Engineering and Construction Services

Phase Two: Construction Contract Change Management Controls Should Be Strengthened

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AUDITOR GENERAL TORONTO

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Executive Summary

$460M spent annually on capital projects between 2013 and 2017

Between 2013 and 2017, the City's Engineering and Construction Services Division (ECS) delivered approximately $460 million annually in capital projects for the construction of vital infrastructure including bridges, expressways, roads, streetcar ways, watermains, sewers, water and wastewater treatment plant upgrades, and water supply systems. In addition, ECS provides engineering review and acceptance of development applications, and bridge inspection services.

The Auditor General's 2017 Audit Work Plan included an audit of construction contracts issued by ECS.

2 reports on construction contract management practices

The audit began in 2018.

Phase one resulted in a report entitled "Phase One: Controls over Substantial Performance and Warranty Inspection Processes Should be Strengthened", which was presented to the Audit Committee on July 13, 2018.

https://www.toronto.ca/legdocs/mmis/2018/au/bgrd/backgroundfile-117959.pdf

Phase two of this audit, the subject of this report, focuses on change order management.

Future phases in the Engineering and Construction Services Division audit are being planned.

ECS uses external consultants for complex projects

The City has a large and complex construction portfolio that needs to be managed effectively, efficiently and economically by ECS. To do this, ECS delivers construction projects using in-house resources and external consultants who provide design and contract administration services.

Change order

A change order formalizes modifications or alterations beyond the scope of the original contract, and establishes any necessary new contract items, any other basis of payment, and any time adjustments for work affected by the changes.

For lump-sum contracts, the change order describes the method of adjustment or the amount of the adjustment in the contract price, if any, and the extent of the adjustment in the contract time.

For unit price contracts, the change order can apply to contingencies, and establishes the basis for payment and the time allowed for the adjustment of the contract time, if any.

Change directive

Change directives are written instructions, signed by the Owner or the Contract Administrator, directing the contractor to proceed with a change in the work.

Scope

This phase two audit focused on the change management process.

Between 2013 and 2017, ECS spent a cumulative total of approximately $2.3 billion on construction projects and consulting costs. This included approximately $222 million (or 10 per cent) in change order cost. ECS internal staffing cost of $186 million is not included in the $2.3 billion.

For our review, we considered contracts that had change orders amounting to at least $100,000 and 5 per cent or more of the base contract value. A total of 248 contracts out of 739 contracts met this criteria. From the 248 contracts, we selected 10 completed contracts with contract values ranging from $3M to $30M which had total change orders per contract ranging from 5 per cent to 15 per cent of the contract base value.

The 10 contracts included six unit-price construction contracts, three lump-sum construction contracts and one lump-sum professional services contract. The total value of the 10 contracts was $103.5 million. These contracts had 385 change orders with a total value of $16.2 million which amounted to approximately 16 per cent of the total contract base value.

A total of 90 change orders representing $9.6 million were selected for review.

We assessed these contracts to determine whether ECS policies and procedures for change order review and approval were followed.

10 contracts and 90 change orders reviewed

From our review of the 10 contracts and an examination of the 90 change orders, we noted that ECS has policies and procedures in place, but it must strengthen compliance with those procedures. Specifically, ECS needs to focus its efforts on:

- Improving oversight over consultant-managed construction projects, and on ECS project managers overseeing large and complex projects; and
- Strengthening controls over change order approvals, documenting pricing negotiations, liability assessment for errors and omissions, verification of work, and in maintaining appropriate change order documentation.

165 control deficiencies noted

We noted 165 instances of control deficiencies, including non-compliance with ECS policy and procedures. Table 1 summarizes the issues identified in the 90 change orders reviewed. For more details on the issues identified, refer to Exhibit 1.

Table 1: Issues Noted in 90 Change Orders Reviewed

Issues Identified	Number of Instances
Change orders resulting from design error & omission	46
Change orders approved after work commenced or completed	32
Evidence of price negotiation and reasonability check not documented	21
Delegation of signing authority not followed in approving change orders	9
Evidence of work verification not available	9
Scope change by Client Division resulting in change orders	7
Change order splitting	6
Invoices not obtained from the contractor to verify third-party costs	3
Pricing dispute arising from not finalizing change order price prior to commencing work	4
Work completed without authorization	3
Other Issues	25
Total Instances Noted	**165**

Design Errors and Omissions

51% of change orders had design errors

ECS documentation indicates that 46 out of 90 change orders occurred because there were design errors and omissions. Over half (30) of these errors and omissions were caused by consultants. When approving change orders, it is necessary to assign responsibility and accountability for errors and omissions that resulted in the change, and reasonable efforts should be made to recover the costs from the parties at fault.

Consultants not held accountable

We noted two key issues:

1. ECS staff do not consistently assess consultant liability for errors and omissions, and

2. In cases where ECS has identified consultant liabilities, there was no evidence that these liabilities were pursued.

In 14 out of 90 change orders reviewed, ECS staff had determined partial or full consultant liability, but no further follow-up on recoveries has been made to date.

ECS needs to establish criteria to effectively assess consultant liability and provide guidelines to staff on the protocols to follow when pursuing claims against consultants. In addition, ECS should track and analyze the reasons for change orders on an ECS-wide basis as this may be useful to assign accountability and assist with process improvements.

Change Order Management

Change orders may result in additional costs to the City, and although they may be necessary, they should be minimized or avoided where possible. It is very important to ensure that changes are justified and the contractors' costs are reasonable. We noted process and control deficiencies in the day-to-day management of change orders in the following areas:

Change order work completed without prior authorization

- We found 32 (36 per cent) of the 90 change orders where the contractor did not obtain written approval prior to commencing change order work. In these cases, the work started prior to receiving an approved change directive or change order.

Significant delays by consultants in submitting change orders

- We noted 17 change orders that were submitted late by the consultants. The delays ranged from three months to one year after the work had already begun or was completed. This caused significant delays in approval of these change orders by ECS management.

Delegated signing authority was not followed

- According to ECS's Capital Works Procedures Manual, appropriate signing authority must be obtained based on the value of the change order or change directive. Out of $9.6 million in change orders reviewed, we noted nine change orders totaling $1.1 million where ECS staff did not obtain the appropriate signing authority.

Insufficient evidence of pricing assessment and negotiation in change orders

- In 21 change orders, we could not find documented evidence of price negotiations by ECS on the contractor's price proposal. This was often because the consultants submitted the change orders for approval months after the work began or had been completed (this was the case for 17 change orders). Proceeding with change work without finalizing prices with contractors can lead to disputes, as was noted in four change orders.

There is no established guideline or criteria to assist staff to challenge or to conduct a critical review of a contractor's pricing proposals for change orders, specifically on the necessity and reasonableness of hours and material quantities charged.

Verification of change order work not always performed

In five of the 10 contracts reviewed, we noted that nine change orders did not have proper records to support verification of the work by ECS staff or the consultant.

In one example, the project was substantially completed in September 2018; however, there was a disagreement between ECS and the contractor over the number of extra hours worked. The work in this change order for approximately $250,000 is still under review by the consultant and ECS, eight months after substantial completion of the project.

For time and material change orders, it is important to track labour, material, and equipment costs on a daily basis to ensure the work is done and paid accordingly.

Substantial scope changes initiated by client division after contract award

We noted seven instances where the client division added or modified the scope of work during construction which resulted in change orders.

According to ECS's Capital Works Procedures Manual, no significant scope change should be considered after the contract is awarded or after the purchase order has been issued. This is to avoid any potential contractual disputes and delays.

Change order rates need to be monitored

For the period 2013 to 2017, we noted that the average value of ECS change orders was about 10 per cent (or $222 million) of the total construction and consulting costs of $2.3 billion.

While change order costs for construction contracts were nine per cent (or $177 million), it was much higher at 13 per cent (or $45 million) for professional services (consultant) contracts.

ECS needs to establish performance measures to monitor change orders on a regular basis to ensure that change orders costs are reasonable.

Refer to Table 4 for change order costs as a percentage of total construction and consulting costs.

Engineering costs need to be assessed

Between 2013 and 2017, ECS spent $1.95 billion on construction projects, and $527 million on engineering costs, for a total of $2.47 billion. The engineering costs amount to 27 per cent of the total construction cost of $1.95 billion. Approximately 65 per cent (or $341 million) of the engineering cost is incurred on external consultants, and the remaining 35 per cent (or $186 million) is ECS's internal staffing cost.

Refer to Table 5 for the cost of engineering as a percentage of total construction costs.

While there are no specific benchmarks to determine reasonable engineering costs, ECS should evaluate whether its total cost for engineering is reasonable.

Conclusion

This phase two report highlights areas to improve the management of change orders in ECS contracts. Although change orders can occur on construction contracts, this report highlights the need for staff to comply with ECS guidelines and to improve oversight of change orders to ensure the City receives the best value for money.

Specifically, we noted the need for better planning of contract work to:

- minimize design errors and omissions
- improve controls related to proper authorization of change order work
- assess change order costs and pricing; and
- have better oversight of contractors' and consultants' work

4 audit recommendations

The issues identified in this report are grouped into four overarching recommendations. Implementing these recommendations contained in this report will further improve the controls over oversight of construction contracts.

We express our appreciation for the co-operation and assistance we received from management and staff of the ECS Division.

Background

Over $460M in capital projects delivered by ECS annually

For the period 2013 to 2017, ECS delivered approximately $460 million annually in capital projects for the construction of vital infrastructure including bridges, expressways, roads, streetcar ways, watermains, sewers, treatment plants, and water supply systems. In addition, ECS provides engineering review and acceptance of development applications, and bridge inspection services.

The Division's mission is to create safe and sustainable municipal infrastructure that enhances the high quality of life for the people of Toronto through professionalism in project planning, engineering and project management services.

The Division provides specialized engineering and construction services to internal clients including Toronto Water, Transportation Services, and Solid Waste Management Services, and external clients such as the development industry, utility companies and other public agencies.

Over the years, ECS has overseen the construction of some of the biggest infrastructure projects in the City of Toronto. For example, ECS manages the construction projects for the multi-year basement flooding protection program, and other major infrastructure projects, such as the new outfall and ultraviolet irradiation disinfection system at the Ashbridges Bay Wastewater Treatment Plant, and the F.G. Gardiner Expressway Rehabilitation.

ECS's capital program has been growing over the years with more projects delivered each year. For example, ECS delivered $466 million in capital projects in 2015, $491 million in 2016, and over $500 million in 2017.

Capital projects are delivered by ECS's three design and construction sections: Major Infrastructure, Linear Underground Infrastructure, and Transportation Infrastructure. Table 2 provides examples of work performed by each section.

Table 2: Examples of Capital Works Projects Delivered by ECS's Design and Construction

Major Infrastructure	Linear Underground Infrastructure	Transportation Infrastructure
Don River & Central Waterfront Utility relocation associated with facilities projects Wastewater treatment plants Water treatment plants, reservoirs and elevated water tanks Solid waste management facilities Pumping stations Planning and feasibility studies related to water treatment	Local and trunk storm sewer construction – new, replacement and rehabilitation Local and trunk sanitary sewer construction – new, replacement and rehabilitation Local and trunk watermain construction – new, replacement and rehabilitation Watercourse rehabilitation Non-treatment storm water facilities Force mains Inflow and infiltration reduction, Sanitary or CSO Storage tanks, Water distribution studies	Local road resurfacing / reconstruction Major road resurfacing / reconstruction Ramps & expressway on grade Laneway reconstruction Sidewalk reconstruction and new construction Bridge rehabilitation and reconstruction Structural retaining walls Elevated ramps & expressways Required utility cut repairs Streetscape works BIA and City Planning funded projects TTC track reconstruction

Source: ECS Capital Works Procedures Manual, July 2018, page xix.

ECS staff are responsible for ensuring that work performed by contractors on internally managed projects is completed and constructed to the City's standards and specifications.

ECS uses external contract administrators for complex projects

For more technically complex projects for which ECS lacks internal expertise or capacity, it hires external consultants to provide contract planning, design and administration services. These consultants are engineering firms with specialized technical and project management skills.

The consultants acting as contract administrators manage the day-to-day construction work. This includes providing recommendations to ECS staff regarding project changes and related costs. The consultants are also responsible for preparing change orders and accompanying documentation on the projects they oversee.

ECS staff responsible for providing oversight of construction work

ECS staff are responsible for ensuring that consultants complete these tasks, and that change orders are appropriately approved by ECS. Staff are also responsible for preparing associated documentation such as briefing notes, covering letters, and liability assessments in support of change order requests.

Changes can occur in complex construction projects

Changes during construction can occur in large and complex construction contracts. Therefore, to minimize and manage these changes effectively requires foresight and necessary planning.

Change Order

A change order formalizes modifications or alterations beyond the scope of the original contract, and establishes any necessary new contract items, any other basis of payment, and any time adjustments for work affected by the changes.

For example, during the construction work of a contract, a contractor may discover broken watermain pipes that need fixing. A situation like this may be unforeseen and unexpected. To keep the construction work on schedule, a change order may be required. Since the extent and nature of change work was previously unknown, a change order is required to formalize an agreement between the contractor and the owner with regard to price, quantity, scope and timing of the change work.

Changes should be kept at a minimum and always be properly authorized.

Reasons for change orders

Common reasons for change orders:

- Scope change as requested by client divisions
- Unforeseen site conditions
- Discovery of toxic substances that must be disposed appropriately
- Archaeological finds
- Errors and omissions in drawings, designs and contract documents
- Contractor claims
- Poor quantity estimates
- Utility conflicts

Change directives and change orders

ECS uses two key documents for formalizing changes to the scope of the original contract: Change Directives and Change Orders.

- Change directives are used to provide written direction to contractors to proceed with performing changes to the original scope of the contract.

- Change orders are used to amend the contract to reflect the change in work, specifying the terms of payment and extension of time for the work. Change orders are also used to amend contracts to reflect decreases or credits for deleted work scope.

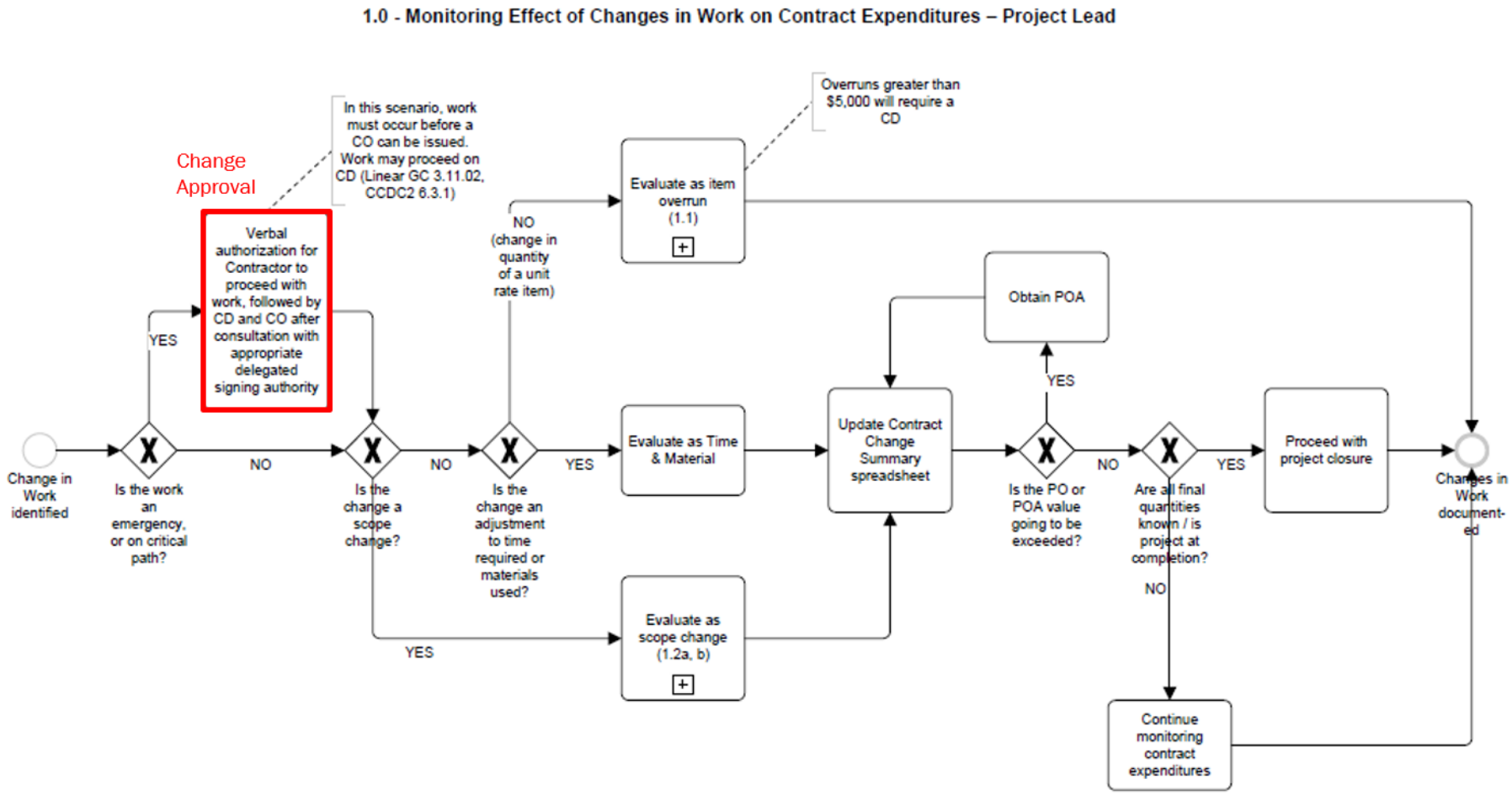
ECS's policy requires that a change directive or a change order must be approved prior to commencement of a change in the work.

Change orders are funded through a contingency fund set aside at the beginning of the project to deal with unexpected changes. The contingency fund is usually set at 10 per cent but can vary from project to project, and is part of the original contract price. When changes exceed the original contract price, a purchase order amendment must be approved prior to commencing the change work.

Change orders are also used to reduce the scope of work or for changes that have no impact on the net cost.

Figure 1 describes ECS process that should be followed for assessment and approval of change work.

Figure 1: Change Order Assessment and Approval Process



Note: ECS process requires approval for change in the work to be obtained after the change is identified and prior to commencement of work.
CO and CD refers to change order and change directive respectively.
Source: ECS Capital Works Procedures Manual, July 2018, Appendix G

Audit Results

Over the years, ECS has executed some of the most technically complex engineering projects in the City. Although we have not audited these projects, we noted that ECS has designed robust guidelines, procedures and standards for use by staff, engineering consultants and contractors when designing and constructing the City's infrastructure projects. It has made continuous improvements to its Contract Administration Manual, Capital Works Procedures Manual, and Field Services Manual.

According to ECS, they have met the following key performance indicators that track and monitor ECS construction work progress and achievements on an ECS-wide basis[1]:

Key performance indicators

- sustaining capital delivery at an estimated 80 per cent of year-end actual expenditure as a percentage of assigned Capital Budget
- sustaining greater than 75 per cent compliance with application review timelines for development applications
- completing 100 per cent of all legislated bridge condition inspections within regulatory timelines
- providing specialized engineering, surveying and construction inspection support to Metrolinx and TTC transit programs
- completing 100 per cent of all legislated environmental certificate of property use requirements including inspections, reports, compliance audits, and Annual Reports on behalf of Parks, Forestry and Recreation

Audit focused on change orders

The main focus of our audit was on the ECS change order process associated with the management of construction contracts. The following sections of the report contain the findings from our audit work followed by specific recommendations.

[1] These areas were not audited by the Auditor General – the focus of the report was on the change order management process.

A. Design Errors and Omissions

A. 1. Majority of Change Orders Were caused by Design Errors, Omissions and Inaccurate Estimates

ECS prepares construction design documents either internally or it outsources the design to consulting firms. It is not uncommon for the external consultant to be both the project designer and contract administrator.

Where a project has been designed by a consultant, a failure to include items of work in the project design may constitute errors and omissions. For design errors caused by a consultant, the consultant may be liable for damages. Similarly, any changes that are caused by the negligence or the fault of the contractor, the contractor may be liable for damages.

When approving change orders, it is necessary to assign responsibility and accountability for the change. The cost of any change work caused by unforeseen or unknown circumstances should be borne by the owner. However, in case of design errors and omissions on the part of consultants or damages caused by the contractor, reasonable efforts should be made to recover the costs from these parties.

For each change order we reviewed, we assessed whether ECS made reasonable efforts to recover damages where it was deemed to be the contractor or consultant's fault.

51% of change orders sampled had design errors and omissions

We reviewed 90 change orders and noted that 46 change orders in our sample were caused by design errors and omissions. Among them, 30 were the result of design errors and omissions caused by consultants, 11 were caused by ECS, and five were due to missing or outdated City records.

Design errors and omissions often result in other incidental costs such as mobilization costs, additional equipment rentals, flagging costs, traffic management, overheads and mark-ups.

Below are some examples of design errors and omissions:

Use of 2008 site survey led to $1.3M in change orders

- In a bridge rehabilitation contract, the consultant prepared tender quantities based on a 2008 site survey. There was significant incremental deterioration in the surface conditions of the bridge since this survey, which resulted in three change orders for a total value of $1.3 million. This contract had 31 change orders totalling $2.75 million. The base value of this contract was $13.9 million.

In the same contract, there was a disagreement between the contractor and the consultant over the description and type of work covered under a tendered item. Due to the ambiguous bid item description prepared by the consultant, the contractor interpreted the item narrowly to exclude a significant portion of the intended scope of work covered by the tendered item.

The consultant disagreed with the contractor but was not able to provide specific reference in the contract language to support their position. This resulted in a $168,000 change order.

Lack of City records led to change orders

- In one lump-sum contract, the City provided limited information to the consultant on when the wastewater tanks were previously cleaned due to the age of these tanks. There were no records confirming when the tanks were last cleaned. An engineering judgement was made and the quantity turned out to be low. The subsequent discovery of significant amounts of sludge in the tanks led to several high-value change orders totalling $1 million. In addition to these change orders, the contractor claimed an extra $727,198 for efforts required to clean the tanks. The contractor argued that ECS misrepresented when the tanks were last cleaned. ECS settled the claim for $180,991. This contract had 32 change orders totalling $1.4 million. The base value of this contract was $7.46 million.

Sidewalk needed to be replaced due to faulty design

- In a major roads contract, the sidewalk design prepared by ECS staff contained design errors in the sidewalk elevation. This issue was identified by the contractor as well as ECS inspection staff during construction and communicated to the project lead. However, this concern was not investigated by the project lead. The project lead instructed the contractor to continue work 'as per the design'. Eventually, the sidewalk had to be removed and replaced to correct the elevation. This led to a delay of three to four months and over $271,876 in unnecessary change orders. This contract had 15 change orders totalling $594,375. The base value of this contract was $3.76 million.

Soil conditions not considered in design

- In another contract, the original design prepared by the consultant did not consider the soil condition for the installation of light poles. With the location being close to the lake with a high water table, it would have been reasonable to expect this condition. This resulted in a $140,000 change order and a 20 day delay.

Bid specifications were unclear

- For an expressway ramp contract, the bid specification for backfilling material was unclear, which caused the contractor to bid incorrectly. This resulted in a $113,000 change order for the correct type of material to be used.

A. 2. Efforts should Be Made to Recover Costs and Damages from Consultants for Design Errors and Omissions

Process to assess consultant liability needs improvement

ECS's current change order process does not include a robust evaluation of potential design errors and omissions caused by consultants. As a result, it does not always hold consultants accountable for design errors, omissions or other performance issues.

Although, ECS has a briefing note template which includes a section on 'Assessment of Liability', there is no specific criteria or guidelines to assess liability and recover damages.

In assessing consultant liability, it may be useful to document elements such as: (1) reasons for change, (2) whether the change was caused by an error, (3) evidence of the consultant's liability, (4) amount of loss incurred by the City, (5) whether recovery is feasible, (6) whether this should be dealt with through other administrative steps (performance evaluation, letter of notice, etc.).

ECS staff informally conduct an assessment to identify full or partial consultant liability on all change orders, but this was not done consistently and no records were kept of how such assessments were conducted. In some cases, where ECS staff assessed partial liability, they did not assign a value for recovery.

More efforts required to recover damages

From our review of ECS briefing notes and change order documentation, we found 14 of 90 change orders where ECS staff determined that consultants had partial or full liability. There has been no further follow-up on recoveries to date. Most of the projects sampled were completed between 2015 and 2017, and there has been little progress to pursue these claims.

Based on discussions with ECS management and project staff, we were informed that in some cases, it is difficult to quantify the incremental cost impact of a change order, which hinders ECS's ability to pursue recovery. For example, a change order involving the omission of an item of work may not necessarily result in a claim. This is because the cost would have been incurred regardless. In such cases, it is difficult to demonstrate the loss incurred by the City.

In our view, design errors and omissions can have serious implications on City resources, because they can cause project delays, cost overruns and other incidental project costs. Also, change order work amounts to work that is not bid on competitively.

A. 3. Reasons for Change Orders should Be Systematically Tracked and Analyzed on an ECS-wide Basis

Reasons for change orders are not tracked

ECS does not track and analyze the reasons for change orders (e.g. design errors, unknown factors, contractor damage etc.) on an ECS-wide basis. This may be useful to assign accountability and also make process improvements.

Based on our review of 90 change orders, some of the reasons for change orders that we observed in ECS contracts include:

(1) Errors & omission
(2) Contract item overruns
(3) Owner initiated scope changes
(4) Geotechnical issues
(5) Environmental issues
(6) Toxic waste requiring special handling
(7) Ambiguous bid specifications
(8) Utility issues
(9) Contract enhancements
(10) Scope reduction or item substitution due to lack of funds

Analyzing reason codes can help ECS determine which reason codes are occurring most frequently and which reason codes have the greatest dollar impact on projects. Codes that occur frequently across project types represent the greatest risk for cost increases on projects.

Tracking reason codes can also highlight engineering issues and administrative issues that may need to be addressed on a priority basis.

Performance indicators for change orders should be established

The following are some examples of performance indicators that may provide useful reference points for process improvements:

- Frequency of change order reason codes
- Average change order dollar amount by reason code
- Average percent change from original contract dollar amount by reason code

Recommendation:

1. **City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:**

   a. **establish a process and criteria to review and assess liabilities arising from third-party errors and omissions.**

   b. **implement enhancements to the Project Tracking Portal to track the reasons for change orders for analysis and process improvements on an ECS-wide basis.**

   c. **analyze the root causes for change orders, change order costs, and track recoveries from third parties on account of errors and omissions.**

   d. **ensure that future bridge rehabilitation project tenders are based on recent condition assessments, undertaken within five years of the construction tender preparation.**

   e. **formalize the implementation of the Professional Services Performance Evaluation, recently piloted by Engineering and Construction Services, to include consequences for poor performance up to and including suspension.**

B. Change Order Process Needs Improving

B. 1. Change Order Work Completed Without Prior Authorization

ECS's policies and procedures require that change orders and/or change directives must be issued as soon as possible after the change is identified to prevent the City from being subject to further claims related to the issue for which the change order or change directive relates.

According to ECS management, where time sensitive or emergency changes are required to protect the City against added delay cost claims from contractors and to reduce construction impacts on residents, businesses and commuters, it is expected that staff obtain approval via e-mail from the correct level of authority with a commitment to complete all paperwork expeditiously.

A change order is an amendment to the original contract, therefore it is critical to establish within a change order, the work scope, method of payment, and schedule impacts on the overall contract. A change directive and/or a change order must be approved prior to commencement of a change in the work to avoid pricing disputes.

Work performed without prior authorization in 36% change orders

We found 32 change orders (36 per cent) where the contractor did not obtain written approval prior to commencing change order work. In these cases, the work started prior to obtaining a change directive or change order.

According to ECS staff, upcoming change order work is discussed at site meetings between ECS, contractors and consultants, and these high-level discussions are captured in site meeting minutes. However, we noted that these minutes did not have sufficient information on the specific scope of work and pricing.

For change order controls to be effective, the only way to proceed with the change order should be written approval. Verbal instruction should not be accepted, except for emergency work. Where verbal instruction is provided to proceed with the change order, it should be immediately followed up with a properly authorized written approval.

Unauthorized change work resulted in subsequent pricing disputes

Out of 32 change orders where no change directive or change order was issued prior to the contractor commencing the work, four resulted in pricing disputes.

Below are examples where change work commenced prior to approval:

<u>Basement Flooding Protection Program Construction Contract</u>

In one of the change orders for the basement flooding contract, the work was done five months before the Request for Quotation (RFQ) was signed. Such delays in firming up change order pricing significantly weakens ECS's ability to negotiate better prices. In the same contract, the contractor had identified poor soil conditions which would result in a change. Knowing this, a change directive should have been issued with an upper limit cost estimate. However, no action was taken and the work proceeded prior to issuing a change directive or change order.

In the same contract, there were other issues resulting from a lack of adequate ECS oversight of the consultant and the contractor.

Work completed without change order approval

Our review of this contract found that unauthorized change work costing $658,941 was carried out by the contractor without senior management's knowledge and approval.

If approved, this work which was already completed over a year ago, will cause the purchase order limit to be exceeded by approximately $495,000.

The project was declared substantially completed without any due diligence on outstanding work, and included unreported and unapproved change orders.

The amount of pending change order work is currently not recorded in Project Tracking Portal (PTP) and has not been accrued in the City's financial records. As a result, the City's liability is potentially understated by this amount.

In mid-2018, senior management initiated a third-party review of these changes. This contract is still being investigated by ECS management and the Auditor General.

Wastewater Treatment Plant Construction Contract

Change directive not used for significant change work

Another contract we reviewed involved the removal of dewatered sludge from solid waste digester tanks, known as digester cleaning. In this case, significant work was already completed before three change orders for a total value of $1 million, including a 10 per cent mark-up, were approved. Also, no change directives were issued to authorize the work. This contract had 32 change orders totalling $1.4 million. The base value of this contract was $7.46 million.

According to ECS staff, digester cleaning is a continuous operation and interrupting the operation may result in claims by the contractor for time delay and mobilization. ECS policy clearly requires that in emergency situations where a change order cannot be immediately processed, there must be a change directive in place prior to commencement of the change work. This is even more important when the change work is likely to create substantial cost exposure to ECS.

A change directive and/or change order creates a legal contract that defines the new scope of work, price, and impact on the schedule. Without this document, there is a risk of disputes between the parties and a risk that the City's interests are not protected.

B. 2. Significant Delays by Consultants in Submitting Change Orders for ECS Approval

Approval of a change order amends an existing contract. It formalizes modifications or alterations beyond the scope of the original contract, and establishes any necessary new contract items, any other basis of payment, and any time adjustments for work affected by the changes. Therefore, it is important that change order approvals are completed in a timely manner and always before the work commences.

In many cases, consultants submitted change order documentation for ECS review and approval several months after the work was completed — sometimes more than a year later.

Change orders approved up to one year after work commenced or completed

We noted at least 17 change orders that consultants submitted late. The delays ranged from three months to one year after the change work had already commenced or was completed. This caused significant delays in ECS management's approval of these change orders.

It was unclear on many of the consultant-managed contracts why it took several months for the consultants to provide ECS with change order documentation for review and approval.

During our audit, we were approached by a group of prominent contractors in the City with specific concerns about long payment timelines for change orders.

According to the group, *"while the City has improved its systems and timelines, there remains significant problems with its payments for change orders. It is not uncommon for wait times for payments on approved change orders[2] to take well over a year to process, with some cases now approaching two years. Lengthy payment timelines have become very common on Toronto projects and this is an occurrence that is unique to Toronto."*

The group also said, *"contractors have started to price for payment risk on City projects, as many now expect to have to hold City debt for lengthy period of time after conclusion of their projects. This is cost that is being unnecessarily tagged onto City contracts."*

It should be noted that the new Construction Act (2017) requires that payment to the contractor be made within 28 days of receiving a proper invoice for new contracts effective October, 2019.

Various processing delays and disputes with contractors can be avoided if scope and pricing of change orders are finalized before change order work is commenced and proper contract administration procedures are followed throughout the contract duration.

B. 3. Insufficient Evidence of Pricing Assessment and Negotiations in Change Orders

In 21 change orders, there was no documented evidence of price negotiations by ECS on the contractor's price proposal. This was often because the consultants submitted the change orders for approval months after the work commenced or had been completed (17 change orders).

[2] Reference is likely being made to 'approved change directives'.

According to ECS, pricing discussions with contractors may be done verbally. However, our research indicates that some public-sector jurisdictions have adopted more formal procedures to document specific steps taken during pricing negotiations.

For example, one jurisdiction uses a formal document 'Record of Negotiation' that captures the following information:

- List of any meetings/conference calls and specific negotiated items regarding schedule, classifications, tasks, hours, and results of the negotiation; and
- Internal estimate prepared prior to receiving contractor estimate.

No established guidelines to assess change order pricing

There are no established guidelines or criteria to assist staff to challenge or conduct a critical review of a contractor's pricing proposals for change orders, specifically on the necessity and reasonableness of hours and material quantities charged.

Based on discussions with ECS project leads, an independent review of change order pricing and negotiation with contractors is part of the consultant's role. We noted several issues with pricing that consultants did not identify:

- Consultants authorized change order work without finalizing pricing, which resulted in four instances of contractor disputes.

- Some of the quotes submitted by consultants provided only a lump-sum amount without sufficient details of the rates and number of hours or material quantities.

- External auditor certification/attestation were not obtained for labour burden rates in one of the contracts reviewed. This information is important to verify the contractor’s payroll costs when a time and material change order is used.

- In one example, the contractor charged a different price for the same product in two different change orders. The pricing discrepancy was not identified by the consultant. The consultant should have conducted a technical assessment and pricing review before the work started, but this was done three months later. As a result, the City overpaid about $14,857 for material.

Pricing issue on an ECS-managed project

The contractor quoted a higher price for the supply and installation of certain material. The project lead did recognize the issue and made inquiries to obtain these items internally from Toronto Water at much lower prices. However, the project lead did not act in a timely manner to obtain the items from Toronto Water. This resulted in a missed opportunity to save approximately $15,000, as the items were supplied by the contractor at higher prices.

B. 4. Quantity Overruns Are Not Properly Approved through Change Directives

ECS implemented a new control in 2017 that requires a change directive to be issued for any quantity overrun that is estimated to exceed $5,000. A change directive must be issued prior to starting the work. Project leads must continuously monitor item overruns and underruns and as estimated quantities are approached and/or exceeded, a change directive must be obtained.

Quantity overruns are not always approved through change directive

From our analysis of information contained in the Project Tracking Portal (PTP), we selected 10 contract line items that were exceeded by more than $5,000 in quantity overruns. For five of 10 quantity overrun occurrences, we found that no change directives were issued prior to starting the work.

Additionally, in four of the 10 contracts sampled, we noted 25 instances where a change directive was not used as an interim measure to approve change work. Some of these instances included quantity overruns.

In some cases, the change directive was issued only after significant quantity overruns had already occurred. For example, in one case the original bid quantity of 425 metric tons was exhausted and an additional 385 metric tons (or 90 per cent of the original bid quantity) was already spent before a change directive was issued for the quantity overrun. The quantity overrun without proper change directive approval amounted to $36,575. This is indicative of project leads not continuously monitoring the quantity overruns. It also appears that ECS staff did not fully understand the change directive process and the new control. We noted that in some cases staff only enter the quantity overruns at the end of the project, thus avoiding the change directive process.

B. 5. Delegated Signing Authority Limits Were Not Followed

According to ECS Capital Works Procedures Manual, appropriate signing authority must be obtained based on the value of the change order or change directive.

The delegated signing authority limits are described below:

Limit	Approved by
Costs up to $10,000	Project Lead
Costs up to $25,000	Senior Project Lead
Costs up to $50,000	Unit Manager
Costs up to $100,000	Director
Costs greater than $100,000 to the limit of the approved purchase order	Chief Engineer and Executive Director

(Source: Capital Works Procedures Manual)

Delegated signing authority not followed in 9 change orders valued at $1.1M

We noted nine change orders totalling $1.1 million, where the delegated signing authority was not followed by ECS staff. Table 3 lists the change orders where the delegated signing authority was not followed.

In addition, from our review of ECS staff reports, we found another contract, which was not part of our sample, where the project manager authorized payments beyond his signing authority. In 2017, ECS requested a purchase order amendment for $824,067 for a contract due to various scope changes, work acceleration and unforeseen conditions. ECS noted in its confidential attachment to the Public Works Committee that the project manager authorized payments beyond his signing authority for which sufficient funds were not available.

Table 3: List of Change Orders Where the Delegated Signing Authority Limits Were Not Followed

Change Order	Change Amount Before Tax	Issue
1	$107,606*	The work was completed sometime between October 2017 and April 2018 without any approvals from senior management. The change order was prepared in June 2018 and was signed by the consultant, ECS senior project lead, unit manager and the contractor. The change order is awaiting approval from senior management.
2	$420,350*	The work was completed by October 2017, without any approvals from senior management. The change order was prepared in March 2018 and was signed by the consultant, ECS senior project lead, unit manager and the contractor. The change order is awaiting approval from senior management.
3	$130,985*	The work was completed by August 2017, without any approvals from senior management. The change order was prepared in June 2018 and was signed by the consultant, ECS senior project lead, unit manager and the contractor. The change order is awaiting approval from senior management.

Change Order	Change Amount Before Tax	Issue
4	$83,229	The unit manager was delegated signing authority, however, the period of delegation was August 27th to September 11th, 2018, which did not match the change order date of March 21st, 2018.
5	$65,886	The unit manager was delegated signing authority, however, the period of delegation was August 27th to September 11th, 2018, which did not match the change order date of June 28th, 2018.
6	$31,369	Both change orders were signed by the senior project lead. The change orders were for identical work for a total value of $66,952 (split change orders).
7	$35,583	
8	$87,596	New work added was valued at $87,596; work deleted was $70,100; Net change order amount $19,770; Signed by the senior project lead.
9	$181,000	New work added was valued at $181,000; work deleted was $181,000; Net change order amount $0; Signed by the Director.
Total	**$1,143,604**	

**Change orders 1, 2 and 3 are being investigated by ECS management and the Auditor General.*

B. 6. No Signature Dates on Change Orders

Change order must be signed and dated to be effective

A change order becomes effective on the date when all parties sign.

We noted that ECS's change order form does not require the approval signatures to be dated. Although the change order form has a date, it was unclear whether this reflected the date when the change order package was prepared or when it was approved.

Since change order approvals can take several months, it was difficult to determine when exactly a change order was approved because signatures were not dated. Although ECS uses an approval routing form that has a provision for signatures, this form is used only where delegated signing authority exceeds manager level and is not used consistently.

B. 7. Verification of Change Order Work Not Always Performed

9 change orders did not have proper verification of work

To ensure the work is completed and paid correctly, it is important to maintain proper verification of change work. In five of the 10 contracts reviewed, we noted that nine change orders did not have proper records to support work performed.

In one particular change order for $47,000, the field inspector was not aware that the change order work needed to be tracked on a time and material basis. According to ECS staff, the field inspector did not maintain proper daily inspection logs or records of materials used.

Actual quantities not reconciled leading to overpayment

In one change order, costs incurred were not reconciled with the actual quantity used. The contractor provided an estimate of 300 metric tons of toxic waste removal. The price quoted was $254.71 per metric tons for a total of $76,413.

In the estimate, the contractor stated that *"the actual quantity will be based on the actual weigh tickets"*. According to the waste disposal documentation, the actual quantity disposed was 243 metric tons.

After the work was completed, ECS issued a lump-sum change order for the original estimate of $76,413 without verifying the actual quantities which were less than estimated. This resulted in an overpayment of approximately $15,474.

In another example, for an expressway ramp contract, the project was substantially completed in September 2018. There was a disagreement between ECS and the contractor over the number of hours worked. The hours could not be reconciled due to discrepancies between the consultant and contractor time and material records.

This change order work for approximately $250,000 is still under review by the consultant and ECS — eight months after substantial completion of the project. According to ECS, the change order has not yet been issued as the consultant is still reviewing their daily inspection reports with the contractor's records.

B. 8. Substantial Scope Changes Initiated by Client Division after Contract Award

According to ECS's Capital Works Procedures Manual, no significant changes in project scope should be done after the contract award or purchase order issuance. This is to avoid any potential contractual disputes and delays. Additional work should only be permitted in extraordinary cases and with prior authorization of the Client Division and the appropriate authorization protocols.

Substantial scope changes initiated by the Client Division after the contract award may undermine the integrity of the City's procurement process. This may also indicate a lack of proper upfront planning, and may provide undue advantage to the winning bidder.

7 instances where client division modified scope after contract award

We noted seven instances where the Client Division added or modified the scope of work during construction which resulted in change orders. Two examples are illustrated below:

1. In a basement flooding contract, Transportation Services made substantial scope changes by requesting full-depth asphalt road replacement. We requested ECS staff to provide the documentation relating to Transportation Services request for the scope change. This information was not provided.

   In addition, this particular change order for $420,000 had issues with poor quantity estimates as noted below.

   ECS initially underestimated the quantity of asphalt containing asbestos that was to be removed. The consultant advised ECS staff to increase the quantity to 1,000 tons. However, ECS only increased the quantity to 425 tons.

   The consultant recommended that ECS perform additional testing to confirm the extent of asbestos in the asphalt pavement. However, ECS went ahead to tender the contract without conducting the recommended testing.

   This is problematic because the contractor could have easily taken advantage of the City by unbalancing their bid because they knew ECS's tendered quantities were inaccurate. While the winning bidder's rate was competitive, it appears that other bidders did recognize the poor estimate and unbalanced their bids. The bid prices for this item ranged from $95 to $240.

   The final quantity for this work was 4,425 tons which was over 10 times the tendered quantity. This was caused by two factors: (1) poor initial quantity estimates, and (2) substantial scope change after the contract was awarded.

2. In another example, in a watermain, sewer and roadways contract, ECS determined that the tender cost associated with the replacement of sanitary sewer, services and associated road restoration substantially exceeded the estimated and budgeted cost. According to the ECS briefing note, in consultation with Toronto Water and with their subsequent approval, the scope of work was revised from sewer replacement to sewer repair.

   This resulted in a change order of $346,000, which included a payment of approximately $145,000 to the contractor for “loss of productivity” due to the significant reduction in work that was initially bid.

B. 9. Externally Managed Project Documentation Not Readily Available

On externally managed contracts, the Contract Administrator (i.e. Consultant) is responsible for preparing change orders, providing supporting documentation and making recommendations.

The City Project Lead is responsible for ensuring that the Consultant completes these tasks, and that the change order is approved by the appropriate delegated signing authority. The Project Lead is also responsible for preparing briefing notes, covering letters, and liability assessments.

Contract documentation not retained by ECS

For some of the sampled externally managed projects completed between 2013 and 2017, we found that change order documentation was not readily available with ECS staff. Key documents to support ECS's review and approval of change orders, such as inspection reports, weight tickets, and third-party invoices, were not retained by ECS. These had to be requested from the consultants.

It is important for ECS staff to ensure that they exercise the appropriate degree of oversight on work performed by both contractors, as well as consultants. Without having project documentation on hand, it is not clear how project leads and project managers could have maintained proper oversight.

Consistent and timely paperwork protects ECS and its clients in case of disputes with the contractors, and prevents knowledge loss in the event of staff turnover.

In at least three contracts that we reviewed, the project managers or project leads who worked on the contract were no longer with the City. As a result, ECS staff had to make significant efforts to gather information from files and from consultants in order to respond to questions.

B. 10. Change Order Rate Needs to Be Monitored

ECS change order rate is 10%

For the period 2013 to 2017, we noted that on average, the ECS change order rate was about 10 per cent of total construction and consulting costs.

Change order costs for construction contracts were nine per cent, and they were much higher (13 per cent) for consulting contracts.

In our research, we were unable to identify any industry-specific benchmarks on what an appropriate change order rate is. However, the only way to ensure that change order costs are reasonable is to have a robust change order process and to have change orders only when justified.

ECS's current change order process requires improvement. ECS needs to establish performance measures to monitor change orders and costs on a regular basis to ensure that costs are reasonable.

Analyzing change order costs can help ECS perform trend analysis of costs by project type, contract type, type of change order work, ECS staff, contractor, and consultant. The frequency and value of change orders associated with certain contractors, consultants or ECS staff may help identify high-risk areas.

Table 4 provides the change order costs as a percentage of total construction and consulting costs.

Table 4: Change Order Cost as a Percentage of Total Construction and Consulting Costs ($ in millions)

Year	Construction Contracts				Consulting Contracts				Total Construction and Consulting Cost*	Overall Change Order %
	Base Contract Cost	Change Order Cost	Total Construction Cost	%	Base Contract Cost	Change Order Cost	Total Consulting Cost	%		
2013	$264	$28	$292	10%	$50	$9	$59	15%	$351	**11%**
2014	$376	$31	$407	8%	$48	$8	$56	14%	$463	**8%**
2015	$368	$42	$410	10%	$50	$6	$56	11%	$466	**10%**
2016	$378	$35	$413	8%	$71	$7	$78	9%	$491	**9%**
2017	$383	$41	$424	10%	$77	$15	$92	16%	$516	**11%**
Total	**$1,769**	**$177**	**$1,946**	**9%**	**$296**	**$45**	**$341**	**13%**	**$2,287**	**10%**

**Between 2013 and 2017, ECS spent a cumulative total of approximately $2.3 billion on construction projects and consulting costs. This included approximately $222 million (or 10%) in change order cost. ECS internal staffing cost of $186 million is not included in the $2.3 billion.*

Recommendations:

2. City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:

   a. establish specific service standards for the timely approval of change directives and change orders after finalizing the scope of work and pricing.

   b. ensure that work only commences after either a change directive or change order is issued which includes a clear and documented agreement on pricing and scope. For time-sensitive changes, staff should obtain appropriate approval via e-mail and expeditiously follow-up with change order documentation.

   c. ensure that delegated signing authority limits are enforced and that each signature on a change order is individually dated.

   d. establish a formal 'Record of Evaluation and Negotiation' template to internally document the negotiations with contractors over the cost of work and also the assessment of price reasonability.

   e. ensure that a change directive is always issued for quantity overruns that are expected to exceed a set threshold as outlined in ECS's Capital Works Procedures Manual.

3. **City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:**

   a. **in consultation with Corporate Finance, the Fair Wage Office, Legal Services and Purchasing and Materials Management, establish uniform labour burden rates to be used across all construction contracts.**

   b. **ensure that change work is properly tracked and monitored for unit price, time and material, and lump-sum change orders, and that the payment is made after work has been properly verified.**

   c. **ensure that substantial scope changes are minimized after the contract is awarded. Where it is not possible to avoid such changes, the Client Division should be fully informed of the impact of substantial scope changes on contract costs and timelines.**

   d. **ensure that project documentation on externally managed contracts are always retained within the ECS Division.**

   e. **measure and monitor change order costs.**

C. Other Issues

C. 1. Ambiguous Contract Language resulting in Inconsistent Application

ECS uses standard linear and vertical contract templates for construction contracts. We noted ambiguous contract language used in one of the terms and conditions related to bond payments. There is a risk that this can be misinterpreted across ECS contracts and may result in overpayment.

According to the contract template (Specific Condition 32), the payment for bonds are to be paid 100 per cent on the first progress payment, provided that an invoice is submitted as proof of payment. Any amount above the invoice amount is not to be paid.

In one of the 10 contracts sampled, we noted that the contractor claimed the full invoice amount for bond payment in excess of the lump-sum bid price.

Ambiguous contract language

The contractor misinterpreted Specific Condition 32 to mean that any price paid for the bond will be reimbursed by ECS as long as it is supported by an invoice. Because of ambiguous language in the contract, the contractor was able to claim the higher invoice amount ignoring its lump-sum bid price. ECS paid the contractor $15,000 more than the lump-sum bid price.

This is problematic because it circumvents the requirements of the bidding process. Further, the interpretation of specific condition for bond payments can be inconsistently applied across ECS contracts.

C. 2. Cost of Engineering Needs to Be Assessed

The City has a large and complex construction portfolio that needs to be managed effectively, efficiently and economically. ECS relies on external consultants for construction design and contract administration services. These services are obtained through open, fair and transparent City procurement processes.

Engineering costs not directly linked to construction costs in PTP

Engineering costs include ECS's internal costs and the cost of external professional services, such as engineering surveys, designs and contract administration.

Currently, ECS does not have a process to determine engineering costs for construction work on a contract-by-contract basis as PTP has not been configured to track this information.

According to ECS management, significant effort is required to extract this information from PTP due to two reasons: 1) ECS started to distinguish between internally and externally managed contracts a few years ago, and 2) PTP data is not date-driven because a design could have started before 2013, but construction was after 2013. The project information is not directly linked to relate engineering costs with construction costs.

Given the limitations of PTP data, we used five years of actual expenditures incurred on consultants plus internal staffing costs, and compared that as a percentage of actual construction costs to determine ECS's cost of engineering. While we did not have a contract-by-contract match of consulting to construction costs, in our view, our calculation represents a reasonable estimate of the cost of engineering.

65% of engineering cost relate to external consultants

Between 2013 and 2017, ECS spent $1.95 billion on construction projects, and $527 million on engineering costs, for a total of $2.47 billion. The engineering cost amounts to 27 per cent of the total construction cost of $1.95 billion. Approximately 65 per cent (or $341 million) of the engineering cost is incurred on external consultants and the remaining 35 per cent (or $186 million) is ECS's internal staffing cost.

In our research, we were unable to identify any industry-specific benchmarks on what a reasonable cost of engineering is. ECS should evaluate whether its total cost of engineering is reasonable. This is important given that there are some concerns about oversight of consultants for managing changes. Based on our review of ECS's briefing notes and project documentation, we noted that the majority of change orders were a result of design errors and omissions by consultants, with little efforts made by ECS to recover the cost of those errors and omissions.

Table 5 provides the cost of engineering for internally and externally managed contracts as a percentage of construction costs.

Table 5: Cost of Engineering as a Percentage of Total Construction Cost ($ in millions)

Year	Construction Cost* (A)	Cost of Engineering			Grand Total** (A+B+C)	Cost of Engineering as a % of Construction Cost ((B+C)/A)
		Consulting Cost* (B)	ECS Internal Cost (C)	Total (B+C)		
2013	$292	$59	$37	$96	$388	33%
2014	$407	$56	$36	$92	$499	23%
2015	$410	$56	$36	$92	$502	22%
2016	$413	$78	$39	$117	$530	28%
2017	$424	$92	$38	$130	$554	31%
Total	**$1,946**	**$341**	**$186**	**$527**	**$2,473**	**27%**

**includes change order costs*
***Between 2013 and 2017, ECS spent $1.95 billion on construction projects, and $527 million on engineering cost, for a total of $2.47 billion. This includes $186 million in ECS internal staffing costs.*

C. 3. Lack of Data Edit Checks causing Data Errors

The Project Tracking Portal (PTP) tracks construction contract progress and costs. It also acts as a key control to monitor overruns and prevents manipulation of line items.

We noted errors and some data integrity issues in the PTP.

Errors and data integrity issues in PTP

- For example, we noted that 302 contracts with a total contract value of $342 million were missing one or more important dates, such as purchase order issue date, tender award date, order to commence date, and substantial completion dates in PTP. The majority of these contracts were in the execution stage or had been completed. These milestone dates are important to maintain data reliability and to perform any meaningful analysis.

- We found several erroneously entered change orders ranging in value from $12 million to a billion dollars.

  While these change orders were not paid, it is concerning that the lack of edit checks and controls allowed these errors to happen. Inaccurate data in PTP may hinder ECS's ability to leverage data for analysis, process improvement, centralized contract management, and management reporting.

  Table 6 provides some examples of the erroneous change orders.

Table 6: Examples of Erroneous Change Orders

Change Order	Change Order Amount
1	$71,740,900.00
2	$46,625,407.76
3	$12,561,140.99
4	$43,296,400.00
5	$1,278,448,258.83

Edit controls are required

There are also no edit controls in PTP to ensure contract numbers are properly entered. We found numerous entries in PTP that were apparently made for testing or for training purposes. The 'dummy' data entries were intermingled with production data. In many cases, inconsistent naming conventions were used for contract numbers.

According to ECS management, PTP data in the production environment is separated by active and inactive projects. Test projects are identified as inactive. However, the test data and production data reside in the same database tables, which may cause reporting errors and require more efforts to reconcile data for accuracy.

C. 4. Improper Use of Regular Tender Items for Contingency Work

Once a contract is set up in PTP, the tender line items cannot be changed. This is a desired control that prevents tender quantities from being manipulated after the contract has been awarded and set up in PTP.

Regular line items used for contingency work

We noted that staff sometime use regular line items that are 'underrun' or 'unused' for contingency work. Since PTP does not allow this, this is done by booking quantities against an unused line item to use up the tendered quantity and then simultaneously processing a negative change order to the contingency. Using this adjustment, staff are able to circumvent the PTP control and use line items from the base contract for contingency work. This process also circumvents the delegation of authority approval limits.

As a result of such adjustments, the base contract use is overstated and contingency utilization is understated. This practice should be halted as this hides the contingency work in regular work items.

We also noted that in many cases, staff did not check off the selection for contingency and provisional sum fields in PTP. We performed word searches in the database and identified numerous items where non-standard contingency descriptions were used. The actual contingency amounts for contracts were higher than what was identified by staff.

Recommendation:

4. City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:

   a. review and update the contract language relating to Specific Condition 32 to remove any ambiguity.

   b. at the time of construction contract close-out, calculate the cost of engineering associated with the contract and summarize and review on an annual basis the overall cost of engineering as a percentage of construction costs with a view to evaluating whether the cost of engineering is reasonable.

   c. implement edit checks into the Project Tracking Portal to prevent errors and to ensure the accuracy and completeness of important contract information such as tender award date, purchase order date, and substantial completion date. Further, these edit checks should ensure that standard contract naming conventions are used.

   d. ensure that production and training data in the Project Tracking Portal are segregated to maintain data integrity.

   e. develop and implement a standard procedure for transferring funds from unused tender line items to contingency through the use of change orders.

   f. ensure that contingency items such as miscellaneous items, provisional items and various allowances are appropriately tagged in the Project Tracking Portal for tracking, monitoring and analysis of contingency usage.

Conclusion

The two reports identified issues with contract management practices at ECS. Specifically, there is a need to improve oversight of externally and internally managed construction contracts to ensure the City gets the best value for money.

There is a need for:

- better planning of contract work to minimize design errors and omissions
- improved controls related to the proper authorization of change order work
- an assessment of change order costs and pricing
- better oversight of contractors' and consultants' work

4 audit recommendations

The issues identified in this report are grouped into four overarching recommendations. Implementing these recommendations contained in this report will further improve the controls over oversight of construction contracts.

We express our appreciation for the co-operation and assistance we received from management and staff of the ECS Division.

Audit Objectives, Scope and Methodology

Why we conducted this audit

The Auditor General's 2017 Audit Work Plan included an audit of construction contracts issued by the Engineering and Construction Services (ECS) Division.

Audit objective and scope

The objective of phase two audit was to assess ECS Division's contract management processes and controls over capital construction work. The audit focused on assessing the effectiveness, efficiency and economy of the management of construction and consulting contracts.

One of the key objectives of the audit was to determine if ECS could provide reasonable assurance that change orders were justified and reasonably priced.

Our scope included a review of change orders for lump-sum and unit price construction contracts, and lump-sum professional services contracts awarded between 2013 and 2017. The review did not include procurement processes.

The audit included a review of the following:

- Delivery of contracted services according to established terms & conditions, policies and procedures and performance criteria;
- Vendor payment processing, approval and support;
- Oversight of external consultants and contractors for engineering and construction services;
- Change order identification, justification, pricing and approval processes; and,
- Change order tracking and monitoring processes, including financial and performance reporting.

Methodology

Between 2013 and 2017, ECS spent a cumulative total of approximately $2.3[3] billion on construction projects and consulting costs. This included approximately $222 million (or 10 per cent) in change order cost. ECS internal staffing cost of $186 million is not included in the $2.3 billion.

For our review, we considered contracts that had change orders amounting to at least $100,000 and 5 per cent or more of the base contract value. A total of 248 contracts out of 739 contracts met this criteria. From the 248 contracts, we selected 10 completed contracts with contract values ranging from $3M to $30M which had total change orders per contract ranging from 5 per cent to 15 per cent of the contract base value.

These included six unit-price construction contracts, three lump-sum construction contracts and one lump-sum professional services contract with a total contract value of $103.5 million. These contracts had 385 change orders with a total value of $16.2 million which amounted to approximately 16 per cent of the total contract value.

A total of 90 change orders costing $9.6 million were selected for review. We assessed these contracts to determine whether ECS policies and procedures for change order review and approval were followed.

Table 7 summarizes the 10 sample contracts selected for review.

[3] *Actual expenditure recorded in project tracking portal for the period 2013 to 2017.*

Table 7: Sample Summary and Coverage

	Unit Price Construction Contracts	Lump-Sum Construction Contracts	Professional Services Contracts
Contracts Reviewed	6	3	1
Contract Value Reviewed	$81,906,803	$16,154,132	$5,362,300
Total Change Orders	294	84	7
Change Orders Reviewed	69	18	3
Total Change Order Value (A)	$11,017,409	$4,945,133	$224,507
Change Order Value Reviewed (B)	$7,358,252	$2,069,647	$183,117
Dollar Value of Change Orders Reviewed as a % of Total Change Order Value (B/A)	67%	42%	82%

We reviewed contract documentation to determine whether staff followed ECS policies and procedures, as stated in the 'Capital Works Procedures Manual', in respect of change order approvals, management oversight of change order work, delegation of signing authority, and pricing. We also consulted various publications on construction contract management for benchmarks, and best practices where possible.

Compliance with generally accepted government auditing standards

We conducted this performance 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.

Exhibit 1: Issues Noted in 10 Contracts (90 Change Orders) Reviewed

	Issue	Number of instances noted on the 90 Change Orders reviewed	% of change orders with issues	Non-compliance with ECS policies and procedures	Control Deficiency
1	Change orders resulting from design error & omission 1.1 Design errors and omission caused by consultants 1.2 Design errors and omission caused by City staff 1.3 Design errors and omission caused by inaccurate city records	46 30 11 5	51%		✗
2	Ambiguous tender specifications	6[4]			✗
3	Change orders approved after work commenced or completed 3.1 No change directive issued 3.2 Change directive issued after work completed	32 25 7	36%	✗	
4	Late submission of change orders by consultant after work completed	17[5]			✗
5	Evidence of price negotiation and reasonability check not documented	21	23%		✗
6	Delegation of signing authority not followed in approving change orders	9	10%	✗	
7	Evidence of work verification not available	9	10%	✗	
8	Scope change by Client Division resulting in change orders	7	8%		✗
9	Change order splitting	6	7%	✗	
10	Invoices not obtained from the contractor to verify third-party costs	3	3%	✗	
11	Pricing dispute arising from not finalizing change order price prior to commencing work	4	4%	✗	
12	Work completed without authorization	3	3%	✗	
13	Other issues[6]	25	28%	✗	✗
	Total Instances Noted	**165**			

[4] *6 out of 46 change orders resulted from ambiguous specifications (subset of design errors and omission)*

[5] *17 out of 32 change orders were submitted late by consultants (subset of change orders approved after work commenced or completed)*

[6] *Overpayment, unnecessary change orders, avoidable costs, change order submission after substantial completion, contractor commencing work without instructions, third-parties not held liable for costs, and planning and coordination issues between parties*

Appendix 1: Management's Response to the Auditor General's Report Entitled: "Engineering and Construction Services - Phase Two: Construction Contract Change Management Controls Should Be Strengthened"

Recommendation 1: City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:

a. **establish a process and criteria to review and assess liabilities arising from third-party errors and omissions.**

b. **implement enhancements to the Project Tracking Portal to track the reasons for change orders for analysis and process improvements on an ECS-wide basis.**

c. **analyze the root causes for change orders, change order costs, and track recoveries from third parties on account of errors and omissions.**

d. **ensure that future bridge rehabilitation project tenders are based on recent condition assessments, undertaken within five years of the construction tender preparation.**

e. **formalize the implementation of the Professional Services Performance Evaluation, recently piloted by Engineering and Construction Services, to include consequences for poor performance up to and including suspension.**

Management Response: ☒ Agree ☐ Disagree

Comments/Action Plan/Time Frame:

As acknowledged in the report, changes during construction can and do occur in the large and complex construction contracts delivered by Engineering and Construction Services. Change orders are a common occurrence on construction contracts and is the nature of the work when dealing with older buried infrastructure and renovating or upgrading older buildings, due to unknowns that cannot be reasonably anticipated.

To manage changes, ECS relies on change management procedures, which encompass two key documents for formalizing changes to the scope of the original contract: Change Directives and Change Orders.

While the 10 contracts that were analyzed may not wholly represent the number, type and management of change orders on all the contracts delivered during the 2013 – 2017 timeframe that was the focus of this phase of the audit, ECS supports the need to ensure that the reasons for changes to contract scope are clear and the costs associated with change orders are fair and reasonable, and, in the case of errors and omissions, are borne by the appropriate party.

ECS is committed to continuous improvement and has an established record of identifying, developing and implementing improvements that enhance the management and record-keeping of municipal infrastructure construction contracts. Thus, it is important to note that the contracts evaluated as part of this audit were delivered based on contemporaneous procedures and manuals, which have since been updated. The ECS Field Services Manual was updated in 2016, and the ECS Capital Works Procedures Manual was updated in 2017.

While ECS already has established procedures to assess potential liability resulting from errors and omissions, current processes will be corroborated and additional procedures will be put in place as needed.

ECS commits to reviewing and reinforcing the application of processes and criteria to review and assess liabilities arising from third party errors and omissions.

The Project Tracking Portal (PTP) is a custom built integrated project planning, coordination and delivery web application developed and used by ECS. It is a one window, easily accessible system to monitor, track, and report on projects, contracts, development applications, and staff time. For the purpose of delivery of capital projects, PTP is used to record project details, financial information and milestones. ECS has updated PTP annually, since it was first developed.

ECS acknowledges the benefit of collecting statistical information to determine if there are any trends related to the type, frequency and cost of change orders. ECS commits to making enhancements to PTP to provide the capability to identify the reasons for change orders, using the ten (10) categories identified in Section A3 of the report as a starting point. The target date for implementation of the PTP enhancements and the start of collection of trend data is Q2 2020.

The enhancements to PTP will enable ECS to analyze the root causes for change orders and change order costs, and to track recoveries from third-parties on account of errors and omissions. This information will, in turn, be used to identify process improvements on an ECS-wide basis to ensure consistent application and follow up regarding actual recoveries. Procedural updates will be documented in the ECS Capital Works Procedures Manual with a planned target of Q2 2020.

Recommendation 2: City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:

a. **establish specific service standards for the timely approval of change directives and change orders after finalizing the scope of work and pricing.**

b. **ensure that work only commences after either a change directive or change order is issued which includes a clear and documented agreement on pricing and scope. For time-sensitive changes, staff should obtain appropriate approval via e-mail and expeditiously follow-up with change order documentation.**

c. **ensure that delegated signing authority limits are enforced and that each signature on a change order is individually dated.**

d. **establish a formal 'Record of Evaluation and Negotiation' template to internally document the negotiations with contractors over the cost of work and also the assessment of price reasonability.**

e. **ensure that a change directive is always issued for quantity overruns that are expected to exceed a set threshold as outlined in ECS's Capital Works Procedures Manual.**

Management Response: ☒ Agree ☐ Disagree

Comments/Action Plan/Time Frame:

With the promulgation of the new Construction Act, new requirements for timely processing of contract payments will apply to construction contracts. ECS, along with partner Divisions, is in the

process of updating policies, processes and documentation to ensure compliance with the new Act, which will result in the establishment of specific service standards and these may apply to change directives and change orders.

The ECS Capital Works Procedures manual describes in detail the processes and procedures that must be followed in respect of change directives and change orders, including the need for agreement on pricing and scope for changes in the work; the need to issue change directives for quantity overruns when thresholds may be exceeded; and the hierarchy of signing authority levels and limits. To ensure compliance with Divisional procedures, ECS will continue to deliver change management training.

To provide staff who manage construction contracts with guidance to effectively negotiate changes in work scope and to evaluate the reasonableness and fairness of negotiated prices, ECS will develop and implement a Record of Evaluation and Negotiation template, to be included as part of contract documentation in support of change orders.

Recommendation 3: City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:

a. **in consultation with Corporate Finance, the Fair Wage Office, Legal Services and Purchasing and Materials Management, establish uniform labour burden rates to be used across all construction contracts.**

b. **ensure that change work is properly tracked and monitored for unit price, time and material, and lump-sum change orders, and that the payment is made after work has been properly verified.**

c. **ensure that substantial scope changes are minimized after the contract is awarded. Where it is not possible to avoid such changes, the Client Division should be fully informed of the impact of substantial scope changes on contract costs and timelines.**

d. **ensure that project documentation on externally managed contracts are always retained within the ECS Division.**

e. **measure and monitor change order costs.**

Management Response: ☒ Agree ☐ Disagree

Comments/Action Plan/Time Frame:

In consultation with Corporate Finance, the Fair Wage Office, Legal Services and Purchasing and Materials Management, ECS intends to establish uniform labour burden rates that can be applied consistently on all construction contracts City-wide. This effort will be undertaken in conjunction with updates required to comply with the new Construction Act.

As explained above under the response to Recommendation 2, the ECS Capital Works Procedures manual describes in detail the processes and procedures that must be followed in respect of change directives and change orders, including the need to accurately track and monitor items and unit prices, time and materials, and lump sum change orders, and to verify that work authorized via a change order has been completed before payment is made. The CWP manual also describes contract documentation requirements. To ensure compliance with Divisional procedures, ECS will continue to deliver change management training.

Through ongoing dialogue, which typically takes place on at least a quarterly basis, ECS will continue to highlight the impact of substantial scope changes on contract costs and timelines to Client Divisions.

Recommendation 4: City Council request the Chief Engineer and Executive Director, Engineering and Construction Services, to:

a. **review and update the contract language relating to Specific Condition 32 to remove any ambiguity.**

b. **at the time of construction contract close-out, calculate the cost of engineering associated with the contract and summarize and review on an annual basis the overall cost of engineering as a percentage of construction costs with a view to evaluating whether the cost of engineering is reasonable.**

c. **implement edit checks into the Project Tracking Portal to prevent errors and to ensure the accuracy and completeness of important contract information such as tender award date, purchase order date, and substantial completion date. Further, these edit checks should ensure that standard contract naming conventions are used.**

d. **ensure that production and training data in the Project Tracking Portal are segregated to maintain data integrity.**

e. **develop and implement a standard procedure for transferring funds from unused tender line items to contingency through the use of change orders.**

f. **ensure that contingency items such as miscellaneous items, provisional items and various allowances are appropriately tagged in the Project Tracking Portal for tracking, monitoring and analysis of contingency usage.**

Management Response: ☒ Agree ☐ Disagree

Comments/Action Plan/Time Frame:

In collaboration with Legal Services, Purchasing and Materials Management, and client divisions, ECS is currently in the process of updating contracts in support of the new Construction Act. As part of the update, ECS commits to reviewing contract language to remove ambiguities; Specific Condition 32 will be included in this review. The expected timeline for completion of the update and implementation of the updated contract documents is Q4 2019.

Beginning with contracts that are completed in 2019, ECS will calculate the cost of engineering associated with each closed contract, and summarize and review the overall cost of engineering as a percentage of construction costs with a view to evaluating whether the cost of engineering is reasonable.

As the system that ECS relies on for integrated project planning, coordination and delivery, it is imperative that the data input into the Project Tracking Portal is accurate and free of errors. This includes ensuring the accuracy and completeness of important contract information such as tender award date, purchase order date, and substantial completion date.

ECS commits to reinforcing PTP Business Protocols and the requirements contained in the ECS Capital Works Procedures manual, including ensuring that standard contract naming conventions are used, through staff coaching and ongoing PTP training. This will include already established

procedures for identifying items and for transferring unused funds to contract contingency via change orders. To further assure data integrity, mandatory PTP field data entry requirements will be implemented, where possible, by Q2 2020.

With respect to the PTP system itself, ECS commits to removing all five (5) test projects (training data) from the production database of PTP by Q3 2019.

AUDITOR
GENERAL

TORONTO