Auditor General's Office

Full Report

2011

Audit of Watermain Repairs

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This audit was performed by the Auditor General pursuant to section 223.19 (1.1) of the Municipal Act, 2001, S.O. 2001, c.25 in accordance with generally accepted government auditing standards (International Standards for the Professional Practice of Internal Auditing, as set by The U.S. Government Accountability Office).

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EXECUTIVE SUMMARY

Audit Objectives

The primary objective of this review was to identify opportunities to enhance the value for money achieved through watermain excavation and repair processes performed by both City and contractor work crews. Our audit procedures also evaluated whether:

- Watermain breaks/leaks are identified and repaired in a timely manner in order to minimize disruption to customers;
- Watermains are repaired in accordance with the Occupational Health and Safety Act (OHSA), O. Reg. 213/91 ("The Act");
- Workers are equipped to perform the work in a timely and efficient manner;
- The City is achieving value for money in repairing watermain breaks.

It is also intended that any opportunities identified in our review of watermain excavations and repairs should also be considered in all other planned and unplanned water and wastewater excavations and repairs.

Audit Methodology

Our audit methodology included the following:

- Reviewed documentation used to identify, track and report watermain breaks/leaks;
- Reviewed preventative maintenance programs used in identifying leaks/breaks;
- Reviewed the use of alternate technologies in repairing watermain leaks/breaks in order to reduce repair time;
- Observed and reviewed the economy, efficiency, effectiveness and safety of the repair process for both

City and contractor crews.

Our review identified the following:

Summary of Key Issues and Recommendations

- Repairs are generally identified and repaired in a timely manner in order to minimize disruption to customers;
- Repair (excavation/trenching) methodologies observed by City crews did not consistently meet Construction Safety Association of Ontario guidelines and OHSA O.Reg. 231/91 for safety in trenches and excavations. Immediate improvements are required;
- There are opportunities to enhance the value for money achieved through operations by:
    - Modifying the method, equipment and resources used in the repair process;
    - Reducing the crew size, modifying the deployment of workers, and establishing an afternoon shift;
    - Centralizing operations and establishing specialty crews.

Generally Accepted Government Auditing Standards

We conducted this audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

This report contains 11 recommendations related to improvements in watermain repairs. A separate memo containing additional suggestions has also been issued to management.

WATER/WASTEWATER ACCOMPLISHMENTS

Divisional management have made significant advances, investing in the development of strategic plans for the Water and Wastewater Systems based on industry recognized best practices. Some of these plans include the Water & Wastewater Services Tactical Plan, the Emergency Response Plan and the Water and Wastewater Strategic Technology and Business Plan.

The planning for this audit included a review of the Water and Wastewater Strategic Technology and Business Plan completed by management in August 2011. Prior to the audit; management identified specific business plans that tied well into the Auditor General's independent observations, findings and recommendations.

Amongst many other opportunities identified by staff, the Water and Wastewater Strategic Technology and Business Plan referred to:

- A Workforce Reorganization Initiative that will possibly identify appropriate staffing and facility requirements needed to deploy excavation, repair and maintenance crews from a centralized location, and

- A Workforce Flexibility Initiative that will review and possibly consolidate the Operator "B" and Relief Operator positions that enhance deployment flexibility, could allow for smaller crew sizes on various jobs and higher individual productivity.

This audit independently came to similar conclusions through the audit process.

The Water/Wastewater division must also adhere to government regulated policies and procedures such as the Safe Drinking Water Act that defines the operation and maintenance requirements for public water supply systems and Ontario's Clean Water Act which helps protect current and future sources of drinking water. The division conducts internal audits to monitor adherence to these

standards with no significant findings.

AUDIT RESULTS

A. EXCAVATION AND TRENCHING IMPROVEMENTS ARE REQUIRED

278 Repairs Requiring Excavation Completed Per Year

The Distribution & Collection Section completes an average of 455 planned and emergency repairs on underground water and wastewater infrastructure per year with 278 repairs requiring excavation. The average depths of the excavations are seven feet.

Auditors Questioned Compliance With OHSA For Excavation Work

Exhibit 1: Current Slope Excavation (9 foot depth) (Method F)

On January 16, 2012, Auditors observed excavation practices during a watermain repair, where OHSA O. Reg. 213/91 regulations were contravened.

The dimensions of the hole clearly did not meet Construction Safety Association of Ontario and OHSA O. Reg. 213/91 guidelines for trenching and excavations. Excerpts from the

Ontario Ministry of Labour (MOL), OHSA O. Reg. 213/91 regarding excavations as well as the City's Standard Operating Procedures for entering trenches and excavations are outlined in Appendix 2.

When asked, the City's workers responded that they believed they were working in an approved manner in accordance with the regulations.

The City's Health & Safety Commitment

Despite the delivery of multiple recent training sessions on safe trench practices to Distribution and Collection staff, and although the Distribution and Collection Section has identified safety as a high priority, has a good safety record, and has made many improvements to safety practices, trenching safety is a specific area where more improvement is still required. Supervisors at all levels are accountable to take every reasonable precaution for the protection of employees. Employees and contractors must follow this example and perform their tasks in accordance with City of Greater Sudbury (CGS) Policies, Safe Work Procedures and all applicable legislation as it relates to the work process being performed.[1] The City's Health & Safety Commitment is attached in Appendix 3.

Proper Sloping Increases Both Time And Costs Of A Repair Job

Currently, in order to properly slope an excavation (Method A) a larger hole would need to be dug. Our analysis indicated that the surface dimensions of an average excavation would have to be increased from 12' x 12' to 16' x 17'. The volume of materials would be increased from 59 tonnes to 81 tonnes. The increased volumes of materials removed and replaced compound the amount of time required to complete the repair project and consequently increases the costs.

[1] "Health & Safety Commitment", City of Greater Sudbury, April 28, 2011

Exhibit 2: Slope Excavation (5 ft depth) in accordance with The Act (Method A or B)

Sloping An Excavation In Accordance With OHSA O.Reg. 213/91 Would Require (25%) More Hours and Cost (40%) More Than Current Sloping Methods.

Sloping an excavation in accordance with the Act (Method A) would require (25%) more repair hours and cost (40%) more assuming curbs and sidewalks were not affected, compared to the current method of partially sloping the excavation (Method F).

	WORK METHOD IN ACCORDANCE WITH THE ACT	CURRENT WORK METHOD
	METHOD A	METHOD F
	Sloping Excavation Per The Act Using A Single 10 Tonne Dump Truck	Current Sloping Excavation Using A Single 10 Tonne Dump Truck
Cost	$ 4,551.27	$ 3,260.24
Total Hours Required	10	8
Overtime Predicted	Yes	No

Exhibit 3: Comparison of costs and hours required between sloping method (Method A) in accordance with the Act and

current sloping method (Method F)

The Ability To Use A Trench Box Should Always Be Evaluated

The Act allows smaller dimensions when either trench boxes or shoring methods are used. The use of trench boxes would not require as large an excavation and would save repair costs while meeting OHSA O. Reg. 213/91 regulations.

Exhibit 4: Trench Box Examples

Although management has investigated the use of trench boxes by other municipalities, the Auditors confirmed that the City did not own a trench box suitable for watermain repairs at the time of the audit. Management has since ordered trench boxes and arranged for training sessions on their proper use.

Recommendation:

1. When the Auditors brought to Management's attention an excavation that did not appear to meet OHSA O. Reg. 213/91, they investigated and took immediate action to formally address this incident with the workers involved. Management must ensure that tools and options required for excavation work in accordance with the Act are available to all City work crews.

B. FULL SLOPING EXCAVATION METHODS ARE GENERALLY MORE COSTLY THAN TRENCH BOX METHODS

Models Were Developed To Evaluate Key Elements and Costs For The Watermain Excavation And Repair Process

After detailed observation of excavations by both the City crews and contractor crews, standard productivity and standard cost models were developed for the excavation and repair process to a seven foot depth.

The following scenarios were analysed based on current costs within the City's MMMS system and current contractor rates:

Method A	Using a City crew with Backhoe, sloping in accordance with OHSA O. Reg. 213/91 and a 10 tonne dump truck
Method B	Using a City crew with Backhoe, sloping in accordance with OHSA O. Reg. 213/91 and a 20 tonne dump truck
Method C	Using a City crew with Backhoe and Hydro Excavation, a trench box and a 20 tonne dump truck
Method D	Using a City crew with a Backhoe, a trench box and a 20 tonne dump truck
Method E	Using a Contractor with a Backhoe, a trench box and a 20 tonne dump truck
Method F	Using a City crew with Backhoe, current sloping method and a 10 tonne dump truck
Method G	Using a City crew with Backhoe, current sloping method and a 20 tonne dump truck

Current Sloping Methods Are More Costly And Dangerous Than Working With Trench Boxes

Our analysis indicated that the current sloping methods (Methods F and G), whether using a 10 tonne or 20 tonne truck are both more costly than working in accordance with OHSA O. Reg.

213/91 using hydro excavation and/or a backhoe, a trench box and a 20 tonne dump truck (Methods C and D).

	WORK METHODS IN ACCORDANCE WITH OHSA O.Reg. 213/91				
	CITY CREW				CONTRACTOR
	METHOD A	METHOD B	METHOD C	METHOD D	METHOD E
	Sloping Excavation Per The Act Using A Single 10 Tonne Dump Truck	Sloping Excavation Per The Act Using A Single 20 Tonne Dump Truck	Trench Box Sized Excavation Using Hydro Excavator	Trench Box Excavation Per The Act Using A Single 20 Tonne Dump Truck	Trench Box Excavation Per The Act Using A Single 20 Tonne Dump Truck
Cost	$ 4,551.27	$ 4,061.08	$ 2,785.34	$ 2,237.14	$ 2,361.91
Total Hours Required	10	7	8	6	5
Overtime Predicted	Yes	No	No	No	No

	CURRENT WORK METHODS	
	CITY CREW	
	METHOD F	METHOD G
	Current Sloping Excavation Using A Single 10 Tonne Dump Truck	Current Sloping Excavation Using A Single 20 Tonne Dump Truck
Cost	$ 3,260.24	$ 2,760.61
Total Hours Required	8	5
Overtime Predicted	No	No

Exhibit 5: Cost comparisons for various work methods

Potential Cost Savings With Using a Trench Box

Percentage of Excavations Using Trenchbox Method "D"	Estimate Of Annual Savings By Using Trenchbox Method "D" Instead Of Sloping Method "A"
100%	$ 643,328
90%	$ 578,995
80%	$ 514,663
70%	$ 450,330
60%	$ 385,997
50%	$ 321,664
40%	$ 257,331
30%	$ 192,998
20%	$ 128,666
10%	$ 64,333
0%	$ -

Exhibit 6: Potential cost savings with using a trench box

In comparing the costs of these various methods, our analysis indicated that the least cost scenario was having a City crew excavate using a backhoe, trench box and 20 tonne dump truck (Method D). This repair method could also be completed without any overtime.

Exhibit 7: Backhoe – Trench box (Methods D or E)

The impact to the roadways was directly affected by the method

of repair used. Any sloping method increased the amount of road that needed to be excavated and repaired, increasing time and money for material and labour.

Using Work Methods in accordance with the Act Could Save The City $31,000 Per Year and Free Up 1,668 Productive Hours

Based on the experience in other jurisdictions, management estimates that a trench box could be used in about half the digs. Sloping methods in accordance with OHSA O. Reg. 213/91 would be required for all other digs. Using these work methods would reduce costs by approximately $31,000 per year as compared to the current Method "F". It would also potentially free up 1,668 productive hours of Water/Wastewater certified workers which could be used for other core Water/Wastewater work.

Additional Savings Can Be Realized From Using a Trench Box

There are also potential additional improvements that cannot be measured in terms of dollar impacts such as residents being without water for shorter periods of time and less interruption to traffic on City streets.

Recommendation:

2. Based on an average 7 foot depth excavation, our analysis indicated that a 20 tonne dump truck / backhoe / trench box method is the most economical, efficient and effective method. Supervisors should document their work plan instructions on CMMS job cards for all excavation repairs in support of excavation crews who are expected to consider other options based on the actual conditions of each excavation.

C. DUMP TRUCK CAPACITY AND ACCESSIBILITY OF RESOURCES AND MATERIALS HAVE THE GREATEST IMPACT ON COSTS

Truck Capacity And It's Impact On Number of Trips & Unproductive

After the dimensions of the excavation, the largest constraint that has the greatest impact to the cost of the job is the capacity of the dump trucks used. There is wait time for the entire repair crew while the dump truck removes spoils materials or brings back new

Crew Wait Times

materials. The Water/Wastewater department currently has a fleet allocation of five dump trucks. Two are 20 tonne trucks (at 2012 CGS fleet charge of $2,200 /month) and three are 10 tonne trucks (at 2012 CGS fleet charge of $2,036 /month).

When a smaller dump truck (10 tonne) is used, the costs for a repair almost doubled due to the increased cycle time in filling and emptying the truck. Even with using a trench box, if a 10 tonne dump truck was used, the estimated time increased from 8 hours to 14 hours and the cost would approximately double. Therefore, when a 10 tonne dump truck is used, the amount of hours required to perform the repair is compounded and directly increases the costs of labour, the contracted backhoe and owned equipment rentals.

Interestingly, vacuum trucks have the capacity to hold more excavated material than they remove in an eight hour shift. Therefore, there is no wait time in removing the spoils.

Exhibit 9: Hydro Excavator Dump Example

The Use Of 10 Tonne Dump Trucks Often Increases Costs, Extends The Time Required For Each Excavation And Should Be Monitored More Closely

During one watermain repair, Auditors noted that although the dump site was close by, there was a lot of time spent waiting for the dump truck to return in order to continue with the work. The crew was using a 10 tonne dump truck. Each time the truck left to dump or pick up a load, the crew and the backhoe stood idle. Approximately three hours were spent waiting for the dump truck throughout the day. Since the job was 11.5 hours, 26% of the time was spent waiting for the dump truck. The total labour cost spent waiting for the dump truck was $149 which was 15% of the total labour cost of the job. No digging occurred when the crew was waiting for the dump truck. The cost of the backhoe waiting for the dump truck was $177 or 13% of the total backhoe costs. If the crew was working in the south end of

the City where the dump site is further away, the wait time would have been greater. When this unproductive time is being paid as overtime, there are additional costs to the City.

The contract for watermain repairs requires the contractor to use a tandem truck with a minimum capacity of 22,000kg gross vehicle weight, which is equivalent to 20 tonnes.

Recommendation:

3. The volume and carrying capacity of dump trucks commonly used in current excavation projects contributes to unproductive wait times for City excavation resources, and can contribute to unnecessary overtime. Management should take the necessary steps to ensure the consistent use of larger 20 tonne dump trucks which will allow the City to save resource hours on each excavation.

D. A REDUCTION OF CREW SIZE AND UNPRODUCTIVE WAIT TIMES IS POSSIBLE

Crew Size Flexibility

When a watermain is in need of repair, a work crew is dispatched. The crew typically consists of a crew size of four Water System Certified workers

- (1) Operator A (lead hand),
- (1) Operator B, (pipefitter)
- (1) Relief operator (labourer) and
- (1) Relief operator (truck driver).

Unproductive Crew Wait Times Were Identified

Auditors observed a repair and noted that there was a lot of wait time for crew members. Total wait time cost approximately $418 which was 34% of the total labour cost. The Auditors discussed the productivity of the crew with management who decided to remove one of the Relief Operators (labourer) from the repair crew and multi task the remaining relief operator to take on the labour oriented tasks

Management Responded By Reducing The Crew

Size From 4 to 3. This Frees Up 1,807 Productive Hours For Other Core Activities.

as well as drive the truck. Assuming that the recommended mix of trench box and excavation methods in accordance with OHSA O.Reg. 213/91 are implemented by management, this reduction in crew size would free up 1,807 productive hours which could be used for other core Distribution and Collection work.

During a watermain repair, the auditors observed a repair performed by a crew that did not have a Relief Operator (labourer) assigned. The absence of the Relief Operator did not appear to impact productivity.

The Auditors did note that there was still unproductive wait time with the Operator B while the excavation and restoration work was being done. During this particular job, there was approximately 5.75 hours, or 50% of the hours spent on the job waiting (this time does include the time waiting for the dump truck). When such circumstances present, the City should consider deploying the Operator B to do preventative maintenance work within the area of the watermain break. Therefore, productive work can be done and they can easily return to the watermain break site to help in the repair of the break once it is uncovered.

Redeployment of The Operator "B" Would Free Up An Additional 904 Productive Hours For Other Core Activities

Assuming that the recommended mix of trench box and excavation methods in accordance with OHSA O. Reg. 213/91 are implemented by management, this redeployment of the Operator "B" would potentially free up 904 productive hours which could be used for other core Water/Wastewater work.

Emergency locates are called when jobs have not been able to be predicted in advance and that a dangerous condition exists that cannot be put on hold. Some crew members must be onsite prior to receiving locates to secure the job site before beginning work, to notify affected customers, and to receive the locate information. The backhoe cannot start digging until the crew receives the locate information.

Deployment of Excavation Work Resources Before Locates are Received Consumes As Much As

While this site work often requires attention such as controlling erosion from flowing water, ensuring pedestrian and traffic safety and controlling damage to adjacent infrastructure, there are times when less staff presence is required. In some instances where site

33% of Elapsed Time Required To Complete An Excavation and Repair

work is not required, it may be appropriate not to dispatch crews and hired backhoes to the work site prior to locate information being received. Consistently following this protocol represents a potential cost saving opportunity.

Of the eight crew cards tested, 33% of the time recorded was wait time by the crew and the contracted backhoe operator for the locate information. This wait time translates into 26% of the total cost of the repair jobs. When the Auditors observed a valve repair, the Auditors also noticed that the backhoe was on site one hour and 40 minutes prior to the crew attending. The City is paying for a contracted backhoe when it is not doing productive work.

Recommendations:

4. Update the Standard Operating Procedures to reduce to a standard repair crew size to three rather than four. The crew size can be reduced by 1.0 FTE (Relief Operator) on each excavation. Some exceptions may be required.

5. During unproductive wait time, Management should consider scheduling preventative maintenance work within the same proximity of the job for the Operator B.

6. Management should review the current process of dispatching entire crews to the job site. When safe to do so, less staff may be required to be dispatched to the work site until locate information is obtained, providing the opportunity to save resource hours.

E. ENHANCED SUPERVISORY CONTROL OVER OVERTIME IS REQUIRED TO ELIMINATE ABUSE

Supervisory Review and

Supervisors sign off on the validity, accuracy and completeness of crew cards. The supervisor may not be available to all areas at

Approval of Timecards Is a Key Managerial and Financial Control

the end of the shift, however, it is the workers responsibility to get prior approval for any overtime, and it is the supervisor's responsibility to ensure the time entered on the time card is valid prior to them approving it.

The Auditors observed that the time card for one repair indicated the City crew worked until 8:30PM. Upon further investigation, it was noted that the crew had actually left for the employee parking lot approximately one hour earlier.

The City repair crew had also indicated that they had worked through their lunch, thereby claiming 1½ hours pay for their ½ hour lunch break. Since the Auditors were on site observing the repair, they noted that the repair crew had in fact left the work site during their lunch break.

Improved Controls Intended To Detect Overtime Abuse Will Save On Overtime

Once brought to management's attention, they immediately verified these discrepancies, retracted the overtime and took corrective disciplinary action with those involved.

Recommendations:

7. Management must continue to improve and re-enforce the organizations commitment to internal controls intended to detect the abuse or falsification of overtime.

8. Allowing workers to work through their lunch does not provide value for money. This practice should be discouraged whenever possible unless required to improve service to the public.

F. COLLECTIVE BARGAINING AGREEMENT AND LABOUR LAW CONSTRAINTS ARE IMPACTING DIVISIONAL PERFORMANCE

Collective Bargaining

There is no afternoon or weekend shift provided for in the current Collective Bargaining Agreement (CBA). According to

Agreement Constraints

Article 18:00, "Hours of Work" in the Collective Bargaining agreement between the City of Greater Sudbury and the Canadian Union of Public Employees and its Local 4705 Outside Unit,

- "The normal work week for all Employees, except employees of the Plants Section, shall consist of five (5) eight (8) hour days from Monday to Friday inclusive for a total of forty (40) hours per week.
- The normal work day shall not commence before 8:00 am nor finish later than 4:30 pm.
- No eight (8) hour Shift shall be spread over a period longer than eight and one-half (8 ½) hours, with one-half (½) hour off for lunch."
- Overtime is paid for any work after 4:30 pm and if workers are unable to take their ½ hr unpaid lunch.
- Overtime is paid at the rate of time and one-half of the regular rate of pay.

Employment Standards Act Constraint

According to the Employment Standards Act (ESA), an employee must receive at least 11 consecutive hours off work each day. If a repair job were to run more than 13 hours, the City would either have to cordon the work site off and return to it the next day, or call in a second crew or contractor to complete the work. Paying additional overtime and/or calling in a contractor increases costs and liability to the City.

Repairs can occur at any time. There are additional costs to the City to perform this work if crews are paid an overtime premium. In addition, core system operation activities and preventative maintenance work such as swabbing and leak detection are often best done at night.

There is also the potential for abuse of overtime as crews may not work as efficiently during the regular scheduled hours in order to obtain overtime premiums. Audit observed inefficiencies in watermain repairs which in part, contributed to overtime costs on

the job.

Management did identify to the Auditors a need for an afternoon/ weekend shift as well as their past and continuing efforts to attempt to modify the CBA to enable expanding non-dayshift operations.

City Crews Would Be The Less Expensive Option

The Auditor's analysis indicated that the use of a trench box potentially reduces the amount of time it takes to repair a watermain. In comparing costs between City crews and contractor crews assuming the same productivity, the Auditors analysis confirmed management's assertion that if work can be completed at straight time rates, the City crews would be the less expensive option.

Core Preventative Maintenance Work Is Often Best Done At Night

Based on an estimated depth of hole and productivity of equipment, it is estimated that the repair could be done within six hours if the crew used a trench box, backhoe and a 20 tonne dump truck. In order for the City not to incur overtime costs, the job would have to begin by 10:00AM. Furthermore, due to the restrictions within the ESA in which an employee cannot work more than 13 hours in a day, that would mean that any watermain break that occurs after 3:30PM would need to be repaired by the contractor. Prior to 3:30PM, the decision would need to be made whether the break could be repaired within six hours and the City would pay overtime.

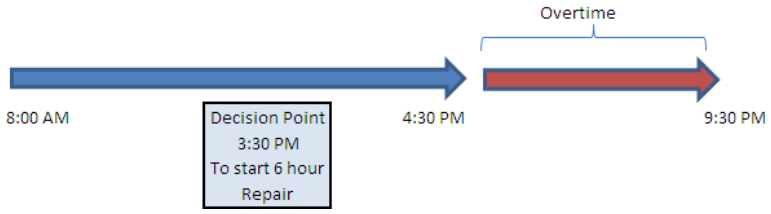


Exhibit 10: Current Work Schedule:

Using the same base case example, if the City had an afternoon shift, the City crews could repair more watermain breaks using straight time. If a break took more than eight hours, the afternoon crew could take over to complete the repair using straight time. Any new break identified prior to 5:00PM could be repaired by the afternoon shift on straight time. Again, considering the average

The Simple Lack of An Afternoon Shift Increases Costs

repair takes six hours, a repair that is found up until 10:00PM could be repaired by City crews with overtime. Only repairs started after 10:00PM would need to be performed by the contractor. Considering the City crews at straight time are the more cost effective for the City compared to the contractor, cost savings can be found by having City crews perform more repair work.

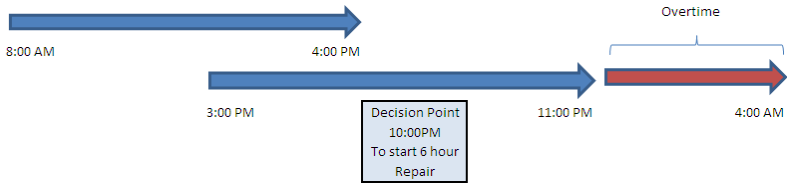


Exhibit 11: Proposed Schedule with Afternoon Shift:

Having An Afternoon Shift May Reduce The Risk Of Abuse Of Overtime By Eliminating The Incentive To Extend Excavation Jobs

In watermain repairs, there are also social aspects that must be considered. For example, some jobs may not be able to be stopped as houses and/or businesses may be without water during the repair period. Having crews that work afternoon shifts would allow the City to reduce overtime. The fact that the collective bargaining agreement does not allow for an afternoon shift appears to be causing work to be provided to the contractor. Having an afternoon shift may also reduce the risk of abuse of overtime by eliminating incentives of extended excavation jobs. On occasions where no watermain repair work is required, the City could also use the additional afternoon shift to perform more preventative maintenance work since some tasks are better performed in the evening.

Recommendation:

9. Management should continue to work with the Union in order to explore the use of afternoon shifts and other non-dayshift options for Water/Wastewater work crews.

G. CENTRALIZED DEPLOYMENT OF WATER/WASTEWATER DISTRIBUTION AND COLLECTION WORK CREWS MAY AID IN IMPROVING DIVISIONAL PERFORMANCE

Crews are currently deployed from two different depots, one located on Frobisher in Sudbury, and one in Rayside. The work is distributed based on zone. Therefore, operators can perform a multitude of tasks on any given day depending on that day's scheduled work. Some specific work tasks, such as acoustic leak detection do take special skills and training.

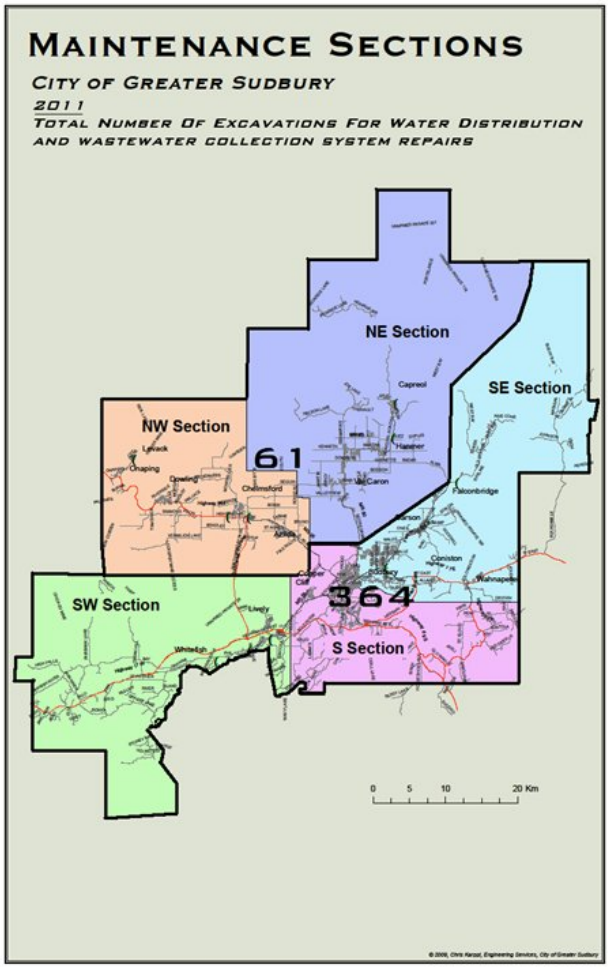


Exhibit 12: Total Number Of Excavations For Water Distribution and Wastewater Collection System Repairs In 2011

Establishing Specialty Teams May Result In Further Efficiencies

If all crews were dispatched from one location that is central to their busiest service area, the department would be able to assemble specialty teams. By having specialty teams, the City would develop and preserve excavation and repair or preventative maintenance expertise of certified water distribution system professionals. Having this expert knowledge would result in gained efficiencies in the work being performed.

A focus on enhancement of worker skills such as acoustic leak detection could directly impact the effectiveness, efficiency and economy of excavation related repairs. Audit observed one Trouble Investigator (TI) using the acoustic leak detection in order to identify a watermain leak prior to any excavation work commencing. The TI had accurately identified the location of the leak which helps to reduce the time spent on additional digging to locate the leak as well as reduce the amount of road degradation.

Consolidation of Repair Parts For Improved Control And Turnover Is Warranted

Parts inventory is stored in five depots within the City of Greater Sudbury. These depots all hold various quantities of inventory and City staff indicated that some inventory may be obsolete. The value of the inventory cannot be determined as an inventory count at all locations has not been conducted. At each depot, the inventory was found to be stored in various buildings and not always in an organized manner. Some of the buildings are not well lit and require repair. Items are also stored on the floors which, combined with poor lighting can make it a possible safety hazard. Smaller, more valuable parts were found to be secured in most locations; however, at one location, a lock to a storage cabinet had been cut, but not yet replaced. The Auditors notified management and the lock was immediately replaced.

Recommendations:

10. Management should consider centralizing water/ wastewater operations. The location should have adequate storage for parts, stockpiles and meet all health and safety requirements. Centralization will enable the establishment of specialty teams, aid in

supervision and employee deployment.

11. Management should focus on the consolidation and rationalization of obsolete or overstocked repair parts and establish and maintain desired inventory levels for parts. Centralizing inventory will reduce costs of maintaining buildings, assist in ensuring parts are stored in a safe and organized manner, and that desired inventory levels are maintained.

CONCLUSION

This report contains 11 recommendations related to improvements in Watermain Repairs. A separate memo containing additional suggestions has been issued to management.

Our recommendations relate to the need to :

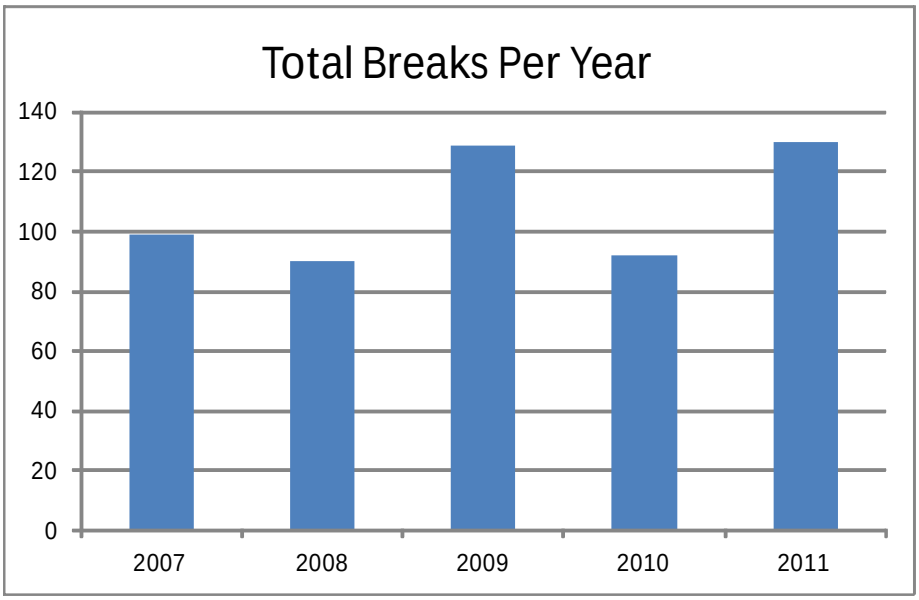
- Improve the current excavation work methods to enhance employee safety and reduce costs;
- Improve the flexibility of the workforce by deploying workers as individuals rather than a full crew, reducing the crew size and unproductive wait times as well as consider adding an afternoon shift;
- Centralize the Water/Wastewater work crews and establish specialty teams to improve performance;
- Improve efficiencies by utilizing more efficient equipment and establish more accessible resources and materials.

Implementing the recommendations contained in this report will enhance the value for money achieved in the Watermain Repair process as well as other repair processes within Water/Wastewater Services.

APPENDIX 1 – BACKGROUND

According to the Ontario Municipal Benchmarking Initiative's (OMBI) 2010 Report, the average age of water pipes in the City of Greater Sudbury is 45 years with the average of 9.8 breaks per 100 km of distribution pipe. The average number of breaks is 20% higher than the median of 8.2.

The graph below illustrates the number of water main breaks for the past five years.



A significant portion of the City's water losses (non-revenue water), is thought to result from watermain breaks. One of the components in optimal management and operation of a water distribution system is the speed and quality of the repair in a watermain break.[2] According to best practice identified by the National Guide to Sustainable Municipal Infrastructure, "Speed does not (always) mean how fast a watermain failure can be repaired, but rather how quickly a watermain failure can be detected, located and repaired using the highest standards for safety, quality and efficiency." [3] The severity of a watermain break is dependent on a number of factors

[2] "Speed and Quality of Linear System Repairs: A Best Practice by the National Guide to Sustainable Municipal Infrastructure", InfraGuide, National Guide to Sustainable Municipal Infrastructure, July 2004, p4.

[3] "Speed and Quality of Linear System Repairs: A Best Practice by the National Guide to Sustainable Municipal Infrastructure", InfraGuide, National Guide to Sustainable Municipal Infrastructure, July 2004, p xi.

including the size of the watermain that has failed, social impacts, environmental impacts, as well as impacts to surrounding infrastructure.

In 2011, a single watermain excavation and repair on Paris Street near Health Sciences North was reported to have cost over $300,000 and had forced the watermain repair and maintenance program over budget. A significant portion of the cost of this and other watermain repairs was attributed by management to additional time and resources spent during this initial repair phase in an effort to minimize any settlement or differential heaving of the road surface which may lead to rework at that location at a later date.

The graph below illustrates the annual costs for Water Repairs and Maintenance and Wastewater Repairs and Maintenance from 2008 until 2011.

	Total Expenses by Year (in thousands)			
	2008	2009	2010	2011
Water Repairs and Maintenance	3,224.3	3,940.3	3,387.9	4,472.6
Wastewater Repairs and Maintenance	749.6	831.3	746.5	955.7

The City currently maintains over 900 km of watermains, approximately 5,000 hydrants and hydrant lead valves and more than 7,000 control valves.

In 2011, the Water Repair and Maintenance budget totalled $3.4 million, with $1.4 million budgeted for contractors. The Wastewater Repair and Maintenance budget totalled $1.1 million annually, with $300,000 budgeted for contractors.

Repairing watermain breaks in a quality and timely manner is essential in order to increase water accountability and reliability of supply, ensure water quality, protect property and the environment, and to ensure public and staff safety. As a result, the overall process is reliant on a delicate balancing of resources employed to complete preventative maintenance work and the repair of system components identified in need of repair.

The Construction Safety Association of Ontario and OHSA O. Reg. 213/91 provides regulations specifically directed to safe work practices and the required dimensions for trenches and excavations. Safety related to excavations and trenches is a key element that requires constant vigilance, as it is clear that repair costs and the impact to road surfaces increase significantly when the dimensions of excavations and trenches increased.

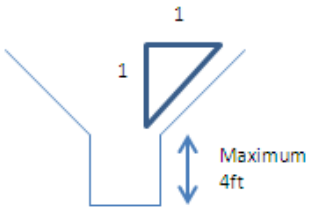
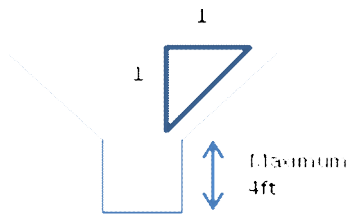
“Each year in Ontario, there are 3-4 fatalities and about 350 lost-time injuries in the sewer and watermain industry. A significant number of deaths in sewer and watermain work are

directly related to trenching. Trenching fatalities are mainly caused by cave-ins."[4] "Most fatal cave-ins occur on small, short duration jobs like water, gas, electrical and sewer connections." [5]

[4] www.local1089.ca/site/contractorstraining/trenching-safety.html

[5] Ministry of Labour, Fact Sheet #11, "Safe construction trenches and excavations", May 2011

APPENDIX 2 –SAFE SLOPING REQUIREMENTS

Soil Type	Description[6]	Slope Requirement
Type 1	• Hard, very dense and only able to be penetrated with difficulty by a small sharp object; • Low natural moisture content and high degree of internal strength; • Has no signs of water seepage and; • Can be excavated only by mechanical equipment	
Type 2	• Is very stiff, dense and can be penetrated with moderate difficulty by a small sharp object; • Has a low to medium natural moisture content and a medium degree of internal strength; and • Has a damp appearance after it is excavated	
Type 3	• Is still to firm and compact to loose in consistency or is previously excavated soil; • Exhibits signs of surface cracking; • Exhibits signs of water seepage; • If it is dry, may run easily into a well defined conical pile; • Has a low degree of internal strength.	
Type 4	• Is soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength; • Runs easily or flow, unless it is completely supported before excavating procedures; • Has almost no internal strength; • Is wet or muddy; and • Exerts substantial fluid pressure on its supporting system.	

[6] "Entering Trenches & Excavation", City of Greater Sudbury Standard Operating Procedure, No. WWS-DC-S024 v.1.0

SOIL TYPES[7]:

227 (3) If an excavation contains more than one type of soil, the soil shall be classified as the type with the highest number.

GENERAL REQUIREMENTS

233 (1) A level area extending at least one meter from the upper edge of each wall of an excavation shall be kept clear of equipment, excavated soil, rock and construction material.

234 (1), Trench boxes and or shoring methods must be used to support the walls of an excavation, except

234 (2), (c) if no worker is required to be closer to a wall than the height of the wall of an excavation (where the surface dimensions of the hole are greater than the depth of the hole), or if,

234 (2), (f) made in Type 3 soil, walls of the excavation are to be sloped from it's bottom with a slope having a minimum gradient of one horizontal to one vertical.

234 (2), (g) made in Type 4 soil, walls of the excavation are to be sloped from it's bottom with a slope having a minimum gradient of three horizontal to one vertical.

[7] Ontario Ministry of Labour, Occupational Health and Safety Act, O. Reg. 213/91

APPENDIX 3 – CITY OF GREATER SUDBURY HEALTH AND SAFETY COMMITMENT

April 28th, 2011

Health and Safety Commitment

The City of Greater Sudbury provides a great employment experience which we believe leads to a great citizen experience. A key aspect of a great employment experience is a strong, shared commitment to workplace health and safety. We are committed to accident and illness prevention through the integration of health and safety considerations into all planning, operations and departmental activities.

CGS will continue to uphold our commitment by implementing and maintaining a comprehensive Health and Safety Program with a goal of achieving a healthy and safe work environment that is free from occupational injury and illness.

The Senior Management Team is responsible to provide Health and Safety leadership. The senior team leads, challenges and measures continuous safety performance improvement. Concern for Health and Safety is an esteemed leadership competency.

Supervisors at all levels (from the CAO to the Front Line Supervisor) are accountable to take every reasonable precaution in line with this Policy and Program for the protection of Employees.

Employees and Contractors must follow this example and perform their tasks safely and in accordance with CGS Policies, Safe Work Procedures and all applicable legislation as it relates to the work process being performed.

The legal duties and responsibilities of employers, supervisors and workers overlap and complement each other. Together, they create what's known as the internal responsibility system or IRS. At CGS a healthy IRS means everyone in the workplace has a role to play and everyone understands their role and actively ensures work and workers are safe. Management, Employees and Employee representatives support Joint Health and Safety Committees in their efforts to prevent workplace injuries and occupational illness.

Active participation by all Employees, every day, in every job, is essential for achieving the safety excellence for which we strive. By sharing this responsibility and working together, we will continue to build a strong culture of health and safety within our workplace, our community and the everyday lives of our valued Employees.

Doug Nadorozny – Chief Administrative Officer

Kevin Fowke – Director, Human Resources and Organizational Development

Caroline Hallsworth – Executive Director, Administrative Services

Lorella Hayes – Chief Financial Officer

Catherine Matheson – General Manager, Community Development

Bill Lautenbach- General Manager, Growth and Development

Gregory Clausen – General Manager, Infrastructure Services

Tim Beadman – Chief, Emergency Services

Marc Leduc – Chief, Fire Services