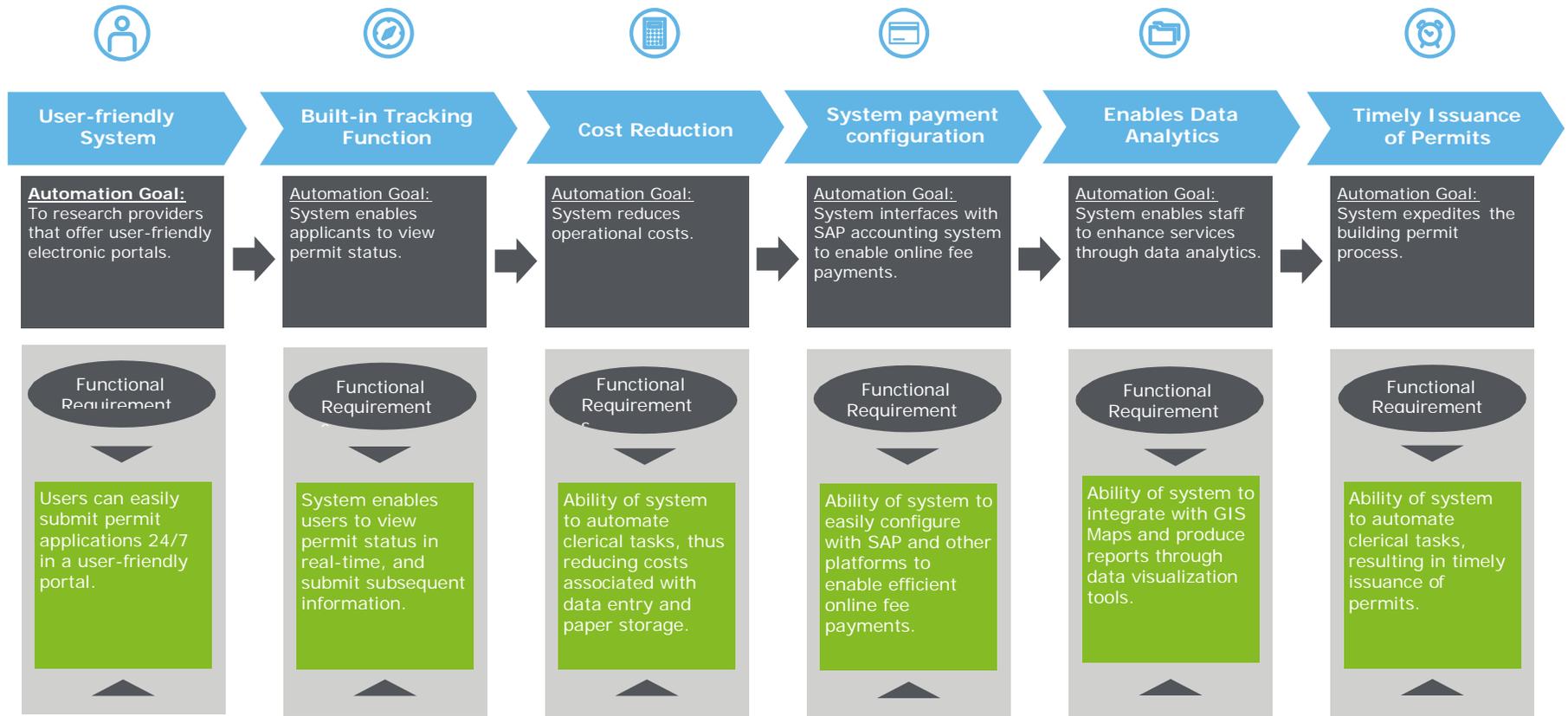
Functional and Non-Functional Requirement

The diagrams depicted on the following pages illustrate the functional and non-functional requirements that the City expects the building permit system to meet. The functional and non-functional requirements are defined as follows:

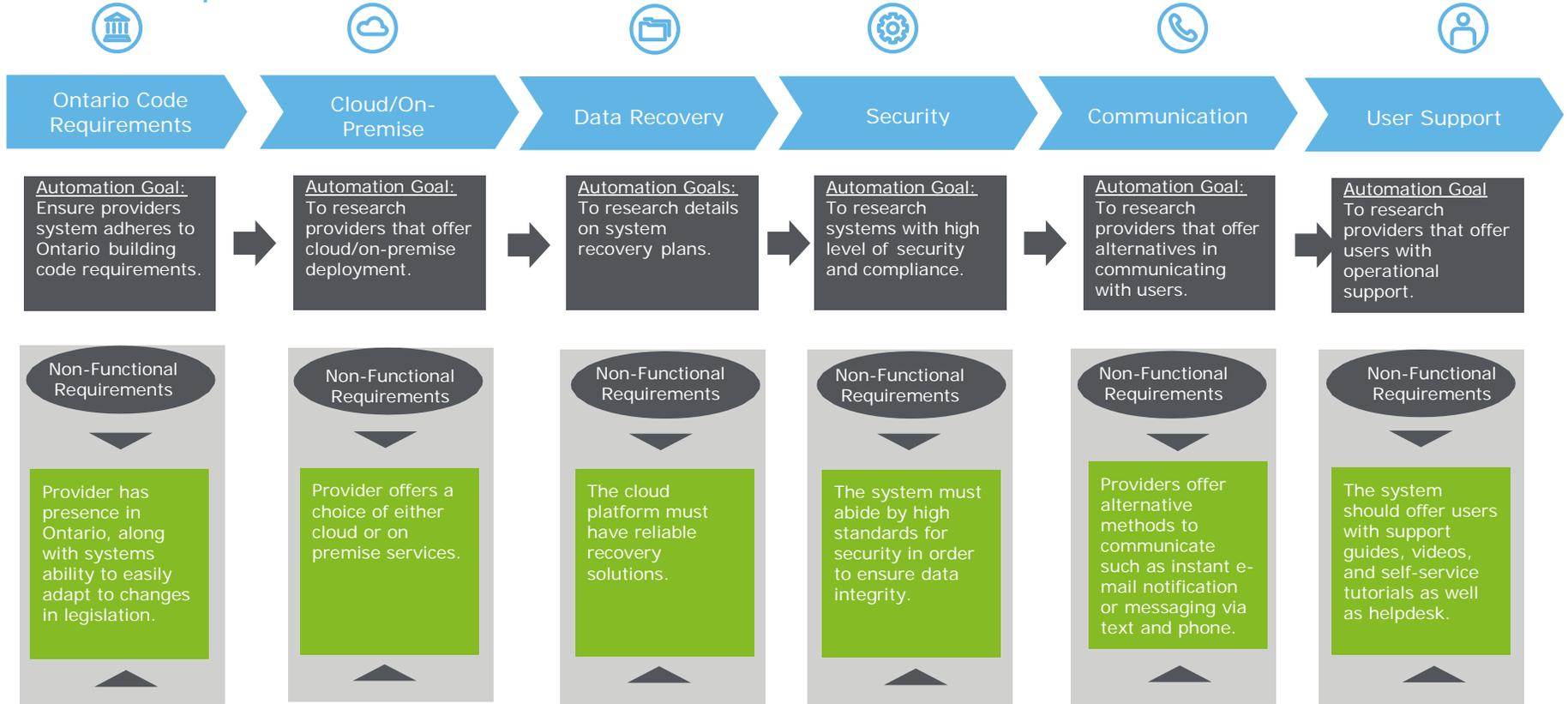
- A functional requirement defines the system abilities that a potential providers system should adhere to.
- A non-functional requirement will place constraints on how the system will perform those functionalities.

³⁷ Why GIS is important in Urban Planning, University of Southern California, 2019.

Functional Requirements



Non-Functional Requirements



Cost-benefit analysis

Overview

This section looks at the high level cost-benefit analysis of implementing an e-permitting solution. The cost quotes discussed in this section are estimates, and the actual costs will vary depending on the City's selected vendor, system functionality, integration, and deployment option (on-premise or cloud).

One of the major deficiencies in the City's existing paper-based permitting system is the time it takes to issue building permits. As mentioned in the Key Findings section on page 42, it currently takes 3 weeks to review and issue a permit for a detached dwelling home permit, far below the industry standard of a few days under an e-permitting system. Ultimately, delays in the permitting process, can have a significant financial impact such as delayed recognition of tax revenue.

Not only does a paper-based permitting system impact delays in recognition of property tax revenue (as discussed on page 52), but it also has an impact on the housing market as a Fraser Institute report found that a 6 month delay in approvals, reduces growth in new housing supply by 3.7%.³⁸ Thus, the City of Pickering should consider implementing an e-permitting solution in order to avoid a decline in new housing supply and prevent delays in tax revenue. The discussion below illustrates the market costs, benefits, and potential cost savings of implementing an e-permitting system. Also included in this section are results of our research on quotes from vendors providing e-permitting solutions to municipalities across Ontario, and a breakdown of the different cost components. On average the cost of implementing this type of system is between \$1M to \$1.8M.³⁹

Market Cost & Illustrative Quotes

This section looks into the high-level cost estimates derived from meeting minutes and council reports for the City of Windsor and the City of Kingston, which are publicly available. The costs include but are not limited to system installation, software maintenance, implementation, and training fees.

The City has the option to purchase the system and host it on-premise or on the cloud through various hosting platforms not limited to Microsoft Azure, Amazon Web Servers (AWS), Google, or Salesforce cloud. Maintenance costs for e-permitting solutions can vary by provider and can be based on percentage of licensing fees, number of applications processed, or the number of subscriptions.

Cloud-Based Deployment

The costs below were derived from the City of Windsor's deployment of a cloud-based e-permitting system.⁴⁰ Please note that the costs outlined below are estimates from Evolta based on the City's implementation plan, and actual figures will likely vary depending on the implementation strategy adopted.

³⁸ Fraser Institute, The Impact of Land-Use Regulation on Housing Supply in Canada, 2016.

³⁹ City of Windsor Meeting Minutes, June 2018 and City of Kingston Report to Council June, 2014.

⁴⁰ City of Windsor Meeting Minutes, June 2018.

Figure 4: Cloud-Based Development and Implementation Costs

Summary: The following table outlines the cost estimates for a cloud-based deployment of an e-permitting system. The cost quotes include but are not limited to deployment of a cloud-based software system including development of user interface (both internal and external), mobile capabilities, GIS integration, electronic review portal, and training. Moreover, this includes system configuration and integration with the Amanda system, including implementation of an off-site cloud based system, and built-in tracking functionality enabling users to clearly see stages and progress of both application and inspection results.

Cost Scope	Cost (in CAD)
Phase 1 <ul style="list-style-type: none"> • Business process development • Departmental staff and customer workshops • Development of user interface software including: online application, engagement and consultation, payment, status updates, and issuance of permit 	• \$589,000
Phase 2 <ul style="list-style-type: none"> • Development of inspections module • Mobile interface for inspections • Scan code development 	• \$195,000
Phase 3 <ul style="list-style-type: none"> • Electronic archive development • Document management and search engines • Online document storage systems 	• \$189,000
Phase 4 <ul style="list-style-type: none"> • System integration and internal staffing costs 	• \$414,785
Phase 5 <ul style="list-style-type: none"> • Includes the following additional assumptions: <ul style="list-style-type: none"> – Financing costs – Equipment – Contingency (10%) 	<ul style="list-style-type: none"> • \$125,000 • \$40,000 • \$150,000
	\$1,720,8875

Software Management and Maintenance Costs

The ongoing system management and maintenance costs for the City of Windsor cover data storage, troubleshooting assistance, and any future upgrades to the system. This consists of both a fixed and variable fee (based on the number of applications processed). The City of Windsor processes approximately 5,400 applications per year, with an annual fee of \$9,000, and a variable fee of \$40 per application processed. The software management and maintenance costs are estimates, and actual fees will vary depending upon the number of applications processed.

On-Premise Deployment

The cost estimates discussed in this section were derived from the City of Kingston's request for proposal process for an on-premise system deployment.⁴¹ Please note these costs are estimates to provide an

⁴¹City of Kingston Report to Council, June 2014.

illustrative quote that is being offered in the market, and actual costs will vary depending on the City's defined scope and strategy for the implementation, as well as the system selected.

The City of Kingston received quotes for deployment of an on-premises system from Accela, Computronix, and Calytera. The costs quoted from these vendors are as follows: \$1,233,504 for Accela, \$1,896,650 for Computronix, and \$1,569,326 for the Calytera System. These quotes are based on the costs for software, hardware, training, along with support, and implementation services. As mentioned above, these are illustrative estimates, and actual costs will vary depending on the scope, solution, level of integration, and implementation strategy selected. The key features of the system quotes include enhancing user experience for both staff and residents through mobile capabilities, built-in tracking functions, document management, and automation of review tasks.

Benefits

This section describes the qualitative and quantitative (potential cost saving) benefits of implementing an e-permitting system for the City of Pickering, along with the cost savings experienced by municipalities across Ontario and Canada in implementing an e-permitting system.

The high level qualitative benefits of implementing an e-permitting solution for the City includes:

- Faster issuance of building permits
- Increased tax revenue
- Reduction in costs associated with paper storage
- Increased workforce productivity as staff will be spending less time on clerical tasks, and
- Improved communication channels between City Staff and applicants, as users will be able to view application status in real-time through active dashboards.

Apart from the benefits discussed above, municipalities both in Ontario, and across Canada have experienced cost savings in multiple areas. According to Rescon and Ryerson University's report on "Modernizing Building Permits", municipalities have experienced the following cost savings as a result of implementing an e-permitting solution:⁴²

- Reduction in manpower by 44% as staff are no longer needed to perform clerical data-entry duties
- Reduction in printing costs associated with permit applications by 72%, and
- Reduction of storage costs associated with storing permit documents and inspection blueprints by 65%.

Along with the cost savings experienced by municipalities across Canada as discussed above, jurisdictions have also prevented delays in recognition of property tax revenue as a result of implementing an e-permitting system. According to the "Evaluation of Current Construction Permitting Process in City of Toronto and Future of Permitting in the Global Construction Industry" report, a one year delay in high-density buildings can result in millions of dollars delayed in tax revenue.⁴³ For example, consider a high-density building with 250 units worth \$400,000 each. A one year delay in building approvals at the City of Pickering based on the City's 2018 tax rate of (0.01153004), could potentially result in delayed recognition in tax revenue of \$4,612 per unit, and approximately \$1,153,005 for the entire building.⁴⁴ These figures are just estimates to highlight the impact of delays in the permitting process can have on property tax revenues. Actual recognition will vary depending on the number of units pending approval, market growth, and current delay in the permit process.

⁴² Modernizing Building Approvals in Ontario Report, Rescon Residential Construction and Ryerson University, 2017.

⁴³ Shahi, Kamellia, Evaluation of Current Construction Permitting Process in City of Toronto and Future of Permitting in the Global Construction Industry, University of Toronto, Toronto, ON 2018.

⁴⁴ City of Pickering, Property Taxes, Pickering, ON 2018.

Potential Cost savings

As discussed above, this section provides an overview of the potential cost savings of implementing an e-permitting system at the City. The analysis includes reviewing areas of the City's expected outcomes (extracted from the Pickering Project description overview) such as implementing built-in tracking functionalities, reducing staff and paper resources, along with expediting faster issuance of building permits as discussed in the potential increase in revenue section on page 56. Based on meetings and information provided by City staff, along with the analysis conducted around permitting activities, the potential cost savings for the City can be realized in five areas: photocopying, scanning, public inquiries (status updates), clerical data entry, and inspection assignment.

The goal of this analysis was to identify areas where the e-permitting system can reduce and/or eliminate the time spent by City staff on clerical duties, thus leading staff to spend more time on specialist tasks. Additionally, apart from the cost savings identified in the permitting activity analysis below, the team discovered that costs associated with photocopying of \$6,500 (discussed on page 46, and costs associated with scanning documents of \$40,000 annually can be reduced significantly, as the City will no longer need staff to scan the permitting documents in the future.

Additional cost savings could be realized through automation of other permitting functions that municipalities across Ontario have experienced, including:

1. Public Inquiries (Status Updates)
 - This activity includes the time spent by Clerks, Zoning Examiner, and Supervisor at the Building Permits department, along with the Supervisor at the Building Inspections department in answering public queries such as status updates.
2. Input into System (Clerical Data Entry)
 - This activity includes the time spent by the Building Services Clerks in inputting application information into the system.
3. Assign Examiner (Inspection assignment)
 - This activity looks at the time spent by the Zoning Examiner in assigning inspections to inspectors.

The estimated cost savings identified per permitting activity are outlined in figure 5 below. The actual savings will vary depending on level of public inquiries, employee salary metrics, and the actual time spent on each activity, which vary depending on permit type.

Figure 5: Permit Activity Analysis Cost savings

Summary: The information in the chart below shows the staff time spent on each permit type activity, and it was obtained from the Pickering 2017 process maps workbook which was provided by the Building Permitting team. The Pickering 2017 process map workbook shows the time spent by staff in performing key permitting activities for each permit type category. Given the sensitivity of sharing salary information, a conservative estimate of \$30/hr has been used to quantify the staff's effort involved in each permit type. Based on those assumptions, the estimated cost savings are outlined below:

Annual Cost savings per Permit Type Activity			
Permit Type Category	Public Inquiries <i>(Status Updates)</i>	System Input <i>(Clerical Data-Entry)</i>	Assign Examiner <i>(Inspection Assignment)</i>
Assembly (Finished)	95	30	5
City Initiated - Assembly	95	30	5
Institutional (Finished)	75	30	5
City Initiated Projects - Institutional	75	30	5
Residential (apartment)	75	30	5
Residential (other)	85	20	5
Residential (stacked townhouses)	85	20	5
Residential Minor Structures	95	15	5
Residential Alteration	35	10	5
Business Personal Service	60	30	20
Industrial (Finished)	75	30	10
Minor Non-Residential Structures	55	0	0
Non-Residential Alterations	35	10	5
Authority to Occupy	65	15	5
Conditional Permit	35	15	0
Demolition Permit	15	10	0
Change of Use Permit	140	15	5
Signs	0	25	25
Total activity (minutes) per month	1195	365	115
Total activity (minutes) annually	14340	4380	1380
Total savings at \$30/hr	\$7,170	\$2,190	\$690

The City is expected to save the costs outlined in figure 5 as a result of automating key activities in the permitting process. The built-in tracking functionality may gradually reduce the amount of status inquiries from in-person City visits and phone inquiries, as the residents of Pickering can view the status of their applications in real-time. Additionally, the clerical staff may no longer need to input applicant information in the system as applicants can submit their applications online, thus eliminating the amount of clerical data

entry. Similarly, the zoning examiner may no longer need to spend time in assigning inspections, as the system could automatically assign and route inspections requested by applicants to inspectors.

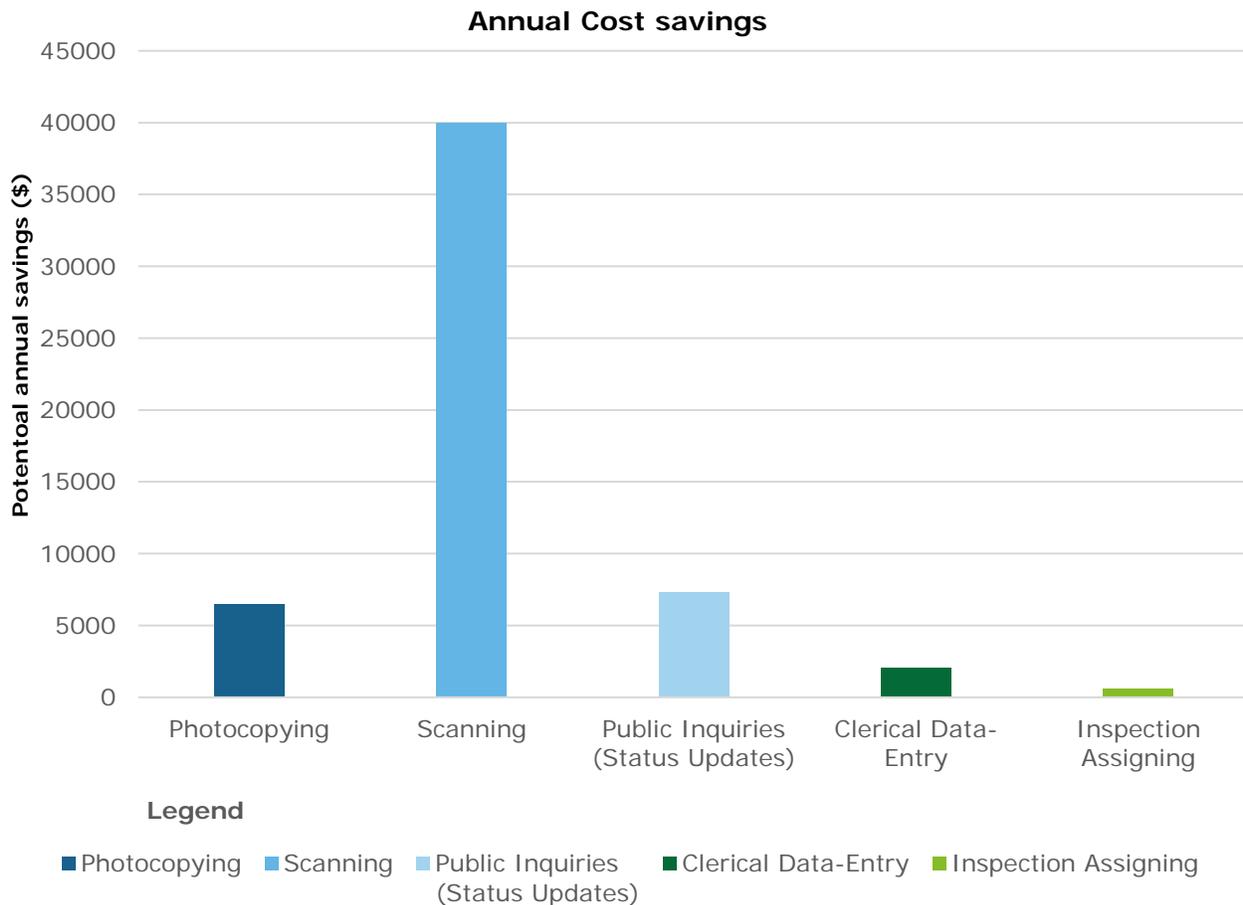
The City should initiate a business case to uncover further cost savings in permitting activities in order to quantify more accurate cost savings of implementing an e-permitting solution.

Total Cost savings

Given the data points and assumptions described on pages 53-54 the potential cost savings for the City would be \$56,550 per year based on the cost saving areas of photocopying, scanning, public inquiries (status updates), clerical data entry, and inspection assignment. These figures are estimates regarding the level of permit activity and resources in terms of time and effort the City may expect to save as a result of automating key permitting tasks. Figure 6 below provides an overview of the potential cost savings that the City could experience as a result of implementing an e-permitting system.

Figure 6: Annual Cost savings

Summary: The table below describes illustrative cost savings areas such as photocopying, scanning, public inquiries (status updates), clerical data entry, and inspection assignment. Overall, the costs, benefits, and potential cost savings discussed above are estimates of the level of cost savings the City could experience as a result of implementing an e-permitting system. These are based on the effort levels found in Figure 5 as well as based on information received from the City defining total time spent on the activities described below.



Potential Revenue Increase

This section discusses the potential increase in building permit revenue based on estimates provided by leading e-permitting solution providers.

Industry leaders in building permitting systems have estimated that on average municipalities that implement e-permitting systems can expedite the issuance of permits by 30-90%. Not only does this lead to faster issuance of building permits as a result of automating key permitting tasks, but it also increases building permitting revenue. As the City's current building permit revenue for fiscal 2018 is \$2,150,000, based on the August BP Activity report, a conservative assumption of 60% has been used as a best case scenario in order to conduct a sensitivity analysis.⁴⁵ The midrange estimate of 60% is based on the average percentage quoted by various industry leaders (high-level 90% and low-end 30%). The team has conducted a sensitivity analysis based on a low-level of 30%, mid-level of 45%, and a high-level of 60% to derive projected revenue increases of \$645,000, \$967,500 and \$1,290,000 respectively. Note that these assumptions are just estimates, and actual increase in revenue will vary depending on permit type, volume, and permitting fee structure.

Figure 7: Permit Revenue Sensitivity Analysis

Summary: The figure below depicts a sensitivity analysis regarding the potential increase in revenue as a result of implementing an e-permitting system. Both the projected annual increase, along with the total cumulative revenue (assumption based on projected annual increase and 2018 figure of \$2,150,000) is illustrated below.

Permit Revenue Sensitivity Analysis			
Ranges	30% <i>(Low- Level)</i>	45% <i>(Mid-Level)</i>	60% <i>(High-Level)</i>
Projected annual increase in revenue	\$645,000	\$967,500	\$1,290,000
Cumulative Revenue ⁴⁶	\$2,795,000	\$3,117,500	\$3,440,000

The potential cost savings of \$56,550 and projected revenue increases of a minimum of \$645,000 discussed above are just estimates of the quantitative benefits the City could experience as a result of implementing an e-permitting system. The City should consider initiating a formal business case to further quantify and accurately calculate the expected cost savings of implementing an e-permitting solution.

⁴⁵ Information derived from August BP Activity report – provided by City staff.

⁴⁶ Cumulative revenue calculation: 2018 revenue of \$2,150,000 + projected annual increase in revenue per sensitivity level.

Opportunity areas

Following the discussion in the preceding section, the three system specific cost savings categories identified are: system automation, built-in tracking function, and inspections. Within each category the research has derived an opportunity area that the City can leverage as a result of implementing the e-permitting solution.

System Automation	Built-in Tracking Function	Inspections
<p>Minimize Clerical Data Entry</p> <p>Automate the permitting process and reduce the time spent by staff in performing clerical data entry tasks.</p>	<p>Real-time tracking of application</p> <p>Enhance service delivery through built-in dashboards in order to provide status updates in real-time</p>	<p>Inspection – GIS Maps</p> <p>Mandate a system providing real-time data access to inspectors through GIS Maps, enabling inspections to be requested, assigned, and routed automatically.</p>
<p>Eliminate Paper Storage</p> <p>Leverage the benefits of the automated system by eliminating costs associated with paper storage.</p>	<p>Cross-Functional Communication</p> <p>Establish communication between departmental information systems. This will achieve increased accuracy in cross-functional decision making.</p>	<p>Mobile Access</p> <p>Provide inspectors with greater flexibility in reviewing site data in real-time through mobile access.</p>
<p>Electronic Payment Process</p> <p>Ability of system to configure the payment processing application both at the time of application and at the time of permit pick up.</p>		

The existing and potential cost savings in these three areas are based on RESCON and the University of Ryerson data, along with the City's input regarding costing metrics. The team has reviewed each opportunity area, while identifying potential risks, benefits, and cost savings to the City in the following diagrams below.

System Automation

Potential Opportunity	Description	Next Steps	Potential Savings
Minimize time & costs associated with issuing building permits	<p>Opportunity</p> <ul style="list-style-type: none"> To automate the building permit application process through implementing a 24/7 self-serve electronic permitting system while eliminating the need to store paper. <p>Current Operations</p> <ul style="list-style-type: none"> Applications are submitted in person during the City Halls hours of operation (Monday – Friday from 8:30 am – 4:30 pm). Residents pay for fees in person as there is no online payment processing system set-up. <p>Benefits</p> <ul style="list-style-type: none"> Staff can focus on specialist tasks as the automation of the permitting process will eliminate the time spent by clerical staff data-entering applicant information. Provides residents with the flexibility to submit applications at their convenience 24/7. Reduction in paper storage costs. 	<ul style="list-style-type: none"> Identify average time spent by City staff in entering application data and processing payments. Determine current costs associated with storing blue-prints and applications for permits. Research platforms that can auto-calculate fee payments, and configure the payment processing application both at the time of application submission (collect initial fees) and at the time of permit pick up (collect final payment). 	<ul style="list-style-type: none"> The City will no longer need to hire additional staff to scan documents which will result in cost savings of \$40,000 per year. Eliminate photocopying costs of \$6,500 per year, as applications will be stored on e-portal. The cost savings realized from clerical staff not manually entering applicant information is \$2,190 per year (as mentioned on page 54).
<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> Server down-time or inability to process payments will impact citizen satisfaction. Citizens may find the system not user-friendly if resources/instructions are not clear. Staff may be susceptible or resistant to change as they are used to doing tasks in a certain way. Change management will be key in order to have a successful implementation. 			

Built-In Tracking Function

Potential Opportunity	Description	Next Steps	Potential Savings
<p>Reduce costs associated with communicating permit status and improve cross-functional communication channels</p>	<p>Opportunity</p> <ul style="list-style-type: none"> Built-in tracking function enabling applicants to see the status of their applications at any time through dashboards, without the need to attend the City's office during business hours. <p>Current Operations</p> <ul style="list-style-type: none"> Residents can request for status updates by either calling in or visiting the City during business hours. City Staff follows up by phone regarding any missing documents. <p>Benefit</p> <ul style="list-style-type: none"> Reduces the time spent by staff members communicating status or following up with applicants as currently various level of staff spend 14,340 minutes in answering public inquiries. Improved communication between departments as the status of applications is viewed in real-time through dashboards. 	<ul style="list-style-type: none"> Identify average time spent by the City staff in communicating status updates. Determine cost savings of staff time saved in communicating status. 	<ul style="list-style-type: none"> The potential cost savings from staff time spent in addressing public inquiries/status updates via phone or in-person City visits is \$7,170 (as mentioned on page 54).
<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> Residents may still call or visit the City for more information if they are not satisfied with the information provided through the dashboards. 			

Inspections

Potential Opportunity	Description	Next Steps	Potential Savings
Improve efficiency in the inspection scheduling process	<p>Opportunity</p> <ul style="list-style-type: none"> System that provides real-time data access to inspectors through GIS Maps, enabling inspections to be requested, assigned, and routed automatically through mobile access. <p>Current Operations</p> <ul style="list-style-type: none"> Inspections are currently booked either by phone or online by filling out an "Inspection Request Form." There is currently one staff member allocated to scheduling and assigning inspections. Inspectors run task lists, conduct inspections, and dial in through Citrix Amanda to physically make a change through VPN. <p>Benefit</p> <ul style="list-style-type: none"> Eliminate errors and time spent by scheduler coordinating inspections. Greater efficiency as inspectors can make changes in real-time from the field through mobile access. 	<ul style="list-style-type: none"> Investigate the current time spent in scheduling, and rectifying errors by City staff. Quantify the cost savings of automating the scheduling process. 	<ul style="list-style-type: none"> Scheduler will no longer need to communicate with residents in order to book inspections, as system will automatically assign and route inspections. Potential savings of \$690 annually if the system auto-assigns inspections to inspectors (as mentioned on page 54). <i>(Due to the limited amount of information available for the inspections process, further investigation is needed to accurately quantify the cost savings.)</i>
	<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> May require supplementary plan in case of service downtime/unavailability. 		

Technology options

The research conducted evaluated six potential providers such as Accela, Avolve, BasicGov, Computronix, and Evolta, along with the new edition of Calytera's Amanda System for comparability purposes. In selecting the providers, this study has taken into account companies that were not only industry leaders in automating the permitting application process, but also those that have excelled in reducing operating costs, and enhancing departmental efficiencies in the permitting process.



All of the companies selected, except for BasicGov, are internationally-based, therefore having existing establishments or pilot projects in a Ontario or licensing services in a Canadian jurisdiction, was fundamental in ensuring these companies could adhere to the Ontario Building Code Requirements. Other considerations to selecting the providers were: industry reviews through Capterra and Medium, system compatibility with the City's existing ERP system, and the provider's industry success in expediting the permitting process through reviews from multiple municipalities.

The following chart provides a high level overview of how each solution meets the City's expected business outcomes.

Expected Business Outcomes	Accela	avolve SOFTWARE	BasicGov	CALYTERA	COMPUTRONIX	evolta
24/7 application Submission	✓	✓	✓	✓	✓	✓
Built-in tracking Function	✓	✓	✓	✓	✓	✓
Reduction in resource expenditures	✓	✓	✓	✓	✓	✓
Interface with SAP to enable online payments	✓	✓	✓	✓	✓	✓
Data Analytics - Reports	✓	✓	✓	✓	✓	✓
Faster Issuance of Building Permits	✓	✓	✓	✓	✓	✓
Automatically reconcile and track payments	✓	✗	✓	✗	✗	✗

Legend:

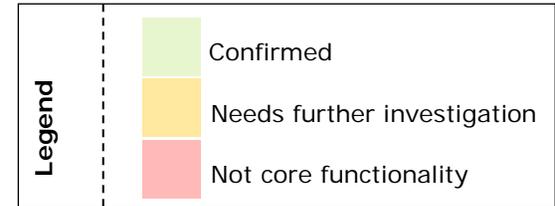
- ✓ Meet the Expected Outcome
- ✗ Fail to Meet the Expected Outcome

Functional Requirements

The following section discusses the functional requirements that a building permit application system should meet in order to achieve the City's mandate for each relevant category identified earlier in the report.

Electronic Application Submission

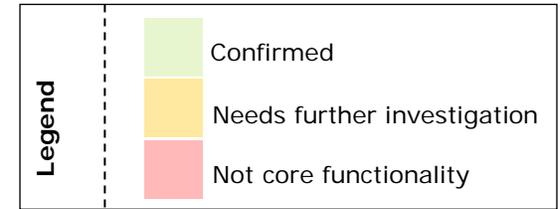
The chart below for electronic application submission outlines the key functional requirements of an e-permitting tool.



Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to support electronic portal in which building permit applicants can submit applications in a user-friendly manner 24/7.	Yes, user-friendly citizen portal through the Accela Civic Platform.	Yes, user friendly applicant submission through OAS.	Yes, user-friendly citizen portal through COTS software solution.	Yes, user-friendly citizen portal through POSSE software solution.	Yes, user-friendly citizen portal through POSSE software solution.	Yes, user-friendly applicant submission through Lupapiste.
Ability of system to allow users to submit and review multiple applications for a single personal or business account.	Yes, users can submit and review past submission of applications.	Yes, users can submit and review past submission of applications.	Yes, users can submit and review past submission of applications.	Yes, users can submit and review past submission of applications.	Yes, users can submit and review past submission of applications.	Yes, users can submit and review past submission of applications.
Ability of system to print and automatically generate permit and send to applicants.	Yes, permit is automatically generated and sent to applicants.	Yes, system can be configured to allow approved plans to be printed.	Yes, option to configure system to notify applicants of updates.	Does not appear to be core functionality, City will have to follow up with vendor to clarify.	Not core functionality.	Yes, system can be configured to allow approved plans to be printed.

System Functionality and Built-In Tracking Function

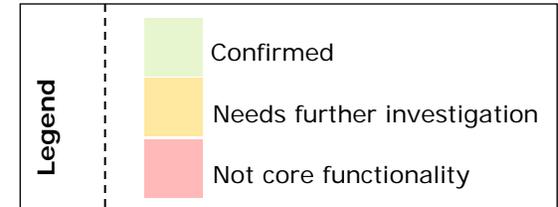
The chart below outlines the essential system functionalities and built-in tracking function to enable residents to review the status of their application in real-time. These functionalities enhance staff productivity in the review process, along with improve citizen services, as residents can update documents and review results.



Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to auto-detect errors in application submission thereby reducing the lead time of staff reviewing applications.	Yes, automatic notifications are sent to applicants informing them of missing content which can be submitted online.	Yes, City can configure application requirements to prevent users from submitting incorrect information.	Yes, incomplete applications will not be processed.	Yes, City can configure application requirements to prevent users from submitting incorrect information.	Yes, City can configure business rules to ensure the application is complete and valid from submitting incorrect information.	Yes, automatic notifications are sent to applicants informing them of missing content which can be submitted online.
Ability of system to request additional information from builders and deliver pass/fail results via e-mail, or mail.	Yes, system requests and delivers pass/fail results via phone, email or mail.	Yes, applicants can monitor review status and upload additional information.	Yes, option to configure system to notify applicants of updates.	Yes, option to configure system to notify applicants of updates.	Yes, option to configure system to notify applicants of updates.	Yes, applicants can monitor review status and upload additional information.
Ability of system to support applicants and process status checking in real-time through dashboards, thereby reducing the time spent visiting/calling City offices.	Yes, applicants are informed of status in real-time through the Civic Platform dashboard and can respond to corrections and upload revisions.	Yes, applicants are informed of status through OAS dashboard in real-time and can respond to corrections and upload revisions.	Yes, the portal can be configured to notify applicants of status through the COTS software solution.	Yes, customer self-service portal can be configured based on City's needs to deliver status updates.	Yes, customer self-service portal can be configured based on City's needs to deliver status updates.	Yes, applicants are informed of application status through Lupapiste in real-time.

Review & Document Management

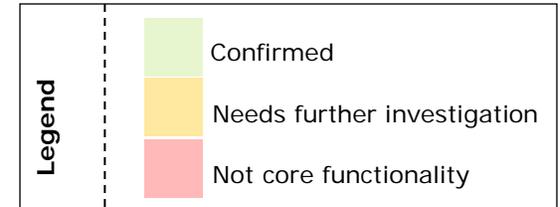
The chart below depicts the functional requirements involved in order to enhance the City's review process with automatic routing of workflows between departments, along with 100% electronic review, resulting in a reduction of paper, storage, and stationary costs.



Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to route documents to the appropriate division using workflow such as examination staff or zoning review.	Yes, system can be configured to route workflow to appropriate departments.	Yes, system can be configured to route workflow to appropriate departments.	Yes, system can be configured to route workflow to appropriate departments.	Yes, automatic routing of license applications to all required departments.	Yes, automatic routing of license applications to all required departments.	Yes, system can be configured to route workflow to appropriate departments.
Ability for multiple reviewers to review plans electronically, mark-up documents, and approve sections of plans simultaneously.	Yes, multiple reviewers can share, mark-up, comment, and approve plans at the same time.	Yes, multiple reviewers can share, mark-up, comment and approve plans at the same time.	Yes, reviewers can review plans online and approve plans at the same time.	Yes, multiple reviewers can share, mark-up and comment approve plans at the same time.	Not core functionality, only some improvements with documents can be made.	Yes, reviewers can review plans online and approve plans at the same time.
Ability of system to support document management and document workflow capabilities, reducing the consumption of paper, supplies, and staff resources.	Yes, system supports document management and workflow capabilities.	Yes, system supports document management and workflow capabilities.	Yes, system supports document management and workflow capabilities.	Yes, system supports document management and workflow capabilities.	Yes, system supports document management and workflow capabilities.	Yes, system supports document management and workflow capabilities.

Payment Processing

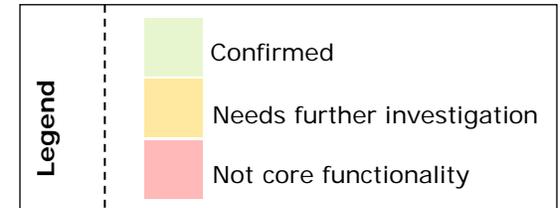
The chart below depicts functional requirements associated with the current deviations in the payment processing system including automatic fee calculation, along with the systems ability to configure the timing of fee payments.



Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to auto-calculate fees applicable to applicants.	Yes, permit fees are auto-calculated and applicants can pay fees online.	Yes, permit fees are auto-calculated and applicants can pay fees online.	Yes, permit fees are auto-calculated and applicants can pay fees online.	Yes, permit fees are auto-calculated and applicants can pay fees online.	Yes, permit fees are auto-calculated and applicants can pay fees online.	Yes, permit fees are auto-calculated and applicants can pay fees online.
Ability of system to support POS systems, enabling applicants to pay online.	Yes, supports POS system, and applicants can pay fees online.	Yes, supports POS system, and applicants can pay fees online.	Yes, supports POS system, and applicants can pay fees online.	Yes, supports POS system, and applicants can pay fees online.	Yes, supports POS system, and applicants can pay fees online.	Yes, supports POS system, and applicants can pay fees online.
Ability of system to configure the payment processing application both at the time of application and at the time of permit pick up.	Yes system can be configured to take initial deposit and final fee payment.	Yes, system can be configured to take initial deposit and final fee payment.	Yes system can be configured to take initial deposit and final fee payment.	Yes, system can be configured to change timing of fee structures, but City will have to follow-up with vendor to see if timing can be changed between different intervals.	Not core functionality.	Yes system can be configured to take initial deposit and final fee payment.

Payment Processing and Financial System

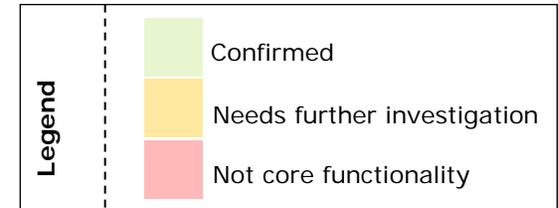
The chart below looks into the functional requirements of the payment processing tool to provide notifications to clients regarding existing payments, along with the systems ability to integrate with SAP, and provide daily reconciliation summaries.



Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to integrate with the payment processing system in order to send automatic notifications to applicants regarding outstanding payments.	Yes, system can be configured to notify applicants of outstanding payments.	Yes, system can be configured to notify applicants of outstanding payments.	Yes, system can be configured to notify applicants of outstanding payments.	Yes system can be integrated, but will have to follow up with vendor whether e-mail notifications can be sent to notify outstanding payments.	System can be configured to send notifications to users. City will need to follow-up to ensure payment notifications can be sent.	Yes, system can be configured to notify applicants of outstanding payments.
Ability of system to provide seamless interface with the City's SAP ERP accounting system to send journal entries to GL.	Yes, website states system integrates with all ERP systems. Follow-up will be required to ensure SAP integration.	Yes, integrates with SAP accounting system to enable online fee payments.	Yes, website and Gartner states integrates with payment processing services. Follow-up is required to ensure SAP configuration.	Yes, open interface that connects with all enterprise applications. Follow up is required to ensure SAP configuration.	Yes, integrates with SAP accounting system.	Yes, integrates with SAP accounting system.
Ability of system to provide daily reconciliation summaries tracking all payments, including overcharges.	Yes, CivicPay reconciles accounts in real-time.	Not core functionality but system integrates with third-party reconciliation systems.	Yes, Payment Cart and Fund Accounting modules can track daily payments and delivers accurate reconciliation information.	Not core functionality but system integrates with third-party reconciliation systems.	Not core functionality.	Not core functionality but system integrates with third-party reconciliation systems.

Inspections

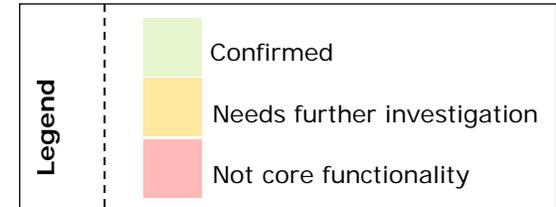
The chart below depicts the functional requirements necessary to enable the inspections department to be more efficient, thus reducing errors in the scheduling process through system automation initiated by applicants.



Functional Requirement	Accele	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to allow applicants to request inspections online, thus mandating the system to assign, route, and schedule inspections automatically.	Yes, inspections are requested online and scheduled, assigned, and routed automatically.	Yes, inspections are requested online and scheduled, assigned, and routed automatically.	Yes, inspections are requested online and scheduled, assigned, and routed automatically.	Yes, inspections are requested online and scheduled, assigned, and routed automatically.	Yes, applicants can request inspections via the E-plan portal or by phone.	Yes, inspections are requested online and scheduled, assigned, and routed automatically.
Ability of system to allow inspectors to access field inspection data in real-time and connect with GIS-ESRI.	Yes, GIS capabilities produce interactive maps and data visualizations.	Yes, plans anywhere allows staff to have field access through geo-location.	Yes, partnered with two-way GIS sync solution.	Yes, integration with GIS maps to track and compare data onto a visual map.	Yes, the system provides embedded GIS for inspector to access data in real-time and connect with GIS maps.	Yes, GIS integration is available.
Ability of system to provide mobile-based applications in order to ensure inspectors can review the checklist and update data in real-time, regardless of geographic location.	Yes, mobile-based app available.	Yes, configures with mobile interface.				

Data Analytics and System Integration

The chart below depicts the high level functional requirements of whether the potential solutions can generate performance reports through data visualization tools, along with the systems ability to integrate with key operating systems at the City.



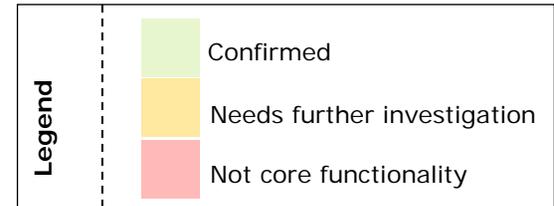
Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to produce performance reports through data visualization tools in order to enhance the services delivered by management to residents.	Yes, reporting and dashboard functionality allows users to derive insightful reports.	Yes, analytical reports available to derive insightful reports.	Yes, reporting and dashboard functionality allows users to derive insightful reports.	Yes, browser-based business intelligence tool allows users to derive insightful reports.	Yes, Amanda analytics creates reports that allows users to derive insightful reports.	Yes, reporting database is provided for custom/ad-hoc reports.
Ability of system to integrate with existing Amanda platform (Parthos Technology).	Yes, system integrates with API connections.	Yes, system integrates with API connections.	Yes, system integrates with API connections	Yes, system integrates with API connections.	The City is in the process of integrating with Parthos.	Yes, system integrates with API connections.
Ability of system to support document record retention and integrate with the City's current retention system Laserfiche.	Yes, Accela is a Laserfiche partner.	Yes, Avolve is a Laserfiche partner.	Yes, Salesforce integrates with Laserfiche.	No, specific mention of integration with Laserfiche, therefore City will need to follow up as Posse claims to integrate with all platforms via API.	Yes, integrates with Laserfiche.	Not out of the box but vendor offers option to develop custom solution.

Non-Functional Requirements

The following section discusses the non-functional requirements that a building permit application system should meet in order to achieve the City’s mandate for each relevant category identified earlier in the report.

Compliance

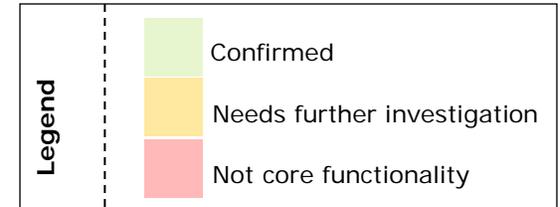
The diagram below looks into whether the system has the ability to comply and adopt to new legislative changes associated with the Ontario Building Code requirements.



Non-Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to adhere to Ontario Building Code requirements.	Yes, system aligns to building code jurisdiction.					
Ability of system to be flexible and easily adapt to legislative changes in building code requirements.	Yes, system is flexible and can be configured to new rules at any time.	Yes, system is flexible and can be configured to new rules at any time.	Yes, system is flexible and can be configured to new rules at any time.	Yes, system is flexible and can be configured to new rules at any time.	Yes, system is flexible and can be configured to new rules at any time.	Yes, system is flexible and can be configured to new rules at any time.

IT Security & Support

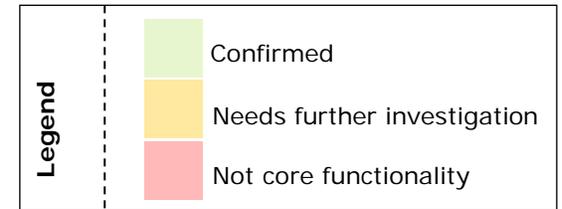
The diagram below depicts the systems ability to offer cloud and on-premises deployment of the system including details on data hosting solutions, along with the provider’s security practices in terms of recovery plans.



Non-Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Ability of system to offer cloud/ on-premise deployment.	Yes, both cloud and on-premise deployment.	Yes, both cloud and on-premise deployment.	Cloud Only.	On-premise deployment.	Yes, both cloud, and on-premise deployment.	Yes, both cloud and on-premise deployment.
Details on cloud hosting solutions and associated data center locations.	Microsoft Azure and data center location in Canada.	Microsoft Azure and data center location in Canada with option to implement additional encryption depending on City needs.	Salesforce and data center location in Canada.	Not applicable.	AWS and data center location in Canada.	Google cloud platform (GCP) and data center location is in Canada.
Details on recovery plans in order to protect information in the event of natural disasters or site-wide outages.	Data is stored securely via synchronized disaster recovery sites in multiple remote locations.	Data is backed up and accessible on own private network segment.	Data is stored in two separate locations, transactions are replicating in real-time to other location for data recovery.	Data is backed up to various host servers to support disaster recovery solutions.	Yes, data is backed up to secondary database server.	Databases are backed up to a secondary database server in real-time to ensure recoverability.

Other Functionalities

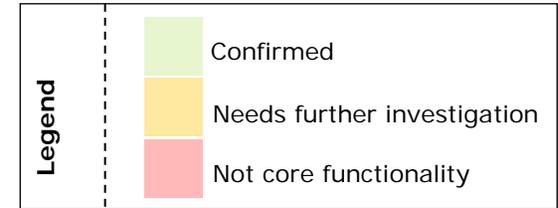
The diagram below depicts the other areas of research that the advisory team conducted research on which will enable the City's permitting process to be more efficient.



Non-Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
The options available for City staff to communicate with applicants (instant e-mail notifications, messaging or phone).	Yes, system can be configured to notify applicants of tasks outstanding through dashboard, phone, and e-mail notifications.	Yes, system can be configured to notify applicants of tasks outstanding through dashboard, phone, and e-mail notifications.	Yes, system can be configured to notify applicants of tasks outstanding through dashboard, phone, and e-mail notifications.	Yes, e-mail notifications sent based on specific triggers. Dashboard available for applicants to see status.	Yes, new notification tool alerts users based on custom rules. City will have to follow up with Calytera based on the level of customization.	Yes, system can be configured to notify applicants of tasks outstanding through dashboard, phone, and e-mail notifications.
Ability of system to allow review staff to electronically markup documents.	Yes, mark up plans and insert comments using text, images, shapes or sketching.	Yes, markup plans and insert comments using text, images, shapes or sketching.	Yes, digital remarks are available.	Yes, mark up plans and insert comments using text, images, shapes or sketching.	Not core functionality.	Yes, digital remarks are available.
Ability of system to provide users with support through help guides, videos, and tutorials.	Yes, support guides are available for users.	Yes, a combination of videos and support guides available.	Yes, support guides are available for users.	Yes, support guides are available for users.	Yes, support guides are available for users.	Yes, support guides are available for users.
Other reporting functionalities or reports generated by system.	Highly flexible and can produce multiple reports. City will have to follow up with specific report adherence.	Highly flexible and can produce multiple reports. City will have to follow up with specific report adherence.	Highly flexible and can produce multiple reports. City will have to follow up with specific report adherence.	Highly flexible and can produce multiple reports. City will have to follow up with specific report adherence.	MPAC and Statistics Canada reports available.	MPAC, Tarion and Statistics Canada reports available.

Core Concerns

The following diagram discusses core concerns derived from customer reviews of their permitting solution and findings from the research conducted.



Non-Functional Requirement	Accela	Avolve	BasicGov	Computronix	Calytera	Evolta
Core concerns derived from customer reviews and our research.	City of Seattle experienced problems with the rollout of the system, as immediately after the system went live, the system could not handle a large number of applications, resulting in system crashes and glitches. Instead of automating tasks, staff were forced to leave their ordinary duties and assist applicants with their problems, resulting in more applicants visiting the City. ⁴⁷	According to Capterra, users have found the software not to be user-friendly and not conducive for effective communication. A product demonstration will be needed to evaluate the user-friendly nature of the portal.	No Canadian municipality has implemented this solution, however Province of Manitoba will be adopting the salesforce platform (Deal negotiated 2019/09/16).	High price is one of the drawbacks of the solution which can be expensive for municipalities.	According to Capterra, users have had problems with the stability of the platform including system crashes, and have found the provider to be slow in responding to inquiries when the system is down.	No customer testimonies or accolades/ success rate mentioned outside of Finland.

⁴⁷ The Seattle Times, Rocky Launch of Seattle’s new construction-permit system causes delays, August 2019.

Technology options – Provider portfolio

The sources for the technology options research include: Gartner report “Market Guide for U.S. Community Development and Regulation Applications”, the providers’ official websites, solution brochures provided by the providers, and customer reviews available on the web.

Accela

Accela is a cloud-based software solution which automates all aspects of the building permit process. This solution moves the building permit process online, thus removing paper, manual steps, and errors, while dramatically cutting the time and cost of permit processing.



Highlights

- Accela is headquartered in California and was founded in 1999.
- Accela provides market-leading SaaS solutions that empower state and local governments to build thriving communities, grow businesses, and protect citizens.
- Accela specializes in land management, licensing, emerging regulations (such as cannabis regulation), asset management, code enforcement, and citizen relationship management.
- Industries: Supports a number of industries on an international level.
- <https://www.accela.com/>



Core Strengths

- According to a testimony from the Chief Building Official from the City of Texas, the Accela solution was “...able to reduce turnaround times for residential permits from approximately 3 weeks to 3 days, and for commercial permits, from two months to 5-10 days.”
- GIS integration provides intuitive visualizations to access land parcel permit history, view code and zoning details, and map as well as route inspections efficiently.
- According to Accela, agencies become “greener” due to less consumption of paper and reduce the public funds needed to process permits.

Figure 8: Accela Application Portal

Summary: The image below illustrates the user interface of the portal for submitting applications, scheduling payments, and submitting additional information.



Avolve Technologies

Avolve is a secure on-premises and cloud-based software vendor dedicated exclusively to electronic building plan review. Avolve provides the option to customize the electronic review process in accordance with municipal requirements. Avolve offers efficient and user-friendly services to stakeholders resulting in faster building permit issuance.



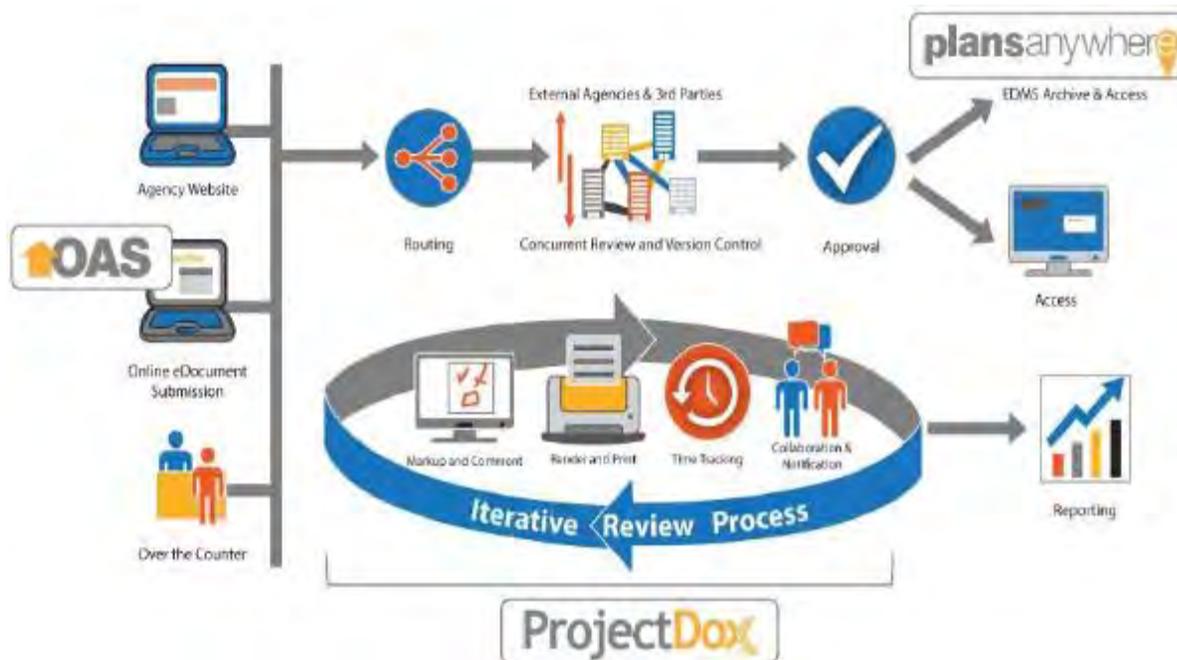
Highlights

- Avolve Software is headquartered in Scottsdale, AZ and provides services across 150 Cities in North America.
- Avolve has provided building plan review services since 2008, and has emerged as an industry leader in defining the building permit licensing process.
- Industries: Supports a number of industries including government and municipalities on an international level.
- <https://www.avolvesoftware.com/>



Core Strengths

- According to the Fiatch assessment, jurisdictions using e-Plan technology have reduced plan review and approval times between 30–40% on average.
- According to customer testimonies, ROI has been 80% as a result of reduced review times.
- Avolve is well known for its ability to integrate with SAP.
- Service is available 24/7, allowing applicants to receive status updates in real time.



BasicGov

BasicGov's provides a cloud-based SaaS solution for building permits that can automate and streamline operations to cut costs, meet the ever changing demand for citizen services, and evolve into a more open, transparent, and collaborative organization.



Highlights

- BasicGov was founded in 1985 and is headquartered in Vancouver, Canada.
- The BasicGov COTS software solution provides multiple modules, including Permitting, Inspections, Code Enforcement, Licensing, Planning, Esri GIS Map Viewer & Sync, Fund Accounting, Payment Cart, and Citizen Portal for applications and payments.
- Industries: Supports a number of government agencies across North America.
- <https://www.basicgov.com/>

Core Strengths

- Solutions are secure to the highest government standards and monitored 24/7 for any breach attempts.
- BasicGov automates key tasks for planners, reviewers, inspectors as well as stakeholders involved in a project.
- BasicGov uses the Salesforce Platform to enable cost-efficient delivery of services by allowing municipalities to improve the speed and efficiency of the inspection and permitting process.

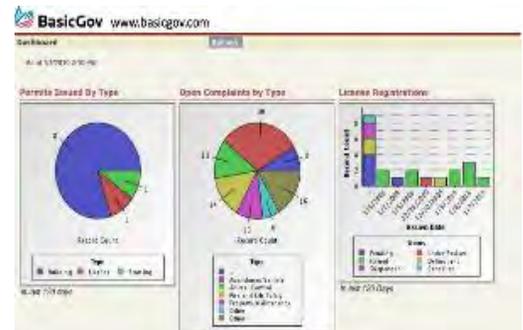
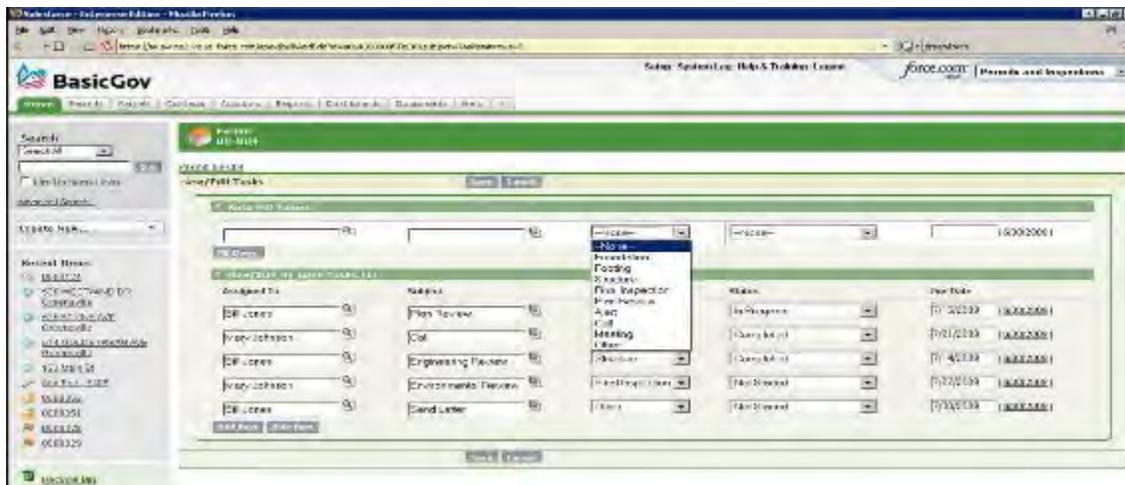


Figure 9: BasicGov Application Portal

Summary: The image below illustrates the user interface portal for submitting applications, through the BasicGov System.



Calytera

Calytera provides automation software to government agencies, providing a mobile and web user experience, along with delivery support. Calytera offers the Amanda E-Plan review system which is a comprehensive case management and flexible process automation platform that can be configured as private cloud, SaaS or on-premises.



Highlights

- Calytera is headquartered in Austin, Texas and provides services across more than 350 Cities across North America.
- The e-permitting solution allows municipalities to log, route, manage and report on all requests, improving responsiveness and security while ensuring compliance with regulations and reporting.
- Industries: Supports a number of government municipalities across North America.
- <https://www.calytera.com>

Core Strengths

- Compared to the City of Pickering's current edition, the latest edition of Amanda, allows users to submit applications online and configure the payment process to auto-calculate permit fees.
- The latest edition of the Amanda system provides embedded GIS, for inspector to access data in real-time and connect with GIS maps.
- The new system includes advanced analytics to allow users to see information in real-time.



Figure 10: Calytera Application Portal

Summary: The image below illustrates the user interface portal for submitting applications, through the Calytera system.



Computronix

Computronix is a software development company, providing the Public One Stop Service (POSSE) line-of-business process automation solutions for government organizations in North America. POSSE specializes in providing licensing, permitting, inspection, code enforcement, and a wide variety of other process automation solutions.



Highlights

- Computronix is headquartered in Lakewood, Colorado and has been recognized consistently by Urban and Regional Information System Association (URISA) for exemplary systems in Government.
- POSSE software has also been inducted into the Smithsonian Institution's collection of innovative software.
- The system can integrate to multiple ERP platforms.
- Industries: Supports a number of government municipalities on an international level.
- <https://www.computronix.com/>

Core Strengths

- According to the City of Edmonton, the implementation of the POSSE software has resulted in greater efficiency and cost savings such as:
 - Time to issue permits was reduced from days or weeks to minutes or hours.
 - Number of wasted inspections reduced from 31% to 3%.
 - Reducing the number of inspectors needed by 50%.
- Adaptable system allows new workflows to be easily configured as the system is highly flexible and can adapt to changes in rules at any time.

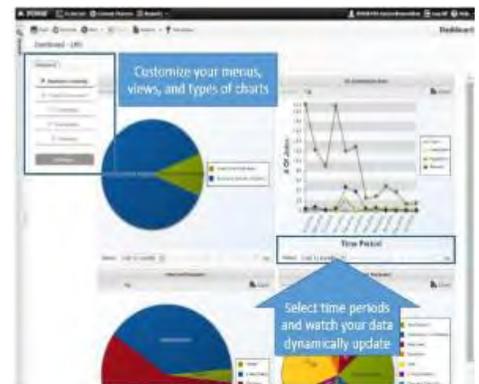
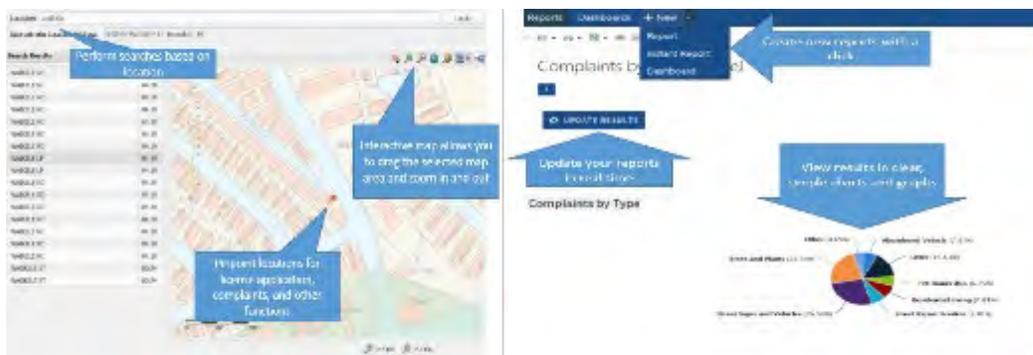


Figure 11: Computronix Application Portal

Summary: The image below illustrates the user interface portal for deriving plans and performance reports.



Evolta

Evolta is a globally oriented company focusing solely on the digitalization of building permits. The fully integrated on-premises, and cloud based solution is highly innovative, which allows government agencies to become more efficient, accessible, and responsive to the needs of the public.



Highlights

- Evolta is headquartered in Finland and currently serves 60% of the municipalities in Finland.
- The system is able to integrate with SAP and payment system associated with SAP.
- Industries: Supports a number of government municipalities on an international level.
 - Currently branching out to Canada with the City of Windsor.
- <https://evolta.fi/en/>

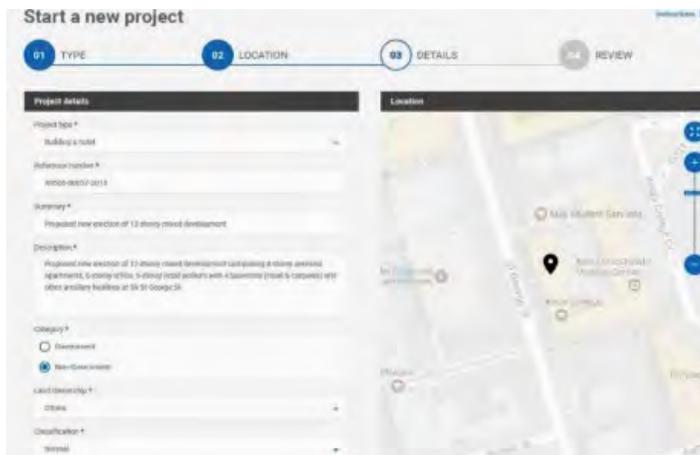


Core Strengths

- Application customer times have reduced up to 90% for municipalities in some cases.
- 24/7 service availability with massive efficiency savings for authorities and time savings for applicants.
- Permit processing times have typically reduced from several weeks to just a few days.

Figure 12: Evolta Application Portal

Summary: The image below depicts the user interface for application submission.



Conclusion

Based on the information gathered in this report, there is a gap between the current permitting software and the expected outcomes set by the City.

The current permitting system is not aligned with industry best practices. The current paper-based permitting system has limited capabilities for electronic review and application submission, payment processing, system integration, and data analytics.

In the efforts of achieving the City's expectation of improving service delivery, expediting the time to issue permits, reducing operational costs from both staff and paper consumption, along with seamless integration with the City's current ERP system, a list of functional and non-functional requirements have been developed, and potential providers of building permitting solutions have been assessed against the requirements.

Please note that the analysis in this report has been conducted based on information made available during meetings and interviews with the City. The functional and non-functional requirements generated on pages 62-72 serve for the purposes of scanning e-permitting solutions offered in the market. A formal system selection with potential vendors and a full list of functional business requirements is needed in order to thoroughly assess the solutions and to accurately quantify the cost savings. A system selection will include formal scoring against the City's defined criteria and detailed solution demonstrations based on real case scenarios.

Below are the expected outcomes of implementing an e-permitting solution as demonstrated in this report:

- Citizen service will be improved as residents of Pickering will have the ability to submit applications electronically, and dashboards will enable residents to receive notifications of their applications in real-time.
- E-permitting solution will eliminate the consumption of paper in the permitting process leading the City to contribute to a more sustainable environment.
- The City will reduce operational costs and will no longer experience delayed tax revenues as result of delays in the permitting process.

The annual potential cost savings of deploying an e-permitting system could be around \$56,550, along with a potential expected increase in permit revenue of \$645,000, as a result of faster issuance of building permits and tax revenues from tax roll reassessments. The estimation of potential increase in permit revenue and savings are described in the cost-benefit analysis section of this report. These figures are estimates, and actual cost savings as well as increases in permit revenue will vary depending on the level of certain parameters such as permit volume. In some cases, the City may be able to expand the scope of the tools mentioned above to support other application processing requests, which could further increase the potential costs savings of such a solution and enhance citizen experiences with the City. In order to successfully implement such a solution, the City will need to review their internal resourcing levels to ensure adequate support for a transformational project and ongoing maintenance.

It is recommended that the City initiates a formal business case to further quantify the benefits and cost savings of a e-permitting solution and develop a strategic roadmap before proceeding with the software procurement in order to accurately quantify the cost savings and justify the investment to the City council and residents.

“Choose good fleet management software and use it in decision making. The main goals of any fleet management system are to provide information to improve efficiency, decrease downtime and in-service breakdowns, reduce inventory, lower ownership cost and avoid waste.”⁴⁸

⁴⁸ Fleet Management Tips For Municipal Decision Makers, The Municipal Technical, Advisory Service, The University of Tennessee

Fleet management system report

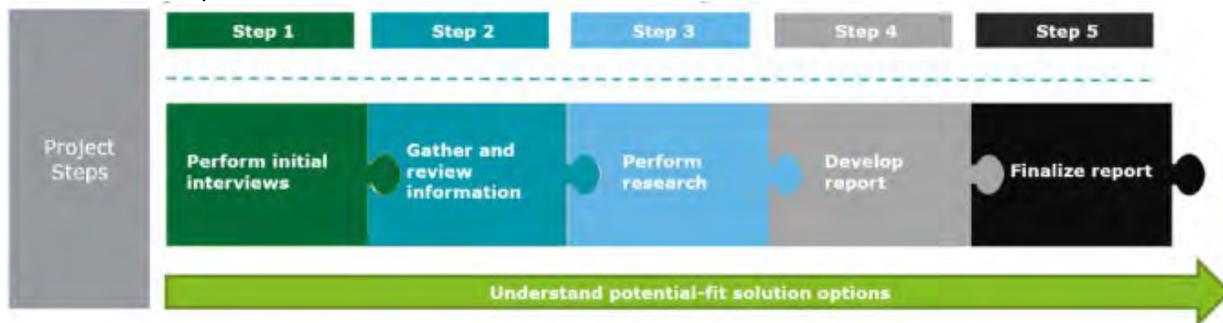
Introduction

Service Review Objectives

The objective of the fleet management and vehicle tracking service delivery review report was to identify technology options that can minimize or remove risks associated with the investment on a fleet management system, increase productivity in the maintenance facilities and identify other areas which could realize cost savings.

Figure 13: Project Steps

Summary: The project steps diagram below illustrates the steps taken as part of this investigation beginning with initial interviews, information gathering, research analysis, followed by development and finalization of report.



Research Methodology

The research methodology for the fleet management and vehicle tracking service delivery review report was to first conduct a preliminary analysis of the current operations of fleet management at the City of Pickering. This consisted of interviewing staff from operations, the municipal garage and fleet services department in order to understand the City's current operational deficiencies, along with researching technological advances in the fleet management industry in order to identify current state gaps. The current state gaps and automation opportunities will help the advisory team to identify the functional requirements that the new fleet management software should be able to meet.

Scope

The scope of the research conducted as determined by the City of Pickering is described below:

- Understand the current fleet management and vehicle tracking systems in place. (See Current State Gaps section on page 88-89)
- Work with the end-users to determine critical requirements for a new system. (See Current State Gaps section on page 88-89)
- Perform research on the key features and functionalities of available fleet management and vehicle tracking systems that could assist the City of Pickering in improving its efficiency and productivity. In particular, examining potential solutions that could provide benefits in areas including but not limited to vehicle telematics (GPS tracking and diagnostics), vehicle management, driver management, speed management and fuel management. (See Key Features section, page 90)

Approach

The following approach was used during the research:

- Research the fleet management industry and identify technological advances which could provide opportunities to improve the City's operational efficiency and productivity.
- Analyze the City's current fleet management and vehicle tracking systems and identify gaps in functionality.
- Use the functional requirements developed in the previous step as the criteria to identify and assess potential-fit fleet management technology options.
- Provide a cost and benefit analysis in order to quantify the benefits of purchasing and implementing a new fleet management and vehicle tracking solution that would meet the City's requirements.

Figure 14: Fleet Management Wheel

Summary: Fleet management can include a range of functions, such as fleet strategy, fleet acquisition, fleet services, fleet maintenance, fuel management, risk management (safety and compliance), tools and technology (telematics), and disposition and remarketing (asset utilization)



Background

Information in this section was obtained from the City of Pickering website, the Region of Durham website, and during meetings/interviews with the City. The current fleet size, vehicle type, services provided by the Operations and Fleet Services department, the City's technology provider and the related cost are introduced in this section as they are essential in understanding the City's current fleet operations.

Fleet Vehicle

Currently, the City has 212 vehicles that include Public Works Vehicles, Fire Vehicles and other "one-off" vehicles custom made to suit the City's needs. The fleet is expanding at a 2% to 5% rate annually. In 2018, the City added six new vehicles and five new vehicles in 2019.

The number of the fleet vehicles changes frequently as the City auctions off equipment and vehicles at the end of their lifecycle. Overall, this is a reasonably modest sized⁴⁹. The City has a partnership relationship with the Region of Durham for tire management. Tires are ordered and managed by the Durham Tire Co-op. The benefits of the partnership include opportunities to tender for larger and more lucrative contracts.

A detailed list that outlines the type, quantity, and size of the City's vehicles and equipment can be found on section Cost Benefit Analysis (page 98).

Services

Operations and Fleet Services department is responsible for the following:

- Public Works
 - Manage the City's municipal fleet
 - Repair, maintenance, and construction of roads
 - Winter control operations
 - Installation and maintenance of playgrounds
 - Boulevard and parkland grass cutting
- Fire operations
- Animal control services

Fleet Management Solution

The City's current fleet management software provider is RTA, a U.S.-based company that provides hybrid (either cloud or on-site data storage) vehicle tracking and inventory management solution. The cost is \$1,000 per year for maintenance and is considered minimal by the maintenance staff and facilities management team.

RTA is also used for part procurement currently. The City is in the process of securing an in-house parts supplier which will create a synchronization between the supply and demand of parts inventory. Upon the City's request, parts will be ready within 12 to 24 hours. No inventory would be kept by the City. This will promote operational efficiencies throughout the maintenance facilities.

⁴⁹ Fleet Maintenance Software – City of Pickering, Ladder Up Consulting Ltd, 2019

Asset Management Solution

The City uses VFA for asset management and capital planning purposes. VFA was implemented four years ago and provides services such as asset life cycle analysis. The annual licensing/maintenance fees for the VFA software in 2019 was \$31,497.36 (excluding HST).

GPS/AVL Solution

The City's current GPS/AVL (Automatic Vehicle Locator) solution provider is Focus, a fleet and fuel optimization system. Focus enables the City to remotely monitor the location of the vehicle fleet. The software maintenance and hardware cost of the Focus solution is \$39,000 per year. More detailed costing information can be found in Current Spending on Fleet Management and Vehicle Tracking Software section on page 99.

On Nov 5th, 2019, a public facing portal went live on the City of Pickering website. This portal allows residents to track the status of snow plows in the events of snow.

Fuel Management Solution

The City works with Coencorp for fuel management and uses their internet-connected peripheral devices on some of the fleet to adopt Internet of Things (IoT) technology in fuel management.

Key findings

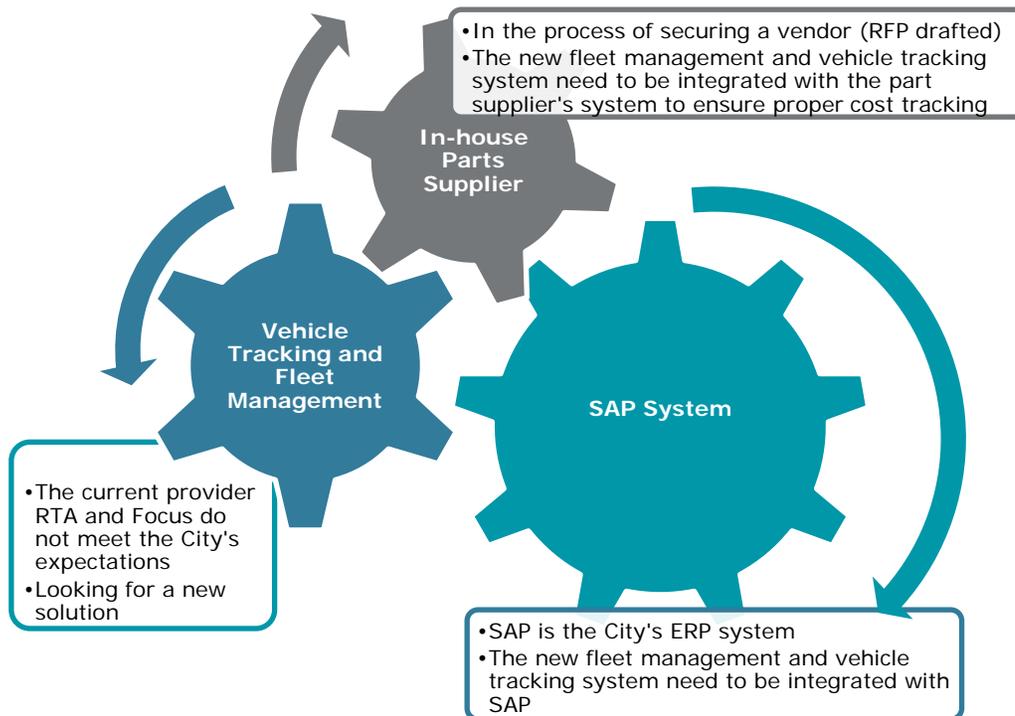
The following are the key findings addressed during interviews with the City of Pickering. These findings are used when determining potential solution providers to include in the assessment included in the Functional and Non-Functional Requirement section of this report.

1. The City's existing fleet management and vehicle tracking solutions are legacy applications that lack the integration and functionality required in order to realize efficiencies, save costs and improve day-to-day functions within several maintenance facilities:
 - The current solution does not provide part management functionalities that would record part usage and enable cost analysis on individual vehicles.
 - The current solution does not provide fleet maintenance functionalities such as schedule maintenance appointments, record the frequency and cost of maintenance, and provide long-term asset utilization analysis of vehicles.
 - The current solution does not promote routing and dispatching optimization, which could improve the service reaction time and citizen's satisfaction rate.
2. Currently, staff are required to record information regarding the fleet vehicle conditions on paper, which results in delays in maintenance services and limited access to usable information such as maintenance needs identified by the technicians.
3. The City is in the process of securing an in-house parts supplier which will create a synchronization between the supply and demand of parts inventory. Upon the City's request, parts will be provided by the supplier within 12 to 24 hours. No inventory would be kept by the City. This will promote operational efficiencies throughout the maintenance facilities. The new fleet management and vehicle tracking systems need to be integrated with the part supplier's system to ensure proper cost and part tracking.
4. The City has a partnership relationship with the Region of Durham for tire management. Tires are ordered and managed by the Durham Tire Co-op. The benefits of the partnership include opportunities to tender for larger and more lucrative contracts.
5. The City works with Coencorp for fuel management and uses their internet-connected peripheral devices on some of the fleet to adopt Internet of Things (IoT) technology in fuel management. The new fleet management and vehicle tracking systems can potentially replace Coencorp and provide an integrated fleet solution.
6. The City adopted VFA for facilities capital planning and asset management. According to the end users, the VFA software has been working well and is able to provide asset life cycle analysis, which is important in supporting asset replacement and vehicle financing decision makings. The new fleet management software will work in conjunction with VFA to track and analyze total cost of ownership, compare and contrast different vehicle options and create budgets for capital spending.
7. The City's current GPS/AVL (Automatic Vehicle Locator) solution provider is Focus. Focus enables the City to remotely monitor the location of the vehicle fleet. However, it does not meet the City's expectation due to:
 - Inability to display work orders assigned to each vehicle.

- Inability for the mechanics to update the work order status and communicate task progress with the central operations team.
 - Inability to track material usage such as salt usage.
8. The current fleet management software used by the City does not support the City’s reporting needs due to:
- Disparate data housed outside of the system in paper format.
 - Limited ad-hoc custom reporting functionality resulting in the need for IT intervention for additional reports.
9. Currently, the City is able to react to emergency work orders promptly. The vision and long-term goal of the Operations team is to automate the fleet operation processes such as part sourcing and procurement, maintenance planning, dispatching and routing, and reporting. Essentially, a “hands-free” fleet management and vehicle tracking system can free up more resources and time, which can be put into efforts to improve resident satisfaction.

Figure 15: Key Findings of the City’s fleet management and vehicle tracking systems

Summary: The City’s part management solution, fleet management and vehicle tracking systems, and the ERP system (SAP S4/HANA) can all be integrated and have the technical capabilities to do so. These systems also work toward the same end goals - lower risks associated with fleet investments, lower operating cost, higher volume of work output, increased worker safety, higher integration level across different departments and improved resident satisfaction, however these are not integrated properly.



Current State Gaps

Based on information obtained through interviews with different end users, the advisory team concluded that the gaps the City is facing with the current fleet management and vehicle tracking systems revolve around the following areas:

Routing & Dispatching	Parts Management	Maintenance Scheduling	User Interface
Current system	Current system	Current system	Current system
RTA, Focus	<ul style="list-style-type: none"> • CityWide and VFA are used for asset tracking, asset planning, and budgeting • Vailtech is used to record invoices, to be replaced by SAP • RTA is used for parts procurement 	RTA	RTA
Current State Gaps	Current State Gaps	Current State Gaps	Current State Gaps
<p>Currently, work orders are being processed manually on a excel spreadsheet.</p> <p>The current GPS tracking solution also does not display the work orders assigned to each vehicle.</p> <p>There are opportunities to improve routing and dispatching efficiency, and increase work output:</p> <ul style="list-style-type: none"> • System automatically generates and tracks work orders for each vehicle • Optimize routing and prioritizing work orders by adopting dynamic routing • Schedule work orders in real-time and enabling faster response to work orders received 	<p>The current system tracks parts ordered by department/cost centres. However, there is no information regarding which vehicle the parts ordered are related to.</p> <p>Additional function is required for:</p> <ul style="list-style-type: none"> • Accurately track cost information to increase operational efficiency by tagging cost to specific vehicles and asset utilization for different types of vehicles 	<p>Vehicle maintenance is mostly reactive rather than preventive.</p> <p>Additional function is required for:</p> <ul style="list-style-type: none"> • Maintenance scheduling: alert for regular maintenance appointment base on the type and condition of vehicles • Record and retrieve data regarding the number of times the vehicle comes in for services; long-term maintenance requirement and life of the vehicle 	<p>The current system is not user friendly and the technicians are reluctant to input data electronically due to the inexistence of data entry fields for certain types or information such as remaining life of the vehicle, historical maintenance records, outstanding repair and maintenance requirements, etc.</p> <p>Additional function is required for:</p> <ul style="list-style-type: none"> • Note-taking: enable the technicians to record findings and information such as worn out tires • Image tagging: enable the technicians to include a photo evidence of the findings such as worn tires • Easy data retrieval: enable the technician and management to search keywords in the system

Vehicle & Equipment Reporting

Labour Cost Reporting

Job Cost Reporting

Current system

Current system

Current system

RTA

RTA

RTA

Current State Gaps

Current State Gaps

Current State Gaps

The system does not meet the reporting needs for vehicle and equipment analysis due to disparate data housed outside of the system in paper format and the limited ad-hoc custom reporting functionality resulting in the need for IT intervention for additional reports.

Additional function is required for:

- Ability to provide reports on vehicle and equipment utilization, cost of ownership analysis, and other ad-hoc requests
- Compare operational efficiency and asset utilization of different types of vehicles
- The report can be used as a strong support in budgeting and funding decision makings

The current system does not accurately track and bill mechanics labour to their cost centres. Discrepancy exists in the mechanics' actual labour rates and the amounts charged back to the cost centres in the SAP system.

Additional function is required for:

- Labour cost information in the backend maintenance system should transfer to the SAP system accurately
- The fleet management system should be fully integrated with the SAP system

The current system does not accurately record the cost for each job or work order. Management has no means to evaluate the cost for different activities such as sign replacement, and pothole repairs.

Additional function is required for:

- Custom reports to provide analysis on the costs of different job types or different work orders
- The report can be used as a strong support in budgeting and funding decision makings

Key Features of Fleet Management System

In order to paint a fuller picture of the features encompassing fleet management solutions, an analysis has been done on Vehicle Financing, Vehicle Maintenance, Vehicle Telematics, Driver Management, Speed Management, Fuel Management, Health and Safety Management, Dispatching and Routing, Public-facing Snow Plough Tracking, and Insurance Benefits.

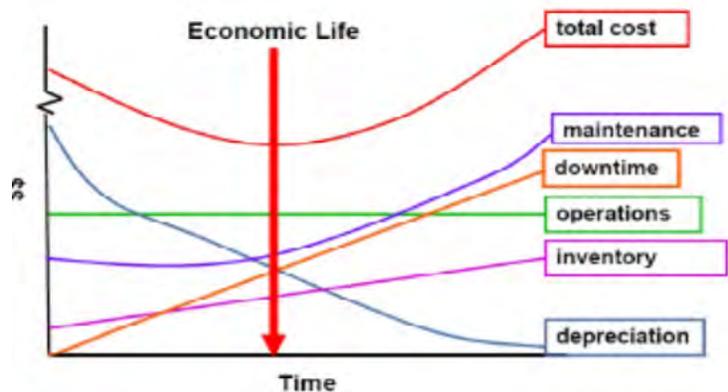
These are the areas that the City expects to see improvements on with the help of a new fleet management and vehicle tracking solution.

Vehicle Financing

Figure 16 Factors affecting the Economic Life of a vehicle⁵⁰

Summary: From an economic perspective the optimal point to replace fleet assets is when the total cost of ownership is at its lowest.

Fleet acquisition and fleet replacement decisions are made base on the estimation of a vehicle’s economic life, trade in values, and operating costs. Trade values can be estimated using the information of the fleet life cycle, travel length per year, and purchase price. This type of calculation and analysis can sometimes be done in a fleet management solution in order to assist vehicle financing decision makings. Some other fleet management software functionalities related to vehicle financing and asset utilization are as follow:



- Describe the trend in operation and maintenance costs for the vehicles
- Reduce fleet capital and operating costs to the City through targeted lifecycle analysis, which can determine how long assets can remain in the fleet before the operation is no longer cost-effective. The goal is to spread capital costs over as long as period as possible. This functionality is possible from a fleet management system or through an ERP system.

Vehicle Maintenance

Preventive maintenance is a regular part of fleet ownership, but additional repairs due to aggressive driving and vehicle misuse are an unnecessary cost to a fleet. Market research suggests that excessive maintenance-related costs are primarily driven by aggressive driving behaviors such as hard accelerations, harsh cornering, and harsh braking, which cause harmful wear and tear on critical vehicle components, drastically increasing a vehicle’s variable rpm. These effects materialize as reduced tire life, reduced brake life, more frequent scheduled maintenance, and more frequent non-scheduled maintenance and repair. These non-scheduled events often result in large losses to organizations that rely on its fleet assets for day-to-day operations. In fact, a non-scheduled maintenance interruption can result in lost profits of \$530 to \$928 per day, in addition to the cost of repairs.⁵¹

The Organization for Economic Co-operation and Development (OECD) reports that telematics technology can help a company reduce maintenance and repair costs by as much as 14%.⁵² As described above, much

⁵⁰ H. Greene & R.E. Knorr, Managing Public Equipment, American Public Works Association, Kansas City, 1989

⁵¹ Understanding the true cost of fleet vehicle downtime. (n.d.) Retrieved from <http://fleetanswers.com/content/understanding-true-cost-fleet-vehicle-downtime>

⁵² Towards smarter supply chains. OECD Observer, No 279, Wright, J. May, 2010

of these savings are tied to driver behavior, and therefore real-time driver management tools and in-cab alerts are the best way to minimize unnecessary wear and tear on fleets.

Vehicle Telematics

A Fleet Telematics System (FTS) allows the information exchange between a vehicle fleet and the Operations team. A FTS typically consists of mobile Vehicle Systems (VS) and a stationary Fleet Communication System (FCS). The FCS may be a stand alone application maintained by the motor carrier or an internet service running by the supplier of the system. The FCS usually includes a database in which all vehicle positions and messages are stored.

Digital maps are often included which allow visualization of vehicle positions and traces. Communication with the FCS is realized by trunked radio, cellular, or satellite. Positioning of vehicles is usually realized by satellite positioning systems and/or dead reckoning using gyroscope and odometer.⁵³

GPS can add value in both the tracking and optimization of cyclical work. It can support fuel reduction efforts and provide driver level feedback on performance as well as provide accurate time and location data in the event of a Motor Vehicle Accident (or to refute a claim against the City). Using the vehicle telematics to flag engine sensor issues early can alleviate costly unplanned failures.

Driver Management

Electronic on-board recorder/Tachograph can be used to analyze driver behavior and defend innocent drivers accused of causing accidents. This function enables additional compliance capabilities.

Increased worker safety can also be achieved through GPS tracking and the ability to know where fleet assets or drivers are at all times.

Geo-fencing technology allows users to set virtual boundaries. This helps manage a group of vehicles within a region to keep time traveling between jobs to a minimum. When drivers are organized within a specific area, response rates are quicker and the area is more attentively covered. Peer-to-peer and dispatcher-to-driver messaging can connect drivers for instant communication, messaging, and knowledge sharing.

Most of these functionalities are tailored to large, long distance, remotely located and highly mobile fleets. As fleet size increases, the absolute payback on these types of investment increases and they become more attractive. At scale, these benefits begin to outweigh the costs (direct and indirect) of these approaches.

Speed Management

Certain fleet management solutions provide in-vehicle, proactive coaching with customized messaging and rules to limit speed, such as:

- With in-cab real-time alerts, an audible buzzer reminds drivers when unsafe driving is detected, allowing them to correct the behavior immediately
- In-vehicle, proactive coaching with customized messaging and rules

These functionalities are tailored to large, long distance, remotely located and highly mobile fleets. More research need to be conducted to determine if the quantifiable benefit can outweigh the cost considering the size of the City's workforce. As fleet size increases, the absolute payback on these types of investment increases and they become more attractive. At scale, these benefits begin to outweigh the costs (direct and indirect) of these approaches.

⁵³ Fleet Telematics: Real-Time Management and Planning of Commercial Vehicle Operations.

Fuel Management

For many fleets, fuel is one of the largest expenses. Managing fuel costs can be a complicated endeavor involving a number of variables, including fluctuating gas prices and inconsistent driver behavior. In fact, the U.S. Department of Energy reports that rapid acceleration and heavy braking can reduce fuel economy by up to 33% for highway driving and 5% on city roads. Idling and speeding can also have drastic impacts on Miles per Gallon (MPG).

Telematics Wire Market research has shown that the effective use of telematics can reduce fuel costs by as much as 14%. Driver coaching is instrumental in achieving these cost reductions. For example, for every 5 mph over 50 mph, a driver can reduce their MPG by approximately 7-14%. Therefore, getting drivers to slow down and observe the speed limit translates into monetary savings. Furthermore, real-time driver idling alerts can be used to drastically cut down on vehicle idling costs and wasted fuel.

Health and Safety Management

Collisions, speeding, and aggressive driving behaviors were found to be a contributing factor in 31% of all fatal crashes, while seat belt use was found to decrease the risk of a fatality by between 45% and 60% according to Guidelines for Employers to Reduce Motor Vehicle Crashes. Aggressive driving behavior can have a big impact on a fleet's safety-related operating costs.

The City can improve savings by monitoring driver behaviors and proactively coaching drivers via the use of telematics. Certain fleet management solutions provide the following functionalities to reduce accidents and minimize risk:

- In-cab driver feedback tools and real-time audible alerts can drastically reduce the likelihood of an on-duty accident.
- The driver safety program includes real-time monitoring of aggressive driving and video analytics to increase self-awareness and accountability on the road.

Again, these functionalities are tailored to large, long distance, remotely located and highly mobile fleets. As fleet size increases, the absolute payback on these types of investment increases and they become more attractive. At scale, these benefits begin to outweigh the costs (direct and indirect) of these approaches.

Dispatching and Routing

Operations and Fleet Services department receives work orders for the following types of services:

- Repair, maintenance, and construction of roads
- Winter control operations
- Installation and maintenance of playgrounds
- Boulevard and parkland grass cutting

The routing and scheduling for work orders can be achieved by using one of the three strategies described below:

- **Static Routing**, which is driven by semi-annual or annual route plans in defined geographic areas, built around forecast work orders, and designed to maximize customer service.
- **Dynamic Routing**, which is driven by daily-built route plans, built around both daily and forecast work orders, and designed to increase efficiency, increase resident satisfaction, and decrease response time of work orders.
- **Real-time Dynamic Routing**, which is driven by daily-built route plans designed to efficiently deliver pre-orders and real-time work orders within its expected time window.

Dynamic routing will allow drivers respond to areas based on priority and traffic, and ultimately to increase the level of service delivered to citizens. In municipalities, the distribution of the work can be either highly variable (i.e., the work locations can be new every day due to road repair, utility maintenance, etc.) or highly programmed and controlled/routed (e.g., street sweeping, snow plowing, garbage pickup, automated water meter reading). The City's situation is vastly different from private sector services and it is rare for the fleet assets to be 'optimally dispatched' on a daily basis to respond to new and unique destinations.

Dynamic Routing would result in improved resident satisfaction. However, more detailed analysis need to be conducted to determine if the routing optimization can provide quantifiable benefits which outweigh the costs in investing in the required technology.

Public-facing Snow Plough Tracking

Operations & Fleet Services department is responsible for the repair, maintenance, and construction of roads, and winter control operations. It is important to ensure transparency and accountability for Public-facing Snow Ploughing. Aligning on meaningful and impactful performance indicators will ensure that improvement is quantified and measured with accountability. Possible KPIs are as follows:

- Equipment turnover rate/refill rate
- Slip and fall claims vs. labour hours cleaning vs. snow levels
- Maintenance cost per km per equipment unit
- Minimize standby travel time

A fleet management solution can benefit the winter maintenance in areas such as: providing real-time snow plough vehicle locations, ensuring transparency of asset usage, track time spent at job sites, and providing preventive maintenance reminders.

Insurance Benefits

Insurance companies have reported a 45% reduction in accidents and a 50% reduction in accident payout costs via the use of telematics.⁵⁴ Moreover, this reduction in accident claims can translate into a 5% to 25% reduction in comprehensive insurance costs.⁵⁵

Please note that these figures are not specific to municipalities and might vary depending on the area and size of cities.

A fleet management solution can potentially help reduce insurance premiums in areas such as:

- Provide historical reports that provide proof of safety driving record, making sure improvements are reflected in insurance rates.
- Use GPS fleet tracking to locate stolen vehicles, increasing the chances for recovery and reducing insurance claim costs.
- Provide telematics data that can be shared with insurance companies, improving fleet driving safety standards which could reduce insurance spend.
- Provide accident detection and instant notification, and detailed second-by-second data that helps prove no-fault to insurance provider.

Functional and Non-functional Requirements

The diagrams on the following pages illustrate the high-level functional and non-functional requirements that the new fleet management and vehicle tracking systems should meet in order to achieve the City's expected outcomes.

⁵⁴ Attention Fleet Manager: Fleet Safety is Important Too! Driver's Alert, Taylor, V., October 13, 2014.

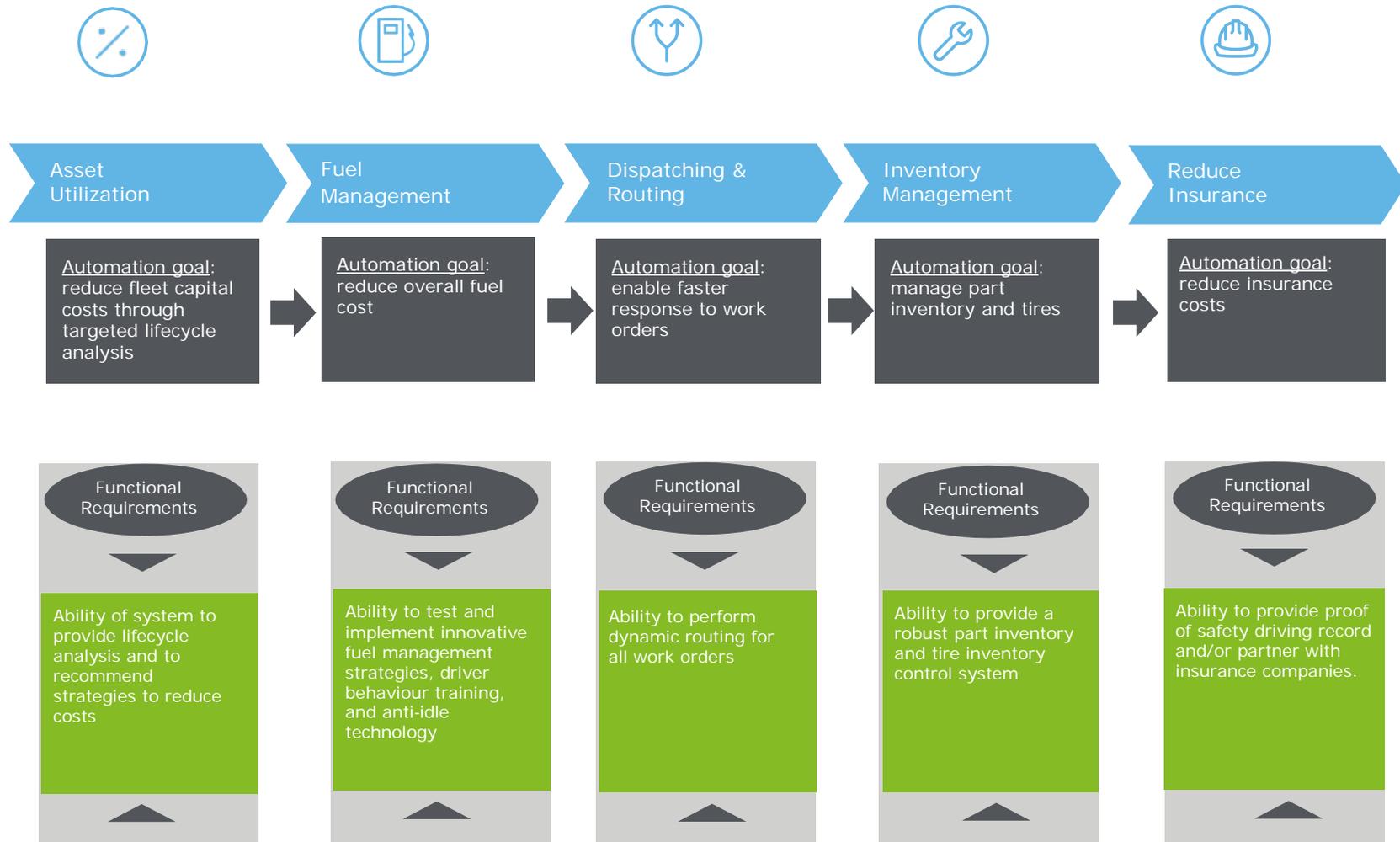
⁵⁵ How Telematics Can Help You Save on Car Insurance. Navigators Insurance, Zhukov, K, March 31, 2014.

A list of more detailed requirements can be found on page 109-115.

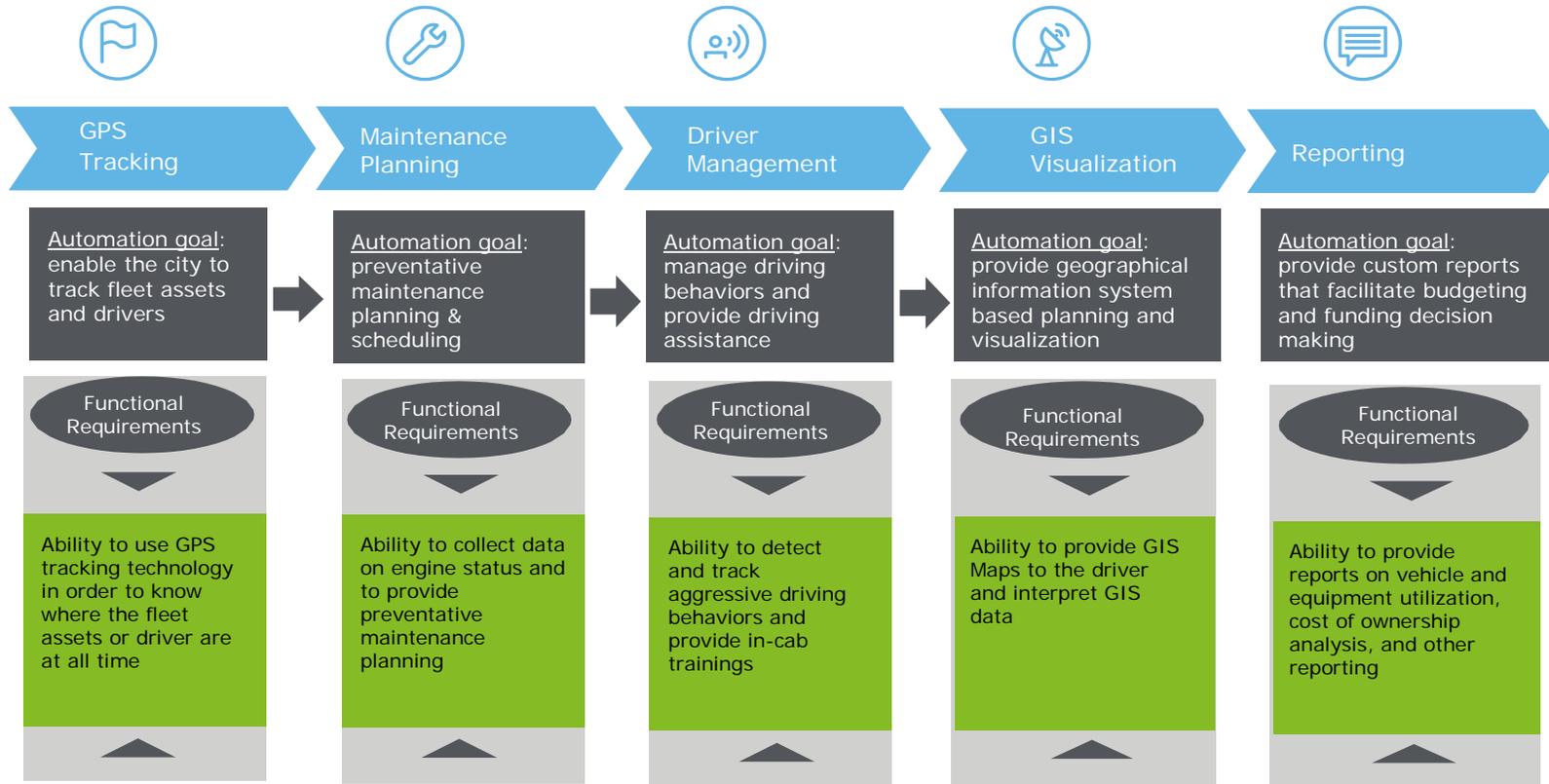
The functional and non-functional requirements are defined as follows:

- A functional requirement defines the system abilities that a potential providers system should adhere to.
- A non-functional requirement will place constraints on how the system will perform those functionalities.

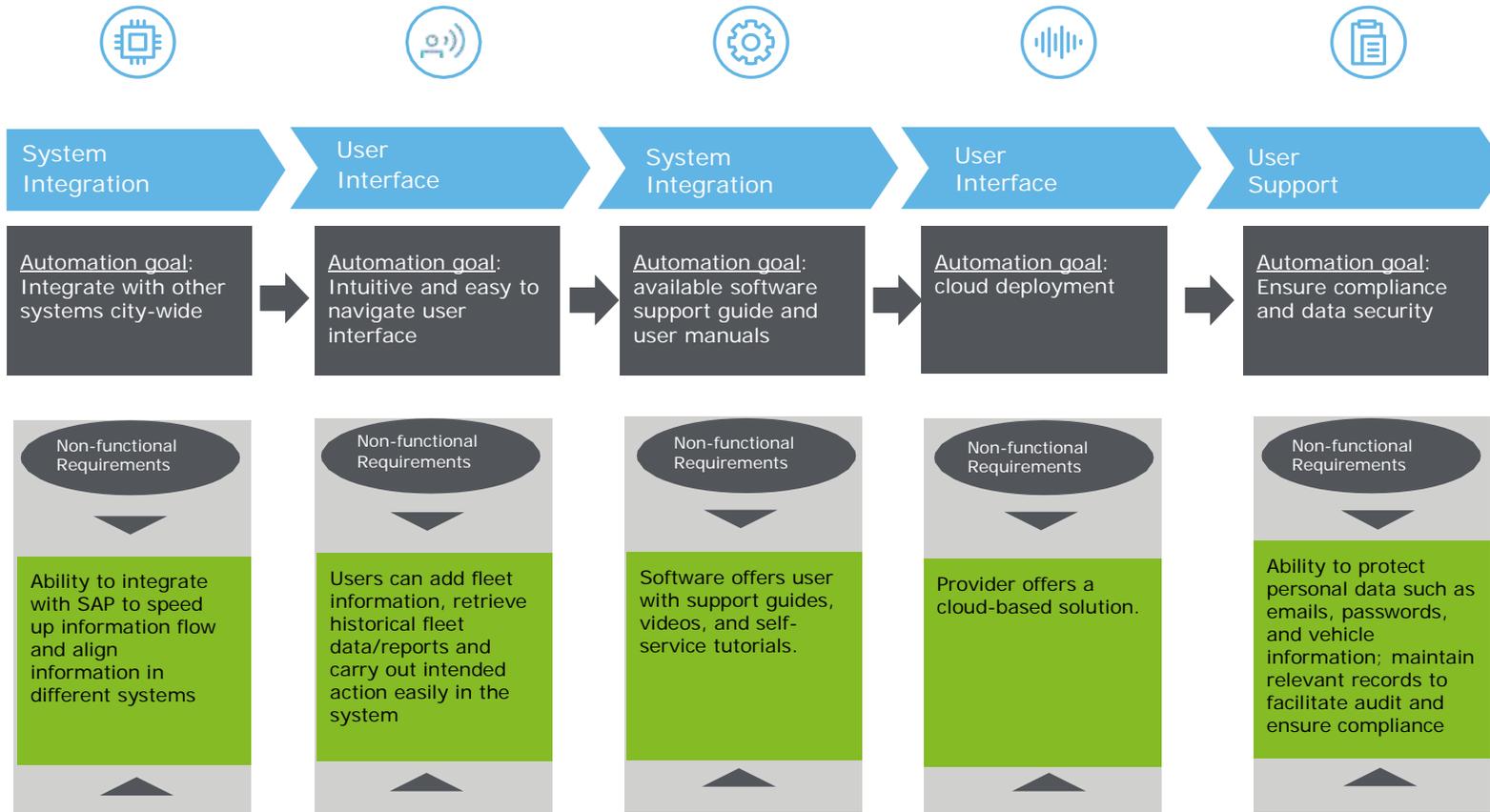
Functional Requirements



Functional Requirements



Non-Functional Requirements



Cost benefit analysis

Market Cost and Illustrative Quotes

Most fleet management providers structure their software and services fees on a case-by-case basis. Factors that affect the pricing include the size of the fleet, the geographical location of the user, functionalities required, and others.

The following table describes the cost information that is publicly available for the three potential providers analyzed in this report.

Questions	Coencorp	RTA	SAP
Which entity use the software provided by this vendor?	Ottawa Airport	Winnipeg uses RTA and other supporting spreadsheet and timekeeping programs	Edmonton's fleet maintenance is primarily supported through the Plant Maintenance Module
How much is the initial deployment cost of the software?	\$72,865 on software maintenance and technical support	Purchased in 2002 for approximately \$44,255 ⁵⁶	The Plant Maintenance Module can be added at no additional cost since City of Pickering is using SAP as their ERP solution
What is the size of the City's fleet?	200 units	Approximately 1,700 units ⁵⁷	Over 5,000 units currently ⁵⁸
What difficulty did the City experience with this software?	No concerns found on the public-facing websites	By 2010, nearly \$2 million has been expended on IT consulting services with the fleet management information system still not fully implemented ⁵⁹	Efficiency and effectiveness was reduced significantly when the Plant Maintenance application software replaced the old legacy fleet management software which had been custom developed over 20 years; The adoption of the Plant Maintenance Module has proven to be more difficult than initially anticipated

Current Spending on Fleet Management and Vehicle Tracking Software

The following table outlines the known costs that have been spent to manage and monitor fleet assets at the City of Pickering for the past four years. The costs include the maintenance fee incurred for the current fleet management system RTA, the current asset management and facility capital planning software VFA, and the current vehicle tracking software Focus.

A new fleet management software could potentially replace RTA in managing fleet maintenance, work order scheduling, and analytics; replace Focus in tracking fleet locations and monitoring driver behaviors; replace

⁵⁶ Winnipeg Fleet Management Performance Audit Final Report, January 2010.

⁵⁷ <https://www.winnipeg.ca/fleet/>

⁵⁸ https://www.edmonton.ca/city_government/city_organization/fleet-services.aspx

⁵⁹ Winnipeg Fleet Management Performance Audit Final Report, January 2010.

VFA in tracking and analyze total cost of ownership, comparing and contrasting different vehicle options and create budgets for capital spending.

Type	Cost Item	Amount (Net of Tax)	Year incurred	One-Time/Recurring
Maintenance	RTA system maintenance fee	\$4,000.00	2016-2019	Recurring
Licensing/Maintenance	VFA licensing and maintenance fee	\$31,497.36	2019	Recurring
Licensing/Maintenance	VFA licensing and maintenance fee	\$29,478.65	2018	Recurring
Licensing/Maintenance	VFA licensing and maintenance fee	\$28,074.90	2017	Recurring
Licensing/Maintenance	VFA licensing and maintenance fee	\$26,738.00	2016	Recurring
Licensing/Maintenance	Focus Public Facing Portal \$1,130.00 per month starting October 2019	\$3,390.00	2019	Recurring
Maintenance	Focus GPS all-inclusive fees and cellular service	\$39,006.60	2019	Recurring
Hardware	Focus GPS/AVL hardware for 4 additional Vehicles	\$902.50	2019	One-time
Maintenance	Focus GPS all-inclusive fees and cellular service (assume same rate as in January 2019)	\$37,500.60	2018	Recurring
Maintenance	Focus GPS all-inclusive fees and cellular service (assume same rate as in December 2016)	\$35,693.28	2017	Recurring
Maintenance	Focus GPS all-inclusive fees and cellular service	\$26,318.16	2016	Recurring
Hardware	Focus GPS/AVL hardware for 79 vehicles (installation fee included)	\$28,500.41	2016	One-time
Total Recurring		\$261,697.55	2016-2019	Total Recurring
Total Hardware		\$29,402.91	2016, 2019	Total One-time
Total Cost		\$291,100.46	2016-2019	Total Annual Cost

The information above shows what the City needs to pay for software in a four-year period to run its fleet operations. It helps provide a baseline for assumed costs when discussing technology options for the future of fleet management and vehicle tracking.

Potential Cost Savings

The benefit for the City to upgrade its fleet management and vehicle tracking solutions can be grouped into four main areas: Safety, Asset Management, Maintenance and Repair, Productivity.

These savings shown in the table below were observed in a use case of a company with a fleet size of 303 units and an average vehicle mileage of 10,920.81 miles. This fleet is similar to Pickering's 212-unit fleet and the potential savings are expected to be comparable to Pickering's.

Type	Annual Cost Savings for one HD Vehicle	Annual Cost Savings for one MD Vehicle	Annual Cost Savings for one LD Vehicle
Safety	\$6,519	\$1,240.2	\$1,113
Asset and Fuel Management	\$6,519	\$858.6	\$524.7
Maintenance and Repair	\$4,611	\$381.6	\$318
Productivity	\$5,724	\$763.2	\$763.2

Municipal Benchmarking Network Canada defines light-duty (LD) vehicles as less than 4,500 kg, medium-duty (MD) vehicles as less than 9,000 kg but higher than 4,500 kg and heavy-duty (HD) vehicles as greater than 9,000 kg.

The table below outlines the type, quantity, and size of the City's vehicles and equipment. As of February 13, 2019, the City has 69 units LD vehicles, 22 units MD vehicles and 17 units HD vehicles.

Type	Quantity	Size (Tare Weight)
Full-size SUV	3	Light-duty
Mid-size SUV	25	Light-duty
4x4 Pick-up Truck	2	Light-duty
1/2 Ton Pick-up Truck	13	Light-duty
Cargo Van	6	Light-duty
Utility Vehicles (UTV)	3	Light-duty
Skid-Steer	2	Light-duty
Trackless Sidewalk Tractor	9	Light-duty
Wide Area Mowers	6	Light-duty
LD Vehicle Sub Total	69 units	
1 Ton Pick-up Truck	10	Medium-duty
1 Ton Truck	2	Medium-duty
1 Ton Van	1	Medium-duty
2 Ton Pick-up Truck	7	Medium-duty
2 Ton Truck	1	Medium-duty

Type	Quantity	Size (Tare Weight)
3 Ton Truck	1	Medium-duty
MD Vehicle Sub Total	22 units	
4 Ton Dump Truck	12	Heavy-duty
5 Ton Dump Truck	3	Heavy-duty
Road Grader	2	Heavy-duty
HD Vehicle Sub Total	17 units	
Snow Blower	5	N/A
Chainsaw	20	N/A
Plow and Wing Attachments	14	N/A
Skid-Steer	2	N/A
Equipment Sub Total	41 units	
Fire Vehicles (aerial truck, etc.)	Unknown	Depends on the size/type
Tractors	5 units	Depends on the size/type
Other Custom Made Vehicles	Unknown	Depends on the size/type

To determine the current fleet management system’s performance level and its potential cost saving opportunities, 11 expected outcomes (extracted from the Pickering Project Description and listed in the table below) have been used as a benchmark. Insurance Benefit, SAP Integration and User Friendly System, are excluded from cost saving analysis as no direct and measurable cost saving would be derived from them. Telematics, Driver/Speed Management, Fuel Management and Vehicle Financing are also excluded since the City is currently working with other solutions (Focus, Coencorp, and VFA) to address these areas. The table below illustrates that, for the 3 expected business outcome analyzed, each outcome would lead to potential cost savings in one area. The estimated potential incremental cost saving (%) represents the incremental cost saving that could be achieved if the new fleet management system meets three of the City’s expectation outcomes.

An annual incremental cost savings of \$308,667 can be estimated by multiplying the estimated annual cost saving for each vehicle type (see table on page 100), the quantity of the Pickering’s fleet vehicle (see above table on page 100), and the % of estimated potential incremental cost savings (see table below):

Expected Business Outcome	Type of Cost Saving Opportunities	Estimated Current Cost Saving with RTA (%)	Estimated Potential Incremental Cost Saving (%)	Estimated Potential Incremental Cost Saving (\$)
Vehicle Maintenance	Maintenance and Repair	0% ; The City schedules maintenance appointments manually. Vehicle maintenance is mostly reactive rather than preventative.	100% ; There are opportunities in collecting data on engine diagnostics and provide preventative maintenance and schedule regular maintenance based on the vehicle type.	\$108,724.20
Part Inventory Management	Asset and Fuel Management	80% ; The current RTA system does not meet the requirements based on the Current	20% ; Additional functionality such as cost tagging can assist cost reduction	\$33,183.30

		Gap Analysis on page 88.	strategy, asset utilization strategy and support better fleet acquisition and replacement decision-makings.	
Dispatching and Routing	Productivity	0%; Dispatching and routing are done manually.	100%; There is an opportunity to increase productivity by re-designing routes to reflect dynamic data such as vehicle locations travel time, and incoming work orders (see page 107 for opportunity Areas – Productivity).	\$166,759.20
Total				\$308,667.00

Detailed calculation of estimated cost savings for each area is shown below:

Expected Business Outcome	Type of Cost Saving Opportunities	Potential Incremental Cost Savings for HD Vehicle	Potential Incremental Cost Savings for MD Vehicle	Potential Incremental Cost Savings for LD Vehicle	Estimated Potential Incremental Cost Saving (\$)
Vehicle Maintenance	Maintenance and Repair	78,387.00 = 17 units*4,611.00	8,395.20 = 22 units*381.60	21,942.00 = 69 units*318.00	\$108,724.20
Part Inventory Management	Asset and Fuel Management	22,164.60 = 17 units*6,519.11*20%	3,777.84 = 22 units*1,240.20*20%	7,240.86 = 69 units*1,113.00*20%	\$33,183.30
Dispatching and Routing	Productivity	97,308.00 = 17 units*5,724.00	16,790.40 = 22 units*763.20	52,660.80 = 69 units*763.20	\$166,759.20
Total					\$308,667.00

Opportunity areas

Following the discussion in the preceding section, the four cost saving categories identified are: Safety and Compliance, Capital and Operating Cost, Maintenance and Repair, and Productivity. Each cost saving category is considered an opportunity area that the City can improve and potentially achieve savings on.

An analysis has been done for each opportunity area, including a description of the automation opportunity identified, the current state of the City's operations, potential benefits, risks, and potential cost savings.

Safety & Compliance

Minimize Aggressive Driving

Ability of system to provide real-time alert to the driver and correct aggressive driving behaviors and/or provides visual in-cab training.

Asset & Fuel Management

Reduce Fuel Costs

Find a fleet management solution that provides fuel management functionalities that meet the City's needs.

Optimize Fleet Replacement Strategy

System provides custom reports that can assist cost reduction strategy, asset utilization strategy and support better fleet acquisition and replacement decision-makings.

Maintenance & Repair

Ensure Scheduled Repair

System enables maintenance scheduling. Ensure all maintenance appointments attendance.

Minimize Non-scheduled Repair

System collects data on engine diagnostics and provides predictive maintenance that helps maintain vehicle with minor repair cost.

Productivity

Dynamic Routing

Re-designs routes to reflect dynamic data such as vehicle travel time, and incoming work orders.

Safety and Compliance

Potential Opportunity Area	Description	Next Steps	Potential Savings
Monitor and correct aggressive driving behaviors	<p>Opportunity</p> <ul style="list-style-type: none"> Monitor and correct aggressive driving behaviors such as hard accelerations, harsh cornering, and harsh braking that cause harmful wear and tear on critical vehicle component. <p>Current Operations</p> <ul style="list-style-type: none"> The current RTA fleet management system does not provide driver management or measures to minimize aggressive driving behaviors. <p>Benefit</p> <ul style="list-style-type: none"> Decrease a vehicle's variable Cost per Mile (CpM). Increase tire life/brake life. Less frequent scheduled maintenance and non-scheduled repair. Fewer speeding incidents. 	<ul style="list-style-type: none"> Identify non-scheduled maintenance and repair and the costs incurred with them. Key components of total downtime costs are: the cost of labour, replacement parts, diagnostic fees and towing costs. Quantify the potential cost savings based on the current speeding violation costs, average non-scheduled maintenance cost that could be prevented from monitoring and correction of driving behaviors. Find a solution that provides real-time alert to the driver and correct aggressive driving behaviors and/or provides visual in-cab training. 	<ul style="list-style-type: none"> A non-scheduled maintenance interruption can result in losses of \$530 to \$930 per day per vehicle. Assuming: Non-scheduled repair results in inability to fulfill work orders for at least one full day. The figures represent the average downtime cost for fleet industry in North America.
Risks/Pitfalls			
<ul style="list-style-type: none"> Change may be met with resistance as the driver behavior will be monitored and analyzed. Experienced drivers may find driving behavior management intruding and unnecessary. 			

Asset and Fuel Management

Potential Opportunity Area	Description	Next Steps	Potential Savings
Reduce fuel costs and fleet capital costs	<p>Opportunity</p> <ul style="list-style-type: none"> Fuel costs could be reduced by minimizing speeding incidents and limiting idle time. Reduce fleet capital costs through targeted lifecycle analyses on specific fleet groups. <p>Current Operations</p> <ul style="list-style-type: none"> The City works with Coencorp and uses their internet-connected peripheral devices on some of the fleet for fuel management. Parts and tires are not linked to vehicles, which makes it difficult to accurately analyze fleet costs and make informed decisions around fleet acquisition and fleet replacement. <p>Benefit</p> <ul style="list-style-type: none"> Reduce fleet capital cost by making more informed decisions around fleet acquisition and replacement with the help of accurate fleet cost analysis. Reduce fuel usage. 	<ul style="list-style-type: none"> Inquiry the fleet's consumption of fuel per trip/per engine hours worked/per time spent idling in order to quantify the current level of preventable fuel wastes. Find a fleet management solution that provides fuel management functionalities that are aligned to the City's needs. Find a fleet management solution that provides data analytics functionalities that can assist with cost reduction strategies, asset utilization strategies. 	<ul style="list-style-type: none"> The optimal fleet acquisition and replacement strategy will lead to lower replacement rate, longer service time, and lower operating costs.
	<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> Fleet acquisition and replacement decisions involve a lot of factors and may involve policy changes. 		

Maintenance and Repair

Potential Opportunity Area	Description	Next Steps	Potential Savings
Minimize scheduled and non-scheduled repair	<p>Opportunity</p> <ul style="list-style-type: none"> Collect data on engine diagnostics and provide predictive maintenance that helps maintain vehicle with minor repair cost. Track regular maintenance based on the vehicle type and set up alerts for regular maintenance to have those vehicles pulled into the shop when needed. <p>Current Operations</p> <ul style="list-style-type: none"> The City schedules maintenance appointments manually. The City uses maintenance triggers such as odometer readings, vehicle breakdowns, and notes from drivers and mechanics. <p>Benefit</p> <ul style="list-style-type: none"> Be notified of minor or major defects before critical breakage occurs, helping minimize downtime and prolong vehicle health. Allow for better planning and scheduling for regular maintenance to ensure vehicle health. 	<ul style="list-style-type: none"> Inquiry the cost of reactive (unplanned) vehicle maintenance and quantify the potential cost savings if minimizing the reactive repair. Analyze historical repair and maintenance data to identify cues and triggers for maintenance needs. Find a fleet management software that enables maintenance scheduling and/or engine diagnostics functions. 	<ul style="list-style-type: none"> The Organization for Economic Co-operation and Development (OECD) reports that telematics technology can help reduce maintenance and repair costs by as much as 14% and much of these savings are tied to driver behavior, and therefore real-time driver management tools and in-cab alerts are the best way to minimize unnecessary wear and tear. The cost savings vary based on vehicle type and annual mileage.
	<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> Lack of accountability from drivers can be detrimental to vehicle utilization and this issue will not be addressed solely with the assistance of a fleet management software. 		

Productivity

Potential Opportunity Area	Description	Next Steps	Potential Savings
Increase routing and dispatching efficiency	<p>Opportunity</p> <ul style="list-style-type: none"> Dynamic routing: re-designs routes to reflect dynamic data such as vehicle locations travel time, and incoming work orders. <p>Current Operations</p> <ul style="list-style-type: none"> Static-routing: uses a forecast of daily/weekly work orders to build the appropriate path a driver would take on each day/shift during the course of the week. <p>Benefit</p> <ul style="list-style-type: none"> The ability to reroute and create new plans throughout the day provides fleets with bigger flexibility. Routing can be adjusted for additional incoming work orders, weather changes, etc. Create scheduling and routing automatically much faster, reducing the time spent on manual adjustments. 	<ul style="list-style-type: none"> Quantify amount (cost/time) of work required in routing and dispatching. Quantify the cost saving if adopting dynamic routing technology. Analyze trending historical data to identify pain points and identify opportunities to revise the current shift structure to improve efficiency of routing and dispatching in complex areas. 	<ul style="list-style-type: none"> Cost savings vary based on the vehicle type. Municipal Benchmarking Network Canada defines light-duty vehicles as less than 4,500 kg, medium-duty vehicles as less than 9,000 kg but higher than 4,500 kg and heavy-duty vehicles as greater than 9,000 kg. \$477 per month per heavy-duty (HD) vehicle with 80,000 miles. \$64 per month per medium-duty (MD)/light-duty (LD) vehicle with 24,000 miles. The above mentioned cost savings are under the assumption that the current routing operation resulted delay in work order fulfillments. Additional cost incurs when drivers and vehicles being idle instead of being on the road as they are supposed to be if routing and dispatching is handled more efficiently.
<p>Risks/Pitfalls</p> <ul style="list-style-type: none"> Dynamic routing might change the daily routine for drivers and might be met with resistance from staff. 			

Technology options

Based on the expected outcome identified by the City in the project description document and the high-level requirements described in this report, eight potential solution providers were selected: Verizon Connect, Fleet Complete, Coencorp, Geotab, Trimble Transportation, along with the new version of RTA, SAP plant maintenance module, and Focus for comparability purposes. The companies selected are not only industry leaders in fleet management, but also those that have experience in working with government fleets or municipal fleets.

Verizon Connect and Trimble Transportation are U.S. based companies and SAP is a German company. The remainder of the companies on the list are Canadian-based companies. Further information regarding the providers can be found in Provider Portfolio section on page 117. The following table provides an overview of how each solution performs in each functional area identified by the City as in scope of this assessment.

Expected Business Outcome								
Vehicle Maintenance	✓	✓	✓	✓	✓	✓	✓	✗
Telematics	✓	✓	✗	✓	✓	✓	✗	✓
Driver Management	✓	✓	✗	✗	✓	✓	✗	✓
Speed Management	✓	✓	✗	✗	✓	✓	✗	✓
Fuel Management	✗	✓	✓	✓	✓	✓	✓	✓
Part Inventory Management	✗	✗	✓	✓	✓	✗	✗	✗
Dispatching and Routing	✓	✓	✗	✓	✓	✓	✗	✓
Insurance Benefit	✓	✓	✗	✗	✓	✗	✗	✗
Integration with SAP	✓	✓	✓	✓	✓	✓	✓	✓
User Friendly System	✓	✓	✗	✓	✓	✓	✓	✓

Legend:

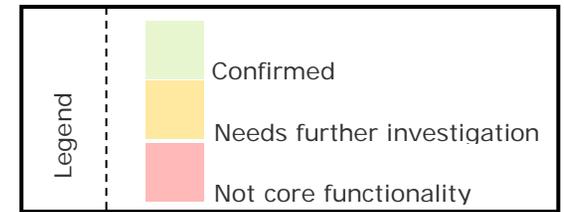
- ✓ Meet the Expected Outcome
- ✗ Fail to Meet the Expected Outcome

Functional requirements

In order to achieve the City’s expected outcomes of the new fleet management and vehicle tracking system, 14 functional requirements were identified and used as the criteria in assessing the 8 technology options.

Vehicle Tracking and Telematics

The fleet vehicle tracking and telematics system allows the information exchange between a vehicle and the operation team from the City. The chart below outlines the key functional requirements related to vehicle tracking and telematics.



Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Ability to provide GPS tracking of assets	This function is supported	This function is supported	Requires a separate vendor contract to enable GPS tracking	This function is supported	Geotab GO7 expandable plug & play telematics device enable GPS tracking	Trimble’s Fleet & Asset Trackers provide GPS visibility, event monitoring, and remote asset data on a near-global basis	Not core functionality	This function is supported
Geo-fencing capability	This function is supported	Not core functionality	Not core functionality	This function is supported	This function is supported	This function is supported	Not core functionality	This function is supported
Ability to provide engine diagnostics	Not core functionality	This function is supported	Not core functionality	This function is supported	This function is supported	This function is supported	Not core functionality	Not core functionality
Ability to provide maintenance scheduling	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported

Supply Chain

Tires, part inventories and fuel are three major components of the fleet supply chain. The chart below outlines the key functional requirements for the fleet supply chain.

Legend	Confirmed
	Needs further investigation
	Not core functionality

Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Ability to track, record the procurement of tires	This function is supported	Not core functionality	This function is supported	Not core functionality	Not core functionality	Not core functionality	Not core functionality	Not core functionality
Ability to track, record the procurement of part inventory	Not core functionality	Not core functionality	This function is supported	Provides part inventory tracking	Provides part inventory tracking and ordering	Not core functionality	Not core functionality	Not core functionality
Ability to track, record and reduce fuel usage	Not core functionality	Provides fuel usage reports	Allows fuel usage tracking and tank level monitoring	This function is supported	This function is supported	Provides fuel theft detection	Provide reports on fuel consumption per kilometer driven	This function is supported

Driver Management

The chart below outlines the key functional requirements related to driver management and enablement functionalities that promote driver-to-driver, dispatcher-to-driver communication, driving behavior coaching, and geographical information system-based capabilities.

Legend		Confirmed
		Needs further investigation
		Not core functionality

Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Ability to enable real-time driver communication	Enables messaging between drivers and dispatchers	Not core functionality	Not core functionality	Not core functionality	This function is supported	This function is supported	Not core functionality	Provides instant messaging between drivers and dispatchers
Provides visual in-cab training	With in-cab real-time alerts, an audible buzzer reminds drivers when unsafe driving is detected	Includes real-time monitoring of aggressive driving and video analytics with in-cab coaching	Not core functionality	Not core functionality	Provides in-vehicle, proactive coaching with customized messaging and rules	This function is supported	Not core functionality	This function is supported
Geographical Information System (GIS)-based capabilities	Records, collects, manipulates, analyzes and interprets all types of spatial or geographical data	This function is supported	Not core functionality	Not core functionality	Not core functionality	Provides an interactive, easy-to-use interface with 2D, 3D and Driver Safety views	Not core functionality	This function is supported
Electronic on-board recorder/Tachograph	This function is supported	Vision dash cam uses sensor technology to track driver performance	Not core functionality	Not core functionality	Geotab's GPS vehicle tracking and telematics starts recording as soon as the driver begins driving	Provides a platform that brings forward-facing camera technology and PeopleNet's Onboard Event Recording (OER) into an integrated system	Not core functionality	Not core functionality

Fleet Optimization

The chart below outlines the functional requirements related to optimization of the fleet operation, productivity increase by adopting technology such as dynamic routing.

Legend	Confirmed
	Needs further
	Not core

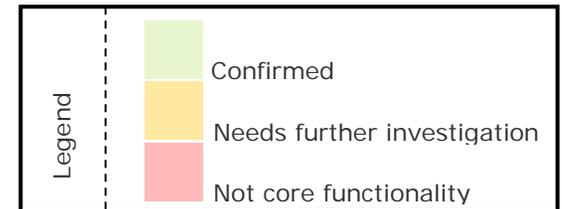
Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Dynamic dispatching and routing	This function is supported	This function is supported	Not core functionality	This function is supported	This function is supported	Not core functionality	Not core functionality	This function is supported
Ability to reduce insurance premiums	Provide proof of safety driving record; Verizon works with a number of insurance companies to leverage the telematics data, improving fleet driving safety standards	Partnered with Intact Insurance to offer clients significant saving	Not core functionality	Not core functionality	Assist to prove no-fault to insurance by providing safety driving records; No partnership with insurance companies	Not core functionality	Not core functionality	Not core functionality
Ability to provide custom reports to assist decision making	This function is supported	This function is supported	Not core functionality	Not core functionality	This function is supported	This function is supported	This function is supported	This function is supported

Non-functional Requirements

In order to achieve the City’s expected outcomes of the new fleet management and vehicle tracking system, 7 functional requirements were identified and used as the criteria in assessing the 8 technology options.

IT - Integration & Compatibility

The diagram below shows requirements that a fleet solution should be able to meet in order to achieve a direct integration with the City’s other applications and connect to Internet of Things (IoT).



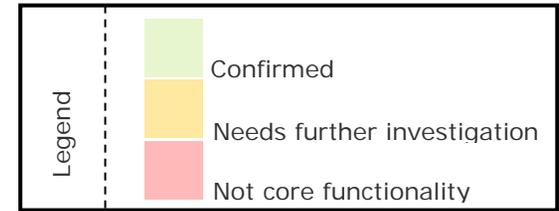
Non - Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Ability to achieve direct integration with SAP	Can be integrated with SAP	Can be integrated with SAP	API* features enabled	Can be integrated with SAP	Fleet telematics data can be integrated into City's other system by leveraging software development kit (SDK)**	API features enabled	This function is supported	This function is supported
IoT application enablement	This function is supported	This function is supported	This function is supported	This function is supported				

*An application programming interface (API) is an interface or communication protocol between a client and a server intended to simplify the building of client-side software. It has been described as a “contract” between the client and the server, such that if the client makes a request in a specific format, it will always get a response in a specific format or initiate a defined action.

**The SDK is available in the following ways: HTTP JSON web service, Native C# library and Native JavaScript library

IT – Deployment and Supports

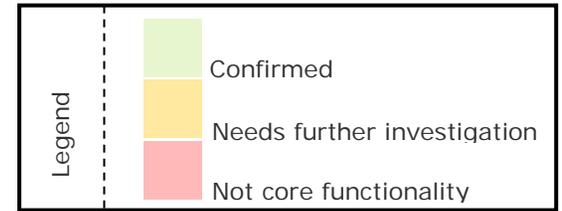
The chart below depicts the system’s ability to offer cloud-based solution and provide a user-friendly platform with fast issue resolution support.



Non - Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Ability of system to offer cloud-based solution	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported	This function is supported
Ability to provide intuitive and easy to learn user interface	This function is supported	This function is supported	Received complaints from current users within the City	This function is supported				
Ability to provide fast issue resolution supports	Received complaints for poor customer support and issues with engine diagnostics synchronization , system glitches, and mileage tracking	This function is supported	RTA Fleet Management offers the following support options: FAQs, Forum, Knowledge Base, Online Support, Phone Support, Video Tutorials	This function is supported				

Security & Safety

The chart below depicts the system’s ability to ensure data security and safety to protect personal data such as emails, passwords, and vehicle information.



Non - Functional Requirement	Verizon Connect	Fleet Complete	RTA	Coencorp	Geotab	Trimble	SAP	Focus
Data Security	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected	Networks and systems are secured, monitored and managed centrally to protect against unauthorized access or abuse	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected	Comprehensive data privacy policy in place to ensure personal data such as emails, passwords, and vehicle information are protected
Details on Cloud Hosting	Within the United States of America	Within Canada	The service is controlled, operated, and administered by RTA within the United States of America	Within Canada (Quebec)	All Geotab server infrastructure is hosted in Google Cloud Platform	Within the United States of America	Depends on the location of SAP Cloud Platform (SCP)	Vendor has data centres in Canada

Technology options – Provider portfolio

The sources for the technology options research include: Gartner report “2018 Market Guide for Transportation Mobility Technology”, the providers’ official websites, solution brochures provided by the providers, and customer reviews available on the web.

Verizon Connect

Verizon Connect offers a cloud-based, software-as-a-service (SaaS) platform. It provides innovative fleet tracking solutions with advanced GPS tracking to seamlessly monitor and manage the entire mobile workforce.



Highlights

- Verizon Connect (formerly Verizon Telematics) is a U.S.-based company that offers telematics, field service management, routing and scheduling and analytics.
- Verizon Connect has become the largest global fleet telematics provider after its acquisitions of Telogis and Fleetmatics in 2016.
- Industries: Supports a number of industries including government and municipalities on an international level.
- <https://www.verizonconnect.com/ca/solutions/gps-fleet-tracking-software/>

Core Strengths

- According to Gartner Research’s Market Guide, Verizon is a large vendor with global reach that offers broader solutions, not only in telematics but also IoT.
- With in-cab real-time alerts, an audible buzzer reminds drivers when unsafe driving is detected.
- Verizon Connect uses asset utilization reports to make better use of the equipment and provides actionable suggestions to sell off rarely used assets and scale back on daily maintenance costs.
- Enables reshuffle and prioritization of stops on the fly to decrease the distance traveled between jobs, improving response times.
- Historical reports provide proof of safety driving record, helping lower insurance rates. Verizon also works with a number of insurance companies to leverage the telematics data, improving fleet driving safety standards which could reduce insurance spend.

Fleet Complete

Fleet Complete is a cloud-based fleet management solution for businesses of all sizes. It is a leading global provider of mission-critical fleet, asset and mobile workforce management solutions to over 6,000 customers worldwide.



Highlights

- Fleet Complete is a Canadian company based in Toronto, Ontario.
- With a reported growth rate above 53% in 2018, Fleet Complete currently ranks as one of the fastest growing telematics companies among the top international aftermarket solution providers in fleet management.
- Industries: Supports a number of industries including government and municipalities on an international level.
- www.fleetcomplete.com

Core Strengths

- The driver safety program includes real-time monitoring of aggressive driving and video analytics with in-cab coaching to increase self-awareness and accountability on the road.
- Fleet Tracker collects over 20 data points from the vehicle’s onboard computer, along with Diagnostic Trouble Codes. It notifies the fleet manager of minor or major defects before critical breakage occurs, helping minimize downtime and prolong vehicle health.
- Fleet Complete partnered with Intact Insurance to offer clients savings and contribute to stable insurance costs.

RTA Fleet Management Software

RTA Fleet Management software is an integrated vehicle tracking and inventory management solution designed for transport businesses of all sizes. The solution can either be installed locally on-premises or hosted on a secure cloud facility.



Highlights

- RTA Fleet Management is a U.S.-based company.
- RTA was founded in 1979 and based in Glendale, Arizona.
- Industries: Supports a number of industries including government and municipalities in North America.
- www.rtafleet.com/rta-mobile/

Core Strengths

- RTA Fleet Management software offers a robust inventory management feature, allowing fleet managers to manage parts inventory, assign unique numbers to each item and keep a record of parts usage. It provides Vendor Tracking, Cost Markup, Unlimited Cross-Referencing, Warrant Tracking, and Back Order Tracking.
- The solution also tracks warranties for each item and measures vendor performance.
- Tire management: RTA provides Tire Size Tracking, PSI Tracking, Tires in Inventory List, Tire History, Tire Tread Depth Tracking, and Tires in Inventory.

Figure 17: RTA Dashboard

Summary: The dashboard shows a facility's vehicle availability, inventory count/values and labour hours.



Coencorp

Coencorp is a leading innovator of automated fleet and fuel management solutions. Site Manager 2 (SM2) is Coencorp's web-based software platform that incorporates dedicated hardware peripheral devices to provide a fully integrated hardware and software solution.

Highlights

- Coencorp is a Canadian company founded in 1991 and headquartered in Montreal.
- Industries: Supports a number of industries including government and municipalities on an international level.
- www.coencorp.com/

Core Strengths

- Coencorp aims to reduce environmental footprint, monitor fuel loss through leakage using the electronic system, and aid operators in recognizing the potential problem and halting the leak before both fuel is lost and damage to the environment is caused. This has a direct impact on insurance costs, labor and health expenses, as well as giving a potential extra access to green funding.
- SM2 automatically monitors the remote generators and engine status, provides seamless and accurate updates of critical maintenance planning data such as mileage, engine hours, and fuel consumption.

Figure 18: Coencorp Dashboard

Summary: An example of Coencorp's custom dashboard that can be configured according to the user's needs.



Geotab Inc.

Geotab Inc. is a privately held company that specializes in the area of global positioning system, fleet management and vehicle tracking.



Geotab focuses on building a platform where businesses are able to customize their solution, access data, and discover actionable insights on one web-based software solution.

Highlights

- Geotab was founded in 2000 and is headquartered in Ontario, Canada. In June of 2018 Geotab acquired FleetCarma, a telematics player in the electric vehicle fleet management space.
- In 2018 Geotab announced the launch of "IoT Data Insight Solutions". This publicly available tool helps enable smart cities, leveraging data collected from over 1 million vehicles equipped with Geotab telematics devices.
- Industries: Supports a number of industries including government and municipalities on an international level.
- www.geotab.com/

Core Strengths

- Geotab has been included in Deloitte's Technology Fast 500 list in North America for 5 years (2010–2014). In 2014, Geotab was in the top 20 in the Software sector of the Fast 500.
- Geotab uses customized driver "zone" for geo-fencing and provides exception reporting and notifications for exiting defined "zones".
- The system provides electronic logging device (ELD) compliance with alerts to minimize Hours of Service (HOS) violations with in-app driver warnings; Real-time alerts for violations and drivers not logged in; Compliance managers can track driver logs, violations and hours remaining.
- Visibility into trends on fuel usage and fill-ups, access to critical engine data for proactive vehicle maintenance; Tracks key fuel metrics: Fuel consumption, Fuel economy (the actual MPG), Fuel level, Fuel idling, Engine faults (such as faulty oxygen sensor).

Trimble Transportation

Trimble Transportation, formerly PeopleNet, a Trimble (NASDAQ: TRMB) Company and leading provider of fleet mobility technology.



Highlights

- In 2018, Trimble unified PeopleNet, TMW and 10-4 under a singular brand, articulating its approach in providing a comprehensive fleet mobility, management and logistics platform, enabling customers to connect all aspects of their business—trucks, drivers, freight and assets—to make more informed decisions and reach new levels of productivity, efficiency and safety.
- Industries: Supports a number of industries including government and municipalities in North America.
- www.transportation.trimble.com

Core Strengths

- The system is capable of engine management and tele-diagnostics, and has options for extensive customization.
- The platform utilizes a professionally managed network that uses satellites and wireless carriers to return all telematics data to the data centers almost instantly. The data stored in the system can be accessed via any web based software application, mobile devices, or 3rd party platform with an access to the API.
- Trimble's Fleet & Asset Trackers provide GPS visibility, event monitoring, and remote asset data on a near-global basis.
- The system provides an interactive, easy-to-use interface with 2D, 3D and Driver Safety views; Safe, accurate and truck-legal spoken turn-by-turn navigation.

SAP Fleet Solution

SAP is a German multinational software corporation that makes enterprise software to manage business operations and customer relations.

SAP offers a fleet management solution that can be added and integrated into its existing suite of solutions.



Highlights

- SAP is the City's new ERP system and was included in the research given the City already has a software contract in place with the vendor.
- Key SAP fleet management features are:
 - **Fleet Administration:** Fleet administration manages the procurement, leasing, insurance, depreciation, and personnel allocation of fleet objects.
 - **Fleet Maintenance:** Fleet maintenance includes repair, tire management, and warranty management.
 - **Transportation Logistics:** This process includes capabilities for vehicle tracking, scheduling, and routing to improve fleet efficiency, productivity, accountability, and profitability.
 - **Fleet Analysis:** Fleet-specific reporting that analyzes the cost of fleet, performance analysis, transportation logistics analysis, fleet consumption analysis.
 - **Capacity Planning** Capacity requirements planning can help determine which fleet objects are available and when to assign them to order operations.

Core Strengths

- As a standalone solution, SAP S/4HANA's sophistication makes it a popular choice for fleets that form part of a larger supply chain.
- SAP partners with companies in the fleet management sphere as well. These include a mix of global players: Telogis, ARI, TomTom, Chevin, and others.
- The fleet object can be used as a reference object for maintenance or service tasks, notification or an order. User can also perform maintenance planning for a fleet object.

Focus

Focus was established in 1972 and initially involved in the radio communication service industry. Focus later launched projects to develop cloud-based vehicle tracking software that transferred GPS data to fleet dispatchers and started to provide a solution that fully integrates fleet tracking, fuel inventory monitoring and maintenance management.



Highlights

- Focus is the fleet management provider for the Ministère des Transports du Québec.
- Focus is a Canadian company founded in 1972 and headquartered in Quebec.
- Industries: Supports a number of industries including government and municipalities on a national level.

Core Strengths

- Focus introduced its new fuel management system integrated with its fleet management solution with electronic driver and equipment I.D. These new services were designed to help users optimize productivity and achieve fuel savings.
- Focus has a task management feature that monitors material resources used in predefined tasks.
- The system generates calendar-based, mileage-based, and hour-based maintenance alerts.
- Focus Fuel extension controls the activity of fuel tanks, supervises filling activities per equipment, per employee and per supplier, and provides analytical reports on fuel consumption.
- For City of Pickering, Focus installed GNX-5P on-board model in each vehicle. It was the latest model offered by manufacturer and supports multiple wireless communication options including General Packet Radio Services (GPRS), 4G, 3G High Speed Packet Access (HSPA) and 2G Code-Division Multiple Access (CDMA).

Figure 19: Focus Repair Report Screen

Summary: Focus provides mechanical history for each vehicle, maintenance work category, mechanics, cost, and time spent associated with each repair.

REPAIR REPORT - ALL DATES - VEHICLE 692

EQUIPMENT	DATE	DESCRIPTION	NOTE	CATEGORY	WARRANTY	PROVIDER	#CMD	# INVOICE	\$ PARTS	\$ LABOR
Truck 692	2015-05-04			Repair	No	Garage A.B.C.	40200235	607490	285.935	221.735
Truck 692	2014-10-16	Tire Change		Repair	No	Garage A.B.C.			0.005	0.005
Truck 692	2013-12-16			Oil Change	No	Garage Y.R.	RE-3327	708246	81.705	0.005
Truck 692	2013-11-29	Front Brakes		Repair	No	Garage Y.R.	RE-3319	25813	0.005	69.365
Truck 692	2013-11-16				No				0.005	0.005
Truck 692	2013-11-15				No				0.005	0.005
Truck 692	2013-09-14				No				0.005	0.005

Equipment(s): 1 Repair(s): Category(s): 5 Provider(s): 5 \$370.63 \$291.68

TOTALS

EQUIPMENT	CATEGORY	PROVIDER	NO.	\$ PARTS	\$ LABOR	TOTAL
Truck 692	Repair	Garage A.B.C.	1	0.005	0.005	0.005
Truck 692	Repair	Garage A.B.C.	1	0.005	0.005	0.005
Truck 692	Oil Change	Garage Y.R.	1	81.705	0.005	81.705
Total:				81.705		81.705

Conclusion

Based on the information gathered in this report, there is a gap between the City's current software capability and processes, and the desired performance of its fleet operations.

The City's existing fleet management and vehicle tracking solution has aged. It lacks the functionality required to realize efficiencies, save costs and improve day-to-day functions. These functionalities are well-developed in some fleet management software on the market today. The current software has very limited capabilities in fleet data analytics, vehicle tracking, and maintenance scheduling, which were the areas identified with the most significant opportunities for improvement.

In the efforts of achieving the City's expected outcome of lower risks associated with fleet investments, lower operating cost, higher volume of work output, increased worker safety, higher integration level across different departments and improved resident satisfaction, a list of functional and non-functional requirements for a new fleet management software has been developed, and 8 potential providers of fleet management and vehicle tracking solutions have been assessed against the requirements.

Please note that the analysis in this report was conducted based on information that was made available during the meetings and interviews with the City. The requirements generated are high-level and serve the purpose of scanning the potential fleet management and vehicle tracking solutions available on the market. A formal system selection with potential vendors and a full list of detailed functional and non-functional requirements is needed in order to thoroughly assess the solutions and to accurately quantify the cost savings. A system selection will include formal scoring and detailed solution demonstrations and should follow the City's bylaws for software procurement and potentially a RFP (Request for Proposal) process.

An estimate of potential cost savings is calculated based on the 108 vehicles that have been actively managed by the Operations team and the cost savings observed in a use case of a similar sized fleet.

An annual incremental cost savings of \$308,667 could potentially be achieved by upgrading Pickering's fleet management and vehicle tracking system, assuming the new solution meets the City's requirements around Vehicle Maintenance, Dispatching and Routing, and Inventory Management. In order to successfully implement such a solution, the City will need to review their internal resourcing levels to ensure adequate support for a transformational project, including system implementation, process changes and ongoing maintenance.



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