PUBLIC SECTOR DIGEST

Public Sector Digest (PSD) is a consulting firm specialized in enterprise asset management and budgeting for local governments. Their capabilities include research, consulting and software. PSD’s research division produces a monthly digital and quarterly print publication – the Public Sector Digest – as well as webinars, case studies, grant applications, and applied research projects.

CANADIAN WATER NETWORK

Canadian Water Network (CWN) is Canada’s trusted broker of research insights for the water sector. When decision-makers ask, ‘What does the science say about this?’ they frame what is known and unknown in a way that usefully informs the choices being made.

CANADIAN WATER AND WASTEWATER ASSOCIATION

Canadian Water and Wastewater Association (CWWA) is a non-profit national body representing the common interests of Canada’s public sector municipal water and wastewater services and their private sector suppliers and partners.
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EXECUTIVE SUMMARY

In 2017, Public Sector Digest (PSD), Canadian Water Network (CWN), and the Canadian Water and Wastewater Association (CWWA) partnered on a national study of municipal asset management practices to identify and assess what data is being collected by Canadian utilities on water, wastewater, and stormwater assets, and how this information is being used to inform operations and long-term planning decisions. The study included a national survey of municipal asset managers and water system managers, as well as in-depth interviews with utilities that had more advanced asset management programs.

The purpose of the study was to better understand current asset data collection and analysis in Canada for water, wastewater, and stormwater systems and to identify strategies to improve operations and planning outcomes.

This study is unique in a Canadian context as it focuses on the capacity side of asset management planning, rather than technical practices or operational outcomes. At the national level, several studies have measured the state of municipal infrastructure in Canada — such as the Canadian Infrastructure Report Card — but few have looked at asset management at the local level. Several municipal associations have measured progress within their own jurisdictions. For example, PSD partnered with the Association of Municipalities of Ontario (AMO) in 2015 to complete an analysis of 93 municipal asset management plans, which highlighted recent progress in asset management capacity and identified a need for further work (AMO, 2015). A follow-up study to this earlier research will be published by AMO later this year.

PSD, CWN, and CWWA’s national survey showed that Canadian municipalities, small and large, are increasingly employing asset management practices. Smaller municipalities consistently reported fewer dedicated resources for implementation and also reported that asset data was updated less frequently. Small municipalities were also more likely (relative to larger municipalities) to indicate lacking a formal asset management plan or indicate that they were still in the process of developing one. This is not surprising given the lower capacity and resourcing for asset management in smaller municipalities/utilities.

Despite these capacity differences, both large and small municipalities/utilities rely more heavily on reactive and time-based asset interventions rather than proactive interventions. Thirty-nine percent of respondents indicated that more than 50 percent of decisions were reactive, indicating that asset management capacity and resourcing alone does not guarantee better predictive outcomes. While the higher proportion of reactive maintenance may more accurately reflect the current state of infrastructure than a municipality/utility’s capacity or maturity of asset management practices, reactive maintenance ultimately limits a municipality/utility’s ability to plan long-term.

When asked what data would be most important to reduce reactive maintenance, inform planned maintenance activities, and support long-term infrastructure planning, municipalities of all sizes indicated assessed condition data would be most useful. Despite this, when asked to report on the approximate reliability of captured condition data for water system assets, 65 percent of respondents indicated that 50 percent or less of their collected data is objective (i.e., accurate field condition data). The majority of survey respondents reported that subjective data/analysis (e.g., relying on age-based asset data) comprises a large portion of their asset database and that accurate (or actual) condition assessments are not routinely collected. Thirty-eight percent of respondents have
condition data for more than 75 percent of their vertical assets, but only 28 percent have condition data for more than 75 percent of linear assets.

Without a sufficient level of confidence in collected asset data, an accurate view of the state of infrastructure and operations is incomplete, which makes decision-making more challenging. However, it is inefficient and potentially costly to collect high-quality condition data on every aspect of a water system, especially on components that provide little ability to predict maintenance needs. Finding the right balance between collecting high-quality condition data and understanding when other less-intensive means of data collection and analysis may be sufficient is an important aspect to implementing effective asset management practices.

The results of the national survey indicate good adoption of municipal/utility asset management plans across Canada, and the application of asset data to inform decisions on performance, cost optimization, and risk reduction. However, the results have also highlighted a significant shortcoming in the reliability of the data captured in municipal/utility asset management databases, leading to some uncertainty in how effective this data is for decision-making. Support and incentives over the last decade from upper-levels of government and others have focused on the development of asset management plans, which has largely been responsible for the increased number of asset management plans employed at the local level in Canada. However, as more municipalities/utilities begin to adopt asset management plans, there is an opportunity to shift support, capacity, and incentives from plan development to optimizing data collection practices and building capacity to maintain data collection on an ongoing basis. Focusing on improving the quality and reliability of data will be key to achieving robust asset management plans. Good quality data will help support decisions and lend confidence to municipalities/utilities that the right decisions for operations, maintenance, and planning are being made.

**EXPERT INSIGHT**

“The results of this study are informative and timely as Windsor commences work on their 2018 AMP. Some of the results will prove helpful for our report to reference experiences of other municipalities similar to ours and could be leveraged to continue to enhance our asset management plans and practices.”

— Melissa Osborne, Senior Manager Asset Planning, City of Windsor
Vice Chair, Canadian Network of Asset Managers
KEY INSIGHTS

- **60 percent** of survey respondents indicated that asset inventory data is collected and analyzed to inform decisions about performance, cost optimization, and risk reduction.

- Municipalities of all sizes indicated that the most important data to inform planned initiatives, reduce reactive maintenance, and develop long-term infrastructure plans is **assessed condition data**.

- **65 percent** of respondents indicated that 50 percent or less of the data collected is objective data (i.e., accurate field condition data).

- Only **half** of the respondents indicated that they update their asset data at least every six months. Some municipalities are developing data governance standards to facilitate more regular updates to asset inventory data.

- The top three approaches reported by respondents for prioritizing asset investments:
  - Risk-based approach (financial, regulatory and technical risks) – **83%** of respondents
  - Fiscal approach (government taxes and expenditures) – **66%** of respondents
  - Asset lifecycle costing approach – **52%** of respondents

- ‘Political priorities’ was listed more frequently among smaller municipalities as an approach used to prioritize investments.

- **22 percent** of respondents, primarily smaller municipalities (<80,000), indicated that a completely reactive approach is used to prioritize investments.

- Larger municipalities typically have **dedicated asset management staff**, which allows for more frequent updates to asset management plans (AMPs) and asset inventory data. The majority of smaller municipalities (<80,000) surveyed indicated limited staff resources dedicated to asset management.
NATIONAL CONTEXT

With Canada’s mounting infrastructure deficit, increased investment has become a priority for all levels of government. The federal government has invested billions of dollars in Phase 1 of its $186 billion National Infrastructure Plan. The rollout of Phase 2 is currently being negotiated with the provinces and territories, and agreements will be signed by the end of the first quarter of 2018 (Infrastructure Canada, 2018a). Two billion dollars of federal funds have been allocated to the Clean Water and Wastewater Fund (Infrastructure Canada, 2016), which targets projects that rehabilitate water treatment and distribution infrastructure and existing wastewater and stormwater treatment systems, as well as improved asset management, system optimization, and planning for future upgrades. The federal government also recently established the Canada Infrastructure Bank to support new infrastructure projects across the country. Provincial and territorial governments have been matching some of these federal investments and launching their own programs. At the local level, some municipalities have introduced dedicated tax levies for infrastructure renewal.

The increasing frequency and severity of extreme weather events are putting added strain on our water-related infrastructure. Accurate asset condition data is more difficult to ascertain for underground infrastructure than for above-ground assets, often limiting the quality and quantity of linear asset data available to decision-makers. However, through innovative and standardized approaches to condition assessments, municipalities can generate data that will help inform their decisions. Combined with accurate asset replacement costs and risk assessments, good data empowers municipalities to do the right thing, to the right asset, at the right time, thereby reducing costs and allowing cities to “size” their infrastructure appropriately. Effective asset management is critical, given the significant health and safety risks associated with asset failure. Canada’s municipalities need to have a clear understanding of the value and condition of their assets to prioritize maintenance, upgrades, and new builds accordingly.

ISO 55000 defines asset management as, “the coordinated activity of an organization to realize value from assets.” In Canada, asset management came into greater focus at the municipal level in 2009, when the Public Sector Accounting Board introduced its new accounting standard PSAB 3150, which required municipalities to account for their tangible capital assets on an annual basis (Public Sector Accounting Group, 2007). Several provinces and the federal government have since introduced asset management planning requirements to promote maturity in the sector, and last year the Federation of Canadian Municipalities (FCM) launched the Municipal Asset Management Program (MAMP), a five-year $50 million program funded by the Government of Canada to assist municipalities in building asset management capacity.

Canada is not alone in its efforts to strengthen asset management practices at the local level. A 2015 study completed by Hukka and Katko (2015) analyzed current approaches to “resilient asset management and governance for deteriorating water services infrastructure” across several OECD countries (p.112). The study found that asset management planning requirements for municipalities were in place in England, Australia, and Canada. Since this study was published, some U.S. states have also moved ahead with asset management legislation. Michigan now requires municipalities and utilities to submit asset management plans for drinking water, wastewater, and stormwater systems by January 1, 2018. Ohio recently enacted Bill 2, which will require all public drinking water systems in the state to prepare an asset management plan by October 1, 2018.
METHODOLOGY

A national survey was sent to municipal water, wastewater, and stormwater utilities across Canada. A leading advisory committee of experts and practitioners helped to refine the scope of the research, reviewed the survey results, and contributed to the report’s findings. Interviews were also conducted with municipalities and utilities with more advanced asset management programs, which are highlighted in two case studies.

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The information conveyed in this report does not necessarily represent the views of the contributors’ employers.
RESULTS AND ANALYSIS

The survey included 23 questions in three sections: water services, asset management data, and infrastructure decision-making (see Appendix). The survey was sent to municipalities and utilities across the country in April 2017. The respondents were encouraged to work collaboratively with multiple departments when completing the survey to capture a complete picture of asset management practices. Fifty-nine municipalities/utilities, who provide water services to 53 percent of Canada’s population, completed the survey. All ten provinces were represented, with respondents providing services to populations ranging from 153 to 2.8 million people (see Table 1).¹ This sample provides an informative snapshot of current municipal asset management practices across the country.

<table>
<thead>
<tr>
<th>Province</th>
<th># of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>32</td>
</tr>
<tr>
<td>AB</td>
<td>7</td>
</tr>
<tr>
<td>MB</td>
<td>4</td>
</tr>
<tr>
<td>BC</td>
<td>3</td>
</tr>
<tr>
<td>SK</td>
<td>3</td>
</tr>
<tr>
<td>NL</td>
<td>3</td>
</tr>
<tr>
<td>NS</td>
<td>2</td>
</tr>
<tr>
<td>PE</td>
<td>1</td>
</tr>
<tr>
<td>QC</td>
<td>1</td>
</tr>
<tr>
<td>NB</td>
<td>1</td>
</tr>
</tbody>
</table>

² Note: All 59 respondents provided serviced population information, but two respondents did not provide their location, as reflected in the charts above.
SUMMARY OF SURVEY RESULTS

- Approximately half of all surveyed municipalities/utilities have a formal asset management plan, but several more are currently in the process of creating or formalizing a plan.

- Municipalities/utilities of all sizes indicated that assessed condition data is the most important data for developing long-term infrastructure plans, informing planned maintenance activities and reducing reactive maintenance.

- Many of the surveyed municipalities/utilities have limited assessed condition data in their asset databases and rely more heavily on subjective condition data. Larger municipalities collect data using more objective methods and generally reported greater confidence in data reliability.

- A majority of respondents reported that they have asset replacement cost information as well as component level asset data in their inventories, which supports more accurate asset management planning. More than half indicated that they frequently update their asset data (i.e., at least every six months), which contributes to higher quality asset databases.

- The top three approaches listed by municipalities/utilities for prioritizing asset investments are:
  - Risk-based considerations (i.e., financial, regulatory, and technical risks) – 83% of respondents
  - Fiscal considerations (i.e., government taxes and expenditures) – 66% of respondents
  - Asset lifecycle costing – 52% of respondents

- Twenty-two percent of survey respondents — primarily smaller municipalities with a population under 80,000 — indicated that a completely reactive approach is used to prioritize investments.

- The vast majority of respondents use specialized software to facilitate various asset management functions. They indicated that they are most satisfied with the data management function of their software and least satisfied with its analysis and integration capabilities.

- Larger municipalities typically have dedicated asset management staff, which allows for more frequent updates to asset management plans and asset inventory data. The respondents reported that the majority of these staff participate in data collection but utilizing the collected data for decision-making and collaboration is less common.

- Most municipalities/utilities have cross-departmental access to asset databases using GIS or asset management software, which indicates that the potential for greater corporate-wide collaboration in asset management planning and decision-making is possible.
ASSET MANAGEMENT OUTCOMES

Good data is the foundation for asset management programs. There should also be processes in place to support the continued use of up-to-date data. When asked what outcomes they are achieving using asset data, the majority of survey respondents (65%) indicated that they are using data to “sustain performance, optimize costs, and reduce risks” (Figure 1). Most respondents also indicated that they are achieving more than one outcome as a result of their asset data. Approximately half of the respondents reported achieving other positive outcomes, including “managing assets to optimize lifecycle” (55%), “optimizing capital investments” (51%), and “developing strategic long-term goals” for their respective organizations (49%).

When considering population size, municipalities/utilities serving smaller populations indicated multiple positive outcomes despite the limited capacity for asset management. Of the respondents that service fewer than 80,000 people, the least commonly reported outcome was “developing strategic long-term goals for your organization.” Without a corporate asset management team, small communities must often rely on existing staff to conduct asset management work in addition to performing regular duties. An asset management policy helps define roles and responsibilities, ensuring that longer-term asset management outcomes can be achieved — even in smaller communities — with support and direction from existing staff. Involving City Council in the development of the asset management policy and strategy will help build Council buy-in for the asset management program.

Figure 1 Outcomes Achieved with Asset Data

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing assets to optimize asset life cycle</td>
<td>55%</td>
</tr>
<tr>
<td>Sustaining performance, optimizing costs, reducing risks</td>
<td>65%</td>
</tr>
<tr>
<td>Optimizing capital investments and plans for sustainability</td>
<td>51%</td>
</tr>
<tr>
<td>Developing strategic long term goals for organization</td>
<td>49%</td>
</tr>
</tbody>
</table>
ASSET MANAGEMENT CAPACITY

Without support from grant funding, it may be difficult for some municipalities to implement an AMP and allocate dedicated resources to corporate asset management (Table 2). Overall, the greatest number of survey respondents (37%) indicated that they have “limited staff” dedicated to asset management, with an additional 9 percent indicating that they have “adequate staff but no dedicated individual/team.” In most cases, this means existing staff are spending an insufficient amount of time on asset management as they are responsible for other duties. However, 32 percent of respondents indicated that they have a “dedicated team” for asset management and another 15 percent reported having a “dedicated employee.” Just 7 percent of respondents reported having no staff available for work related to asset management, indicating that despite resource constraints, the majority of communities are finding ways to assign some resources to asset management programs. Although asset management does require an upfront investment of time and resources, a properly implemented asset management program can result in significant cost savings over the long term for local governments and utilities.

EXPERT INSIGHT

“Good asset data is essential to the understanding of level of service provision, often measured through outcomes achieved, such as the balance between overall performance, risk and cost metrics.”

— John Murray, General Manager of Asset Management, PSD Inc.
Chair, Canadian Network of Asset Managers

Table 2 Asset Management Staffing Capacity

<table>
<thead>
<tr>
<th>Staffing Capacity</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>No staffing</td>
<td>7</td>
</tr>
<tr>
<td>Limited staff</td>
<td>37</td>
</tr>
<tr>
<td>Adequate staff but no dedicated individual/team</td>
<td>9</td>
</tr>
<tr>
<td>Part-time employee</td>
<td>0</td>
</tr>
<tr>
<td>Dedicated employee</td>
<td>15</td>
</tr>
<tr>
<td>Dedicated team</td>
<td>32</td>
</tr>
</tbody>
</table>
There is a positive correlation between the population size served by a municipality/utility, and the asset management staffing capacity within each organization. This is unsurprising given the advantages that larger municipalities have, such as larger operating budgets and economies of scale. The majority of those who indicated that they have a dedicated team for asset management have service populations greater than 80,000 people, whereas the majority of those who indicated that they have limited staffing capacity serve populations of less than 80,000 people (Table 3). Only those respondents that serve populations of less than 80,000 people indicated that they currently have no staff working on asset management. Of note is that one respondent that serves less than 10,000 people reported having a dedicated asset management team in place.

<table>
<thead>
<tr>
<th>Population (000's)</th>
<th>Dedicated team</th>
<th>Dedicated employee</th>
<th>Limited staff</th>
<th>Adequate staff</th>
<th>No staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10-80</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>80-500</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>500+</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total frequency</td>
<td>19</td>
<td>9</td>
<td>22</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Having a dedicated asset management employee or team is likely to improve asset management outcomes for a community. Regardless of staffing resources, clear priorities and responsibilities can help direct daily activities, leading to increased efficiency and productivity. When asked about the duties of staff associated with asset management, the majority of respondents indicated that staff have a combination of key responsibilities (Figure 2). Of those indicating that staff have one primary asset management responsibility, 21 percent pointed to collecting and managing asset data, while just 2 percent of respondents reported that using asset data for planning/decision-making is the sole asset management duty of staff.

**EXPERT INSIGHT**

“In order gain more capacity for asset management data collection, municipalities can work closely with graduate students and professors with a research focus on engineering asset management. This will enhance the analysis capabilities of the users while giving graduate students opportunities to practice what they have learned in research labs. Funding agencies such as NSERC and MITACS can help cover some costs of these graduate students.”

— Ming Zuo, Professor, University of Alberta
Of those respondents serving a population greater than 80,000, most answered that their asset management staff were responsible for collaborating with other divisions and departments (in addition to other asset management responsibilities). In a larger organization, cross-departmental coordination can promote enterprise-wide buy-in for the corporate asset management strategy, as well as facilitate the collection and analysis of asset data from across departments for inclusion in corporate asset management planning. As discussed in the Guelph case study contained in this report, cross-departmental coordination can also strengthen Council buy-in for asset management initiatives, presenting a united front and demonstrating the corporate-wide benefits that can be achieved through asset management.

**Figure 2 Key Responsibilities of Asset Management Staff**

To facilitate cross-departmental collaboration in asset management, access to asset data is paramount. When asked which departments have access to their organization’s asset inventory data, almost all survey respondents indicated that either all their departments have access or that access was mainly provided to finance and public works/operations. Respondents also indicated that access is primarily facilitated through GIS and asset management software tools and that the data is accessed to inform asset management plans, operations activities, and capital planning. It is evident that surveyed municipalities do recognize the importance of cross-departmental coordination in asset management and have processes in place to support this. What is needed is better data to be shared across departments.
ASSET MANAGEMENT PLANNING

With renewed Federal Gas Tax Fund agreements requiring municipalities in each provincial/territorial jurisdiction to meet specific asset management planning deadlines (Infrastructure Canada, 2018b), developing an AMP has become a key priority for communities across the country. An AMP is a strategic resource for a municipality to communicate the state of its infrastructure, plan for lifecycle activities over the long term, and ensure that those activities will be funded. A robust AMP will also incorporate risk analysis and levels of service to help prioritize community infrastructure projects.

While 51 percent of survey respondents reported having completed an AMP, only 19 percent reported updating their plan on an annual basis (Table 4). 15 percent indicated that they do not currently have an AMP in place, while 34 percent responded “other”, indicating that they are in the process of developing or implementing an AMP. These survey results suggest that at the time of the survey, almost half of the responding municipalities were not yet implementing a formal asset management plan. Larger municipalities (> 80,000 population) tend to update their AMPs more frequently and generally have greater capacity to complete regular asset management activities. Municipalities with fewer than 80,000 people are more likely to lack an AMP, or to be currently working toward completing their first AMP.

<table>
<thead>
<tr>
<th>Frequency of AMP update</th>
<th>% of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 6 years or more</td>
<td>2</td>
</tr>
<tr>
<td>Every 4-5 years</td>
<td>17</td>
</tr>
<tr>
<td>Every 2-3 years</td>
<td>13</td>
</tr>
<tr>
<td>Annually</td>
<td>19</td>
</tr>
<tr>
<td>No AMP</td>
<td>15</td>
</tr>
<tr>
<td>Other (first AMP in process)</td>
<td>34</td>
</tr>
</tbody>
</table>

Within some jurisdictions, municipal AMP completion rates are nearing 100 percent as a result of legislative and funding requirements. According to the Ministry of Infrastructure, 95 percent of Ontario’s municipalities currently have an AMP in place. The next step for these communities is to ensure that the AMP is informed by accurate data and built into the municipality’s ongoing asset management program for greater sustainability and improved decision-making. The frequency with which the AMP is updated will matter less than the quality of the data captured in the plan and the capacity for the municipality to use the AMP data for decision-making. More advanced jurisdictions are also requiring that municipal asset management planning be integrated with other strategic plans and studies. In Ontario, municipalities are required to incorporate proposed new development — as captured in development charge studies — into their asset management plans to ensure the added long-term costs to maintain and replace new infrastructure is taken into consideration in capital planning. This helps ensure that longer term sustainability goals for the community can be achieved.
ASSET MANAGEMENT TOOLS

Asset management software can assist municipalities and utilities with hosting cross-departmental asset data in one place and facilitating efficient and frequent updates to asset data. The vast majority of survey respondents (90%) reported using specialized software to facilitate various asset management functions (Figure 3). 67 percent of survey respondents indicated that they use software programs for the collection and analysis of tangible capital asset inventory data, making it the most popular use of asset management software. 53 percent of respondents reported using software to track asset maintenance work orders and 48 percent reported using software for infrastructure capital planning and analysis using asset inventory data. Just 10 percent of respondents indicated that no specialized software programs are used for asset management (i.e., other than Microsoft Excel).

Of the respondents that do not use specialized software, one respondent serves a large population (>500,000), while the remaining five respondents serve populations less than 80,000. 71 percent of respondents using software to track asset maintenance work orders service populations greater than 80,000 people.

When asked to describe the effectiveness of the software programs utilized for asset management, respondents were most satisfied with the data management functions of the software (searches, data sorting, etc.) and the accessibility of software to multiple users. Respondents were least satisfied with the analysis/reporting capabilities of software and integration with other management software. This lack of integration may contribute to the difficulty in translating asset data into strategic planning and decision-making. One respondent commented, “There are many software packages available that do not seem to be compatible with existing GIS systems used by the City. Asset management software should be compatible with existing GIS systems to cut down on rework by City administration.”

<table>
<thead>
<tr>
<th>Figure 3 Software Used to Facilitate Asset Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>No software programs used for asset management 10.3%</td>
</tr>
<tr>
<td>Software programs used for the collection and analysis of tangible capital asset inventory data 67.2%</td>
</tr>
<tr>
<td>Software programs used for infrastructure capital planning and analysis using asset inventory data 48.3%</td>
</tr>
<tr>
<td>Software programs used for tracking asset maintenance work orders 53.5%</td>
</tr>
<tr>
<td>Other 20.7%</td>
</tr>
</tbody>
</table>

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ASSET MANAGEMENT DATA

Collecting and inventorying asset data is a significant challenge for most communities across the country. Many municipalities originally implemented asset management practices as an accounting exercise to ensure compliance with PSAB 3150, but are now interested in adding more meaningful asset data to their inventories and achieving benefits from their asset management programs. While two survey respondents indicated that they currently have no asset inventory in place (both communities with populations less than 10,000), 73 percent of respondents reported having more than 75 percent of their linear assets in an inventory, and 61 percent reported having more than 75 percent of their vertical assets in an inventory.

An asset inventory that segments assets into individual components (e.g. segments of a pipe) provides a municipality with far greater analytical capability, supporting more fine-tuned long-term planning. Figure 4 depicts the population distribution of survey respondents according to whether they have assets broken down into components within their inventories. Overall, 78 percent and 61 percent of respondents have asset component data for their linear and vertical assets, respectively. Only one respondent that serves a population greater than 500,000 reported not having component-level data for assets.

In addition to creating inventories of assets, determining the value of those assets is critical to sound decision-making. Replacement cost data allows municipalities to calculate the true value of an asset based on what it would cost to replace it, compared to the more readily available historical cost of the asset (which relies on inflation calculations to determine present value). The replacement cost of an asset is particularly difficult for small and rural communities to calculate as they have fewer local price comparisons to draw from. Despite these limitations, 60 percent and 55 percent of respondents reported having replacement costs for linear and vertical assets, respectively. The survey demonstrated that among the largest municipalities (>500,000 population), the majority have replacement costs for assets, whereas in smaller communities, municipalities are less likely to have this information (Figure 5 depicts asset inventory information for both vertical and linear assets).
Like replacement cost data, actual asset condition data can be challenging to collect but has a significant impact on the accuracy of asset management planning. According to the Association of Municipalities of Ontario (2015) Roads & Bridges Study prepared by Public Sector Digest “evidence indicates that assets with condition ratings are performing better than their age and expected useful life would suggest” (p.2). The study, which analyzed 93 municipal AMPs across Ontario, found that when field condition data is replaced with only subjective age-based condition data, the percentage of assets in poor condition increases and the percentage of assets in fair or better condition decreases for each asset class. Gathering more field condition data can yield a more accurate picture of the state of a community’s infrastructure and may provide a more realistic outlook.

In this study, few respondents reported having no captured condition data, but a large proportion of respondents reported having condition data for less than 50 percent of their total assets (Figure 6). In particular, there was a high proportion of respondents (48%) that had condition data for less than 50 percent of linear assets. Collecting condition data for underground linear assets is typically more difficult and costly than for water and wastewater facilities (vertical assets). This is further supported by our survey results, which indicate that 38 percent of municipalities have captured condition data for more than 75 percent of their vertical assets, while only 28 percent have condition data for more than 75 percent of their linear assets.

**EXPERT INSIGHT**

“It’s not cost-effective to strive for gap-free asset data registers, or arguably for 100% coverage of CCTV inspection of gravity sewers, but utilities certainly need enough data to make good decisions and avoid interventions too early or too late. How much is enough, when you consider that collecting and troubleshooting data costs lots of money?"  

— Colwyn Sunderland, Specialist in Asset and Demand Management, Kerr, Wood and Leidal
Programs like FCM’S Municipal Asset Management Program provide funding for municipalities to conduct more condition assessments to improve asset data quality and accuracy. Condition assessment protocols and data-gathering tools can also assist municipalities and utilities in the effort to collect, sort, and make use of accurate condition data more efficiently.

Figure 6 Percentage of Assets with Captured Condition Data, by Asset Type

When asked to report the approximate reliability of captured condition data for water system assets, 65 percent of respondents indicated that 50 percent or less is objective data (accurate field condition data). As evidenced in the AMO Roads & Bridges Study referenced above, this lack of quality condition data can result in a significant over or under estimate of the replacement needs of pipes and other infrastructure. Furthermore, when asked what information — which is not currently being collected in your asset management data — would be most helpful to further reduce unplanned (reactive) initiatives, the majority response was “actual condition data” or “condition assessments”, indicating a potential confidence issue in the data currently contained in municipal asset databases. The effectiveness of an asset management plan, or any other strategy or process that utilizes asset inventory data, will largely depend on the quality of the data that is used to populate it.

EXPERT INSIGHTS

“The collection of condition data is a trade-off. As discussed in the Halifax case study included in this report, more condition data is not always better. There is no need to collect it on assets that aren’t very important, or for which condition data doesn’t help predict anything.”

– Neil Montgomery, Strategic Business Manager for Reliability and Sustainability, Canadian Bearings Ltd.
Data quality is often dependent on the methodology of data collection/verification and how up-to-date the data is. Approximately half of the respondents (58%) indicated that they frequently update their asset data (i.e., every six months) and approximately one third (32%) have their asset data collected and verified by a dedicated internal asset manager (or equivalent). Just 7 percent of respondents reported having an independent third party verify their asset data. Respondents serving all population sizes reported frequently updating asset information and using either an internal or external resource to verify asset data (Figure 7). Those respondents that indicated they did not frequently update or verify asset data suggested that a new process is under development. One respondent provided the following comment, indicative of a challenge that may be facing many municipalities: “We struggle with data governance and there are significant delays in asset data updating. We have a Data Governance Standards project underway to assist with this issue.”

![Figure 7 Quality of Organization's Asset Inventory Data, by Population](image)

**INFORMED DECISION-MAKING**

An asset management team facilitates a sustainable asset management program, which in turn supports good governance. A good AMP helps focus planned maintenance activities and is an effective communication tool for city councils and the public. When populated by sound data, properly implemented asset management software tools can help facilitate regular updates to an AMP and strengthen the analytical capacity of an asset management team. Ultimately, these tools, strategies, and drivers should inform the decision-making process that occurs at the departmental and corporate levels regarding municipal assets. When asked what percentage of recent asset maintenance, repairs, and replacements have been attributed to reactive decision-making, 39 percent of respondents indicated that more than 50 percent of decisions were reactive. 13 percent of respondents indicated that more than 50 percent of recent asset interventions were proactive, whereby the organization predicts, plans, and schedules the asset intervention. Two respondents
made 100 percent of recent asset intervention decisions reactively, while one respondent made 75 percent of recent decisions proactively (the most of any respondent). To a lesser degree, respondents indicated that recent asset intervention decisions were also attributed to the following decision criteria: time-based, reliability-based continuous improvement, and precision maintenance.

There was no observed correlation between served population size and the percentage of recent asset interventions attributed to proactive decision-making. Both large and small municipalities/utilities rely more heavily on reactive and time-based interventions, with some outliers in all population bands. It is important to note that the higher proportion of reactive maintenance may not necessarily indicate the maturity of asset management functions within a municipality. Instead, this may more appropriately reflect a municipality’s current state of infrastructure. As highlighted in the Canadian Infrastructure Report Card, a large portion of municipal water, wastewater, and stormwater assets are in fair, poor, and very poor condition, which could be leading to much of the reactive interventions of a municipality. More reactive interventions may ultimately limit a municipality’s ability to develop longer-term maintenance plans, maintain levels of service, and optimize system performance.

EXPERT INSIGHT

“A goal of asset management is to arrive at the correct maintenance strategy for assets, taking into account business factors, risk, technology, criticality, and so on. I would even go further and suggest that the whole field of asset management arose in part as a reaction to maintenance and reliability tactics ignoring the wider business context.”

– Neil Montgomery, Strategic Business Manager for Reliability and Sustainability, Canadian Bearings Ltd.

ASSET MAINTENANCE – WATER

For individual assets, respondents report conducting the most predictive maintenance on their buildings, pumps, pipes, storage tanks, valves, and hydrants. Conversely, wells and well fields receive the least reactive maintenance of the listed water assets. For one respondent, 80 percent of their yearly operating costs associated with storage tanks can be attributed to predictive maintenance. One outlier exists in relation to water meters, with a respondent indicating that 95 percent of yearly operating costs for water meters can be attributed to predictive maintenance.

According to the 2011 International Infrastructure Management Manual, predictive maintenance refers to “condition monitoring activities used to predict failure,” while preventative maintenance refers to “maintenance that can be initiated without routine or continuous checking (e.g., using information contained in maintenance manuals or manufacturer recommendations) and is not condition-based” (NAMS & IPWEA, 2011, n.p). Preventative maintenance on water assets generally consumes a larger portion of annual operating budgets than predictive maintenance. For seven respondents, more than 50 percent of the operating budget for storage tanks goes to preventative maintenance. Well fields receive the least preventative maintenance work, with 11 respondents indicating that zero percent of their operating budget goes to preventative maintenance on these
assets. Not surprisingly, reactive maintenance receives the largest portion of annual operating budgets for water assets. For buildings, pipes, and valves, at least 25 percent of respondents have allocated more than 50 percent of operating budgets to reactive maintenance.

**ASSET MAINTENANCE – WASTEWATER**

For wastewater assets, respondents reported a similarly limited budget allocation to predictive maintenance activities. Wastewater lagoons had the highest number of respondents indicating that more than 50 percent of their operating budget went toward predictive maintenance activities (five respondents). However, that same asset type also had the highest number of respondents reporting no budget for predictive maintenance (eight respondents).

Compared to water assets, a higher number of respondents reported more than 50 percent of operating costs going toward preventative maintenance for wastewater assets. Wastewater pumping stations appear to receive the most preventative maintenance work, with 29 percent of respondents reporting that 50 percent of operating costs for pumping stations went toward preventative maintenance.

Finally, manholes and miscellaneous equipment each received more than 50 percent of operating costs for reactive maintenance for more than 25 percent of respondents.

**EXPERT INSIGHT**

“Reducing the level of reactive maintenance is the most immediate opportunity for improving many performance metrics. Doing more predictive maintenance is necessary to find issues and remove the sources demanding high-level maintenance decisions.”

— Dr. Klaus Blache, Research Professor, Industrial Systems Engineering
Director of Reliability and Maintainability Centre, University of Tennessee

**USING DATA TO SUPPORT PLANNED INITIATIVES**

Proper asset management practices should help an organization decrease the percentage of operating costs attributed to reactive maintenance and increase the percentage of operating costs attributed to planned initiatives, while decreasing spending overall through the extension of asset useful life. It is important to note that an asset management program may not always lead to cost savings. Programs may identify that greater investments in operations or infrastructure may be required to meet the desired levels of service determined by Council, staff, and the public. Nevertheless, with better data and the capacity to derive insights from that data, municipalities and utilities can plan and optimize lifecycle activities throughout the year. For water, wastewater, and stormwater assets and for municipalities of all sizes, the highest number of respondents indicated that age and condition assessment data were the most important types of asset management data currently used to inform planned initiatives (Figures 8-10). They also indicated that the number of breaks was important, particularly for water assets. Among respondents selecting age as a data type used to inform planned initiatives, those respondents serving a population of fewer than 80,000 people made up the majority for water, wastewater, and stormwater asset categories.
Figure 8 Types of Data Used to Inform Planned Water Initiatives, by Population

- Serviced population ranges (000's)

Figure 9 Types of Data Used to Inform Planned Wastewater Initiatives, by Population

- Serviced population ranges (000's)
When it comes to utilizing data to minimize reactive initiatives, survey respondents pointed to age and condition data most frequently. In the case of wastewater initiatives, however, condition was the most frequently reported dataset. When asked what information would be most helpful in further reducing reactive initiatives, the highest number of respondents answered condition assessment data (15 respondents each for water and wastewater, 14 for stormwater). For water initiatives, respondents also pointed to risk, pressure information, GIS data, and leak detection as desired datasets. For wastewater, respondents reported GIS data, replacement costs, and level of service datasets as valuable additions to further reduce reactive initiatives. Finally, for stormwater assets, soil and water assessments, material type, and climate change impact datasets were reported as information that would be helpful in reducing reactive initiatives for respondents.

PRIORITIZATION OF INVESTMENTS

Better asset data, supported by stronger asset management practices, serves to optimize lifecycle activity planning for an organization and can also facilitate the effective prioritization of asset investments. A key component of an AMP is the financial strategy, which informs the organization’s long-term approach to financing its infrastructure needs. This can incorporate data from various sources, such as the Canadian Infrastructure Report Card, and lifecycle and risk analyses. For communities with mature AMPs, a robust level of service framework can also inform the financial strategy, taking into consideration the strategic priorities of City Council and the wider community.

When asked how water system investment decisions are currently being prioritized, most respondents (83%) reported using a risk-based approach (financial, regulatory, and technical risks). Over half of respondents (66%) reported using a fiscal approach (government taxes and expenditures; see Figure 11), while approximately half (52%) reported using an asset lifecycle costing approach to investment prioritization. Nearly a quarter (22%) of respondents indicated that they are utilizing a completely reactive approach to investment decisions.
Large municipalities/utilities (>80,000) favour fiscal, risk, and asset lifecycle costing approaches to make investment decisions (Figure 12). However, there were three respondents that serve populations of greater than 80,000 people that reported using a completely reactive approach to investments. Among those respondents serving populations of less than 80,000, risk and fiscal approaches to investment decisions are most widely used, but political priorities overtake the asset lifecycle costing approach as third most prevalent.

When asked how asset management data is used to support investment decisions, most respondents pointed to condition and risk rankings (Figure 12). Several respondents also indicated that either no asset management data is used or it is unknown whether any asset management data is used to support investment decisions. The majority of the respondents that provided the answer “none/unknown” serve populations of less than 80,000, suggesting that limited asset management capacity may hinder the ability of organizations to make investment decisions supported by asset data.
When developing a strategic long-term infrastructure plan, the greatest number of respondents indicated that the most important data to be considered is “assessed condition” and “actual replacement cost” (Figure 13). Historical replacement cost was considered to be the least important information when developing a long-term infrastructure plan, demonstrating the importance of determining actual replacement costs for assets.

The results of this study provide a snapshot of the current asset management practices in Canada. While strong emphasis and support has come from upper levels of government to assist local governments in developing and implementing asset management plans, it is clear from the survey results that there is still work to be done in data collection. Municipalities and utilities recognize the importance of having reliable asset data to prioritize investments and make the right decision, to the right asset, at the right time. As staff resourcing and capacity increase and new approaches and technologies for data acquisition find more broad scale application, asset management becomes a very effective and useful tool for prioritization and decision-making. The following case studies highlight examples of municipal water utilities that have applied effective asset management and underscore the potential of asset management to support long-term planning.
CASE STUDY: Halifax Water

The Halifax Regional Water Commission has been responsible for the region’s water system since 1996, and its wastewater and stormwater systems since 2007. Following the 2007 transfer of wastewater and stormwater assets from the Halifax Regional Municipality, the utility became responsible for over $4 billion worth of assets, necessitating better planning and strategic decision-making. Halifax Water built a sustainable asset management program to assist them in making sound long-term capital and maintenance decisions.

We interviewed the General Manager of Halifax Water, Carl Yates, and Jamie Hannam, Director of Engineering and Information Systems, to discuss their experience and some of the practices they have found useful with asset management from the perspective of a utility.

Profile: Carl Yates, General Manager, Halifax Water

Carl is a professional engineer and received his undergraduate degree in civil engineering from Memorial University in Newfoundland in 1984. He completed a master’s degree in geotechnical engineering at the Technical University of Nova Scotia, now Dalhousie, in 1992.

Carl began his career with an engineering consulting firm, Jacques Whitford and Associates, which was subsequently acquired by Stantec. In the fall of 1988, he was hired by Halifax Water as a Project Engineer. In 1993, he was appointed Chief Engineer of the Halifax Water Commission. A year later, he was appointed General Manager, and now oversees the utility’s strategic decision-making.

PROGRAM INCEPTION AND PROGRESSION

How did Halifax Water come to be?

In 1996, in what we affectionately refer to as our “shot-gun wedding”, four municipal units were amalgamated to form the Halifax Regional Municipality. Halifax Water existed before 1996 and after, but it gained additional assets as part of the overall metro amalgamation. At that time, assets were transferred from Dartmouth and Halifax County to the Halifax Regional Water Commission. From there we ran a regional water utility up until 2007, and at that time, the Halifax Regional Municipality transferred the wastewater and stormwater assets to the Halifax Regional Water Commission.

In 2007, we took on the responsibility of a “one water” utility, with water, wastewater and stormwater services under one roof, so to speak. We have just completed ten years with that responsibility. In conjunction with the one water mandate, the utility was rebranded as Halifax Water.
What has your experience been with the evolution of asset management within the utility?

Asset management has certainly ramped up quite a bit in the past few years. We always had an asset management program, but since 2007 it has taken on a much more significant role in the organization because there is so much more to keep track of. The other thing to recognize — that is unique to Halifax Water — is that we are regulated. When I say regulated, I mean more than our provincial environment regulator. I am talking about an economic regulator, a business regulator: The Nova Scotia Utility and Review Board. From that perspective we are unique in Canada – we are one of two regulated water, wastewater and stormwater utilities in the country.

“We always had an asset management program, but since 2007 it has taken on a much more significant role in the organization because there is so much more to keep track of.”

Is there a reason for this regulatory framework?

Yes. It is something I like to call “sound governance.” It was the right approach to ensure that the system got turned around into a mature, sustainable approach to service. The water utility has been regulated since 1945. As it continued to evolve and take on greater responsibilities, the Nova Scotia Utility and Review Board continued to provide oversight. Prior to 2007, water and wastewater were not regulated, and as a result, there needed to be a whole new framework to establish sustainability.

In conjunction with the 2007 merger, we did a very formal cost of service that may be foreign to many city departments, but in a regulated environment, it’s like a bible in how you establish your rate structures to ensure that the utility adheres to cost/ causation principles. Those who derive the benefit pay for the service in a fair and equitable manner and is the key framework for a regulated utility. We conducted the formal cost of service on all three services, which really highlighted the gaps that were present for each asset category, and we started down the path of our first integrated resource plan (IRP).

In 2012, we completed our first IRP. The plan is a 30-year framework, which establishes the investments we need to make in the strategic areas of asset renewal, regulatory compliance and growth – all drivers for infrastructure needs. We are about to undertake the next iteration of our IRP in 2019, which will benefit from better information. The key to asset management is getting accurate information.

In 2007, we inherited a significant infrastructure deficit. Services were underfunded and not in compliance with wastewater and stormwater standards. Our mandate was to bring these services into compliance and put together a framework to keep them in compliance. In 2007, there were fifteen wastewater plants and only two were in compliance. Today, we have fourteen plants (we have since decommissioned one) and all but one plant is in compliance. The plant that is not in compliance will be upgraded this spring.

“The key to asset management is getting accurate information.”

This was one of the key strategic drivers from the merger in 2007. Next year, we will complete another version of the IRP. With each iteration, there is better information. We inherited both an infrastructure deficit and an infrastructure information deficit — we didn’t know what we didn’t know. This is how we got started in 1945;
Halifax Water came about as a result of crises. The water system was devastated after two World Wars and the Great Depression, which necessitated a sound governance framework and the birth of Halifax Water. In essence, we are like a Crown Corporation of the municipality, as we are still owned by the Halifax Regional Municipality. We have our own Board of Directors, but like other municipal utilities (hydro, gas, etc.) we report to the Nova Scotia Utility and Review Board.

Halifax Water serves over 83,000 customer connections and employs approximately 470 people. The Halifax Water Board of Commissioners includes four members of Halifax Regional Council and three residents who are all appointed by Council and the Chief Administrative Officer of the Halifax Regional Municipality.

What is your role in asset management and how do you interact with the asset management team?

We operate as a team. The budget process happens with consultation from the whole organization. As leader of the executive management team, I have the final purview of the capital and operating budgets, and I sign off on any plans that go to our Board.

We also do a lot of research and are always striving to find innovative approaches and best practices. We work with researchers at Dalhousie University, which helps guide our long-term investment to improve water policy and infrastructure. We are also subscribers to the Water Research Foundation – we interface with them to help make the best investment decisions. Through this approach, I assist with continuing to build up the knowledge base to support asset management within the organization.

Are there similar asset management regulations for you as a utility as there would be for a municipality? For example, many municipalities are required to meet certain asset management criteria to be eligible for Federal Gas Tax Funding.

We don’t get any money from the Federal Gas Tax or the municipal tax system; our revenue base is strictly user pay. We are eligible to apply for programs like the Clean Water and Wastewater Fund. We have recently taken full advantage of that, so we do still go after these grants from higher levels of government. We have similar reporting requirements to Ontario utilities who follow guidelines set out by the Public Sector Accounting Board. The Nova Scotia Utility and Review Board has an accounting handbook that we must follow, which stipulates how assets are to be categorized and recorded.
We have full accounting for the depreciation of assets and have always used that as a framework for our capital funding. We are still working on making our own internal plans more refined, and that comes with better information. With better information, we can have better asset management plans.

You mentioned how you were like a Crown Corporation of the municipality. Can you give a sense of how you interact with the municipality?

We certainly work closely with the municipality. Council does not approve our budget or our rates, but we do bring our business plans to them for information. One of the things we try to take advantage of is an integrated approach to projects. If the City is going to be doing some work on the street, we want to be there as well. Hopefully, we will leave the street in good shape for a longer term. We interact with City Councillors on a daily basis. We are working in their neighbourhoods, so we want to keep them apprised of what we are doing by treating them as a true shareholder.

RATES, DATA, AND STRATEGIC DECISION-MAKING

Have you seen a focus on levels of service within your utility?

Yes, we are trying to do some calibration on levels of service. However, one of the biggest challenges within asset management is defining the levels of service. Some areas are easier than others. You can look to benchmarks nationally and internationally to find something that is meaningful. We have incorporated some aspects into our balanced corporate scorecard, which we use to measure performance. We know that over time, this will be one of the focal points of asset management plans — how to link them with a level of service that is appropriate for those you serve.

Level of service is certainly the new frontier in asset management. Here is an example: You can run a driveway culvert to failure and that is probably all right, but you cannot run a road cross culvert to failure, because as part of a public transportation corridor it has greater consequence. You must catch the road cross culvert before it fails. Nonetheless, as our system matures, we might be able to catch driveway culverts before they fail as well.

With some assets, it makes sense to run them to failure. You look for that sweet spot between reactive and proactive — where do you get the most for your money? When do you let your watermain fail? You can repair many watermains in a cost-effective manner, but depending on where that watermain is located, its size and importance, it can be very disruptive to the community in many ways: social, economic and environmental.

There are considerations outside of strict economics that can prompt you to replace a watermain earlier which is where it ties to level of service. That level of service is very difficult to get to, because certain watermains will have a different level of service than others. For example, you can tolerate more failures to a smaller distribution main than to a transmission main, because a transmission main affects a bigger population and has more impacts. As a result, you will approach these two differently.
Halifax Water has a stormwater rate in place. Did you see political pushback with the introduction of the rate?

The stormwater charge was a legacy issue from the municipal amalgamation in 1996. Previously, the municipality charged a combined wastewater and stormwater management fee. With this fee, stormwater was based on water consumption, and of course, there is no connection between runoff and water consumption. The stormwater charge was also only levied when customers had a physical water or wastewater pipe connected to their house or property. Regardless of whether or not there was a piped connection, the Halifax Regional Municipality was providing stormwater service to all residents, including those who were on wells and septic systems, whose stormwater system were ditches and culverts in the road right-of-way. These rural residents did not get billed at all, which meant that they were getting free stormwater service. Revenue from urban and suburban customers was covering the cost. When you do a cost of service study, what jumps out at you is a clear recognition that the situation is not fair or equitable. Having one group of customers subsidize services for others is against the Public Utilities Act, so this previous situation was against the law for regulated utilities.

When we started sending bills to rural residents, there were a significant amount of people who were upset. They assumed that we were double-billing, as they thought that their taxes paid for stormwater service. There was a lot of political backlash, and it is unfortunate to be on the receiving end, but ultimately we had to do what was right and what is required by the Public Utilities Act. We transitioned from a dysfunctional stormwater rate structure to one that is functional and based on user-pay principles. We can now say it is fair and equitable to the customer.

Introducing the stormwater rate has helped with maintaining stormwater assets. When we inherited these assets, we didn’t know (nor did the Halifax Regional Municipality) how many culverts there were. We know now that we have 20,000 culverts, and we completed condition assessments on all the cross culverts, which are more critical. We also did some selective condition assessments on driveway culverts to create a clearer picture for an ongoing renewal program.

“We came from a dysfunctional stormwater rate structure, to one that is functional and based on user-pay principles. We can now say it is fair and equitable to the customer.”

When you are creating higher level strategic documents, how do you prioritize being proactive versus reactive?

This is where maturity comes into it — where you tie in the final pillar, the level of service. You can look at it just from the perspective of economics, but it really is a triple bottom-line issue (i.e., economic, social and environmental). That is where we need to focus and bring those pillars together. It’s still a work-in-progress. Since Halifax Water has such a large infrastructure deficit, the investments we make now are still good value investments. Once we narrow that gap, the investment decisions become more difficult, and we will need to refine our approach.

“We know that over time, this will be one of the focal points of asset management plans — how to link them with a level of service that is appropriate for those you serve. Level of service is certainly the new frontier in asset management.”
When you come to budget time, what types of information are you using to help make investment decisions (i.e., risk, condition assessments, etc.)?

Again, it is still a work-in-progress. For watermains, a lot of the information is still on spreadsheets, where we look at different factors like main breaks. Age is a factor, of course, but not the only factor. We are always very careful when people talk about age, as some of the older assets are still in great shape. For example, we have mains that were installed from 1925 to 1945 that are still working very well. We even have mains that have been operating since 1856 and function well. There is good documentation that some pipes had a rougher time than others, which we take into consideration. The worst pipe in our system was installed in the 1950s just after World War II when system expansion was rapid (i.e., the baby boom).

We also have to look at the impact to the environment, impact on local businesses, and property damage. If there is a failure, how much damage will it cause? There are some older assets that we don’t have good information on. As we go, we add refinements and look into areas where we have gaps. In addition, we are still working with those who are in the field who have that know-how; we are working to digitize that information.

“In terms of asset management, there is a lot more data that needs to be gathered to make better decisions, and it will always be a work-in-progress.”

FUTURE OUTLOOK

Where do you see the future of your asset management program? Is there a lot more to be done?

There is a lot more information that needs to be gathered, and in particular, more integration with operational data. Recently, we embarked on a computerized maintenance management system. It was postponed due to the 2007 merger, but we have now implemented our system and it is our main operational framework for collecting information on maintenance activities and work orders. That is going to be the next piece of information that we can use on a go-forward basis to help us track our activities to make better investments and facilitate better prioritization.

We have also completed the upgrade of our linear infrastructure in our Geographic Information System (GIS). In 2007, many of the assets were not in a database, so we have had to bring them up to date. This year we will be 99 percent complete with updating our linear assets and that is as good as it gets in GIS. As we all know, GIS is often a journey, not a destination. It will be an important tool.

In terms of asset management, there is a lot more data that needs to be gathered to make better decisions, and it will always be a work-in-progress. We participate in the National Water and Wastewater Benchmarking Initiative facilitated by AECOM to try and stay abreast of best practices in Canada and internationally. We use these different avenues to incorporate best practices and to make the best decisions we can, all with the goal of getting better data. It is hard to find a formal framework that works for everyone; you find bits and pieces when talking to other utilities, and some have made more efforts than others. I think that is what’s missing: a more formalized approach. The Canadian Network of Asset Managers is looking at more formalization and we will continue to support them in that regard.
What kind of advice would you give to other utilities and municipalities who are hoping to put good asset management programs in place?

At a high level, I always tell people to start with governance. People may ask how that relates to asset management, but it does in a big way. The fact that we have a regulator that takes a very objective approach to our business helps us to perform over the long term. The system we have here in Halifax is certainly something that has been recommended as a best practice, but not all utilities have gone there because it takes political will. In the case of Halifax Water, this political will commenced in 1945, continued in 1996 and was reinforced in 2007. So, if you can get your governance right you can look longer term, which is the key to a sustainable approach.

Profile: Jamie Hannam, Director of Engineering, Halifax Water

Jamie is the Director of Engineering & Information Services at Halifax Water, where he is responsible for water, wastewater and stormwater infrastructure master planning, asset management, capital project delivery and information services. Prior to this, he was Chief Engineer at the Halifax Regional Water Commission from 1994 to 2007. Jamie spent the early years of his career in municipal government in Halifax and Dartmouth working on a variety of engineering tasks. He is a graduate of Acadia University (BSc 1983), the Technical University of Nova Scotia (BEng 1985), and Dalhousie University (MBA 1990).

ASSET MANAGEMENT PROGRAM PROGRESSION AND CAPACITY

Can you go into some detail on your organizational structure and where asset management fits in?

Under our General Manager, there are six departments, one of which is Engineering and Information Services. Asset management is one of the sections that reports directly to the Director within this department. For clarity, Asset Management reports through the Engineering & Information Services department and not as a separate corporate section.

What outcomes are you getting from your asset management program?

Our program works towards achieving the big objectives: managing assets to optimize asset lifecycle, sustaining performance, reducing risks, optimizing capital investments and developing strategic long-term goals for the organization. What is interesting is that we also see more day-to-day practical use of the program. With our asset management program, we have more documented knowledge about our individual assets, and as a result, our engineers and operators can make better day-to-day decisions on which assets to renew, repair and maintain.

A good example is our stormwater culvert program. Historically, we had limited knowledge about these assets. However, as we completed our first AMP we gained knowledge on each and every one of those culverts and their condition. Now, as we encounter them in the field, we are able to be less reactive and step back and look at the AMP and know that they are on track for capital renewal next year, or that they are in great shape and just need
regular maintenance. I think one of the big benefits has been a more personal understanding of the exact condition and prescribed direction for an asset, which helps us with our day-to-day activities.

How has your program matured and evolved to get to the point where every member of your organization is contributing to asset management on a daily basis?

Our utility has a long history of managing its assets effectively. However, we recognized from our scan of the industry and best practices that a formal asset management program was a critical component of long-term success. As a result, we chose to embrace asset management as a core corporate activity. We developed an initial team of two or three staff and gave them an asset management mandate. The initial task was to go out and understand what others in the industry are doing and what some of the best practices are, and to engage with some of the industry associations and understand asset management. We developed a foundation at Halifax Water and really looked at what our gaps were and where the opportunities were. We pursued this from a very top-down structured approach, recognizing that this is where the leaders in the industry are heading.

Would you say that in a utility, asset management is more of an engrained practice than in a municipality?

A little of both. I will say that within my work in municipal government, there was a significant amount of maturity with asset management around street infrastructure and pavement condition assessment. However, on the utility side, a big motivator is that we are a regulated utility. We are financially independent, and we have to justify all of our expenditures through our rate base and our regulator — there is no tax-based money. Within our rate building process, we develop a strong business case relative to investment in our infrastructure. How can we continue to make solid business case investments in infrastructure without having a solid asset management program? We saw asset management as foundational in order to move forward and to justify the levels of expenditure on capital that would be required in the future. Replacing assumptions with real data improves our process to justify our long-term spending needs with our decision-makers and regulators. Asset management has been very critical to understanding what we own, what it’s worth, and what condition it’s in.

Over the next 30 years, Halifax Water plans to invest about $2.6 billion to upgrade infrastructure to ensure the continued delivery of high-quality water, wastewater and stormwater services to benefit customers and the environment.

Can you expand on what your staffing capacity for asset management is like? How many staff do you have, and how many non-dedicated staff will assist when needed?

We started our formal program with one senior engineer assigned to asset management. With her aptitude and interest in asset management, the initial assignment was to champion the industry scan (i.e., what is the best
practice, what is the direction we should go, etc.) to develop a vision for our program. As we developed a roadmap and began collecting data, assessing inventories and condition, making financial projections etc., we quickly evolved to a staff of five technical professionals who work under the manager. The team is responsible for coordinating the collection and analysis of data and developing asset management plans. Importantly, there is also another core staff group who liaise with the asset management team. These are our functional experts, who are responsible for the delivery of capital programs, operational maintenance programs and financial management. These core experts provide key input on program direction, data and data validation. We also utilize a series of external consultants to complete discrete condition assessments and data collection assignments.

*Do you find the current capacity to be adequate, or do you feel that you need more staff working on asset management?*

We have built a team of six professional/technical staff with a focus on asset management and related activities. This capacity is providing great progress in our program. A slightly larger team would likely be ideal, as these staff could continue to gather data where there are gaps, update data as new projects come along and apply higher level analytics on the data to determine things like capital priority and operational priority. There may not be a magic number for a utility of our size, but our asset management team do a very thorough job with the aforementioned, and there is still a role for significant input from our engineering and operations team.

*How would you say that a utility’s asset management plan differs from a municipality’s?*

In principle, a utility’s AMP should be generally similar to a municipality’s. However, a utility’s AMP would have a discrete asset base and include buried infrastructure that complicates the condition assessment process. In addition, a utility may have a more formalized business case process for capital expenditures, based on different regulatory requirements.

We have made a commitment to produce an annual AMP for each asset class, which allows the document and information to stay current. It is important to understand from a utility perspective that it is a discrete asset base; there are water, wastewater, and stormwater assets. We like to be able to hear the story that the asset management plan tells, because one of the early parts is simply an inventory (i.e., knowing what you own), followed by putting a condition to each asset and a replacement cost, and then based on that condition, generating a prioritization list for capital and maintenance plans. We can create a very solid vision.

Beyond the short term, the AMP allows us to look to a 30-year financial vision of the kind of investments that we need. With a confident long-term vision, we can have a smooth rate increase, which is often much easier to deal with from an approval standpoint and acceptance by customers. The more underlying core data that we have, the more confidence we have in painting a long-term vision with a level of certainty.

*Who is involved in the process of completing and updating your asset management plan?*

We use a corporate-wide process that is both top-down and bottom-up. Our core asset management team is responsible for delivering asset management plans for each of our asset classes, which equates to fourteen separate asset classes across water, wastewater and stormwater. This team engages in a bottom-up exercise, with consultants doing some raw data collection, our engineering staff identifying projects they’ve been working on, and our operations staff reviewing maintenance activities to update the condition of assets.
From the top-down, the Directors and the General Manager review all of the asset management plans, to ensure that based on their knowledge of the assets we are telling the right story and that the information is used to drive the capital and operating budget. This corporate initiative benefits from having a core team that can do a lot of the background detail work, so that when you reach out to the practitioner experts, you don’t have them doing this. Similarly, from the top-down, when we look at a complete asset management plan, we can look at it from a corporate governance perspective and ensure that it’s going in the right direction. It is very comprehensive across the whole organization, but significantly benefits from having that core team being able to drive a lot of the documentation.

DATA COLLECTION AND ASSET MAINTENANCE

How do you use software tools to support your asset management program and decision-making?

We developed our asset management program from the ground-up, and approached it from an asset ownership, asset inventory, and data collection process that was not driven by specialized software. We built the data sets ourselves and use fairly standard tools like Excel, Access databases, or our corporate GIS database to store the data. This has worked well for us, because we haven’t been tied to any particular vendor or software system. It has allowed us to focus on the inventory, raw condition data and the financial information. We are at a state now where we are looking for software, as we want to start making higher-level analytical decisions, using software that will look at the inventory and condition data and make more comprehensive assessments of long-term capital priorities.

We have a work order system with an initial primary corporate focus to improve maintenance activity at the operational level. A by-product is that we are getting maintenance history that we can push over to our asset management system and enhance asset condition data. We also have a good capital planning tool and are currently looking to enhance our functionality with improved analytics that can compare capital priorities across discreet asset classes for optimal corporate benefit.

Do you have a process for gathering condition data? And why do you have less condition data on linear assets?

For each asset class we have a different and discrete methodology for collecting condition data, because the assets are uniquely different. Our vertical assets have a higher percentage of data, as these are fairly discrete data sets and most of the infrastructure is accessible. For example, we have 17 wastewater treatment plants, so at some level we can go around and look and touch all seventeen. For our linear infrastructure, however, we have thousands of miles of buried pipes. We are directly impacted by limited access and a large volume of required data. This is a challenge, and will take a longer-term perspective to mature.

Where you are unable to get condition data, do you use age-based condition?

Age-based condition is used as a surrogate for real condition assessment. Sewer data is a bit easier to obtain than water main information, based on the relative ease of sewer CCTV information. The industry has developed a standardized condition assessment based on CCTV information. We use less age-based surrogates on sewers, because we are able to get that condition data when needed. For watermains, where it is far more intrusive to do any sort of inspection, we use a combination of maintenance history and age, and from there you can build a
reasonable picture of the watermain condition. We have developed age-based degradation curves for a variety of pipe sizes and material to improve the accuracy of age-based assessments.

“We developed our asset management program from the ground-up, and approached it from an asset ownership, asset inventory and data collection process that was not driven by specialized software. We built the data sets ourselves and use fairly standard tools like Excel, Access databases or our corporate GIS database to store the data.”

Can you give us an explanation for the process of updating your asset inventory data?

One core approach is to be transactional with a maintenance activity or a capital program. For example, we have a capital program to replace a watermain or sewer. On the way back into the office, one of the business processes is to update that information in our records (GIS and Record Drawings), which also gets flagged to be updated in our asset management processes. It is the same as if we are doing a maintenance activity; the work order that was sent out would be flagged and changed in our records. However, we are still working on the data gaps. For example, with gravity sewers, we have a multi-year program where we are completing a volume of CCTV inspections to continue to build the condition data. There are gaps where we are continuing to build that data. However, with anywhere that is stable, we are making updates on a transactional basis.

Are there barriers to linking your GIS system with your asset inventory?

No, our GIS data model has been revised to align with our asset inventory for asset management purposes. Our next step is to coordinate an opportunity to include our current condition information. For example, with this we would be able to see in one environment where our watermains are, as well as the maintenance history, and condition rating.

Are there certain asset types where you spend more time doing either preventative or reactive maintenance?

An overall goal is to do more preventative maintenance and less reactive maintenance. However, there are many assets where there is very little preventative maintenance done, and all you do is react to a final failure and replace it. A good example is a driveway culvert; there is limited preventative maintenance to be done, and when the culvert fails, it’s replaced. That class is maintained on a reactive basis, but it works, and the level of service is very high.

Other assets are different. A fire hydrant, for example, has a lot of preventative maintenance completed on an annual basis to maintain components, but every five years we conduct a complete overhaul. This preventative approach is required to ensure that a fire hydrant works at the exact time you need it, and you cannot risk it becoming dormant.
Then there are some assets that are in between, where you have planned maintenance, but you still get breaks and have to do reactive maintenance. Over time, our plan is to trend toward more preventative maintenance, but there will still be some assets where failure and replacement is the best option. It’s all about finding that balance: where it is critical, you have to ensure that the asset is functioning, and then perform maintenance on static infrastructure where it is harder to do preventative maintenance.

**CASE STUDY: City of Guelph**

Asset management has been at the forefront for Ontario municipalities. With the introduction of O. Reg. 588/17, all municipalities in the province must now comply with certain asset management requirements. For many communities, it has been difficult to implement a sustainable asset management program due to limited resources and expertise. The City of Guelph has worked over the last few years to allocate resources and build out a cross-functional asset management team, allowing for significant achievements within their program and preparing the community for compliance with O. Reg. 588. They have been able to move forward due to a combined effort from Finance and Engineering, who clearly demonstrated to City Council the need for a better way of managing their assets.

With buy-in from City Council and senior management, the City formed a corporate asset management division that works with members from each area of the organization. The division is not only responsible for completing the organization’s asset management plans, policies and procedures, but is involved in facilitating asset management practices. This core group has given the City the capacity to advance their asset management practices, creating a noticeable difference in the state of their infrastructure and long-term planning efforts.

We chatted with several members of the City’s senior management team to discuss the steps they have taken to implement a successful asset management program and where they plan to go in the future.

**THE STATE OF ASSET MANAGEMENT IN GUELPH**

*Daryush Esmaili, Manager of Corporate Asset Management, began the discussion by providing a high-level overview of the City’s asset management program and an understanding of how their program has reached its current maturity.*

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**Profile: Daryush Esmaili**

**Manager of Corporate Asset Management, City of Guelph**

Daryush is experienced in leading organization-wide asset management implementation to enable the best possible decisions which balance lifecycle costs, levels of service and risk management. His expertise includes maximizing value in services such as utilities, transportation, facilities, parks and fleet.

Daryush has a master’s degree in Civil Engineering and Asset Management, and he actively contributes to the international industry by serving on the ISO Technical Committee 251 for Asset Management.

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Daryush: The City of Guelph has been doing asset management in water, wastewater, roads, stormwater and facilities for a long time. Many of the leaders in those services had been taking the initiative on various asset management tasks, but in terms of developing asset management plans and overall strategies, there was limited resource availability. Like other municipalities, the City did not have a dedicated asset management team until March 2016, which is when I was hired.

In 2011/2012, the City developed infrastructure report cards and sustainability assessments, which were invaluable in justifying the formalization of the asset management program and communicating sustainable funding levels for infrastructure. Report cards like this have now become common practice across the industry, and a lot of the support for and success we are seeing now started from these reports. Part of our initial work included the collection of information and data related to all of our assets, putting it into one place, generating full lifecycle profiles, as well as 100-year long-range lifecycle forecasts. This helped us to understand what the investment requirements are for our assets, as well as the impacts and risk of them failing.

When the corporate asset management division was created, we observed that there were pockets of excellence across the organization. One of our first tasks was to pull that information together and look at it from a corporate perspective and identify the strengths and opportunities for improvement. The first document we created was a corporate AMP and an integrated capital budget for right-of-way infrastructure: water, wastewater, stormwater, roads and transportation.

We documented the level of confidence in the information we had and what information needed to be updated or improved. Generally, we have found it extremely valuable to highlight any uncertainty in the numbers that we are presenting. For example, in some cases we may be reporting the investment backlog number, but only have 20% or 30% confidence in that number because it is based on several assumptions. In a situation like this, the report is accompanied by an action plan to improve the confidence level in future assessments.

We presented our Corporate Asset Management Policy to City Council at a workshop. They were receptive to the fact that we quantified and communicated the level of accuracy or confidence in the information. Since developing and publishing the AMP, we have been executing an asset management improvement plan — a road map of improvement initiatives to increase the confidence in our data, which includes condition assessments, risk assessments, and inventory data collection. Beyond collecting data, we are also developing an information management strategy related to all of our asset information. It will be important for us to document what information we have, where it is, who is responsible for it, whether it is duplicated, what the master source is and how we can use the information for decision-making.

“There are many different ways to structure the governance of a corporate asset management program, but we have found it effective having champions in each area across the organization.”

FUNCTIONS OF THE CORPORATE ASSET MANAGEMENT GROUP

Our team guides the overall strategy and ensures a holistic approach to asset management across the organization. There are many different ways to structure the governance of a corporate asset management program, but we have found it effective having champions in each area across the organization. We formed an asset management steering committee which meets quarterly to discuss the work plan, approve our strategic direction and ensure buy-in across the organization.
The division’s responsibilities include developing the overall policy, strategy and governance for asset management, coordinating the steering committee, and supporting the coordination of the overall capital budget, with a focus on incorporating asset management principles. This work requires bringing everybody together and thinking of asset management from a corporate perspective, looking at opportunities to optimize and prioritize, and building out the evidence and the business case for budget recommendations. We work very closely with Finance to ensure that the infrastructure investments are being sustainably-funded, with adequate reserves to support future investments.

We lead a few initiatives on the operational level: We run condition assessment programs for various assets, including our linear network (water, wastewater, stormwater and roads), and we act as a support for other groups across the organization. For example, in the next year we will be managing a wastewater facility inventory and condition assessment, which will require developing a full inventory, developing maintenance plans and developing a capital program. Although we are not the subject matter experts in those areas, we will provide our asset management expertise and act as the coordinator to provide the resources and support needed.

We also support the coordination and continuous improvement of asset maintenance. We are heavily involved in supporting the advancement and eventual optimization of maintenance practices. We have a dedicated resource that is working with the maintenance staff across the organization to ensure that there are appropriate processes and resources in place to support planning, scheduling, executing and tracking maintenance activities and moving toward best practices. The upfront or capital costs of assets are sometimes only 20% of the overall lifecycle costs of that asset, whereas the remaining 80% can be related to operation, maintenance and renewal activities. We plan to incorporate the full lifecycle into decision-making.

There are a lot of engaged staff at the City, which is the best thing for asset management. The biggest challenge is ensuring that we are all aligned as we move forward. We want to work with people to ensure that asset management is being done in a consistent way, and to ensure that every department and division has the resources and support they need to meet corporate objectives.
**PROGRAM INCEPTION**

**Daryush:** The real drive for the creation of a corporate asset management division in the City was internal. Historically, Finance has led the way in developing the City’s asset management capabilities. They were responsible for the Public Sector Accounting Board 3150 implementation and reporting, as well as meeting with the various groups to assess the overall maturity of asset management in the organization. They recognized that a corporate resource dedicated to asset management was needed. They brought the business case for dedicated resources for corporate asset management to City Council. The first time it was not approved, but the second time, a multi-departmental approach involving Engineering and Finance helped reinforce the business case, and the creation of a new division was approved.

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**Profile: Kealy Dedman, General Manager**  
**Engineering & Capital Infrastructure Services, City of Guelph**

With over 20 years of professional experience, Kealy has led innovative projects that create sustainable infrastructure for communities in Ontario. She is past President of the Canadian Public Works Association and the Ontario Public Works Association. She has also served as a member of several federal stakeholder groups to inform infrastructure-related government policy matters, including the Municipal Infrastructure Forum and the Canadian Report Card Advisory Committee.

Kealy holds BSc degrees in Civil Engineering and Biology from Queen’s University, and a Master of Public Administration from the University of Western Ontario. She is a registered Professional Engineer in the Province of Ontario.

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*Kealy describes the creation of the City’s corporate asset management program:*

**Kealy:** For many years, there had been asset management activities completed on our water, wastewater and stormwater linear assets. For example, we developed an infrastructure report card, a common tool that other communities use. These report cards provide a good overview of the state of assets and are a starting point for the sustainability conversation. We leveraged the report card to demonstrate to City Council and the community that we needed a program to better manage our assets. Although our water and wastewater assets were considered sustainable, stormwater was rated as an “F” and although we did not include road assets, we knew that they were rated low as well. We leveraged these report card results to support the discussion on why we needed dedicated resources.

We also provided perspectives on the long-term benefits of addressing the anticipated backlog of work needed to address the infrastructure gap. The data provided evidence to support the story.
Daryush: Once the creation of the corporate asset management division was approved by City Council, a Manager of Corporate Asset Management was hired. It was a multi-departmental effort to ensure that the position was shaped around a corporate perspective. The team has since evolved, and now includes some positions that were previously in the infrastructure services division: Infrastructure GIS Technologist and Infrastructure Management System Coordinator. Next, we hired an Asset Management Analyst to work on corporate plans and strategies. We also hired an Asset and Maintenance Management Analyst to assist in developing strategies for operations and maintenance and to set up computerized maintenance management system processes.

Recently, we had an opportunity to bring a current employee into the department through a six-month internal secondment. They are developing an AMP and supporting our overall division. After completing their secondment, they will return to their home department with asset management knowledge and new skills. There is a great business case for this and we are hoping to pursue this opportunity again next year. It is a great mechanism for knowledge sharing, as well as building asset management expertise across the organization. We have also implemented a stretch-project initiative for City staff in other areas to work on asset management-related projects. They can access coaching and mentoring from the corporate asset management division and develop an AMP for a specific asset class within the City.

The biggest challenge in the industry at the moment is limited experience in asset management. We view secondment and stretch-projects as mechanisms that help people to gain skills and understanding of asset management, and also increase overall corporate knowledge by embedding asset management champions throughout the organization. These projects take a lot of time and coordination, but they are valuable exercises. Developing the plans and the strategies are the easy part of asset management; getting the philosophies ingrained in the culture of the organization is what takes the most time. To be able to do that effectively, you really need to dedicate time and resources appropriately proportionate to the size of the organization.

When we were developing the governance structure for our corporate asset management program, we completed a review of other municipalities across Canada. We also looked into international best practices of potential structures and compositions. What we learned is that there are many different ways to govern asset management within an organization, but the principles are similar. Some use an owner-advisor approach, while others are program managers or operationally-focused. It depends on where asset management is located within the organization, the size of the organization and the level of influence that the asset management team can have at the operational level.

“Developing the plans and the strategies is the easy part; getting the philosophies ingrained in the culture of the organization is what takes the most time.”

Our team has two positions that are focused on continually improving the asset management system, a position that is dedicated to maintenance, one for GIS and data management, and a position for condition assessments and program management. An appropriate structure depends on the level of asset management maturity. As our program becomes more operationalized, more program management roles may be needed, but at the moment we are developing many of the processes and practices and are in the process of conducting assessments. I expect that over time our roles will continue to evolve.
Initially, our division was located in Engineering and Capital Infrastructure Services, as 70-80% of the City’s assets fall within the responsibility of the Engineering capital budget. However, we now work with the entire organization. We are occasionally faced with the misperception that we are only responsible for asset management within Engineering and Capital Infrastructure. Generally, people are receptive to us once they know and see that we support the entire organization. There is no right or wrong answer as to where an asset management team should be located within an organization. For example, if the group is within the finance area, then it is important to ensure that they also work with the engineering and operations groups to ensure their perspectives are considered. You have to take a holistic approach wherever you sit within an organization.

To move us forward, we have started looking at where asset management fits into people’s roles and the level of training that they require. We are currently working on a corporate asset management training program. An introductory 1-day session will help people familiarize themselves with the concepts of asset management. We will also offer a 3-day session for employees who are aiming to be technical specialists in asset management to assist them in becoming leads within their department and/or division. We see this training program as a way to standardize asset management within the organization and bring people across the organization up to speed with some of the key concepts and terminology.

When people join our corporate asset management division, we always provide additional training. They generally have a good understanding of certain components of asset management, so the training we provide them gives the big picture view of how all the pieces fit together to achieve the organization’s objectives.

DATA, LEVELS OF SERVICE, AND DEVELOPING A COMPREHENSIVE ASSET MANAGEMENT PLAN

Daryush: When we developed our AMP, we used it as an action plan as well as a communications document. In our first plan, the initial focus was to pull all of the information from across the organization into a single document and summarize not only the condition and the current investment levels versus the required investment, but more importantly, to document the action plan which would improve our asset management program.

Once we had compiled the data together in one place, we established a confidence ranking scale for the data and ranked each line item. This allowed us to communicate the overall confidence of our analysis results. One of the first steps in developing the AMP was developing a state-of-the-infrastructure section.

For the level of service section, we gathered our documented levels of service and included them in the plan, but saw this as an opportunity for improvement in the near future. We also determined required funding levels based on a lifecycle analysis and compared these figures to historical funding levels to establish funding gaps. Pulling all of these things together is what we focused on in the first AMP, knowing that key areas of the action plan would be establishing levels of service and quantifying risk.

In the next AMP, we plan to place more emphasis on the impact of funding decisions on levels of service. A key step to determine levels of service is to define what you mean by service. We spent a lot of time defining how we categorize a service. We approached the service categorization from the outside looking in, as if we were a member of the public looking at the break down of our tax and rate bill. We tried to capture the key line items that a member of the public would expect to see on the bill in terms of the service we receive. We consulted between our strategic initiatives group and our business improvement group and came up with a master list of what we consider the 19 asset-based services that people receive. These were then sub-divided into what we consider services to members of the public, and supporting services such as the corporate fleet.
We completed an exercise of allocating the capital and operational budgets to the services, which then allowed us to quantify the investment and operating costs. The next stage was defining the performance indicators or metrics for those services. For example, with parks we looked at what percentage of the population is within a ten-minute walk. We looked at quality indicators such as the condition and design standards and the level of finish of the assets. After defining the indicators, we established which ones had a performance change over time that we could forecast. For example, condition deteriorating over time is fairly easily modelled. By applying that relationship, as well as allocated funding, we can then see how level of service might deteriorate or increase over time.

Looking ahead, our aim is to quantify the impacts of any project to the levels of service. This will then be used for evaluating the optimal project selection overall. A corporate asset management plan can only get to a certain level of detail due to the large amount of assets covered in a single document. Specific asset classes or services often have intricacies that are challenging to highlight in a corporate level plan, so we are also creating asset-specific management plans. For us, that will likely be 17 documents. We are trying to keep them concise, as well as evidence-based. Each document will outline the key facts and business processes to facilitate easier updates, whereas the corporate plan will provide introductory or summary information and the theory underpinning asset management.

**THE VALUE OF CONDITION DATA**

**Daryush:** Next year we will be completing several studies to collect inventory data, assess condition and develop risk management plans. We are also working on using our computerized maintenance management system as our main point of entry for much of our inventory and condition data. To do this, we are building forms for periodic inspection that can then feed into the system on a regular basis. We are working on integrating our key corporate information systems so that there is a consistent inventory in analysis.

I think there will always be the need to develop updated inventories and condition assessments periodically, but our goal is to build a business process so that the inventory is updated on an ongoing basis. We have an annual condition assessment program for linear wastewater and stormwater assets. We have increased our inspections, and intend to inspect the full inventory within the next three years. The next step is using a combination of “starting from the beginning” and “working our way through” using a risk-based approach. We are currently completing a risk management study on our linear water, wastewater and stormwater networks. This study includes evaluating system hydraulics and the number of customers that would be impacted if certain assets fail, what the consequences of the failure would be, and the likelihood of failure. The project will help define strategies to manage the risk or understand the likelihood of failure through specific inspection or monitoring programs.

**THE ASSET MANAGEMENT POLICY**

**Daryush:** To develop our Corporate Asset Management Policy we reviewed best practices and guidelines like the International Infrastructure Management Manual, BSI PAS55:2008 and ISO 55000. We also reviewed the draft of O. Reg. 588/17 to identify any potential specific regulations that might be coming. Based on these reviews, we developed our policy, making sure that it was in line with best practices, upcoming requirements and our organizational objectives.
Within the policy, we established goals and guiding principles for asset management at the City. A month prior to presenting the policy to City Council, we facilitated an internal workshop with our Steering Committee using a similar exercise to the one we planned to use with Council. We presented the basics of asset management and why we have a policy. We displayed a poster of the key activities of our asset management system and asked everyone in the room to write down on a sticky note what they would like asset management to achieve within the next two years. They were then asked to place the sticky note where it fit into the asset management system. This was a valuable exercise to see what was in and out of scope. We did the same thing during the Council session, which was also open to the public. We incorporated the objectives from the Steering Committee and Council within the guiding principles and goals. We also provided Council with an opportunity to share comments after the workshop. We presented the final version of the corporate asset management plan a month later. The AMP and Policy were both unanimously approved by Council, which are now the guiding documents for our overall program.

“I think there will always be the need to develop updated inventories and condition assessments periodically, but our goal is to build a business process so that the inventory is updated on an ongoing basis.”

SUPPORT FOR A DEDICATED TAX LEVY

Daryush: Last year we were approved for a 1% dedicated infrastructure levy. This levy is dedicated to asset replacements and renewals, and a portion is dedicated to “city building,” which is the expansion of city services.

We also have a stormwater utility, which is something that I would highly recommend to other municipalities. Similar to most municipalities, historically our stormwater infrastructure funding was limited due to the lack of a dedicated funding source. In our 2012 infrastructure sustainability assessment, we found that stormwater was being funded at about 30% of what it should be. We now have a 10-12 year plan for sustainable funding that would be challenging to accomplish without the stormwater levy.

MINIMIZING REACTIVE MAINTENANCE

Daryush: We have preventative maintenance programs to prolong the life of assets as much as possible. These programs are documented, but we have identified some opportunities for improvement. In some areas we will be implementing reliability-centered maintenance techniques to establish risk-based maintenance programs and minimize asset failure. We plan on using a high level of detail for less critical assets. For critical assets we would look at an even greater level of detail.

Our risk management plans establish the likelihood and consequence of failure, allowing us to target our strategies. For example, we have an aqueduct that carries a large percentage of our water supply and the City has been completing various monitoring and inspection programs on this asset. Through our risk assessment, we can highlight the most critical areas and then identify specific monitoring or testing programs. If there is a potential for failure in any of the areas, then we can detect it beforehand if that is a possibility, or come up with mitigation and management strategies to reduce the likelihood or consequence of failure.
On our linear assets, we complete regular inspections — things like minimum maintenance standards for roads and CCTV inspections for sewers. A mix of strategies is used depending on the criticality of those assets, as well as the costs and benefits of obtaining that information. For example, pressurized pipe condition assessment can be expensive and disruptive to the system, so we always weigh the benefits and costs, as well as what we aim to discover from the inspection. Sewers are generally a lot easier to access and inspect, so we have a regular annual inspection program which provides a wealth of information. For water, our risk management strategies include some advanced condition assessment approaches at the most critical locations.

Profile: Peter L. Busatto
General Manager of Environmental Services, City of Guelph

Peter has spent over thirty years at the City of Guelph in progressive positions related to operations and management of municipal water and wastewater systems, with a focus on system optimization, automation, compliance and management development. He currently serves as General Manager of Environmental Services.

Peter: We have a certain limited capacity — as most municipalities do — to look after our infrastructure. That work involves asset breakdown maintenance on one end of the spectrum, to reliability and strategic maintenance on the other end. The City’s current position involves resourcing for breakdown maintenance, because it is still going to happen regardless of our best-laid plans. If we right-size that part of our operations, the folks doing this work will remain busy.

Because we have an older infrastructure in Guelph, we’re always going to have reactive breakdown maintenance for linear assets and plants. What we’re trying to do when additional strategic capacity is available, is to fine-tune or optimize that work first to improve response and reduce breakdowns. We’ve made great strides in this work. With the arrival of the corporate asset management division, we have implemented formal processes for managing assets based on better data. We also now understand our linear systems better than we ever have, thanks to more real-world and modelled information. On the plant side, we are a little further behind, but we’re trying to catch up using the same approach. We’re trying to be more strategic, knowing full well that we still have that base group doing the breakdown maintenance.

Daryush: We are also working on using a full lifecycle approach at every opportunity. When we are reviewing capital needs, typically we include operators and maintainers, the design and construction team, as well as those involved in long-range planning and capacity assessments. Our role is often to support the integration of the various disciplines in a holistic fashion.

Kealy: One of the biggest benefits of having the formal asset management group is that they facilitate cross-departmental cooperation, whether it is with Environmental Services, Finance or Engineering Design and Construction. A big part of launching an asset management program is the education piece. Having City Council and senior staff understand how critical asset management is for the organization and engaging them early in the process is essential.
Tara: The asset management team brings forward reports throughout the year, explaining the state of our assets. Our infrastructure deficit has now increased to approximately $400 million, and that number is going to continue to grow to $700 or $800 million if we don’t make the proper capital investments.

That messaging coming from the experts — not just Finance — is significant. Council then has that base information and understand it, so that when they discuss the budget, they recognize its importance and can make more informed decisions because they are fully briefed.

From a capital perspective, I think we are sitting at 13.64% of our property tax base transferred over to capital. On top of that, we have user fees. Part of our communication strategy is to reach 100-year sustainable capital funding. With the work that our corporate asset management division is doing, they can tell us the need over 100 years. That’s where we are heading.

Back when we had our first report card, stormwater assets were listed as an “F.” That was the initial kick-off to the stormwater function, which resulted in the switch to a user fee model.

Kealy: The user fee model was a key recommendation in the Stormwater Master Plan when it was presented to Council in 2011. The Plan was approved by City Council, which recommended that staff conduct a feasibility study to evaluate various methods of funding stormwater. That was a very long process, and educating the community and Council was a big part of it. Through the feasibility study, we looked at a number of different ways of calculating a stormwater rate. In the end, an ERU (i.e., equivalent residential unit) stormwater rate was recommended. Last year was the first year it was implemented; we are also launching a credit and rebate program in 2018.

All residential units in Guelph have a base charge. The rate for non-residential consumers (e.g., industrial, commercial, institutional) is calculated on an area basis and translated to a number of ERUs. The reason that we went with this approach is because it was a good balance between administrative effort and fairness. When stormwater assets are funded from the tax base, the cost is mostly carried by the residential sector, whereas it is the non-residential sector that owns the majority of impervious area, so in terms of fairness and equity, that was a big seller during the approval process.
FUTURE OUTLOOK AND THE BENEFITS OF ASSET MANAGEMENT

**Tara:** I think one of the most significant benefits of the corporate asset management function has been the communication of the state of our assets and how this incorporates into the budget and our needs and priorities. For 2018, I think it has really all come together. Just because you have asset management practices in place does not mean that everything is going to happen all at once. The 2018 budget is the first budget that is really integrating the data and the information that the corporate asset management division has pulled together. The benefits are just beginning, and we are going to see that really start to take effect as we move forward.

Besides the budget, there is also benefit in forecasting. We have ten-year forecasts which are on everybody’s wish list of needs, but they are not tied to any funding. Our next major piece of work led by the corporate asset management division is to get us into that 10-20 year funded capital forecast based on prioritization and risk. We have not been able to get there in the past, but collectively, this is where we’re going.

**Kealy:** For Engineering and Capital Infrastructure, our next step is completing corporate risk analysis and levels of service and incorporating this information into decision-making. This will be important when we begin prioritization. It will help us with prioritization of projects across the corporation to ensure that it’s not just more visible or “nice to have projects” that gain endorsement, but also the critical work that needs to be completed to provide the highest value to the community.

**Peter:** We have learned now that a group approach to asset management is the most effective. If we do service area asset management plans, it would still be fully integrated into our corporate plan. We would not just go off into water and wastewater and have our own approach, which was the old way. It is much better if it’s integrated all the way through and there are overlaps. As an operator, the system has to be reliable. Reliabilities tighten the levels of service; I want to know what’s critical and what could critically fail, and I want to make sure that we’re at least maintaining these things. We are getting better at knowing information around our systems, but we’re still getting surprises occasionally about how critical some assets were when we go to take them offline to work on them or when they break.

**Tara:** For me, being able to communicate to Council is important – communicating the level of service to say, ‘this is your investment and to enhance it, it costs this much.’ It’s about talking about things in a funding way. We talk more about it as services right now; you can enhance it, but we don’t have cost incorporated.

**Daryush:** We also have a dedicated Climate Change Office that we work closely with to better integrate climate change and asset management. Inherently, in a lot of our asset management studies we consider climate change impacts anyway; through master plans we look at different design storms and different scenarios through general energy management and demand management practices. However, we are collaborating to put greater emphasis on the links between climate change and our asset management strategies. We are still navigating those waters and are exploring the interrelationships.

The way that we are approaching it is to keep each other involved in our initiatives as time goes on. Our Climate Change Office is involved in the level of service study and our water, wastewater, stormwater risk management project. They are also planning on completing various studies related to flooding and the overall risks associated with climate change which we will be involved in. In terms of our plans and strategies, we’re making sure that climate change is a priority. In our level of service framework, we have incorporated climate change and environmental stewardship related objectives. For example, we have targets for tree canopy coverage and the level of CO2 reduction and energy consumption with various asset classes.
Our work plan also includes developing asset management strategies for our natural capital assets. Our Forestry division has probably one of the more advanced asset management programs in the City. We have a full inventory of trees, and we have risk-based condition assessment, scheduling and maintenance. We are also currently working with our Planning, Urban Design and Building Services department on how to expand that into the natural environment. We did incorporate our land assets into our AMP. As time goes on, we are going to be building out the natural capital inventory and management plan.

“Our next major piece of work being led by the Corporate Asset Management division is to get us into that 10 to 20-year funded capital forecast based on prioritization and risk. We have not been able to get there in the past and I think collectively that is where we are going.”
CONCLUSION

With federal, provincial, and local governments working collaboratively across the country to build asset management capacity, supported by municipal associations, non-profits, and industry experts, Canada continues to make progress in municipal asset management. There is, however, much more work to be done to ensure that the policies, legislation, and funding programs launched from the top-down are reaching all communities across the country and achieving the intended goal of capacity development. The results of this study clearly identify the need for greater attention on the quality of asset management data available to municipal decision-makers and asset managers. To date, regulations and funding incentives introduced in Canada have emphasized and supported the completion of asset management plans at the local level rather than the development of optimal asset data gathering practices. This is not true of all programs or requirements, but has certainly become the trend.

As Canada’s utilities and local governments work to build more sustainable and resilient water systems, while delivering value for money, access to accurate and well-managed asset data will be essential. Making use of that data to routinely inform and optimize infrastructure planning and maintenance activities is the ultimate goal. With better quality asset data, asset managers across the country can feel more confident about the validity of their asset management plans and decision-support tools. The case studies and survey analysis contained in this report contribute to the continued development and dissemination of best practices in leveraging quality asset data for improved infrastructure planning.

An opportunity exists for governments and other leaders to support a stronger focus on instituting optimal data collection methodology and building capacity to maintain data collection on an ongoing basis. Reviewing condition data collection practices, conducting a data inventory gap analysis, and formalizing a governance framework for asset management can also be a great place for local governments to start building maturity in their asset management programs. Ultimately, asset management is about doing the right thing, to the right asset, at the right time. Good quality data will help support decisions and lend confidence to municipalities/utilities that the right decisions for operations, maintenance, and planning are being made.
REFERENCES


APPENDIX
Survey: Leveraging Asset Management Data for Improved Water Infrastructure Planning

Q1: Contact information.

Q2: What is the population size serviced by your municipality/utility?

Q3: What is the size of your water and wastewater systems in terms of operating and design capacity?

Q4: Select the statement below that best describes the outcomes your organization is currently achieving with the use of your asset data. Select all that apply:

Outcomes:
(a) managing assets to optimize asset life cycle
(b) sustaining performance, optimizing costs, reducing risks
(c) optimizing capital investments and plans for sustainability
(d) developing long-term goals for your organization

Q5: How would you describe the current staffing capacity and time devoted by staff to asset management?

Number of staff dedicated to asset management:
(a) no staffing (b) limited staff (c) adequate staff but no dedicated individual/team
(d) part-time employee (e) dedicated employee (f) dedicated team

Average time the staff devote to asset management:
(a) <10% (b) <25% (c) <50% (d) <75% (e) <100% (f) 100%

Key responsibilities of the staff:
(a) collect and manage data (b) assess data (c) use data for planning/decision-making
(d) collaborate with other divisions/departments for planning/decision-making
(e) a and b (f) a, b, and c (g) a, b, and d

Q6: Approximately how frequently does your organization update its asset management plan?

(a) every 6 years or more (b) every 4-5 years (c) every 2-3 years (d) annually
(e) we do not have an asset management plan (f) other (please specify)

Q7: How is software (not Excel) used to facilitate your asset management processes?

Select all that apply:
(a) no software program used for asset management (b) software programs used for the collection and analysis of tangible capital asset inventory data (c) software programs used for infrastructure capital planning and analysis using asset inventory data (d) software programs used for tracking asset maintenance work orders (e) others (please specify)

Q8: How would you describe the effectiveness of the software programs currently being used?

Areas of effectiveness:
(a) type of data captured (b) data management (e.g., searches, queries, sorting)
(c) accessibility to multiple users (d) analysis and reporting capabilities
(e) integration with other management software
Q9: What do you own, what is it worth and what condition is it in?
Answer the following questions regarding your asset inventory for both linear assets (pipes) and vertical assets (facilities):

Percentage of assets in inventory:
(a) less than 50% (b) 51-75% (c) more than 75% (d) no inventory

Inventory is broken down into asset components (e.g., the roof of a facility of segments of a pipe): (a) yes (b) no

Inventory includes historical cost of assets: (a) yes (b) no

Percentage of assets that have captured condition data:
(a) less than 50% (b) 51-75% (c) more than 75% (d) no inventory

Approximate reliability of captured condition data:
(a) 0% objective: 100% subjective (b) 25% objective: 75% subjective (c) 50% objective: 50% subjective (d) 75% objective: 25% subjective (e) 100% objective: 0% subjective

Q10: How would you describe the quality of your organization’s asset inventory data?
Select all that apply:
(a) the asset inventory is frequently updated (updated most recently within the last 6 months)
(b) the asset data is collected and verified by a dedicated internal asset manager (or equivalent)
(c) the asset data is independently verified by a professional third party
(d) other (please specify)

Q11: Which departments/units (e.g., finance, maintenance, operations, environmental services) have access to your asset inventory data?
(a) How is it accessed?
(b) Why is the data accessed?
(c) What data is accessed?
(d) What is the data used for?

Q12: What is the current level of your organization’s GIS mapping for both linear assets (pipes) and vertical assets (facilities)?

(a) % of assets GIS-mapped (b) % of GIS-mapped assets linked with inventory

Q13: Which tools and/or methods are used for assessing asset condition and remaining useful life of your water, wastewater and stormwater infrastructure?

Q14: Approximately what percentage of recent maintenance, repair, and replacements have been attributed to the following: (please ensure the total sums to 100)
(a) reactive (b) time-based (c) proactive (predict, plan, and schedule) (d) reliability based continuous improvements/defect elimination (e) strategic/best practices/precision maintenance

Q15: For maintenance, repair, and replacement initiatives for water assets, approximately what percentage of the yearly operating costs is attributed to predictive, preventative, and reactive maintenance for the following asset types? Please provide a percentage for each category and ensure the percentages sum to 100 for each line:
(a) buildings (b) pumps (c) pipes (d) storage tanks (e) valves (f) hydrants (g) pumping/booster stations (h) chambers (i) water meters (j) well field (k) wells (l) miscellaneous equipment

Q16: For maintenance, repair, and replacement initiatives for wastewater assets, approximately what percentage of the yearly operating costs is attributed to predictive, preventative, and reactive initiatives for the following asset types? Please provide a percentage for each category and ensure the percentages sum to 100 for each line.

(a) buildings (b) pumps (c) pipes (d) pumping stations (e) wastewater facility (f) wastewater lagoons (g) manholes (h) miscellaneous equipment

Q17: What asset management data is used to inform planned initiatives for water, wastewater and stormwater?

Q18: What asset management data is used to inform planned initiatives for water, wastewater and stormwater?

Q19: What information from the asset management data collected is currently used to help minimize unplanned (reactive) initiatives for water, wastewater, and stormwater?

Q20: What information from the asset management data collected is currently used to help minimize unplanned (reactive) initiatives for water, wastewater, and stormwater?

Q21: How are water system investment decisions prioritized? Check all that apply:
   (a) fiscal approach (government taxes and expenditures)
   (b) smart growth framework (long-term sustainable planning vs. short-term focus)
   (c) triple bottom line (social, environmental, economical)
   (d) political priorities
   (e) risk (financial, regulatory, technical)
   (f) asset lifecycle costing approach
   (g) completely reactive
   (h) other (please specify)

Q22: How are water system investment decisions prioritized? Check all that apply:
   (a) fiscal approach (government taxes and expenditures)
   (b) smart growth framework (long-term sustainable planning vs. short-term focus)
   (c) triple bottom line (social, environmental, economical)
   (d) political priorities
   (e) risk (financial, regulatory, technical)
   (f) asset lifecycle costing approach
   (g) completely reactive
   (h) other (please specify)

Q23: How is asset management data used to support your investment decisions (e.g., development of condition/risk ranking, evaluating deterioration rates, cost-benefit analysis)?

Q24: What asset management data is typically considered in developing your strategic long-term infrastructure plans?
   (a) historical replacement costs (b) actual replacement cost (c) estimated useful life
   (d) age-based condition (e) assessed condition

Q25: Over the last 10 years, approximately what percentage of funding from the sources listed below were used to finance your organization’s activities (e.g., maintenance/repair/replacements, operations, upgrades, expansions, new projects, etc.)?
   Please ensure the percentages sum to 100 for each asset class (water, wastewater, stormwater):

(a) % own source/utility revenues (b) % financing/loans (c) % funding from provincial/federal grants (d) % funding from municipal taxes (e) other