
Snow & Ice Management Program

Value for Money Report

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Limitations and Responsibilities

This report was prepared by PwC at the request of City of Saskatoon (COS) and is intended solely for the information of City of Saskatoon management, City Council and the Standing Policy Committee on Finance (“SPCF”) of the City Council. The material in it reflects PwC’s best judgment in light of the information available at the time of preparation. This report has been prepared for and only for City of Saskatoon pursuant to our statement of work executed on December 21, 2015 and for no other purpose. The existence of this report may not be disclosed nor its contents published in any way without PwC’s written approval in each specific instance. PwC does not accept or assume any liability or duty of care for any other purpose or to any other person to whom this report is shown or into whose hands it may come save where expressly agreed by our prior consent in writing.

Our work was limited to the specific procedures and analysis described herein and was based on the information made available through April 30, 2016. Our findings are based on the information provided and the data collected during this engagement.

During the course of this audit, Public Works underwent an internal reorganization of their team structure, in which Public Works separated into Roadway & Operations and Water & Waste Streams. For the purpose of this report, any reference to Public Works refers to the newly formed Roadway & Operations.

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Executive summary

The Snow & Ice Management Program of the City of Saskatoon ("the City") is evolving and its ability to better track Program data on a continual basis is improving. This value for money engagement was conducted to determine whether Program management is achieving economy, efficiency and effectiveness in the manner in which they are operating. Our conclusion must be taken in the context of the current level of service being achieved and the amount of funds being expended to achieve that level of service (i.e., what the City is aiming to achieve with its Snow & Ice Management Program and what is being spent to achieve it). Spending, and the value for money thereof, cannot be examined and concluded on without a specific understanding of the approved level of service in place. Conclusions are formed regarding Program effectiveness in terms of the level of service able to be achieved with the funds spent (i.e., should a higher level of service be able to be achieved with existing funding) and correspondingly, conclusions are formed regarding the economy and efficiency of the Program and the funds spent in terms of the level of service achieved (i.e., should the current level of service be able to be achieved with less funding).

As a result of performing this value for money engagement of the Snow & Ice Management Program, we have concluded that the Program in place is effective in achieving the objectives set by management and the Program is achieving economy and efficiency. Additionally, Program management is communicating externally with citizens and setting expectations with Council to ensure that approved funding can provide the level of service agreed upon. The City invested approximately \$8.55 million in Snow & Ice Management during 2015, removing approximately 4,500 tandem truckloads of snow from City streets, and the scope of our engagement is limited to that spending and to the Program operations within.

The City's Snow & Ice Management Program was able to achieve its targeted goals and objectives in 2015. There was significant clarification and communication of goals and objectives in late 2015 and moving forward into 2016. The Program will need to continue to improve its up-front documentation, real-time tracking and post-season reporting in order to continue to meet increased expectations moving forward (with the \$12.7 million budget for 2016 and the commencement of a phased-in approach to city-wide snow removal) and in order to achieve improved results in the annual Civic Survey.

The City's Snow & Ice Management Program achieved economy and efficiency in 2015. Spending was at a 4-year low and significantly below budget despite increases to service levels. At the present time, the mix of contractors is appropriate as the City is achieving its Program objectives with a relatively low level of contractors while maintaining costs at the low end of the range compared to other municipalities. As the City begins its phased-in approach to city-wide snow removal, along with the resulting increase in the Program's budget (to \$12.7 million in 2016), the current mix will likely not be sustainable as a higher mix of contractors will gradually become the norm (i.e., the % of contractor costs to total Program costs will rise as will the proportion of contractors to FTE's). However, at current spending levels and levels of service, the current ratio of 23% in 2015 is efficient and economical.

Given a) the amount of snowfall in the 2013, 2014 and 2015 years; b) the City's desired level of service and; c) the amount of cost expended to clear Saskatoon's lane km, the City is within the reasonable range of Snow & Ice Management costs compared to its peers across Canada from a cost per lane km perspective. In 2015 there were circumstances that led to significantly lower costs, but going forward it would be reasonable and prudent to anticipate costs in the range of \$3,000 to \$3,500 per lane km assuming the level of service does not drastically increase from current levels and no significant additions to the roadway network take place (i.e., 25% or 50% additions). This would indicate the achievement of proper balance between maintaining cost efficiency and performing the proper measures to keep the Program effective and achieving its objectives.

We have provided 21 observations and recommendations in which we believe that opportunities for improvement may be realized, as outlined in Section 1 of the Phase I portion of this report. Of these findings, 2 are designated as high-risk/impact, 14 are designated as moderate-risk/impact, and 5 are designated as low-risk/impact. It is important to note that any positive impact made to any one of economy, efficiency or effectiveness will likely impact one or both of the other areas as well. For example, in general when processes can be modified to increase efficiency it will typically result in monetary savings that can be directed to other areas to increase their effectiveness. While the analysis within this report is based on current state, the impact of the observations and recommendations within bear particular attention when considering future potential changes to the Snow & Ice Management Program, for instance the consideration of moving towards city-wide snow removal that could significantly increase the funding required for the Program.

We have also provided direct comparisons to the municipalities against which we benchmarked the City's Snow & Ice Management Program, which are outlined in the Phase II portion of this report. We have provided comments on areas where the City is meeting or exceeding the practices of some peer cities:

- Strategic decision making – factoring in of other weather elements instead of relying only on cm depth guidance;
- Communication – existence of formalized and thorough communication plan; and
- Resources (personnel) – success in tendering sidewalk clearing to external parties.

We have also provided comments on areas where the City could consider improvements to their current practices based on best practices implemented in other municipalities:

- Documentation - formal documentation of all aspects of the Program including standard operating procedures for Program staff;
- Communication – further formalization of communication plan for both internal and external audiences and effectiveness measures;
- Technology – further utilization including temperature pucks, weather stations, GPS, advanced tracking of application of salt, sand and aggregates; and
- Resources (personnel and equipment) – contracted equipment, seasonal/casual positions, collaboration with Fleet Services, and contracted maintenance.

These comparisons are made with the intent that they provide Program management with the opportunity to critically assess each area that we have identified for the four benchmarked municipalities to identify for each whether direct learnings can be implemented to drive positive improvement in the City's Snow & Ice Management Program.

1 - Background and description of process

a) Background and objectives

One of the key strategic goals for the City focuses on “Moving Around”, which is aimed at providing effective mobility options for the citizens of Saskatoon. The City’s Snow & Ice Management Program, administered by Public Works, plays a key role in enabling effective mobility options. The purpose of the Program is to reduce the inconvenience of winter conditions for motorists, cyclists and pedestrians, and facilitate the operation of Transit and Emergency Services vehicles. The 2015 operating budget for the City increased funding for Snow & Ice Management by almost \$1 million over that provided in 2014, with a budgeted total investment of approximately \$11.1 million (net of the revenue from the Province of Saskatchewan Urban Highway Connector Program) compared to the 2014 net budgeted total investment of approximately \$10.3 million.

In accordance with the 5-year internal audit plan approved in 2015, we were directed by the City’s Standing Policy Committee on Finance (“SPCF”) to perform a value for money engagement of the Snow & Ice Management Program to identify opportunities for improvement and, where applicable, cost savings as well as to highlight key insights from a benchmarking exercise with 3 to 5 comparable cities.

b) Project purpose

The purpose of the project is to assess the efficiency, effectiveness and economy of the City’s Snow & Ice Management Program and to identify positive observations, opportunities for improvement and, where applicable, cost savings. This is accomplished by performing a value for money engagement of the Program including its costs, performance metrics, the management of equipment and staff resources and the Program’s operational processes (i.e., snow clearing process, and citizen communications process). The project includes a benchmarking assessment of 3 to 5 comparable cities in order to compare Program strategies and costs (i.e., street priority system, service level, and hours required to clear key routes) and to identify opportunities for improvement. Lastly, we will identify positive themes and observations related to economy, efficiency and effectiveness, as well as, key risks, control gaps and opportunities for improvement.

c) Scope and approach

The scope of this engagement includes both an internal assessment of the Snow & Ice Management Program for the City (“Phase I”) and a comparison of the City’s Snow & Ice Management Program with 3 to 5 comparable cities (“Phase II”). We examined available information relating to various stages of the Snow & Ice Management Program from planning through to offloading and storage. We performed walkthroughs of City sites to validate the current process, perform analysis, and conduct interviews and discussions with key management and front-line staff to determine the effectiveness of the Program in supporting and addressing strategic goals and objectives.

d) Areas considered

In order to understand whether the processes and activities undertaken as part of the Snow & Ice Management Program are being carried out in an economical, efficient and effective manner, our engagement focused on the seven primary components identified in the Statement of Work, namely:

- Achievement of targeted goals and objectives (Appendix A);
- Timeliness and cost-effectiveness of Program activities (Appendix B);
- Quality of performance reporting (Appendix C);
- Effectiveness of citizen communication process (Appendix D);
- Utilization and cost-effectiveness of equipment and staff employed (Appendix E);
- Identifying issues, challenges, risks, root causes and opportunities for improvement and cost savings (Sections 2 and 3); and
- Identifying positive themes and observations (Section 4).

In order to perform our work in each of the sections highlighted above, we overlaid the framework below in order to provide additional structure to our findings and recommendations, as well as, our Phase II benchmarking with comparable municipalities:

Focus Areas	
1. Program Overview & Strategy	i) Program Definition
	ii) Strategy and Governance
	iii) Organizational Structure
	iv) Performance Management
2. Program Operations	i) Program Processes and Quality
	ii) Program Planning and Operations
	iii) Safety
3. Program Resources	i) People and Contractor Management
	ii) Asset Management
	iii) Budgeting
4. Supporting Components	i) Technology
	ii) Communication

2 - Observations, risks and recommendations (Phase I)

a) Rating objectives

- Assists City Administration and SPCF in assessing and reviewing results;
- Provides the basis for prioritizing follow-up;
- Facilitates comparison across business units;
- Facilitates issues-tracking system usage; and
- Provides a measure of transparency in the rating criteria.

We have risk rated each of our findings in terms of severity of impact and likelihood, on a scale of High (H), Medium (M), and Low (L). The heat map below provides guidance for our rating.

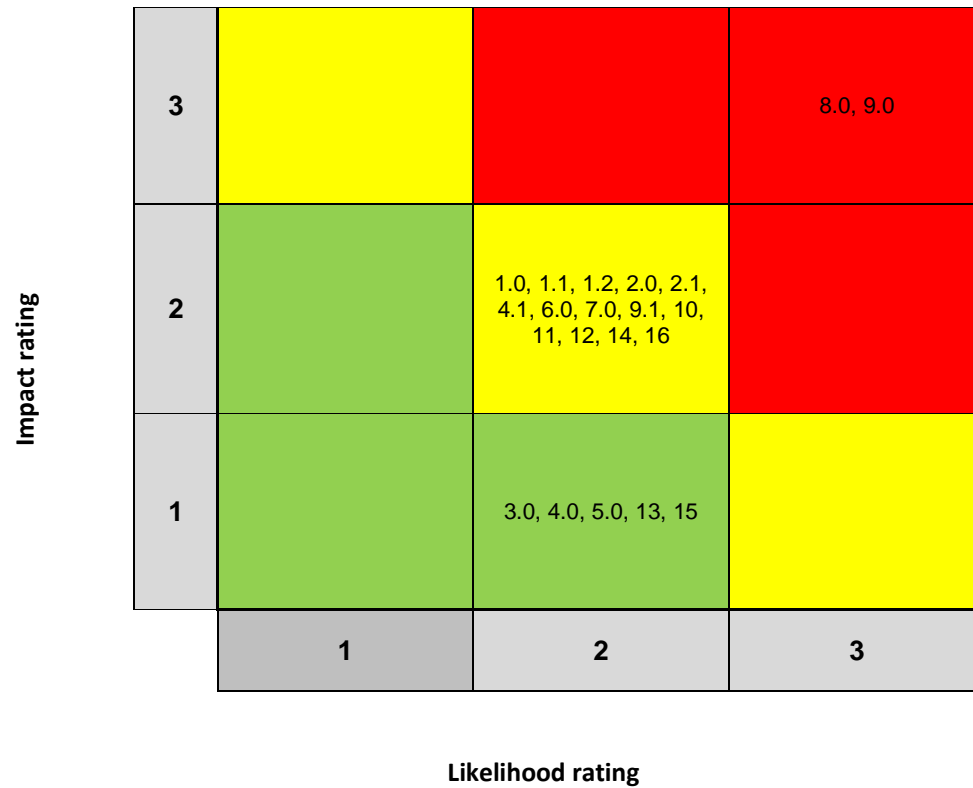
b) Impact rating definition

Individual observations	Impact	Overall report
Significant finding. High risk of significant impact (e.g., fraud, serious financial/operational/reputational risk, serious safety issues).	3	Process or internal review area requires improvement. One or more “red” individual findings indicate that immediate attention is required.
Less severe finding. Requires process change/improvement to reduce the likelihood of a significant finding in the future.	2	No significant issues identified during the stated analysis; however, in order to potentially make meaningful improvements the observation and recommendation needs to be implemented.
Low risk item. Value added process improvement or enhancement.	1	No significant issues identified during the stated analysis; however, the observation and recommendation provides administration with the opportunity to effect positive change.

c) Likelihood rating definition

Likelihood Scale	Likelihood*	Possibility
3	Highly likely, systematic or ongoing	>=60%
2	Possible or occasional	>25% and <60%
1	Rare or unlikely	<=25%




*Likelihood relates to Program failure



d) Summary of risk ratings and heat map

- Total findings: 21
- 2 High risk/impact
- 14 Medium risk/impact
- 5 Low risk/impact

e) Observations, risks and recommendations

The below findings are listed in the sequence of the value framework outlined in Section 1d).

Finding #	Category	Description of Detailed Findings	Risks	Risk Ranking	Recommendations	Management Response and Timeline
1.0	Program Overview/ Strategy: Program Definition	While reviewing the current "Better Winter Roads: Winter Road Maintenance Level of Service" document, we noted that it is effective at outlining the priority system and service timeframes. However, there are opportunities to improve it by including supporting components (technical and other) required to meet the level of service. Program mission statement, objectives and equipment needs are a few areas that can direct the management and staff into maintaining consistent service delivery.	<ul style="list-style-type: none"> Inconsistent service delivery due to undefined supporting components 		<p>PwC recommends that Public Works build the components described below into their current internal Program document. PwC obtained examples of formalized policy documents through benchmarking with similar Canadian municipalities. Two out of three benchmarked Canadian municipalities had the following major components:</p> <ul style="list-style-type: none"> mission statement program objectives weather monitoring techniques material utilization plan technical and equipment needs communications plan personnel plan reporting on Key Performance Indicators ("KPIs"). 	<p><u>Response</u> Administration agrees with the findings and will continue to develop the Winter Roads Level of Service document into a complete Customer and Technical Level of Service. After completion of more complete level of service documents, an asset management plan including resources requirements (staff and equipment), performance standards, demand forecasting, and support tools will be developed.</p>
1.1		PwC observed, through discussions and review of the current policy document, that the Program faces succession planning challenges due to an undefined personnel plan within the current policy document. If key management were to depart, there would be significant knowledge loss and the remaining team members may find it challenging to execute the Program objectives.	<ul style="list-style-type: none"> Exposes Public Works to succession risk if key personnel were to depart 		<p>Note that certain components of the internal policy document were incorporated into an external service document and/or on the municipalities' website.</p>	<p><u>Timeline</u> Updated Winter Road Level of Service documents will be presented to Committee with a report in November of 2016. An asset management plan for the Roadways section will be developed by January of 2018.</p>
1.2		Performance measurement indicators are largely undefined for Program management and staff. This can result in performance of activities with limited accountability, progress monitoring and	<ul style="list-style-type: none"> Ineffective Program and employee performance monitoring without a policy document that 			

	may impact morale if employees exceeding expectations aren't rewarded/promoted for their contributions and vice versa.	defines performance objectives and KPIs.		
2.0	<p>PwC directly observed that knowledge transfer and dissemination of daily activities occurs through Superintendents and Supervisors, who have historical working knowledge of the Program. They are responsible for ensuring operators are executing the Program as instructed putting a significant level of reliance on them.</p> <p>This provides an opportunity to document standard operating procedures (SOPs) for Program operating activities. Standard operating procedures guide staff in performing consistently. Sign off and acknowledgement of SOPs by Program staff can be utilized for performance measurement, accountability and annual reviews as it provides an opportunity to measure actual performance to standard performance.</p>	<ul style="list-style-type: none"> Absence of SOPs have direct implications on the Program operators and daily activities. 	 <p>PwC recommends that Public Works develop SOPs for all staff levels within the Program. All employees should review and acknowledge the SOPs to ensure they have understood their duties. Their acknowledgment will drive the efficiency and effectiveness of the Program activities. PwC obtained examples of formalized SOPs through benchmarking with similar Canadian municipalities. Two out of three Canadian municipalities had the following SOPs documented:</p> <ul style="list-style-type: none"> • maintenance objectives for each class of roadway; • employee schedules; • responsibilities and contacts; • historical weather overview; and • serious incident and emergency management guidelines. 	<p><u>Response</u> The Administration agrees with the recommendation. Job Safety Analysis (JSAs) are currently complete and will form the basis of Standard Operating Procedure (SOP) development.</p> <p><u>Timeline</u> JSAs will continue to be updated annually. Summer SOPs will be completed by April 2017; Winter SOPs will be completed by October 2017.</p>
2.1	<p>If Supervisors/Superintendents weren't able to provide daily directives, there is a risk that operators may not complete their assigned Program activities in the most efficient and effective manner. If SOPs are documented, in the event of management departure, Program activities are able to function as per routine.</p>	<ul style="list-style-type: none"> Poses the Program to a service delivery risk due to succession if Supervisors and Superintendents were to depart. 		

**Program
Overview/
Strategy:**
Performance
Management

3.0 **Program Overview/Strategy:**
Performance Management

PwC observed that the Roadways Manager maintains weather and snow event folders that contain the Superintendent Daily Operations Summary. The monitoring and reporting of these reports is manual in nature and not readily available to the Program stakeholders. The report outlines the following:

- active equipment and staff;
- overtime response rates;
- work completion percentage;
- status of snow storage sites;
- contractor zone progress;
- red flags as determined by management; and
- lessons learned.

This information is important in informing management about service delivery status, key risks (such as red flags, equipment uptime/downtime) and ways to improve future Program delivery through understanding of lessons learned. Additionally, some of the information can be provided to councillors and other stakeholders for oversight and governance.

- Limited continuous monitoring and reporting on Program activities integral to future Program planning and management.
- Absence of aggregated electronic data increases the risk of losing historical knowledge.



PwC recommends conversion of all reporting to an electronic format to facilitate the creation of a dashboard, trending reports, historical information on snow and ice events responses, and all other relevant information relating to these events.

This would ensure that the entire annual picture would be available for review by stakeholders of the Program.



PwC noted through benchmarking with all 3 Canadian municipalities that reporting of this nature was available to stakeholders of the Program in electronic format. For example: "Percent of time that reasonable winter driving conditions are achieved following a snow event on major routes within a specified time-period" – a very direct metric that can be electronically tracked for historical comparison.

Response

The Logistics and Procurement Section will continue to develop SharePoint as an interim solution until the City-wide enterprise resource planning solution is in place.

Timeline


SharePoint development is ongoing. Currently items such as materials management for aggregates are being tracked; however, further development of processes and work flows to prepare for an interim solution are required. Interim solutions for winter programs will be in place for October of 2016.


4.0 Program Overview/Strategy: Performance Management	PwC observed while performing a walkthrough of the central city yard, as well as, review of materials contract, Public Works is utilizing a just-in-time (JIT) replenishment system for maintenance materials. They only maintain enough supplies for approximately 1.5 snow events. Having limited to no emergency reserves or supplier contingency plans in place to compensate for the JIT system could result in service disruptions in the event replenishment hasn't taken place.	If the vendor is unable to meet the contract (due to inclement weather, proximity issues, business failure, etc.):		PwC recommends that Public Works integrate risk management processes as part of future contract planning to ensure a continuous source of materials in the event of a delayed shipment. As there are constraints with respect to storage capacity at existing facilities, ensuring that there is a contingency supply is vital. PwC noted through benchmarking with similar Canadian municipalities that materials were maintained as follows:	<u>Response</u> The Administration agrees with the recommendation. New material suppliers have been secured and delivery requirements are explicit in the contract. A trial of new material management processes will be utilized this winter. <u>Timeline</u> New material supply contracts will be in place by September 2016. A trial Material Management Process will be implemented for the upcoming winter. A report will be presented to City Council in April 2017 with the findings and recommendations.
4.1	Materials contracts are awarded without formal, documented risk management assessments being conducted. Risk management practices help facilitate various types of exposures that the City may face in the event a vendor is not able to deliver on the signed contract.	<ul style="list-style-type: none"> Public Works may have inadequate supplies on hand to meet their level of service mandate. The inventory management issues outlined in Finding # 6 compound this risk. City may have liability exposure if materials vendor is unable to replenish the supply in time for a weather or snow event. 		<ul style="list-style-type: none"> In one instance, an average stock of 180,000 tonnes of sand/salt mix was on hand each year which is sufficient supply for 136 days. Performance bonds are in place if a contractor does not meet the municipality delivery deadlines. In another instance, winter sand and salt annual quantities of 74,000 and 20,000 tonnes respectively were the baseline. Sand was utilized for intersections and problem areas on a shift by shift basis between November and April. Salt quantities were based on historical usage which Program management converted into weather events (approximately 50 for their priority 1 network and 20 for their priority 2). Program management had broken out full application on their road way network as follows: 	

Priority 1 Network:
 160kg per lane km – 292 tonne
 120kg per lane km – 219 tonne
 80kg per lane km – 146 tonne

Priority 2 Network:
 160kg per lane km – 230 tonne
 120kg per lane km – 172 tonne
 80kg per lane km – 115 tonne

This level of information was not available for Saskatoon's Snow & Ice Management Program.

5.0 Program Operations: Program Processes and Quality	There is currently an opportunity to improve real time condition assessments (RTCA) for snow and weather events. RTCA can be improved through people and technology enabled monitoring of these events across the city.	<ul style="list-style-type: none"> Inefficient utilization of people and equipment resources due to limited monitoring of weather activity and the roadways network. 		PwC recommends that Public Works investigate the application of technology such as weather monitoring stations, temperature pucks in major roadways, and supporting components.	<p><u>Response</u> The Logistics and Procurement Section will conduct an investigation of available resources and technology that could be utilized by the City of Saskatoon to monitor the road network.</p>
Supporting Components: Technology	Not all areas of the city experience same weather conditions. For example, there may be a snow event in one area of the city and a weather event in another area. RTCA could yield cost savings and a better allocation of people and equipment resources (i.e., an efficient delivery of the service plan).			<p>Empowerment of field operators can be achieved by providing them with technical training on how they can monitor the roadway network and report back in a timely manner. Also, defining their roles and responsibilities to include this activity would direct the accountability to the right personnel.</p> <p>RTCA would result in tailored deployment strategies throughout the city and a more efficient delivery of the service plan.</p> <p>PwC noted through benchmarking with similar Canadian municipalities that they were utilizing technology such as temperature pucks, weather stations, and on-call meteorologists. Majority municipalities were using a tailored service delivery model for the entire city during a snow or weather event.</p>	<p>Consideration will be given for partnership with local environmental agencies and Emergency Management Operations based on the current infrastructure.</p> <p><u>Timeline</u> A report will be presented to City Council in April 2017 with the findings and recommendations.</p>

6.0 Program Operations: Program Processes and Quality	<p>Public Works has limited tracking, monitoring and reporting of maintenance materials, with the greatest risk being sand and salt due to the volumes required and higher costs.</p> <p>Spreadsheets, which are not integrated into the current Epicor Accounting & Information System, are being utilized to track material volumes and costs.</p> <p>There is also no technology utilized within Public Works yards to track, monitor, and report movement of materials (i.e., weigh scales, cameras, Epicor updates).</p>	<ul style="list-style-type: none"> • Unable to determine if misappropriation of materials has occurred given the absence of monitoring and limited access controls • Decreased governance and accountability due to limited utilization Epicor system, which facilitates an audit trail. 	 <p>PwC recommends that Public Works utilize technology and access controls (security camera, Radio Frequency Identification "RFID") to better protect inventory. Monitoring should integrate the use of Epicor as oppose to manual Excel sheets. This will facilitate an audit trail.</p> <p>Public Works' ability to combat this risk is impacted by the uncertainty around their relocation to the new Civic Operations Centre (or elsewhere), and the relocation of their current yard facilities.</p> <p>PwC noted through benchmarking with similar Canadian municipalities that the implementation of weigh scales, closed-circuit cameras, active monitoring and reporting, and other technology has combatted this risk.</p>	<p><u>Response</u></p> <p>a) Administration from various divisions are working collaboratively to find interim solutions for electronic tracking of materials until the ERP system is implemented. These include trial portable 3D laser truck scales, the use of existing software and tracking solutions, and modernized survey techniques for stockpile monitoring.</p> <p>b) Currently the security for City Yards is under review.</p> <p><u>Timeline</u></p> <p>a) Logistics and Procurement will be trialing electronic tools over the 2016/2017 winter and will prepare a report for City Council with recommendations for October of 2017.</p> <p>b) This review of security will be completed by June 2017.</p>
7.0 Program Operations: Program Planning	<p>Public Works has not performed an evaluation of the priority street system and associated service levels over the past 5 - 6 years. This includes timeframes in which they are to be completed.</p> <p>Analysis to suggest one road/area is more critical than the other during a snow or weather event has not been performed. Historical methods do not account for the growth of the city over the past number of years (neighbourhood growth, high citizen utilization, bottlenecks, risk of major collisions, etc.).</p>	<ul style="list-style-type: none"> • Level of effectiveness of Program funding and efficiency of service delivery may not be optimal due to the current allocation of roadways within the priority system and the related service levels. 	 <p>PwC recommends Public Works review the priority street system and related service levels with a focus on increased collaboration between Public Works and other civic departments (i.e., Construction & Design, Police, Fire, etc.) to establish a tailored priority system that targets the most critical infrastructure.</p> <p>Public Works has recently found success in moving towards a collaborative model, which is evident with the formation of Workplace Process Improvement Team (WPIT) meetings and the Roadways Steering Committee. This process has allowed personnel to collaborate horizontally through problem solving.</p>	<p><u>Response</u></p> <p>The Administration agrees with the recommendation. The Logistics and Procurement Section is currently reviewing and updating the priority streets system based on the winter level of service, emergency services and transportation requirements.</p> <p><u>Timeline</u></p> <p>A report will be presented to City Council in November 2016, along with the updated Winter Road Maintenance Level of Service Document.</p>

PwC noted through benchmarking with similar Canadian municipalities that Priority 1 Streets are less integrated with public transit routes and more focused on critical infrastructure.

All 3 benchmarked municipalities have performed a review of their priority system and related service levels using an integrated approach. Their reviews captured the following:

- definition of priority streets;
- snow clearing requirements for different priority streets and sidewalks (cm of snow, time frame);
- critical infrastructure during snow and weather events;
- available funding for Program, translation into level of service; and
- safety requirements, accident prone sites, emerging bottle necks, high pedestrian areas.

8.0 **Program Operations:**
Safety

There is minimal monitoring occurring within city yards, including the snow management facility, to ensure compliance with safety standards. The storage of materials and dumping of snow is open to the public during standard business hours. There are limited access controls.

- Limited access controls and monitoring increases susceptibility of unidentified individuals accessing the city yard.
- Safety risk for site users and staff. Uncontrolled and unidentified hazards put staff, users and equipment at risk.



PwC recommends Public Works mitigate their risk by performing the following:

- Implement access control mechanism at snow management facilities and city yard to ensure complete daily coverage.
- Discuss personnel liability risk with legal counsel to ensure appropriate coverage is being maintained by the City within their yards and snow management facilities (use at own risk signs may not provide adequate coverage).

Response

The Administration agrees with the recommendation. Currently the security for City Yards is under review. Additional lighting and a new main gate were recently installed.

Timeline

The new Permanent Civic Operations Centre (COC) Snow Management Facility will be opened on January 1, 2017. The facility will be secure, manage users and utilize access control cards and vehicle usage. A report will be presented to City Council in June 2017 with the lessons learned from the COC site and how that can be applied to the City Yards site.

9.0	Storage structures for materials are not certified engineered structures. Through usage and passage of time, these structures are aging. Regular inspections are currently not occurring which could pose safety concerns to those within the city compound. PwC directly observed a non-certified engineered structure during the walkthrough performed in February 2016. This structure was made of concrete blocks which were placed on top of each other. The blocks were containing sand material used in service delivery.	<ul style="list-style-type: none"> • Safety risk for site users and staff. Uncontrolled and unidentified hazards put staff, users and equipment at risk. 		<ul style="list-style-type: none"> • Perform hazard risk assessment within city yards to ensure all risks are contained appropriately. • Obtain engineering inspections of city yard structures to ensure they are certified for their current usage. • Logistics and Procurement Engineers provide guidance on impact of materials being exposed to weather elements and losing their effectiveness. 	The Logistics and Procurement Section is currently leading a master material management plan for a number of sections, this plan will include consideration of the risk for exposed materials.
9.1	The snow and ice materials within the city yards are exposed to weather elements, potentially affecting their technical capabilities.	<ul style="list-style-type: none"> • Liability risk for the city if materials lose technical composition and effectiveness when applied during a snow or weather event. 		PwC noted through benchmarking with similar Canadian municipalities that no significant issues were brought forward with respect to monitoring within the city yards and other snow management facilities, to ensure compliance with safety standards. Other municipalities had adequate controls in place to mitigate the defined risks. Controls such as 24/7 security personnel, RFID entrance, camera monitoring and facility spot checks were some of the techniques used.	

10. **Program
Resources:
Asset
Management**

Fleet Services Capital Reserve Bylaw (Bylaw # 6774) is open to mixed interpretation and may not be receiving appropriate replenishment.

This bylaw dictates the payment of operating expenditures and build-up of the replacement, stabilization and acquisition reserves. The formula for calculating the replacement reserve requires the current replacement cost.

Currently Fleet Services is calculating the replacement reserve by factoring in the current replacement cost, interpreted as current at the time of purchase, which effectively becomes the original purchase price. The original purchase price is not a good indicator for reserve calculation, as it does not include inflationary pressures.

- Reduced replacement reserve increases the risk that equipment will not be replaced once it has reached the end of its useful life.
- Downtime faced by the aged fleet may affect Public Works ability to meet their service level if equipment reached end of its useful life and has not been replenished based upon plan.



PwC recommends Fleet Services review the current replacement costs and useful lives assigned to their equipment as part of the Service Agreement review currently underway.

Gaining sufficient comfort that their reserves are managed appropriately in order to replace assets that have reached end of useful lives will assist Public Works in managing the Snow & Ice Management Program. Over or underutilization of assets has a direct impact on the replacement reserve.



All Canadian municipalities which were benchmarked were using strategies tailored to their Program. Some best practices included:

- Focus on the replacement reserve, ensuring it is accurately stated and replenished.
- Performing a routine fleet rationalization assessment which outlined quantities of machinery on hand, and uptime/downtime metrics.
- Comparing standard useful lives with actual useful lives on a routine basis.

Fleet Services is scheduled to go through an Asset Management Plan (fall of 2016) which will address the condition of all its assets and any funding gaps which may be identified upon adjusting useful life expectancies. Once the review is complete, three bylaws (acquisition, replacement and stabilization) will then be considered and modified if/where required based on the recommendations from the review.

Fleet is currently engaging departments to deploy the concept of being "Business Partners" with departments when managing their equipment needs. This includes, but is not limited to, the full-access concept of data for user departments to be able to properly analyze at what point in their operations an addition to their fleet requirements may be needed.

In regards to existing compliments of equipment, service agreements are being put into place so that every user group clearly understands the roles and responsibilities of all parties involved.

11. Program Resources: Asset Management	<p>There is an absence of a formal service agreement between Fleet Services and Public Works.</p> <p>Given the absence of defined components in the internal Program document (refer to Finding #1) and the formal service agreement, the equipment and associated uptime required have not been formally captured and reviewed by management on an annual basis.</p> <p>PwC noted that preliminary discussions are underway with respect to drafting of service agreements.</p>	<ul style="list-style-type: none"> Public Works may not have adequate resources in place to achieve their level of service. Snow and ice equipment may not be receiving optimal maintenance or servicing to meet Program objectives (maintain equipment up-time). 	 <p>We recommend Fleet Services implement a formal service agreement with Public Works. Public Works and Fleet Services are creating a collaborative work environment, including development of a process for real time status updates.</p> <p>PwC noted through benchmarking with similar Canadian municipalities that formal service agreements are in place. Fleet divisions work with Program management in a collaborative and inclusive relationship.</p> <p>The service agreements capture at a minimum:</p> <ul style="list-style-type: none"> operator responsibilities; maintenance staff responsibilities; planned maintenance schedules; and desired uptime requirements. 	<p>Fleet Services was involved in a Civic Services Review in the fall of 2015 at which time the need for service agreements with various user departments, including Roadways, was identified. Fleet Services is now drafting the final version of the Service Agreement for Roadways and is expecting finalization and implementation by the fall of 2016.</p> <p>In addition to service agreements, Fleet Services has just completed an upgrade to the M5 Fleet Management System. Fleet Services now has the ability to provide real time status/availability reports for vehicle and equipment for Roadways Operations.</p>
12. Program Resources: Asset Management	<p>The shift structure at Fleet Services is misaligned with the service objectives of the Snow and Ice Program.</p> <p>During the winter months, Snow & Ice Management Program operates on a 24/7 basis. Misalignment between the two Programs is evidenced by the absence of a weekend/overnight shift at Fleet Services.</p>	<ul style="list-style-type: none"> Equipment downtime may affect Public Works ability to meet service level, especially given limited communication and non-existent service agreements between Fleet Service and Public Works. This could lead to dangerous driving conditions within the City. 	 <p>PwC recommends Fleet Services and Public Works determine an optimization strategy for the Snow & Ice Management Program based on current shift structures and the operating capacity of Fleet Services.</p> <p>The strategy should focus on:</p> <ul style="list-style-type: none"> up-time requirements; ensuring only cost effective procedures being performed in house; and where efficiencies can be gained with contractors, Fleet Services should utilize these (outsource). 	<p>The shift structure at Fleet Services was an issue raised during the Civic Services Review in the fall of 2015. This shift structure will be evaluated for the 2017 Budget.</p>

13. **Program Resources:**
Budgeting

Public Works has not performed a detailed budget variance analysis for the last-three fiscal years.

Current analysis was limited to comments noting higher than expected variances, or higher snow volumes experienced, without any reference to the actual events. This is compounded by the fact that there is no electronic tracking of snow and weather events (refer to Finding # 3).

Accurate electronic tracking of snow and weather events can present the bigger picture of what actually happened during the year. The picture being captured will describe budget to actual variances and facilitate decision making.

- Inefficiency for the Program if future resource allocation is not optimal.
- Reduced accountability of management due to lower details being captured in budget to actual variances.



PwC noted, through benchmarking with similar Canadian municipalities, that dedicated service bays and priority status is given to snow and ice equipment during the winter months. This allows for focused maintenance efforts on snow and ice equipment, supporting up-time mandates.

PwC recommends Public Works perform detailed activity based budget variance analysis on a monthly basis and then aggregate this information at year-end.

This coupled with electronic tracking of snow and weather events as noted in Finding #3 may lead to future cost savings. The electronic tracking of snow and weather events will assist in documenting budget to actual variances.

If management is aware of root cause for monthly and annual variances, they may be able to adapt their strategies to combat future variances. Detailed budget variances will assist the following year when management is allocating people and equipment resources, managing objectives and personnel performance.

They will be able to understand which activities were over or underfunded and how current year strategy can optimally allocate resources where needed.

PwC noted through bench-marking with similar Canadian municipalities that activity based budgets were in place and Program management had detailed variance analysis available for stakeholders.

Response

The Administration agrees with the recommendation. Activity based budgeting (ABB) will require documented levels of services.

Timeline



For the Winter of 2016/2017, Winter snow and weather events will be electronically tracked.

For the past two years, PW has been tracking job numbers and activities within each program with Timberline.

Winter service levels were updated and approved in 2015. Levels of Services are currently being developed and will be submitted to Committee and City Council throughout 2016 and 2017, with the final item submitted by August 2017.

In the long term, the City is investigating enterprise resource planning and asset management tools.

For the next five-year period, Roadways will use existing systems to achieve this objective. A portion of the 2017 Operating Budget will be developed using ABB. The 2018 Roadways budget will be entirely activity based,

14. Program Resources: Budgeting	<p>Public Works has not explored utilizing a cost recovery model for facilities used by third parties, which includes the snow management facility and other snow dumps across the City. Saskatoon is one of the few major municipalities in Canada that allows third parties to use their snow facilities and not assess a fee or track usage.</p> <p>As a result, there is reduced storage capacity for city snow dumping, cost management load on Program funding and increased liability to the City for those coming in and out of these facilities without adequate safety training.</p>	<ul style="list-style-type: none"> • Significant cost to the Program to operate these facilities. • Reduced snow dump capacity available to Public Works. • Significant liability risk to the City due to inadequate site monitoring. 		<p>PwC recommends Public Works investigate a cost recovery model to determine if this would enhance the sustainability of current funding agreements. Costs recovered could be used to generate snow facility reserves, to maintain current facilities, reinvest in new facilities and cover the costs of access controls.</p> <p>PwC noted through benchmarking with similar Canadian municipalities that the three mainstream cost recovery methods for facilities used by third parties were:</p> <ul style="list-style-type: none"> • pay-per-load system; • annual/seasonal permit system; and • no snow accepted from private contractors. <p>To monitor vehicles entering and exiting the facilities, most municipalities utilized an RFID system.</p>	<p>Response The Administration agrees that this model should be researched fully. The new Permanent Civic Operations Centre (COC) Snow Management Facility will be opened on January 1, 2017. The facility will be secure, manage users and utilize access control cards and vehicle usage. The Administration does not recommend a fee structure until all costs, and benefits, have been reviewed and considered by City Council.</p> <p>Timeline A report will be presented to City Council in June 2017 with the lessons learned from the COC site and how that information can be applied to the City Yards site. This report will address the issue of cost recovery.</p> <p>Of note, the City currently has three temporary snow management facilities in the NW, NE and SE quadrants of the City with limited access control and monitoring. The report will also discuss these sites and recommend the next steps.</p>
15. Supporting Components: Technology	<p>Public Works is not utilizing GPS technology to monitor Program equipment. Efforts are currently underway to outfit equipment with GPS though this process is in the planning stages. Route completion maps are aggregated manually at the end of each shift, and then uploaded to the City website for citizens to track where snow and ice operators have or have not been yet.</p>	<ul style="list-style-type: none"> • Inefficient utilization of people and equipment as data is manually aggregated, tracked and reported taking up significant time to process. • Uploaded information may be stale and non-value added to citizens due to the high variability of winter weather. 		<p>PwC recommends Public Works utilize GPS technology to better track personnel and equipment (refer to Finding 6). The GPS system could allow for automatic updates on route completion, as well as, potential optimization of the routes through analysis by the Logistics and Procurement team.</p> <p>PwC noted in Phase II that other municipalities either have these systems in place or are targeting implementation within 2016. Equipment being purchased either comes directly fitted with GPS technology or after-market modules added at low cost.</p>	<p>Response Trials for GPS units in Sanders have been recently procured for four (4) sanders and will be piloted over the 2016/2017 Winter.</p> <p>Timeline A report will be presented to City Council in 2017 to discuss the findings from the GPS pilot study and present a recommendation.</p>

16. **Supporting Components:**
Communication

The effectiveness of the communication strategy is not being monitored through development and tracking of relevant KPI's.

Public Works has formalized their citizen communication process through the "Snow & Ice Communication Plan for Winter Road Maintenance" document.

This is a significant improvement in the quality of communication to stakeholders and users of the Program service.

- Potential for suboptimal communication strategy and due to undefined KPIs in place to monitor communication performance.



PwC recommends Public Works to integrate communication KPIs and performance monitoring within the formalized communication plan. PwC obtained examples of formalized communication policy documents through benchmarking with similar Canadian municipalities.

These policies included monitoring of KPIs, such as civic surveys on residents satisfaction with the City's efforts to inform them about travel conditions, and the frequency of social media/website views and updates.

Response

The Administration agrees with the recommendation. Key Performance Indicators (KPIs) and performance measuring will form part of each program close-out so adjustments can be made to ensure programs are efficient and optimized.

Timeline

Logistics and Procurement is developing a KPI communications page for winter operations using share point. The lessons learned from the SharePoint trial will be integrated into the Winter Road Maintenance Level of Service document updated to City Council in the fall of 2017.

3 - Observations and recommendations (Phase II)

a) Process of Phase II

PwC utilized the value framework identified in section 1d) – and repeated immediately below - to conduct our Phase II analysis of comparable municipalities.

Focus Areas	
1. Program Overview & Strategy	i) Program Definition
	ii) Strategy and Governance
	iii) Organizational Structure
	iv) Performance Management
2. Program Operations	i) Program Processes and Quality
	ii) Program Planning and Operations
	iii) Safety
3. Program Resources	i) People and Contractor Management
	ii) Asset Management
	iii) Budgeting
4. Supporting Components	i) Technology
	ii) Communication

This value framework was used to conduct interviews, analyze information, and draw comparisons to the City's Snow & Ice Management Program with each of the following municipalities:

- Calgary;
- Edmonton;
- Regina; and
- Winnipeg.

For purposes of the pages that follow, these municipalities, in no particular order, have been assigned the monikers of Municipality A through D.

b) Observations and recommendations

The below observations and recommendations are listed in the sequence of the value framework outlined on the previous page.

The City should critically assess the following areas to identify for each whether direct learnings can be implemented to drive positive improvement in its own Snow & Ice Management Program:

Documentation and communications

- Municipalities A, B and D have formally documented all aspects of their Snow & Ice Management Programs in a technical and customer level of service manual, including standard operating procedures for Program staff. The manual is updated on an annual basis to include the most up to date content which mitigates succession risk if key Program personnel were to depart. The City has recently completed a customer level of service document; however, detail on supporting components has not yet been formalised and included.
- Municipality A has a formalized communication plan for both internal and external audiences which covers the following topics: Communication Objectives, Strategy, Audiences, Strategy Implementation, and Assisting the Media. (Note that regular citizen's surveys are conducted with respect to the effectiveness of the City's communications for the Snow & Ice Management Program which acts as KPIs for the overall effectiveness of the communication plan). The City has recently implemented a communication policy; however, the City will now need to actively monitor and measure the effectiveness of the communication policy.

Technology

- Municipality A, B and D are advanced at utilizing technology such as temperature pucks, weather stations, and on-call meteorologists to monitor forecasts and roadway conditions. Given the size of their service areas relative to the City, this enables Municipality A and B to provide a tailored service delivery model for their citizens during a snow or weather event. This will become increasingly relevant to the City as it considers moving towards a full city-wide snow removal Program.
- Municipality C is advanced at utilizing technology such as Automotive Vehicle Referencing systems (akin to GPS) to provide real time data, as well as historical aggregation of data that is highly useful in responding to citizen complaints, resolving legal claims, and studying route optimization. The City lags behind Municipality C on their use of GPS technology; however, a fleet-wide GPS roll-out is currently in the early planning stages.
- Municipality B is advanced at tracking the application of salt, sand and other aggregates on its priority network. The City does not have the systems in place to track usage to this level of precision.

Resources – personnel and equipment

- Municipality B has found success submitting an RFP for private contractors to provide equipment outside of their 10 dedicated contract areas. As little as one contractor with one piece of equipment can submit a bid to the municipality for use of the equipment during the winter season. The City does not have this level of flexibility as part of their current equipment tendering process.
- Municipality B has found success with their permanent on-seasonal position Program. This requires returning employees to bid on work each winter, where they are added to a spare list and then called-in on the schedule that Public Works determines has the greatest need. The City does not have this level of flexibility given the limitations of their Collective Bargaining Agreement.

- Municipality C is advanced at working collaboratively with Fleet Services to determine the optimal useful life of equipment, including benchmarking with other cities to validate the useful life of assets they enter into their database. Equipment is replaced without exception at the end of its useful life. The City does not have this level of inter-departmental collaboration with Fleet Services and replacement timeframes are generally not communicated in advance.
- Municipality C has found success in contracting out maintenance to equipment dealers. These maintenance contracts require that if a piece of equipment is required to be out of service for more than 48 hours, alternative equipment must be supplied, ensuring that the Program is operating with a full fleet. The City does not have any guarantees with respect to its maintenance downtime, as a significant portion of maintenance services are completed in-house.
- Municipality C has found success with their casual position Program, allowing employees to be called in on the schedule that Public Works determines has the greatest need. The City does not have this level of flexibility given the limitations of their Collective Bargaining Agreement and has had challenges assigning overtime in the past.

The City appears to be exceeding process standards and to have implemented best practices in the following areas:

Strategic decision-making

- The City is advanced with respect to its decision making methodology in place for calling a snow event. Municipality B and C do not factor in other weather elements when deciding on systematic city plowing, instead only relying upon the standard cm depth guidance as referenced within their Snow and Ice Control Operations Manual and Winter Maintenance Policy, respectively. The Manager of Roadway Maintenance for Municipality C has the discretion to call for a systematic plow at his discretion if there have been several accumulations of less than 5 cm.

Communications

- The City has developed and formalised a thorough communications plan, whereas Municipality B and Municipality C do not have a formalized communications plan as part of their standard operating procedures, nor do they track any KPIs. The Program Manager for Municipality C does maintain scripts for various updates to citizens.

Resources - personnel

- The City has found success in tendering sidewalk clearing to external parties, which has increased the level of service to citizens and also reduced the overall cost as compared to providing these services in-house. Municipality C has had significant issues with respect to their sidewalk clearing initiatives and does not currently contract out any of these services.

4 - Positive themes identified during engagement

Our approach to each internal audit project includes not only obtaining an understanding of the in-scope areas and identifying opportunities for improvement, but also identifying strengths and positive themes. During our engagement for Snow & Ice Management, we identified the following positive themes:

1. A strong commitment to high quality of service delivery by Public Works and other departments involved in the Snow & Ice Management Program. While interviewing management and staff at all levels from Public Works and Transportation and Utilities, we observed that they demonstrated a strong commitment to a high quality process.
2. A strong culture within the Division that supports taking ownership, responsibility and accountability for delivering value for money and continuous improvement within the Snow & Ice Management Program. The majority of the staff we interviewed were fully aware of the service level requirements and were consciously seeking ways to maximize the value of the City's spending.
3. A conscious effort on publishing the guidelines to improve service delivery consistency and communication between stakeholders and citizens. On November 9, 2015, Public Works released the Winter Road Maintenance: Level of Service publication, one of the many innovative featurettes their teams are working on to improve Public Works Program management. Excerpts from the document are cited within this report; however, one of the key elements of the publication was the formalization and communication of the roadway network priority during a snow or weather event. The plan focuses on increasing the understanding of winter road maintenance levels of service, educating citizens on their responsibilities, increasing citizen satisfaction and overall compliance with Program requirements.
4. The use of horizontal collaboration in problem solving. Utilizing members from across various divisions within Public Works (and other teams external to Public Works that may impact service delivery) to come together and find innovative solutions. An example of cross collaboration is the use of Workplace Integration Team meetings, otherwise known as WPIT meetings. We directly observed the use of this technique while in discussion with the Roadways Manager at Public Works.
5. An evolving safety culture. Better described as a journey towards an interdependent safety state where departure from appropriate safety practices are corrected by fellow colleagues who see this departure and advise each other of the appropriate practices. Although reporting of departures from safety practice is higher than it has been traditionally, the evolving culture is at work and continuously improving (see point 8 below for safety progression chart).
6. Integration of Logistics & Procurement and the creation of a tactical plan for Program improvement. Over the past year, Public Works has seen the integration of the Engineering Unit of Logistics & Procurement, which has assisted in reviewing current Program affairs and optimizing planning efforts for the Snow & Ice Management Program ahead of time. Their integration has resulted in estimated cost savings of approximately \$700,000 for the Program. The creation of the tactical plan allowed Program management to focus their efforts on quality, function and safety and improving the value provided by their business unit.

7. Daily updates and lessons learned. Superintendents provide Program management and stakeholder daily updates in their “Superintendent Daily Operations Summary” sheets. These are standardized templates that report on the shifts, timing, weather forecast, number of personnel on shift, and red flags (i.e., equipment breakdowns) as well as equipment in use. Although the incorporation of daily updates and lessons learned is a positive theme for the Program, as noted earlier in our report, there remains a need to formally and electronically document this information so that it can become an active method of reviewing past events and results as opposed to a day-to-day updating mechanism. This will allow for more in-depth analysis over longer periods of time that can assist in performance measure reporting and identifying Program trends, both negative and positive.
8. Safety transformation. Although there is no specific legislative governance over Snow & Ice Management, the Occupational Health and Safety (OHS) regulations do impact Public Works employees. OHS regulations govern training, monitoring of safety and dictate the level of seriousness (of safety infractions) and reporting requirements thereafter. Some of the challenges seen by Program management are as follows:
 - Employees: training and consistency of qualified personnel, high-turnover rate, reporting in all areas of safety and significant resources required to manage safety concerns, particularly as the worker to superintendent ratio is approximately 50:1 for weekday shifts.
 - Contractors: same concerns as city crews, although turnover may not be as high due to more competitive compensation packages in industry.
 - Citizens: limited conformance to warning signs and instances where employees have been placed in harm’s way. Examples include not following 15 meters distance behind sanding equipment and plows, driving into and out of work zones and through active maintenance areas such as snow train operations on Circle Drive.

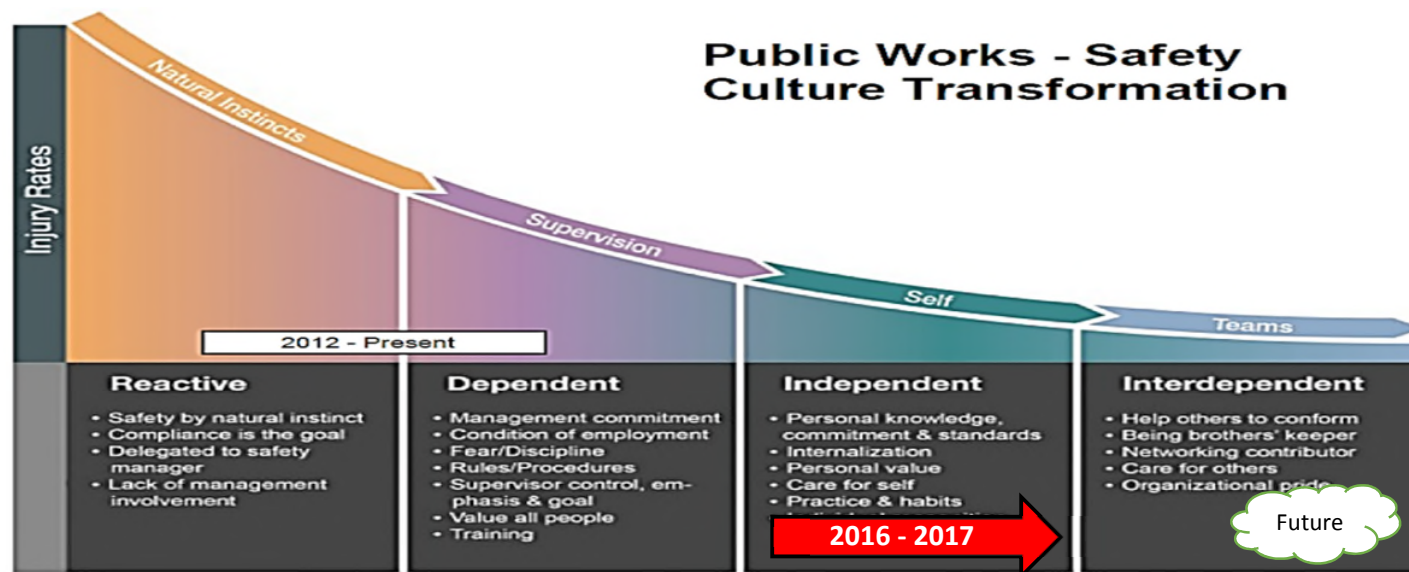
There are indications that the safety culture has shifted over the past few years. In 2012, the culture was to report very few safety incidents, and as a result only 7 infractions were reported in 2012. Training requirements have increased from being as little as 2 hours in 2012 to 5 days (8 hours each) for a comprehensive Safety and Orientation Program in 2016. As a result, the reporting of safety infractions has risen significantly (approximately 383 in 2015) due to increased awareness of safety and a focus by workers on reporting safety-related items so that improvements can be made and potential issues addressed. Public Works is now placing greater emphasis on a comprehensive Safety and Orientation Program and as a result the culture has begun to change. The aim of Public Works is to transform their safety culture to reach an interdependent state with low safety infractions (see the DuPont Bradley Curve shown below).

Appendix A - Achievement of targeted goals and objectives

a) Time of transition

We observed that fieldwork for this engagement was completed in a time of transition for the Program. Program management was working to introduce and implement changes to its activities that would positively impact our findings. Program management has reviewed the recommendations brought forward in this report and plans are in place to mitigate the identified risks. Program management is also working to improve the logistical and administrative aspects of Snow & Ice Management. Specifically, they are currently working to improve:

- How the Program functions;
- How decisions are made that impact the resources being utilized on the ground;
- How to make it easier to plan scheduling for winter maintenance crews; and
- The criteria for the communication strategy (i.e., plan into pre-, active and post-phases).



b) Overview

The City's Snow & Ice Management Program is comprised of the following activities:

- Snow grading;
- Snow removal;
- Snow storage site management;
- Sidewalk and pathway grading;
- Roadway ice management; and
- Fiscal responsibility.

The activities are further broken into subcomponents between varying priorities. The Program is not mandated to follow any national or provincial legislations or regulations; however, Program Management is utilizing the Transportation Association of Canada's publications (TAC) for best practices. Public Works has subscribed to the following TAC publications and incorporated them into their operational planning as best practices:

- Development of Winter Severity Indicator Models for Canadian Winter Road Maintenance;
- Snow Removal Equipment Visibility Guide; and
- Salt Management Guide.

Although the City's Snow & Ice Management Program does not utilize individuals with a Certified Snow Professionals (CSP) certification, the recent integration of Logistics and Procurement and engineering technologists has resulted in certain technical improvements akin to those which might be achieved with the utilization of CSP's in the Program. As a result of this integration and an increase in the level of funding available (from \$10.3 million in 2014 to \$11.1 million in 2015), the latest Civic Survey (released in July 2016) reported that the Snow & Ice Management Program, while still among the lowest areas of satisfaction for citizens, saw its average ranking increase from 5.0/5.2 out of 10 in 2015 to 5.5/5.6 out of 10 in 2016, which is the highest level in 4 years.

The Program's overall strategic direction is affected by the overall vision and values of the City. Captured in a formalized document, the guiding values of the Snow & Ice Management Program highlight the importance of safety, communication and work-life balance, as well as, the overarching City values of trust, respect, integrity, honesty and courage.

c) *Snow & Ice Management level of service*

In 2015, Public Works created a level of service document ("Winter Road Maintenance Level of Service"), which outlines how they will achieve their strategic objectives. The document captures the level of service currently offered by the City to its citizens. In addition, the City has a related operating objective to provide snow grading, snow removal and storage, sanding and salting, winter pothole maintenance, removal of road debris and clearing of ruts as they arise. Please refer to pages 22 and 23 in Section 3 for further details.

While this document highlights the priority system and clearing objectives, it does not include the supporting components (as explained below) required to meet the customer level of service. Incorporating the following items into an internal policy document will enhance the effectiveness of the Program:

- Mission statement;
- Program objectives;
- Strategy;
- Execution phases (including routine operations);
- Description of a snow/weather event;
- Communications (internal and external);
- Personnel requirement;
- Weather monitoring requirement;
- Materials utilization plan;
- Technical and equipment requirements; and
- Performance measurement and reporting.

While reviewing other municipalities' documentation for Snow & Ice Management, we noted many of the identified items above were formalized. Defining these components will establish increased accountability of Program participants and consistent delivery of the level of service, which can then be monitored and tracked to determine if performance indicators are being achieved.

d) Tactical plan

In the first quarter of 2016, Public Works tabled a tactical plan that would impact their entire suite of Program delivery. Three key themes were imbedded into the 11 proposed strategies. These themes were quality, function and safety. The goal of the tactical plan was to have each of the strategies become standalone Program delivery components using the Plan Do Check Act (“PDCA”) cycle to self-manage and continuously improve. This tactical plan would better enable Public Works to continue to move forward with improving the value provided by their business unit. The eleven strategies are as follows:

1. Defined level of service and performance for consistency of service delivery, improved communications, and fostering trust.
2. Business plans to facilitate creation of value added activities and reduction or elimination of non-value added services.
3. Asset management strategies to best manage the long life of the infrastructure under Public Works supervision.
4. Life cycle management strategies - many of the infrastructure assets managed by Public Works are also managed by other departments, such as Major Projects. As such, properly understanding the life cycle management of these core infrastructure assets is critical for determining responsibilities at each stage of the asset’s life and for enabling smooth change(s) of cross divisional ownership.
5. Decision framework to support consistent and transparent decision making based on departmental values. The decision framework will help create clarity and provide a defensible process for decisions over time. The framework will also help foster trust with staff, senior management, and Council.
6. Emergency management plan that clearly defines what is, and what is not, an emergency. Given that planned work is far more effective than unplanned work, the goal is to reduce emergency work/unplanned work to only when it is absolutely required.
7. Defining and documenting work flows within Public Works to facilitate passing of information, find efficiencies, and prevent knowledge loss.
8. An asset risk matrix, to prioritize the work conducted on assets by understanding the critical nature of the asset and the priority of the work to be performed. This will promote a holistic prioritization of work and reduce the probability of asset failure.
9. Public Works human resources strategy, to facilitate planning for training opportunities, succession and staffing needs. A strategy that defines the skill requirements to support Public Works activities will also complement consistent and effective Program delivery.
10. Information management strategy that focuses on capturing large volumes of knowledge within the workforce and management. Consistent communication as well as complex and technical issues need to be documented, captured and stored appropriately.
11. Public Works life cycle procurement strategy that supports obtaining optimum contracts and equipment for their expected life.

The entire portfolio of strategies identified in the Public Works tactical plan will impact the Snow & Ice Management Program. These strategies will bring Program delivery into a higher level of operational efficiency, effectiveness and economy.

e) Conclusion

The City’s Snow & Ice Management Program was able to achieve its targeted goals and objectives in 2015. There was significant clarification and communication of goals and objectives in late 2015 and moving forward into 2016. The Program will need to continue to improve its up-front documentation, real-time tracking and post-season reporting in order to continue to meet increased expectations moving forward (with the \$12.7 million budget for 2016 and the commencement of a phased-in approach to City-wide snow removal) and in order to achieve improved results in the annual Civic Survey.

Appendix B - Timeliness and cost-effectiveness of Program activities

a) Program processes

The processes that Public Works has established to achieve their snow and ice objectives begin with examining current weather conditions at the start of each day. A decision is made into calling a snow event, calling a weather event, or no event.

A thirty-minute morning debrief session sets the objectives for the day. From this session information is taken and disseminated to superintendents, who then have a planning meeting with their supervisors for thirty minutes. If a snow event is called, Program management rolls out the Program in the sequence noted in the breakdown of daily activities shown immediately below. There is no distinction between a snow event and weather event, as the first twenty-four hours would involve the same key activities. Historically, communication originated from the supervisors and no formal process was followed thereafter (i.e., bottom-up information flow). Supervisors communicated to their Superintendents the breakdown of daily activities. Superintendents are now responsible for setting the daily work plans.



b) Snow events

During the core winter season Program staff work rotationally to provide 24/7 Program coverage, with the exception of rush hour commutes to facilitate traffic flow. Following a snow event, priority streets are graded, including removal of snow from bridges and overpasses and the business improvement districts. A snow event is called when snow accumulation is in excess of 5 cm and there is a combination of snow and other storm conditions significantly affecting road conditions. The decision making framework shown immediately below is considered before a snow event is called. Once a snow event is called, Priority 1 roads are graded within 12 hours, Priority 2 roads within 36 hours, and Priority 3 roads within 72 hours. If there are not enough City resources to complete the snow event timing, contractor snow grading may be initiated. The chart below is an illustration of the current decision making framework in place for calling a snow event. A score ranging between 7 and 20 yields a snow event. Although a chart is not filled out for each and every snow event, the framework is utilized by Program management to assess roadway/weather conditions and engage the required Program activities.

Criteria	Measurers	Score	Running Total	
1. Traffic (3)	Rush Hour Impacts (and/or) Major Events Holidays / Pre-holiday travel Will the City have unacceptable traffic risk or delays due to storm	1 1 1 SE		
2. Volume of Snow (2)	Confirmed snow > 5cm Non Confirmed snow > 10cm Confirmed snow > 10cm	1 2 SE		
3. Rate of Snow Fall (3)	Snow, Moderate Snow, or Heavy Snow	1 2 3		
4. Drifting (3)	Wind > 40kph or Wind > 50kph, or Drifting impeding traffic (P2/3), or Drifting impeding traffic (P1)	1 2 3 SE		Conducted By:
5. Snow Density (3)	Water Equivalent (WE) < 10mm 10mm < WE < 20mm 20mm < WE	1 2 3		Date:
6. Existing Snow Pack and Rutting (2)	Snow Pack + Forecast > 15cm Existing Snowpack > 15cm Rutting on P1-3 streets	1 2 SE		Time:
7. Forecast (3)	Forecast Snowfall in 72hrs Snow Moderate Snow Heavy Snow	Environment Canada 1 2 3	()/(20)	Signature:

SE: A Snow event should be called

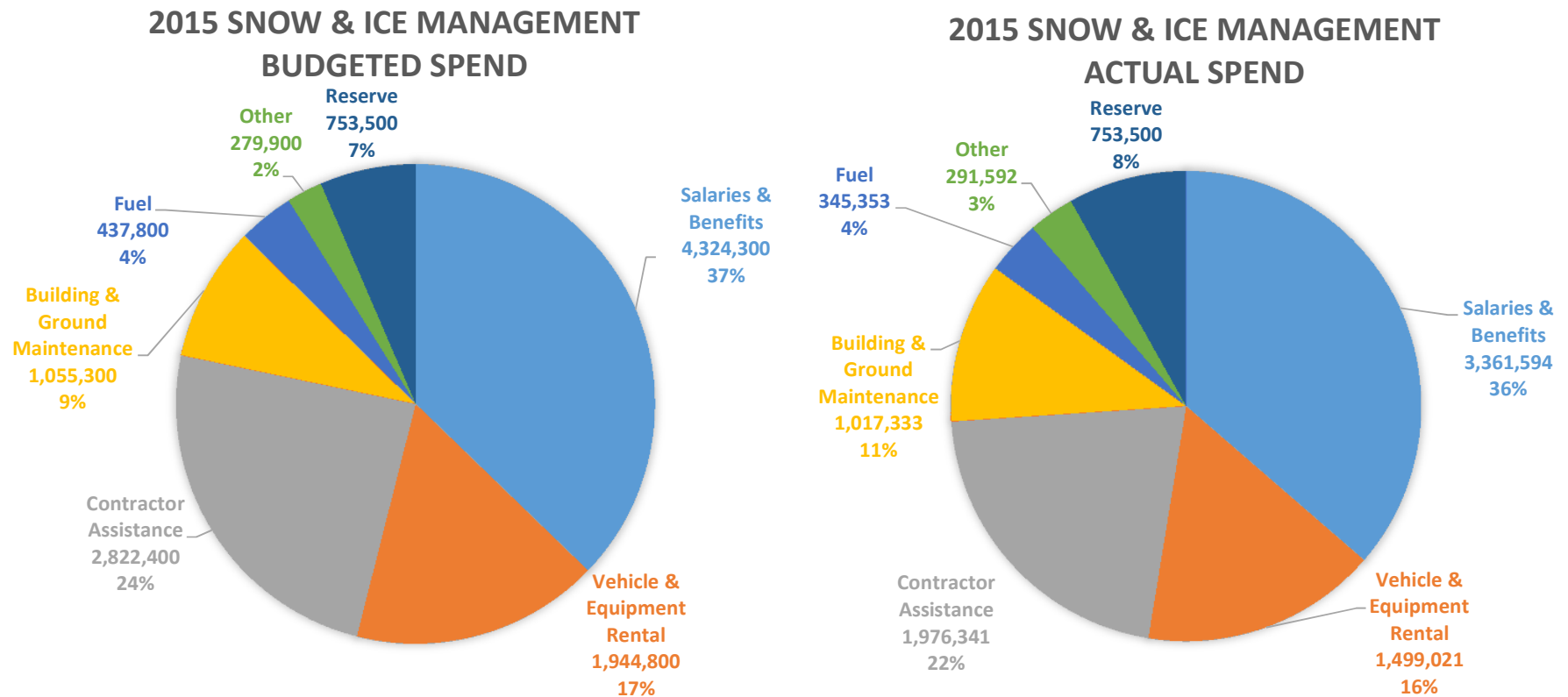
7-20: A Snow event should be called

3-7: A Snow event could be called at the Roadways Manager's Discretion. On Call Managers are responsible for the Roadways Manager's manager unavailable.

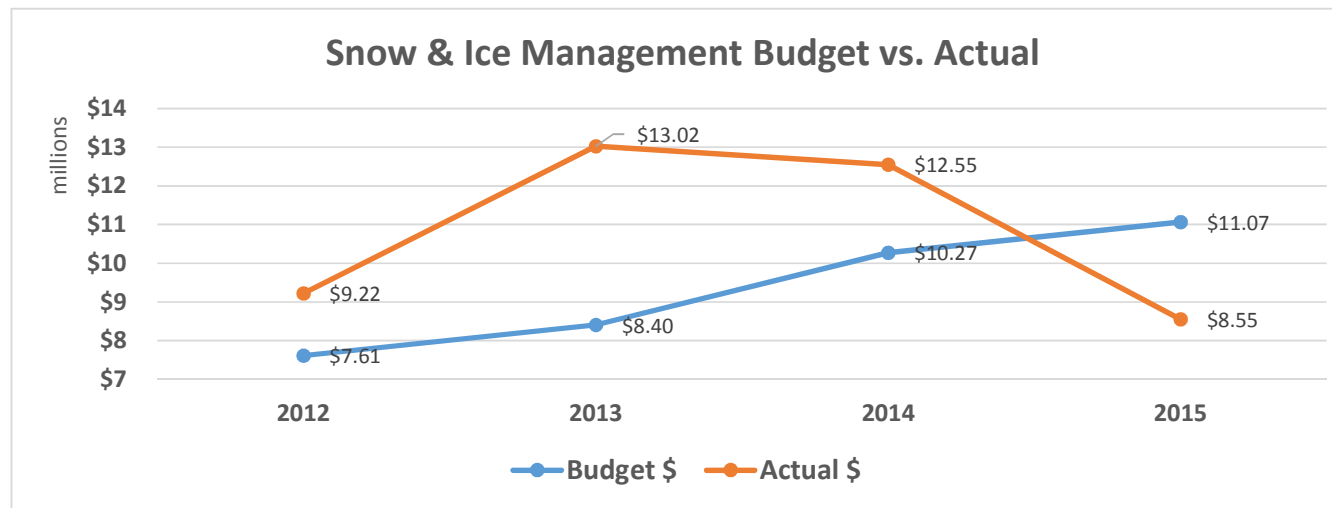
0-2: A Snow event should not be called without Director's approval

c) Funding required to achieve level of service

The following chart outlines the breakdown of the 2015 Snow & Ice Management budget. The largest component of the Program (37%) is salaries and benefits for the employees hired to execute the Program. Note that 7% of the budgeted \$11 million total spend was allocated for reserve funding. Overall, actual allocation percentages remained consistent (i.e., within 1 to 2 percentage points) with those budgeted. However, as noted on the following page, the overall actual spend was significantly lower than that budgeted, with final projected actual costs of \$8.55 million versus budgeted costs of \$11.07 million.



We noted that 2015 was the first year in several in which actual Program spending was lower than budgeted. During the three years prior to 2015, Program management was consistently spending in excess of budget on Program activities as a result of a combination of factors, including weather fluctuations (tougher winter months), tighter operating budgets, and issues with the availability of equipment. The 2015 winter season was milder in comparison to historical winter seasons and there were also some favorable input and contract prices. As a result, actual spending was significantly lower than budgeted.



There will need to be caution exercised in future budgeting, as the low costs achieved in 2015 and the gap between budget and actual was to some extent based on unpredictable external factors, and there will also be growth factors to consider. We note that the budget put forward for Snow & Ice Management operations in 2016 was approved at \$12.7 million, which includes \$1 million representing a 0.55% mill rate increase. This will provide additional funding to start a phased-in approach for a city-wide snow removal strategy. Roadways phased-in for the city-wide snow removal strategy will target current snow removal pressure points as follows:

- School zones;
- Narrow streets;
- Low speed overpasses;
- Sight lines (stored snow on priority street medians that restrict driver visibility); and
- Prioritized P3 median locations.

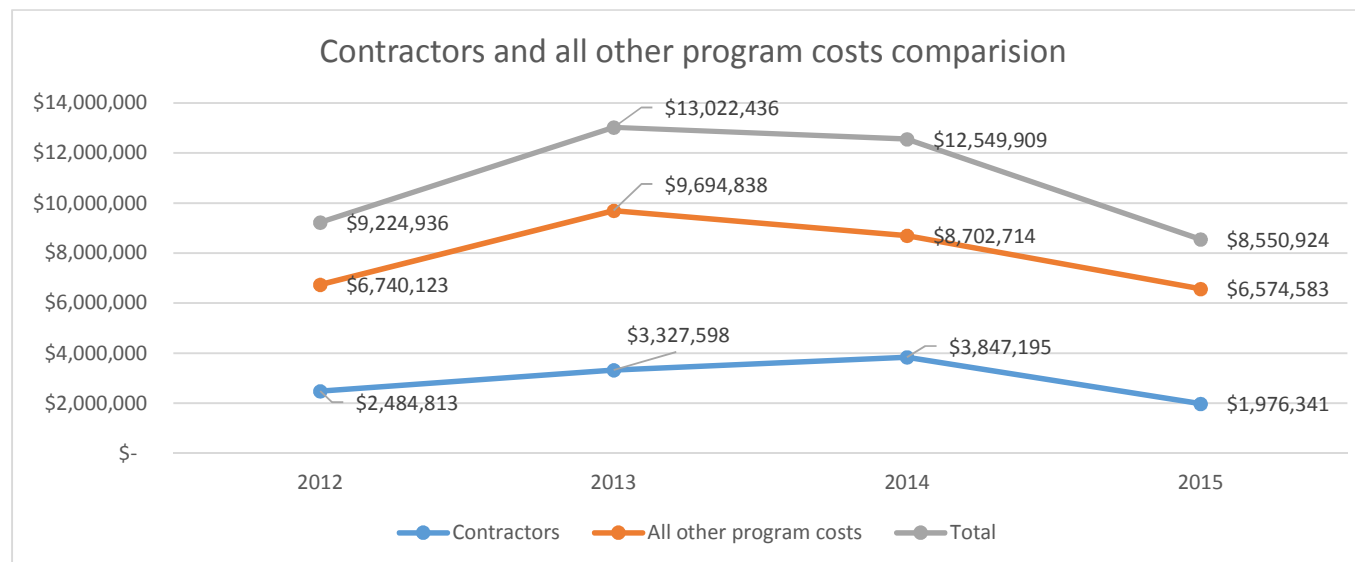
While the current Program focuses on snow removal from Priority 1 and 2 medians, the new phased-in Program will aim to remove the snow sooner. As a result, there will be lower sight lines and decreased amount of water runoff in spring.

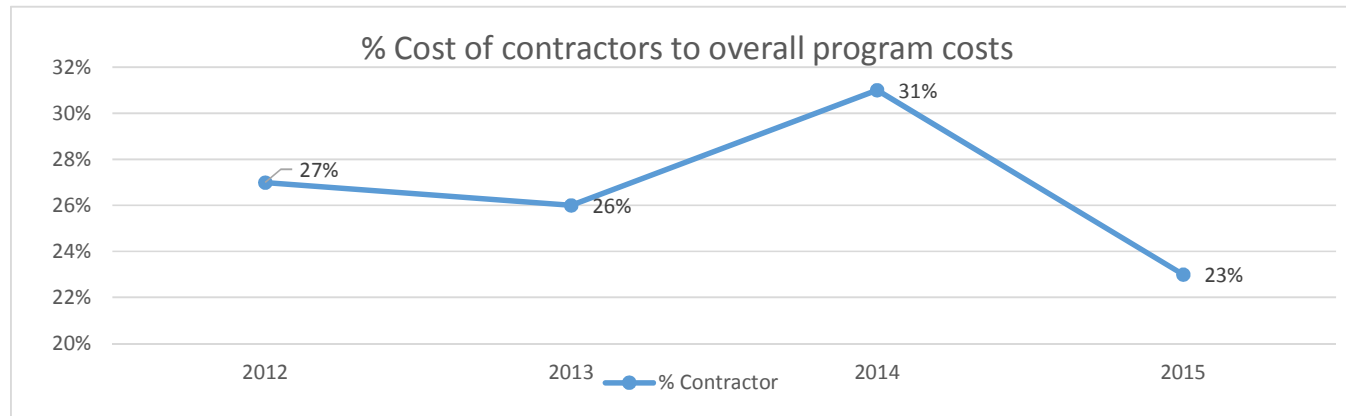
d) *Employees and contractors*

During a snow event, city crews are supplemented by sixteen contracted graders to service priority two and three roadways within four defined service areas. In order for Public Works to meet Program objectives and their snow and ice level of service, they are required to have a specific number of teams scheduled in each area at any given time. Public Works must determine the most efficient mix of employees and contractors to ensure service levels are met. Over the past three years, the Snow & Ice Management Program has experienced internal growth, increasing from approximately 45 full-time equivalents in 2013 to approximately 56 full-time equivalents in 2015. Additionally, in the same time frame contractor costs have decreased due to multiple factors.

As the Snow & Ice Management Program has evolved and the level of service document has become formalized, Public Works divided the snow work zones into four quadrants as opposed to three, which provided smaller local contractors with the opportunity to bid on City work. Also, Public Works is now better tracking the work that they have the capacity and resources to perform in-house as opposed to outsourcing to contractors. A final factor impacting the price of contracted work is that Saskatoon has seen an increase in skilled laborers looking for opportunities due to declines in other sectors and industries in the City and broader province.

Overall, contractor costs have decreased significantly on a pure dollar value basis to a 4-year low of \$1.98 million, as outlined in the chart immediately below, and also on a relative basis, again to a 4-year low of comprising 23% of total Program costs, as outlined in the chart below.





e) Comparison of contractors to all other Program cost (Saskatoon to other municipalities)

In terms of municipalities which we benchmarked against the City, we noted that typically there was a higher ratio of contractor costs to total Program costs than that currently in place at the City. For instance, one municipality maintained a ratio of contractor costs to total program costs ranging from 42% to 47% from 2013 to 2015. Another maintained a range of approximately 80% contractor costs to city crews over that same period in time. In that instance, despite receiving reports that in-house staff could perform the tasks at a lower cost, the municipality concluded that to have all of the additional equipment in-place required to do the work in-house would come at an additional capital and operational cost that was not feasible, particularly taking into account the long periods of non-utilization of the equipment outside of the winter season.

While city crews and in-house equipment come at a lower direct hourly rate in comparison to contractors (i.e., the hourly charge rate for a snow grader), their direct rate is not the sole decision-making factor as to whether the work should be outsourced or kept in-house. The cost effectiveness of external contractors to city crews varies for each municipality, its Programming and most importantly the weather conditions it faces. Within the City, contractors are also utilized due a low response rate to fulfil overtime callouts (i.e., typically a 5% response rate for day shifts) whereas, night shifts generally accept overtime closer to 100% as they are used to working irregular hours. Ultimately, the optimal ratio must address the following questions:

- Can the level of service be delivered completely if we were to change the ratio (i.e., reduce contractors and increase FTE)?
- Are full-time equivalent staff willing to take on additional areas/work load (i.e., nights and weekends)?
- Does the city have the full complement of equipment on hand to deliver the level of service, and if not, what are the capital and operating costs?
- What incremental operating (and future capital replacement) costs will the City incur by putting more load on their equipment?
- Is the equipment in the required maintenance condition?
- How will overtime costs impact the cost effectiveness of transition to more in-house work as opposed to outsourced contractors?

f) Historic cost of Snow & Ice Management Program

Year	2010	2011	2012	2013	2014	2015	Average	Standard Deviation
Total cm	50	33	91	63	47	40	54	21
Total cost	\$ 6,141,900	\$ 8,274,848	\$ 9,224,936	\$ 13,022,426	\$ 12,549,909	\$8,550,924	\$9,627,491	\$2,659,554
\$/cm	\$ 122,838	\$ 250,753	\$ 101,372	\$ 206,705	\$ 267,019	\$ 213,773	\$193,743	\$67,452

In addition to the frequency and severity of snow and weather events, freeze/thaw cycles have a significant impact on achieving service levels and meeting budgetary guidelines. Based on the above chart, we note that the 2015 winter season wasn't as severe as the preceding 3 years. Generally speaking, the greater the amount of snow fall, the greater the opportunity to gain economies of scale and dilute fixed Program operation costs. However, it is important to note that the above numbers do not reflect changes in the levels of service over the last five years, nor do they account for the density of snow. Furthermore, these numbers do not account for abnormal weather conditions such as freezing rain. Most importantly these numbers are not representative from a statistical standpoint. The standard deviation of cost per cm is over 1/3 of the mean. This means that cost per cm is not an effective measure for snow removal and the annual snow forecast cannot be used to estimate costs or budgets. This is likely due to the level of service changing significantly over the last five years. It is clear that the correlation is weak.

A more reliable metric for budgeting and forecasting could be cost per lane km (which could be segregated at the activity level). Although the figures were not available going back multiple years, this is an indicator that is used by other municipalities as well as other Programs (i.e., summer road maintenance). However, even then the change in level of service and the type of snow fall that occurred (mixture of snow and ice, density, etc.) need to be factored in and, as such, these indicators should be used with caution and professional judgement/skepticism.

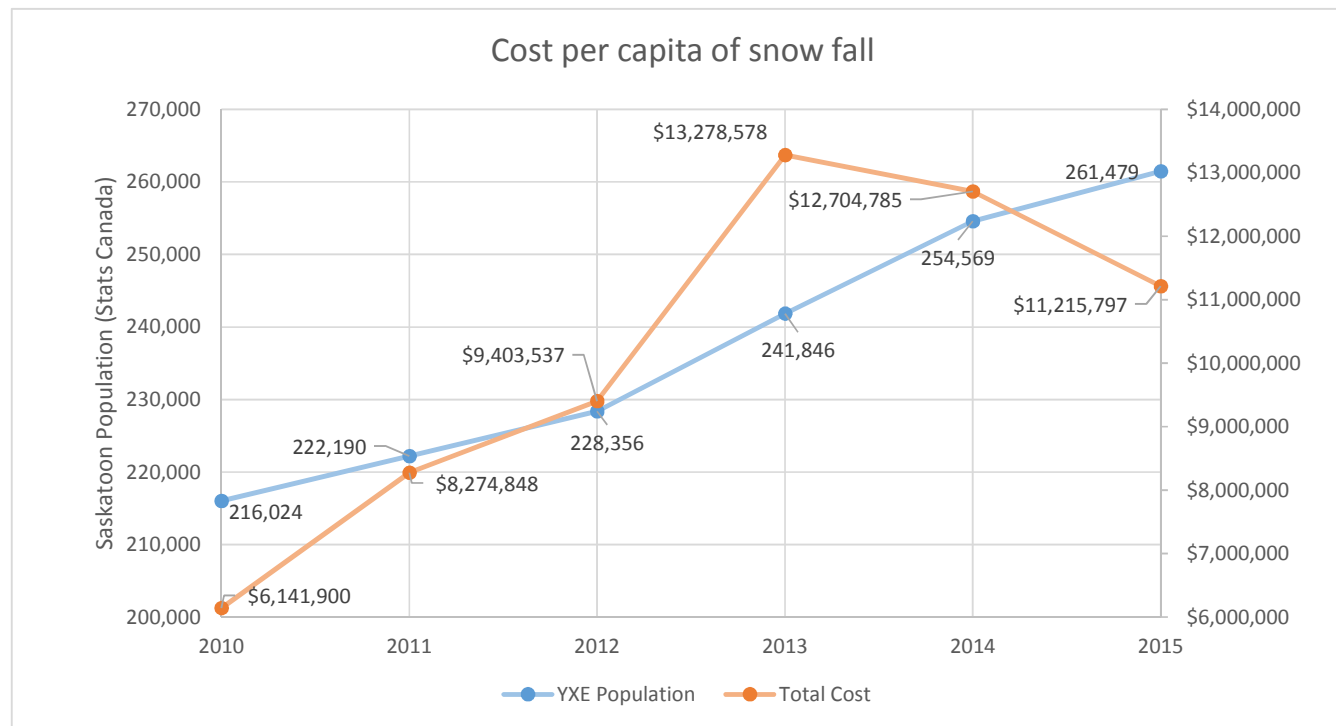
Year	2013	2014	2015
Lane km*	4,005	4,005	4,005
Total Cost	13,022,426	12,549,909	8,550,924
\$/Lane km	3,252	3,134	2,135

* Per City of Saskatoon Municipal Manuals

Across Canada, winter maintenance costs are tracked by members of Ontario Municipal Benchmarking Index ("OMBI") and reported in the annual OMBI Performance Measurement Reports in terms of cost per lane km. When examining the winter maintenance costs per lane km of OMBI single-tier municipalities (responsible for maintaining all types of roads, including arterial, collector and local roads and, in some cases, expressways and laneways), it is clear that there are significant anomalies both from year-to-year and among comparable municipalities, which present challenges in making meaningful, detailed benchmarking comparisons and drawing conclusions.

For example, during the period from 2010 to 2012, one of our benchmarked municipalities reported operating costs for winter maintenance of roadways per lane km maintained of \$3,520, \$5,399 and \$4,298, respectively, during that 3-year period. The average median cost per lane km over that same 3-year period for all OMBI single-tier municipalities was \$3,139. There are significant fluctuations across municipalities with some of our benchmarked and other larger municipalities having costs per year approaching \$5,000 per lane km or higher. The majority of other single-tier municipalities hovered around the \$3,000 to \$4,000 per lane km mark from 2010 to 2012.

Note that we do observe some correlation between the rise in City population and overall Program costs. This however, is expected as the rise in population generally correlates with growth in infrastructure. A greater size of roadway network to maintain during the winter months simply translates into greater costs.



g) *Cost of snow management facilities*

The City currently owns and operates the following snow management facilities:

- Northeast - Central Avenue
- Northwest - Wanuskewin Road
- Southeast - 8th Street
- Southwest - Valley Road

These facilities are accessible to all users free of charge with service hours up to 24 hours a day during the winter months. The new Civic Operations Centre ("COC") includes a snow dump facility that will be able to store one million cubic meters of snow and is expected to be completed for 2016-2017 winter season.

Public works does not track private haulers, but has estimated that approximately 75% of all snow hauled to the snow facilities originates from private operators. Progression to a city-wide clearing Program depends upon ample capacity at the city run snow facilities. This could be affected by the reliance upon the private sector on these facilities.

Based on benchmarking performed and analysis of the City of Regina's 2015 Study on Snow Storage Site User Fees, Saskatoon's policy of not charging private operators appears to be an outlier. Other municipalities have enacted a pay per use policy, or do not allow private operators to use the city-run facilities. In many cases operating costs loaded onto management's operating budget are in excess of 2% of the capital cost of the asset. A cost recovery model would positively impact any budgetary constraints.

h) *Comparison of Program priority street system*

The priority street system affects level of service, Program delivery costs and citizen satisfaction. Roadway vehicle volumes have traditionally set the priority street system across Canada. In the current model for Saskatoon, there is a disproportional percentage of level 2 priorities. This is due to the fact that the current model has evolved from a priority system that traditionally followed the City's bus routes. Within the priority system, there are arbitrary metrics such as 5 cm of snow accumulation, which could be changed to 6 cm or 7 cm and potentially result in Program cost savings. Note that the lowest point on new platform police cars is 5 inches at the skid plate. Although costing wasn't performed on the increase of snow accumulation from 5 cm to 6 cm or 7 cm, this is an area that Program management is looking to address through the implementation of the aforementioned tactical plan. Attached below is a comparison of Saskatoon's priority street system to other municipalities. We noted that Saskatoon has an opportunity to increase priority 1 and 2 time frames, reduce priority 3 time frames and on the whole, potentially split the current priority system into more sections (i.e., instead of 3 priorities, potentially adding an additional 1 or 2 more). In addition to this, given that police vehicles are seen as highly critical for mobilization through Saskatoon and the lowest point for ground clearance is 5 inches, Program management may also be able to save additional costs by adjusting their snow accumulation rule to a higher amount for calling a snow/weather event.

	Saskatoon	Regina	Calgary	Edmonton	Winnipeg
Priority 1	<ul style="list-style-type: none"> •Road Classes and AADT*: All Expressways (Driving Lanes); All Freeways (Driving Lanes); Arterials (AADT >15,000); Collectors (AADT > 15,000); •Some additional Arterials and Collectors with for route continuity; •Access to the following facilities: <ul style="list-style-type: none"> ▪Police Headquarters; Fire Halls; Hospitals; Ambulance Depots. 	Freeways/expressways including ramps and loops; major arterial roads, and any road on a designated hospital emergency route.	<ul style="list-style-type: none"> •Streets in the Central business district with traffic volumes exceeding 8,000 vehicles per day (4 Avenue S to 12 Avenue S and 14 Street W to 6 Street E); and Designated routes on high-traffic-volume arterials (currently based on traffic volumes of 20,000 plus vehicles per day). Bare pavement standard applies. 	<ul style="list-style-type: none"> •Freeways, Arterial Roadways, Business Districts, Bus Ways <ul style="list-style-type: none"> ▪Sanding standard frequency, every 4 to 8 hours ▪Sanding storm frequency, every 2 to 4 hours 	<ul style="list-style-type: none"> •Includes all regional streets, in addition, some streets around the Health Sciences Centre have been plowed as Priority I to facilitate ambulance access to the hospital.
<i>Snow Clearing Timeframe</i>	Within 12 hours	Within 24 hours	90% Within 24 Hours	Within 36 hours after end of snowfall	Within 36 hours
Priority 2	<ul style="list-style-type: none"> •Road Classes and AADT: All Expressways (Shoulders); All Freeways (Shoulders); Arterials (15,000 AADT >7,500); Collectors (15,000 AADT >7,500); •Additional Arterials and Collectors with AADT < 7,500 for continuity; •Bus Routes: Bus Rapid Transit •Access to Emergency Measures Organization, HQ/Staging Area, Saskatoon Airport 	<ul style="list-style-type: none"> •Minor arterial roads, major collector roads with traffic volumes > 5,000 vehicles per day and all roads in the area referred to as Regina downtown. 	<ul style="list-style-type: none"> •Designated streets with volumes of 5,000 to 19,999 vehicles per day. Traffic lights and controlled crosswalks. Designated emergency routes (adjacent to hospitals and police and fire stations). Roadways which facilitate marked, on-street bike lanes. Problem areas. Bare pavement standard applies. 	<ul style="list-style-type: none"> •Collector/Bus Route Roadways, Transit Park and Ride Access Roads. <ul style="list-style-type: none"> ▪Sanding standard frequency: 8 to 12 hours ▪Sanding storm frequency: 4 to 8 hours ▪Plow within 48 hours after the end of snowfall 	<ul style="list-style-type: none"> •These include non-regional bus routes and collector streets based on traffic counts although some streets in industrial areas are exceptions to the traffic count standard.

<i>Snow Clearing Timeframe</i>	Within 36 hours	Within 36 hours	90% Within 48 Hours	Within 48 hours	Within 36 hours
Priority 3	Road Classes and AADT: All remaining Arterials (AADT 5 7,500); All remaining Collectors (AADT 7,500); Some Local roads for route continuity; Bus Routes: Local and DART Routes; Access to the following facilities: City Downtown Yards; City Hall; and Schools.	Major collector roads (with traffic volumes < 5,000 vehicles per day), industrial/commercial roads, and any minor collector or major residential local roads on a designated transit or truck route.	Designated feeders, collectors and bus routes at: School and playground zones. Designated hills. Stop/yield signs. Bus stops. Hard pack snow standard applies.	Local Industrial Roadways ▪Sand on an as required basis ▪Plow within 5 days after the end of snowfall	Residential and/or little used industrial streets.
<i>Snow Clearing Timeframe</i>	Within 72 hours	Within 48 hours	Within 96 hours after completion of Priority 2	Within 120 hours	Within 120 hours
Priority 4		Minor collector roads and major residential local roads which lead into school bus unloading zones.	Residential areas at: School and playground zones. Designated hills. Hard pack snow standard applies.	Residential Roadways, Alleys	Includes all (community and neighbourhood) parks pathways that have been designated.
<i>Snow Clearing Timeframe</i>	Within 60 hours		Within 96 hours after completion of Priority 2	Within 120 hours	No timeframe noted – Only when funding available
Priority 5	Residential local roads.				
<i>Snow Clearing Timeframe</i>	No timeframe noted				
Priority 6	Gravel roads.				
<i>Snow Clearing Timeframe</i>	Within 60 hours				

*AADT is an abbreviation for average annual daily traffic

i) Conclusion

The City's Snow & Ice Management Program achieved economy and efficiency in 2015. Spending was at a 4-year low and significantly below budget despite increases to service levels. At the present time, the mix of contractors is appropriate as the City is achieving its Program objectives with a relatively low level of contractors while maintaining costs at the low end of the range compared to other municipalities, as outlined further in the next paragraph. As the City begins its phased-in approach to city-wide snow removal, along with the resulting increase in the Program's budget (to \$12.7 million in 2016), the current mix will likely not be sustainable as a higher mix of contractors will gradually become the norm (i.e., the % of contractor costs to total Program costs will rise as will the proportion of contractors to FTE's). However, at current spending levels and levels of service, the current ratio of 23% in 2015 is efficient and economical.

The conclusion that can be drawn from examination of the above historical measures and OMBI Performance Measurement Reports is that, given: a) the amount of snowfall in the 2013, 2014 and 2015 years; b) the City's desired level of service and; c) the amount of cost expended to clear Saskatoon's lane km, the City is within the reasonable range of Snow & Ice Management costs compared to its peers across Canada solely from a cost per lane km perspective. In 2015 there were circumstances that led to significantly lower costs, but going forward it would be reasonable and prudent to anticipate costs in the range of \$3,000 to \$3,500 per lane km assuming the level of service does not drastically increase from current levels and no significant additions to the roadway network take place (i.e., 25% or 50% additions). This would indicate the achievement of proper balance between maintaining cost efficiency and performing the proper measures to keep the Program effective and achieving its objectives.

Appendix C - Quality of performance reporting

a) Information flow process

Program management within Public Works monitors the achievement of their service level objectives through the issuance of daily reports to City administration. These reports provide progress on the following metrics.

- Communications plan, including any public service announcement to be issued in the event of a weather or snow event;
- Sanding operations;
- Plowing operations;
- Contractor assistance;
- Sidewalk and pathway clearing;
- School zone snow removal;
- Snow storage sites;
- Customer service updates including any major issues reported; and
- Other activities, including training programs, in the absence of a snow or weather event.

During fieldwork, we observed that standard operating procedures (SOPs) for Snow & Ice Management operating activities were not well defined or formalized. Information is currently disseminated from superintendents and supervisors who have a historical working knowledge of the Program. The absence of SOPs has direct implications on the Program operators, as they receive direction and daily objectives from program management.

We have reviewed the current level of service documents and confirmed via interviews with the roadway manager, superintendents, and supervisors that SOPs have not been formally documented. The implication of this deficiency is that it could potentially negatively impact future operations as a result of a potential breakdown in the communication channel in the event there was voluntary or involuntary turnover of superintendents or program management.

Although service levels and several key performance indicators (KPIs) have been defined, monitoring and reporting of KPIs is manual in nature. The information is not readily available to the various stakeholders of the Program and is only tracked on the snow and weather close-out summaries, which are manual paper files maintained by the roadways manager. If this information was converted to an electronic format, it would facilitate the creation of a dashboard, trending reports, historical information on how snow and weather events were handled, and all other relevant information relating to the Program. The entire annual picture would be available for review by stakeholders.

We have reviewed the daily close-out summaries and noted that although areas relevant to KPIs are discussed, they are not aggregated electronically for historical review. This limits the ability of Public Works to review past snow events and create “lessons learned” documents. By not capturing the information electronically, Public Works is limiting their access to historical information, which could be useful for the formation of future Program planning.

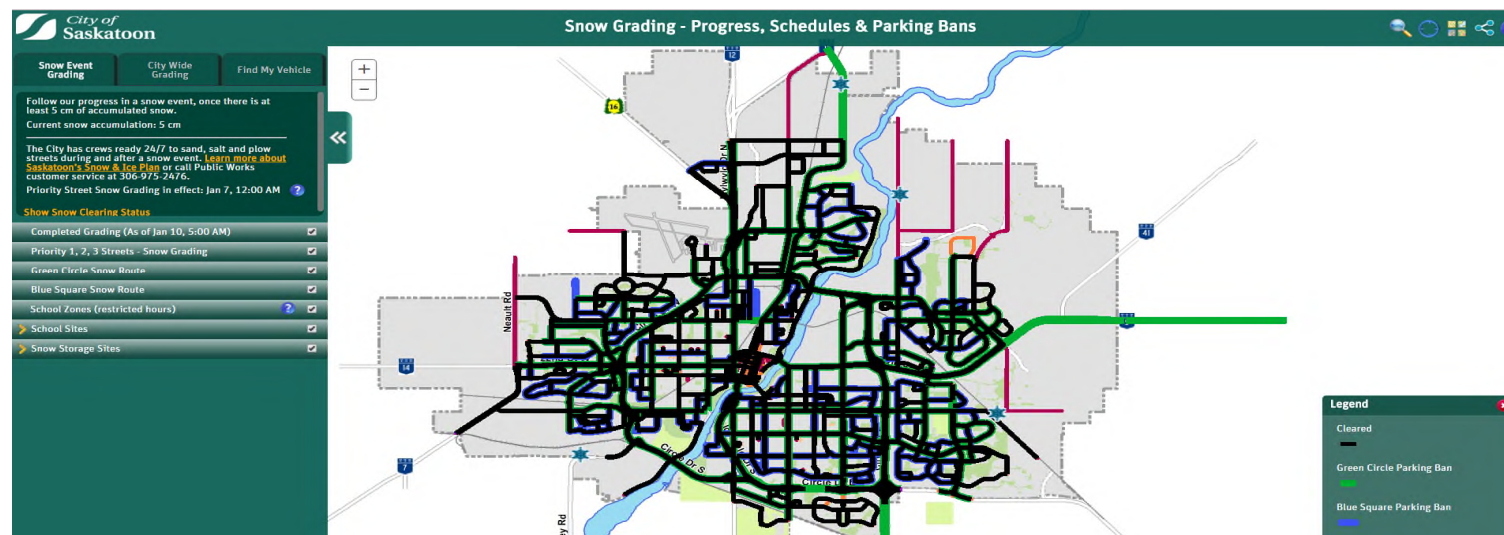
Additionally, budget variance analysis was focused at a higher degree on larger variances or where complaints related to service levels were received.

Risk management practices are evident in the hierarchy and level of authority established within Public Works. To ensure Program objectives are met, contractors are engaged to complete work for the city when full-time equivalents (FTE) are not available. Program management's primary preference is to allocate and direct work to their FTE pool to ensure staff utilization is adequate. As more experienced employees reach retirement age, a model to prevent Program failure as a result of loss of knowledge is being put in place (incorporating early training opportunities, ramping up use of technology, and the continued development of further enhanced operating procedures).

With the on-boarding of engineering technologists, some of the administrative burden on superintendents has been eliminated, allowing for increased effectiveness with respect to drafting contracts and monitoring quality of contractors. Contractors are now held accountable if they do not meet the terms of the contract (i.e., completing sector in specified timeframes). Engineering technologists and the integration of Logistics & Procurement have created value for Public Works as their integration has resulted in estimated cost savings of approximately \$700,000 for the Program as a result of renegotiating/redrafting area contracts. Their collaboration in the creation of the tactical plan allowed Program management to focus their efforts on quality, function and safety and improving the value provided by their business unit.

We noted that opportunities exist within the Program to better monitor material usage and optimize the costs incurred for snow and ice materials. There were oversights and gaps present in the current model for monitoring materials. Opportunities to collaborate between Roadways, Logistics and Procurement, Transportation, Police, SGI and Traffic Safety will result in monitoring accident and other traffic related data for various intersections and city streets, which could improve service delivery. Note that these stakeholders have met twice in 2016 and are receptive to further collaboration.

Below is a representation of the online map that is manually updated upon completion of snow grading across the City. Currently the map is not real time although Program Management is working to transition towards a real time model (similar to Saskatoon Transit's model of knowing how far the bus is from your current stop/route). Operators clear their routes and complete the daily summaries as discussed above. This information is then provided to Program management, who then update the progress map.



b) Weather monitoring

Program management is not utilizing snow and ice condition assessments, and instead the Program relies upon the experience of senior employees to guide Program decisions as opposed to scientific methods. Winter road maintenance happens in a dynamic environment and crews are constantly moving. In order to perform condition assessments in a dynamic environment, management should have access to real-time data which can be gathered through technological advancements (i.e., temperature pucks in roadways and friction management trailers). Currently none of these are in place at the City, therefore the Program relies upon historical data and cumulative knowledge of personnel. Additionally, condition assessment information is provided through citizen complaints, which trigger a response from the Program supervisors to remediate any deficiencies.

The City utilizes weather monitoring stations outside city limits (the closest one being Radisson, SK). As the inclement weather approaches Saskatoon, service delivery is tailored to the weather conditions approaching. The typical trigger point to engage service delivery is snow fall. However, sub components such as depth of snow, type of snow and level of precipitation are not accurately known due to limited monitoring.

Through our benchmarking analysis with comparable municipalities, we understood that the Program management in other municipalities also monitors forecasts through duty supervisors and staff; however, in addition they subscribe to meteorologist services through contract relationships. One benchmarked municipality was utilizing the services of MeteoGroup, a full-service weather solutions firm. This municipality subscribed to 24/7 local area forecasting, on-call consultation and road weather information service between October and April and 5 days a week service during summer months at an approximate cost of \$700 per month.

c) Conclusion

The "Winter Road Maintenance Level of Service" document published in November 2015 contains 35 direct tasks and related performance measures. While formal documentation of these tasks and performance measures is a significant step forward for the Program, additional formal documentation, real-time tracking and in-season and post-season reporting will be necessary in order to transparently report progress against these performance measures. Our findings and recommendations address this conclusion.

Appendix D - Effectiveness of citizen communication process

a) Civic survey results

The latest Civic Survey (released in July 2016) reported that the Snow & Ice Management Program, while still among the lowest areas of satisfaction for citizens, saw its average ranking increase from 5.0/5.2 out of 10 in 2015 to 5.5/5.6 out of 10 in 2016, which is the highest level in 4 years.

b) Communications strategy

Program management recognized that the City's severe winters meant they required a formalized snow and ice communication plan. The overall cost of the communication strategy was approximately \$60,000. The goal of this plan was to:

- Increase understanding of the City's Winter Road Maintenance levels of service, how they meet the needs of residents, and where to get further information;
- Educate citizens on their responsibilities during winter (sidewalk clearing, winter driving habits and respecting work zones);
- Provide opportunities for residents to engage with the City; and
- Reduce complaints and negative feedback about the City's snow clearing bylaws.

In order to achieve their goals, Program management outlined a strategy of providing regular news updates through the use of a variety of mediums to reach residents and drivers. Program management positioned winter as a community issue, in which everyone played a role to achieve ultimate success. Further, an on-call guide was created to enable consistent communications to be carried out during the work week and after-hours.

c) Conclusion

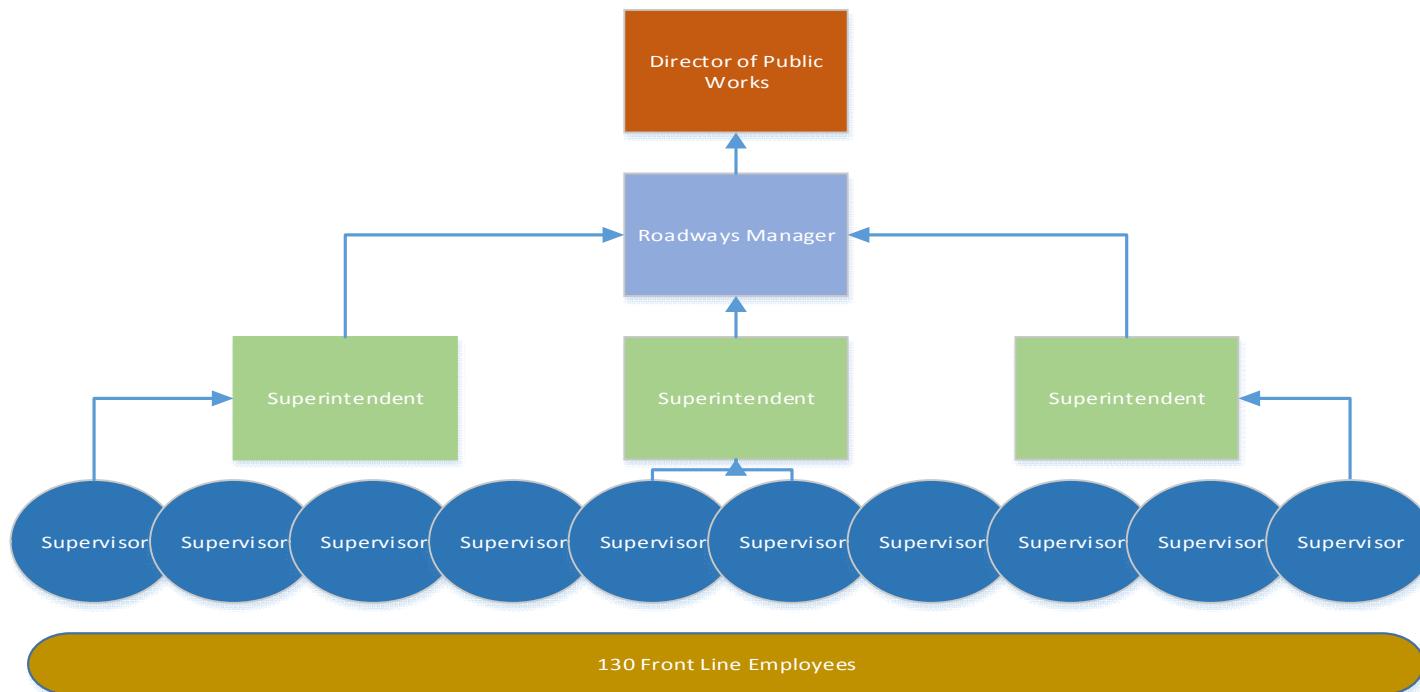
The implementation of the formal communications strategy represents a significant step forward for the City's Snow & Ice Management Program and aligns it with best practices currently being followed by certain municipalities who participated in the Phase II benchmarking. We note that these municipalities have gone so far as to conduct regular citizen surveys specific to the Snow & Ice Management Program to seek citizen input on the effectiveness of the City's communications in this area, which is the only true manner in which to gauge whether those being communicated with are being positively impacted by the communications. We also note that not all municipalities who participated in the Phase II benchmarking had implemented formal, thorough communication plans.

Appendix E - Resource and asset management

a) Structure

The hierarchy structure with the Program follows a top-down approach with defined hours of work and productivity expectations for each level in the hierarchy. This represents an effective governance model, as supervisors and up are held accountable for managing their work crews.

Team members have a voluntary availability arrangement that utilizes horizontal collaboration and team flexibility to adapt to the changing needs of the section and division. Team member voluntary availability has the goal of providing coverage for superintendent gaps, as well as, to provide support to supervisors and the existing Public Works on-call system. On a rotational basis, Superintendents and the Roadways Manager are available on-call during night and weekend shifts, should the Roadway Supervisors or staff have any concerns. Currently, the night and weekend Roadway operations shifts do not have on-staff any member above a supervisor rank. In order to provide guidance and direction where needed and ensure operations are running as expected to alleviate any concerns for morning traffic, the Roadways Manager and Roadways Superintendents are available on a rotational basis.



Level	Responsibilities
Roadways Day, Night, and Afternoon Work Crews	<p>Structure of standard work day: Shift 10.0 hours per day, weekend and shift work may be required Total Time: 10.0 hours per day, 80.0 hours per 2 weeks</p> <p>Breaks: Two 15 minute coffee breaks are permitted at reasonable and logical times that result in the continued efficiency of work. Any personal time taken during work hours, including computer use, phone use, or smoking breaks will be applied towards work break time.</p> <p>Work tracking: Each team member is responsible to fill out his or her own time sheet. Each lead team member of each crew is to complete and submit a standard work tracking form at the end of each day and submit it to their supervisor. The purpose of this work tracking form is to capture measurable work which includes material quantities (such as tonnes of sand and salt placed) and work completed (such as length of road/lane maintained or loads of snow removed).</p>
Roadways Engineering Technologists	<p>Structure of standard work day: Shift 8.57 hours per day, weekend and shift work may be required Total Time: 8.57 hours per day, 80.0 hours per 2 weeks</p> <p>Breaks: Two 15 minute coffee breaks are permitted at reasonable and logical times that result in the continued efficiency of work. Any personal time taken during work hours, including computer use, phone use, or smoking breaks will be applied towards work break time. An unpaid lunch break occurs at 11:30 am and goes until 12:00 pm.</p> <p>Work tracking: Each team member is responsible to complete and submit a standard work tracking form at the end of each day to their supervisor. The purpose of this work tracking form is to capture measurable work.</p>
Roadways Manager and Superintendents – All Members of the Saskatoon Civic Middle Management Association (SCMESMA)	<p>Structure of standard work day: Shift 7.85 hours per day, weekend and shift work may be required Total Time: 7.85 hours per day, 73.34 hours per 2 weeks</p> <p>Breaks: Two 15 minute coffee breaks are permitted at reasonable and logical times that result in the continued efficiency of work. Any personal time taken during work hours, including computer use, phone use, or smoking breaks will be applied towards work break time. An unpaid lunch break occurs at 12:00 pm and goes until 1:00 pm.</p> <p>Roadways Voluntary Availability:</p>

	<p>The Roadways Team has the following three guiding values: Safety, Communication, and Work-Life Balance. To achieve this, team members have a voluntary availability arrangement that utilizes horizontal collaboration and team flexibility to adapt to the changing needs of the Section and Division. Team member voluntary availability has the goal of providing coverage for Superintendent gaps as well as to provide support to Supervisors and the existing Public Works on-call system.</p> <p>Work Tracking:</p> <p>The Roadways Section works on a variety of Programs to support Public Works and insure public safety. We use project management skills to keep ourselves and our staff on track and to account for productivity. We focus on our priorities and look for opportunities to remove barriers to productivity for ourselves and others.</p>
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Utilization of staff is currently being tracked using limited tools and details. During the current year, Public Works has implemented a detailed job tracking system. Program management agrees that not all of their staff is being utilized to the fullest potential. One such example was Utility C Operators, who can only operate one piece of equipment. Program management is in the process of determining new methods to utilize their entire staff complement.

With respect to the general labor pool, there are no pre-qualification requirements to join Public Works, except for a Grade 12 diploma. Public Works also incurs significant costs (up to \$5,000) for class 1a license training for their new hires, in addition to many other staff related costs. This aspect of Program delivery will be influenced by the implementation of the tactical plan (focusing on HR). Superintendents are being required to complete a two year post-secondary diploma prior to bidding on the role. Management team and above are typically professional engineers with multiple years of experience in a related field.

b) Collaboration








A linear reporting structure existed previously within Public Works. However, more recently, Public Works has found success in moving towards a horizontal collaboration model from the Roadways Manager downwards, which is evident with the formation of Workplace Process Improvement Team (WPIT) meetings and the Roadways Steering Committee. This process has allowed personnel to collaborate horizontally through problem solving, which has been especially important during the transitional phase discussed above. Horizontal (within Public Works) and cross line of service (Logistics & Procurement, Construction & Design, Asset Preservation and Rehabilitation, etc.) collaboration will result in efficiency gains relating to Program activities. It will also reduce the communication barriers between staff and roadways management.

We verified by observing the current team structure in place and having meetings with the various levels from Supervisor through Director, that the current horizontal collaboration model was working well for the team. The utilization of horizontal structure for problem solving of operational issues could result in more wholesome strategies with buy-in from all levels, and cross line of service. Additionally, Public Works has recently integrated engineering technologists who have a keen attention for quality in the work performed, as well as, understanding of technical requirements for Program delivery.

c) Technology

Public Works is exploring a new GPS model that will allow them to increase the efficiency and effectiveness of their performance measurement tracking mechanism. The new GPS system will allow for the tracking of items such as the time it takes to perform key activities throughout the city (i.e., sanding, salting, grading, and snow removal), materials used while executing specific activities, current location of human and equipment resources, etc. Additionally, as part of weather monitoring and real time condition assessments, the City is exploring the use of temperature pucks that allow a wide variety of data to be collected. Per benchmarking with comparable cities, we were able to obtain the following screen shots. The screen shots allow us to get an understanding of the in-depth information that can be utilized by Program management.

City Of
Current Time: 2/20/2016 16:49

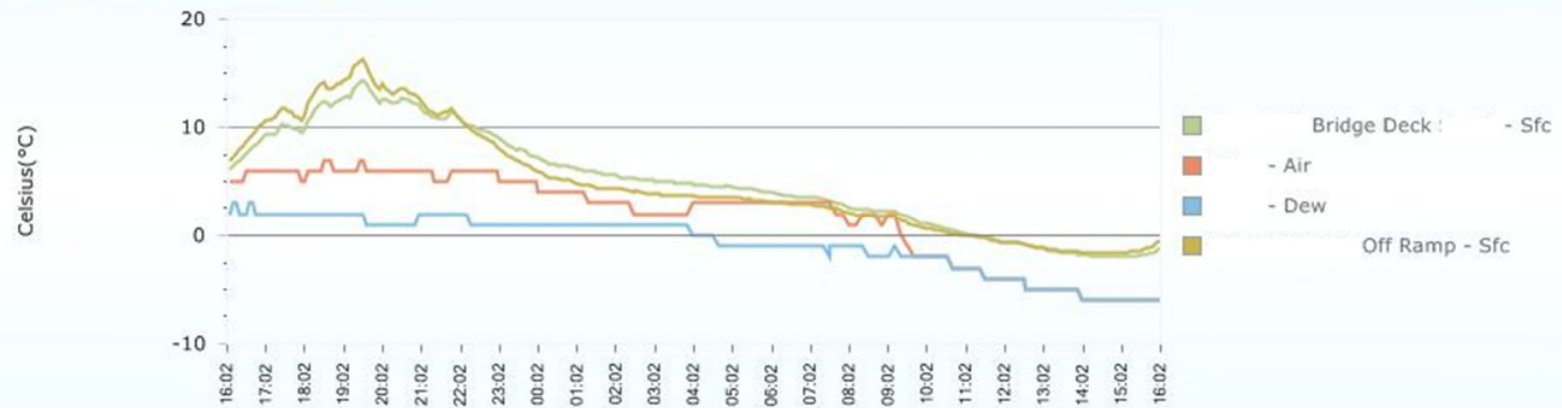
Station Summary												
	Station Name	Reading Time	Status	Sfc	Air	Dew	RH	Precip	Pc Rate	Wind Dir	Wind Spd	Vis
+		2/20/2016 16:41	DRY 	-1.6 °C	-6 °C	-6 °C	99 %	NONE	0 cmph	N	Calm	1.8 km
+		1/25/2016 15:02	WATCH 	-3.9 °C	-7 °C	-7 °C	94 %	-	-	-	-	-
+		10/21/2015 14:10	DRY 	6.4 °C	6 °C	-2 °C	55 %	NONE	0 cmph	N	-	-
+		2/20/2016 16:43	DRY 	-2.7 °C	-7 °C	-7 °C	99 %	-	-	NW	Calm	-
+		2/20/2016 16:45	DRY 	-0.7 °C	-6 °C	-8 °C	88 %	NONE	0 cmph	N	13 kph	2 km
+		2/20/2016 16:45	DRY 	-1.3 °C	-7 °C	-8 °C	93 %	NONE	0 cmph	N	7 kph	2 km
+		2/20/2016 16:45	DRY 	-1.4 °C	-7 °C	-8 °C	89 %	NONE	0 cmph	NW	9 kph	2 km
+		-	-	-	-	-	-	-	-	-	-	-

Current Time: 2/20/2016 16:52

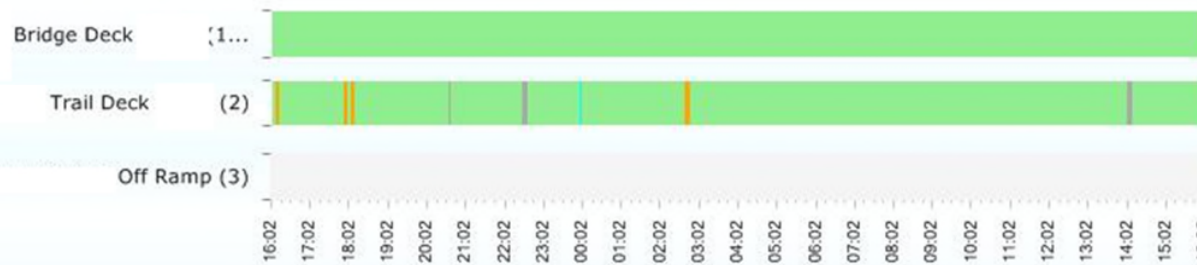
Station History Graph

[View in History Grid](#)

Temperature Readings



Surface Conditions



Sentry Warnings

Warnings

History

Warning Name	Readings Last Observed At	Warning Issued At	Next Scheduled Detection	Description
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No records to display.

d) Asset management

The Snow & Ice Management Program fleet is managed by Fleet Services, a division external to Public Works. Fleet Services currently manages the following assets which are utilized by Public Works to deliver the Snow & Ice Management Program:

- **Sanding Operations** - focus their efforts on Circle Drive and Priority 1 streets with the upcoming weather event.
 - The sanding fleet consists of a total of 23 sanders: 8 tandem sanders, 9 tandem front plow/sander combos, 2 tandem belly plow/sander combos, and 4 one-ton sanders.
- **Priority Street Plowing Operations** - completed on Circle Drive, Priority 1 and 2 outlying streets and rural roads, as required.
 - The priority street plow fleet consists of a total of 14 plows: 9 tandem front plow/sander combos, 2 tandem belly plow/sander combos, and 3 tandem belly plows.
- **Sidewalk/Pathway/Walkway Plowing Operations** - plowing operations continues with City Crews, as required.
 - The sidewalk/pathway/walkway plow fleet consists of 9 trackless sidewalk plows.

We noted that there was a lack of formal policy that could be referred to which would suggest under what circumstances an asset should remain in service as opposed to being sold off. An example of this is tandem trucks and ½ ton rear wheel drive trucks dating back to 1997 and earlier which are still in service. We also noted examples of vehicles that had 400,000 to 500,000 kilometers placed on them within a 5 year span; however, we noted no formal decision making model that would suggest what the optimal course of action would be (i.e., part ways or continue to keep asset in service and maintain). Finally, we noted that reserve build ups for future fleet replacement were not factoring in future replacement costs, which poses a risk that required fleet replacement may not be happening in a timely manner, directly impacting service delivery.

Rental payments to fleet services cover the following:

- Replacement of fleet in a timely fashion;
- Repairs and maintenance to current fleet; and
- Overhead cost of fleet services.

Fleet Services should be included in level of service discussions. They support up to 50 different divisions and are essential to allow Program delivery. Fleet Services is currently working on setting up a live feed within their own building that will enable Public Works to monitor the status of their fleet while it is in the maintenance queues at Fleet Services.

Public Works is not managing inventory in their EPICOR enterprise resource planning system. Current inventory tracking takes place on various Excel spreadsheets. We consider this to be an opportunity for operational improvement. Other municipalities are utilizing cost effective technologies to keep track of their inventory, such as drones for monitoring aggregate piles and weigh scales for sites. Another area of concern is sample testing to check quality specifications for inventory purchased for Program delivery as it is currently not a practice of Program management. Lastly, we noted that the related inventory software hadn't been upgraded since 2010 and was 8 versions outdated.

Appendix F – Interview list

Department/Cities	Interviewees
Department of Public Works City of Winnipeg	Streets Maintenance
Department of Public Works City of Calgary	Planning and Infrastructure Maintenance
Department of Public Works City of Edmonton	Contracts and Materials
Department of Public Works City of Regina	Winter Maintenance
Department of Public Works City of Saskatoon	Roadways Maintenance Logistics and Procurement Operations Engineer, Construction and Design Operations Superintendent Operations Supervisor Fleet Services Health and Safety Communications and Marketing
Department of Facilities and Fleet Management City of Saskatoon	Fleet Services Accounting Coordinator

Appendix G – References and documents obtained

Description
Winter Road Maintenance Level of Service
2012-2015 Budget
Public Works Organizational Chart
2015 Civic Services Survey
Strategic Plan 2013-2023
Snow Grading and Removal on Residential Streets
2013-2015 Staffing and Overtime
2013-2015 Overtime
Citizen Complaints 2013-2015
Snow and Ice Contracts
Equipment Rates
Code of Conduct
Fleet Services Bylaws
Snow and Ice Communications Plan
Public Works 2016 Tactical Plan
Public Works Capital Budget
Public Works Safety Program
Roadways Scheduling
Snow & Ice Policy Matrix
Strategic Traffic Safety Action Plan
Weather Scoring Chart
WPIT Meeting Communication Strategy and Plan