CITY OF ST. ALBERT

ADMINISTRATIVE BACKGROUNDER

TITLE: CAPITAL PROJECT COST AND PROCESS REVIEW

On November 26, 2015 Council passed the following postponed motion:

(PM52-2016)

"That $125,000 be allocated in the 2016 Capital budget such that the 2017 (and 2016 if needed) through 2019 Capital Project Charters be updated (scope and cost estimates) and develop operating cost details for capital projects."

BACKGROUND:

The Capital Project Cost and Process Review was approved through the 2016-2025 budget postponed motions. Administration accepted the direction from Council and developed the following scope elements:

- A survey of six key municipalities to understand practices currently in use across the region and the similarities differences with the City of St. Albert's current practices;
- A review and analysis of recommended estimating practices and standards for the purposes of identifying relevant suggestions for improving City practices; and
- Review and validation of specific project charters created for key City of St. Albert capital projects planned for the next 3 years.

SMA Consulting was selected as the lead consultant, and a summary of the study results is below.

Municipal Survey

The survey showed above all that the City of St. Albert's practices are not significantly different from other municipalities of comparable size. Indeed, not only were similar practices for estimating employed and similar challenges encountered across municipalities, but many municipalities expressed interest in implementing innovative estimating approaches already in place at St. Albert.

Similar uncertainties in project scope and budget were being faced in all instances. This challenge is often compounded by constraints in resource availability, so that the majority of estimates undertaken in cities of comparable size to St. Albert are prepared by external cost or consulting engineers. For instance, most of the municipalities surveyed encounter variation between the estimate and the construction bid; a major challenge for municipalities is to predict the market

condition. These challenges are all in keeping with issues that the City of St. Albert is also facing.

Larger municipalities (City of Edmonton and City of Calgary) have been able to adopt different methodologies partly due to the nature and size of the projects undertaken; in some cases, these practices have been modified to form recommendations in this report. Nevertheless, all municipalities faced challenges in their estimating practices and were looking for ways to improve. As exemplified by the decision to implement this study, St. Albert appears to be taking a lead in responding to such key challenges.

Review and Recommendations Regarding City of St. Albert Current Procedures

Based on SMA's observations of the City's existing estimating process and practices, a comparison of estimating practices in other municipalities, and a review of best and recommended practices advocated by industrial and academic bodies (including the AACE International [American Association of Cost Engineers], PMI [Project Management Institute], and Construction Industry Institute [CII]), SMA has identified fifteen recommendations for consideration by the City of St. Albert. These recommendations have been discussed and refined through workshops with City personnel. Notably, many of these recommendations build upon innovations and practices that are already being implemented at the City.

The overall recommendations of the study follow:

Charter Development Process:

1. Focus development effort on projects planned to commence within the next three years.
2. Use a structured scorecard approach to enhance and measure project scope definition and assist in aligning the project team.
3. Implement a more formal scoping exercise at the initiation of the project, which includes a broader range of City personnel and results in a documented scope statement.
4. Allocate funding to implement planning exercises such as value engineering and constructability reviews.
5. Implement formal quantitative risk assessment of the project cost and schedule.
6. Use the expertise of consultants when estimating large and complex projects.
7. Implement a more robust records management system.

Estimating Process:

8. Implement additional training to standardize and enhance cost estimate knowledge.
9. Use standardized tools for documenting and applying historical cost information to enhance the quality of the estimates early in the project.
10. Adopt a City-wide estimate classification system and explicitly include degree of accuracy in charter documents.
11. Align design contingency allowance with identified and quantified risks.

12. Implement a mandatory Basis of Estimate (BOE) document for all projects.
13. Implement a detailed review, validation, and documentation process for project estimates at each project milestone.
14. Revise operating estimate guidelines to provide clearer methodology and implement additional training to standardize and enhance cost estimate knowledge.

Budgeting Process:

15. Establish a dynamic Management Reserve approach to reflect realization of unidentified risks or required scope changes at the Senior Leadership Team level.

Project Charter Cost Estimate Analysis

SMA reviewed the select project charters (see Attachment titled "Summary of Project Charter Review" for more details, and refer to the complete study for the complete package of information.

In summary the cost estimates they calculated when they applied their recommendations regarding industry escalation factors, contingencies, etc. varied from -16.24% to +7.02 from the current estimated project costs.

Administration's Response & Next Steps

There is significant value in this review and the resulting new cost estimates and process improvement recommendations. It is recognized that a number of the fifteen recommendations are in varying stages of implementation while some are new. Regardless of the current state, each needs to be considered within the context of the current financial and project development processes, and Council's vision.

Therefore, Administration will review the actual estimates for the project charters contained within 2018 and 2019 and rationalize them for adjustment to the 2018 - 2027 Budget Process. This timing is supported by the fact that the project estimates variances that are greater than 5% are in the year 2018/2019 or the cost estimates will be refined through design planned to occur in 2017. Consequently, this allows time to consider the recommendations and *charter review values* provided through this study.

In terms of the fifteen recommendations Administrations will evaluate each of them within the context of the overall budget and capital project development system, and provide a response and implementation plan to respond to each recommendation. This will be presented to Council as information in Q2 2017.

ATTACHMENT:

Capital Project Cost and Process Review

Report Date: October 3, 2016
Author(s): Monique St. Louis
Committee/Department: Build St. Albert
General Manager: Gilles Prefontaine
Interim City Manager: C. Jardine

DATE
2016-09-20

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Capital Project Cost and Process Review

City of St. Albert

Final Report

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September 26, 2016

City of St. Albert
St. Albert Place
5 St. Anne Street
St. Albert, AB T8N 3Z9

Attn.: Monique St. Louis, Director, Build St. Albert

Re: Capital Project Cost and Process Review Project

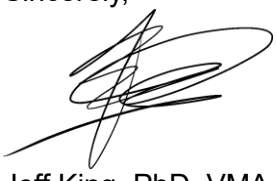
Dear Ms. St. Louis:

We are pleased to enclose our report documenting the results of the Capital Project Cost and Process Review project (#ITT16-0032). In addition to the main body of the report, we have also included the following appendices:

- Appendix A - Review of Best and Recommended Practices
- Appendix B - Review of Designated Project Charters
- Appendix C - Municipality Comparison of Estimating Practices Report
- Appendix D - Sample PDRI Scorecard
- Appendix E - Planning Exercise Descriptions
- Appendix F - Sample Basis of Estimate (BOE) Document
- Appendix G - Schedule of Industry Assumptions/Metrics

If you require any further information or elaboration on our findings, please do not hesitate to contact us.

Sincerely,



Jeff King, PhD, VMA
Project Manager
SMA Consulting Ltd.

Executive Summary

As an urban municipality with nearly 65,000 residents and an annual capital project budget of $20-30 million, the City of St. Albert aims to develop project plans and estimates that use its resources responsibly and with transparency. The extent to which this objective is successfully met requires regular review and assessment. To do this, the City of St. Albert developed a mandate to review its Capital Budgeting process, contracting SMA Consulting to provide this service.

This review of the Capital Budgeting process includes several interacting components:

1. ***An understanding of the existing processes and practices for estimating repair, maintain, and replace (RMR) and growth projects used at the City of St. Albert.***
   Within this study SMA reviewed several City documents and completed numerous interviews with various City personnel to develop its understanding of the City's charter development and estimating process. The result of this work was summarized in a detailed process description and flowchart in Section 2.
2. ***Review and validation of specific project charters created for key City of St. Albert capital projects planned for the next 3 years.***
   In this context SMA reviewed and validated specific project charters provided by the City. General commentary on the capital and operating estimating practices used in the development of these charters has been included in this report in Section 3, with the detailed review and validation of each charter included separately as an appendix.
   On the whole, the review of the base costs and design and construction costs indicated that these were relatively rational. The review recommends introducing further consistency in the application of scoping exercises, contingencies, escalation, and project soft costs to enhance charter development.
3. ***A survey of six key municipalities to understand practices currently in use across the region and the similarities and differences with the City of St. Albert's current practices***.
   The findings of the review were assessed alongside the outcomes of the other major component of this project. This involved a survey of other municipalities to better understand the context of the City of St. Albert's current estimating practices and to determine whether best or recommended practices currently implemented in other municipalities might be of relevance and benefit to the City of St. Albert. Six municipalities were contacted for this part of the study. These included the City of Edmonton, the City of Lethbridge, Strathcona County, the City of Red Deer, the City of Calgary, and the City of Airdrie. A questionnaire was developed in conversation with St. Albert's project team.
   The survey showed above all that the City of St. Albert's practices are not significantly different from other municipalities of comparable size. Indeed, not only were similar practices for estimating employed and similar challenges encountered across municipalities, but many municipalities expressed interest in implementing innovative estimating approaches already in place at St. Albert.

Similar uncertainties in project scope and budget were being faced in all instances. This challenge is often compounded by constraints in resource availability, so that the majority of estimates undertaken in cities of comparable size to St. Albert are prepared by external cost or consulting engineers. For instance, most of the municipalities surveyed encounter variation between the estimate and the construction bid; a major challenge for municipalities is to predict the market condition. These challenges are all in keeping with issues that the City of St. Albert is also facing.
Larger municipalities (City of Edmonton and City of Calgary) have been able to adopt different methodologies partly due to the nature and size of the projects undertaken; in some cases, these practices have been modified to form recommendations in this report. Nevertheless, all municipalities faced challenges in their estimating practices and were looking for ways to improve. As exemplified by the decision to implement this study, St. Albert appears to be taking a lead in responding to such key challenges.

4. ***A review and analysis of recommended estimating practices and standards for the purposes of identifying relevant suggestions for improving City practices.***
Based on our observations of the City's existing estimating process and practices, our comparison of estimating practices in other municipalities, and our review of best and recommended practices advocated by industrial and academic bodies (including the AACE International [American Association of Cost Engineers], PMI [Project Management Institute], and Construction Industry Institute [CII]), we have identified fifteen recommendations for consideration by the City of St. Albert. These recommendations have been discussed and refined through workshops with City personnel. Notably, many of these recommendations build upon innovations and practices that are already being implemented at the City. This continuity was highlighted during the final workshop with the City, and we have attempted to represent it wherever possible in the findings below.

The overall recommendations of the study have been organized in terms of three interrelated processes at the City of St. Albert: charter development, estimating, and budgeting. An accompanying Executive Report provides more specific guidelines on the prioritization of the above recommendations based on benefit and timing of implementation.

Briefly, the recommendations are:

Charter Development Process:

1. Focus development effort on projects planned to commence within the next three years.
2. Use a structured scorecard approach to enhance and measure project scope definition and assist in aligning the project team.
3. Implement a more formal scoping exercise at the initiation of the project, which includes a broader range of City personnel and results in a documented scope statement.
4. Allocate funding to implement planning exercises such as value engineering and constructability reviews.
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Estimating Process:

8. Implement additional training to standardize and enhance cost estimate knowledge.
9. Use standardized tools for documenting and applying historical cost information to enhance the quality of the estimates early in the project.
10. Adopt a City-wide estimate classification system and explicitly include degree of accuracy in charter documents.
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13. Implement a detailed review, validation, and documentation process for project estimates at each project milestone.
14. Revise operating estimate guidelines to provide clearer methodology and implement additional training to standardize and enhance cost estimate knowledge.

Budgeting Process:

15. Establish a dynamic Management Reserve approach to reflect realization of unidentified risks or required scope changes at the Senior Leadership Team level.

Alongside these recommendations, we have also developed a proposed overall process, which builds upon existing practices, while also attempting to integrate the new recommendations in a rational and effective manner. Several preliminary suggestions were also developed to facilitate the implementation of these recommendations, including additional training, more detailed cost-benefit analysis, and further review of existing processes to uncover opportunities for greater flexibility.

Table of Contents

1 Project Background

As an urban municipality with nearly 65,000 residents and an annual capital project budget of $20-30 million, the City of St. Albert aims to develop project plans and estimates that seek to use its resources responsibly and with transparency. The extent to which this objective is successfully met requires regular review and assessment. To do this, the City of St. Albert developed a mandate to review its Capital Budgeting process, contracting SMA Consulting to provide this service.

The review of the Capital Budgeting process involved several interacting components:

1. An understanding of the existing processes and practices for estimating repair, maintain, and replace (RMR) and growth projects used at the City of St. Albert.
2. Review and validation of specific project charters created for key City of St. Albert capital projects planned for the next 3 years.
3. A survey of six key municipalities to understand practices currently in use across the region and the similarities and differences with the City of St. Albert's current practices.
4. A review and analysis of recommended estimating practices and standards for the purposes of identifying relevant suggestions for improving City practices.

This effort, as described in this report, informed the development of several recommendations to improve the City of St. Albert's current capital and operating estimating processes. These recommendations were reviewed and elaborated in workshops held with key department and managerial staff.

2 Current City Capital Budgeting Process

The City of St. Albert has undertaken a rigorous review of several of its existing estimating processes and is currently working towards refining and improving these. These initial efforts to improve the overall estimating and budgeting system have included the introduction of new tools (such as the Cost Analysis Checklist) and processes, key aspects of which have been captured below.

To understand the City of St. Albert's Capital Budgeting process, SMA focused primarily upon the project charter development process. The charter development process is part of a much larger business planning and budget process. While charters must be developed (either as new or "refreshed" charters) for approval by Council on an annual basis, they are planned as part of a three-year business planning and budget cycle and, once approved, are included as part of the City's rolling 10-Year Capital Plan. A high-level illustration of this lifecycle for a single sample project is shown in Figure 1. Further details on the charter development process are included below.

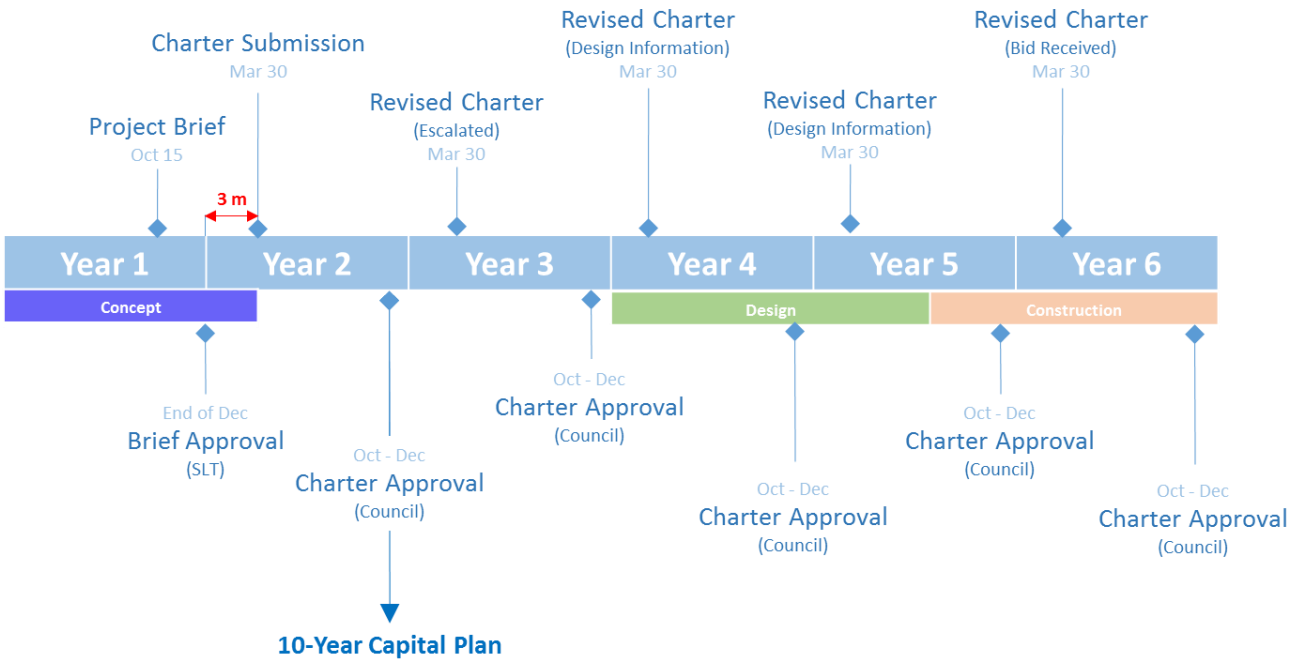


Figure 1. Lifecycle of a Sample Project

SMA reviewed several City documents and relied upon interviews with various City personnel to develop its understanding of the City's charter development process. In addition to the information provided in the specified charters for review and validation, the documents included official City policy (C-P&E-02 – Capital Project Management), internal process documents for capital project development, operating impacts calculation guidelines, and capital estimate checklists. City personnel interviewed included general managers, directors, project managers and other key individuals involved in the development of the project charters and initiation of projects.

2.1 CHARTER DEVELOPMENT

The process of developing a Project Charter and capital estimate can begin several years before it is formally submitted. This development occurs through the higher-level work of planning, including the development of master plans, functional plans, strategic plans, and other municipal planning documents. These planning documents include initial scope recommendations and will often also contain preliminary estimates. Project Charter development may also be triggered through a formal Council Motion, which may be accompanied by a predetermined budget. This information and other inputs, if available, feed into the development of a Project Brief, which is initiated in September of each year.

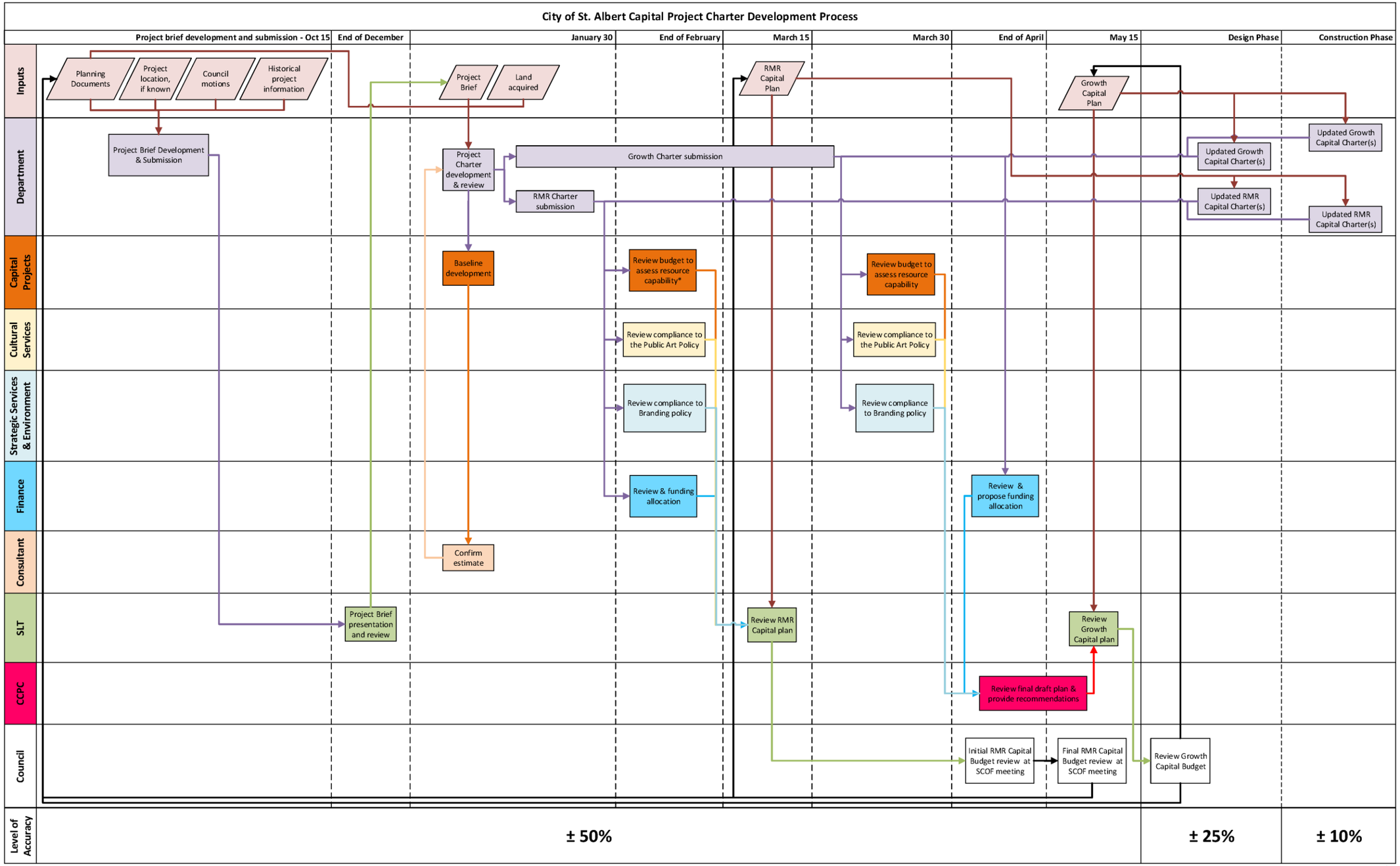
The Project Brief, which includes an outline of one or two paragraphs and a preliminary estimate, is submitted to the Senior Leadership Team (SLT) by October 15, with the SLT review taking place by the end of December. Any Project Briefs that are approved are then developed into a Project Charter, which is a document that "formally authorizes the existence of a project, and provides the Project Manager with the authority to apply organizational resources" (City

Council Policy, C-P&E-02). It includes information on scope; project justification; timeline/schedule; project risks, constraints, assumptions and impacts; stakeholders; costs; and operational impacts.

Project Charters require input from several groups within the City of St. Albert. The Capital Projects Office typically reviews the cost estimate, which involves confirming the estimate provided in the Project Brief (and derived from planning documentation) in consultation with the consultant that originally developed it. Once the Project Charter has been drafted for submission, Cultural Services and Strategic Services will also review the Charter to assess, respectively, its compliance to the Public Art Policy and to the Branding Policy. The reviewed Charter is next reviewed by Finance to determine the funding allocation for each project. Finally, Capital Projects will again review the budget to assess its ability to resource the project adequately.

The deadlines for review and submission depend upon whether the Project Charter is for a RMR or a Growth project. The SLT's review of the RMR Capital Plan is scheduled for March 15; its review of the Growth Capital Plan is May 15. An initial RMR Capital Budget review by City Council's Standing Committee of the Whole (SCW) is held in April, with a final review scheduled to take place by May 15. In the case of Growth projects, the draft is first sent to the Corporate Capital Projects Committee for review. The scope and budgets for Growth Capital Projects are then reviewed by City Council, typically in October.

Based on the input received, SMA developed a detailed swimlane flowchart to illustrate the above process and interactions between units within the City (see Figure 2). Note that the levels of accuracy identified correspond to the three phases of the Capital Project defined in the City Council Policy (C-P&E-02), with the concept phase targeting +/- 50% level of accuracy in initial analogous and/or parametric cost estimates; the design phase, allowing for design cost estimates with a target of +/- 25% level of accuracy; and the construction phase, allowing post-tender cost estimates with a target of +/- 10% level of accuracy.



*Process commence in September of each year

Figure 2. Project Charter Development Process

2.2 ESTIMATING PRACTICES

Based primarily upon the review of Project Charters and interviews with City staff, we reviewed the City of St. Albert's current capital and operating estimating practices. On the whole, the base costs and design and construction costs appeared relatively rational. As shown in the summary chart in Appendix B, the amount of variance between the original charter estimate and our recommended charter review was generally minimal.

The review recommends introducing greater consistency in the application of scoping exercises, contingencies, escalation, and project soft costs to enhance charter development. In the detailed charter reviews included in Appendix B, we have attempted to address these specific issues and, where applicable, offer correction. For more details on the methodology we employed in reviewing the charters, please see Section 3 below. For the benefit of building the City's overall estimating resources, we have also included a Schedule of Industry Assumptions/Metrics in Appendix G. This table provides the assumptions and metrics that have been used in the course of our charter review as well as recommending databooks for specific kinds of construction.

2.2.1 Capital Estimating

Estimating practices vary across the City departments. While this variety appears at times to derive from the nature of the project being estimated, it can also be due to the nature of the information available for the estimate or as a result of differing estimating methodologies between departments. Other municipalities of comparable size to the City of St. Albert indicated a similar variation in estimating approach. City policy on Capital Project Management likewise permits the use of differing estimating approaches depending on the nature and phase of the project (e.g., parametric vs. analogous estimating).

The following general observations on estimating practices can be made:

- In certain charters (e.g., CULTR-009, CULTR-010, CULTR-011, DARP-005, DARP-006, RECR-010, RECR-050), the basis of estimate was developed through the use of design consultants engaged to prepare a functional or master plan. For those concept plans that were developed several years ago, the associated costs have been brought forward by applying a general escalation factor. For some of these charters, the scope has gradually evolved over the years, with the result that various line items – initially part of the phased estimates in the original master plan – required redistribution to other phases of the work in order to account for what scope has been accomplished and what is still remaining.
- Project charters in some cases provided support for their estimates using preliminary spreadsheet estimates (e.g., RECR-045, RECR-051), which appear to have been developed by in-house staff based on previous master plan estimates. These initial estimates are then either updated to current dollars or escalated using a general escalation factor.
- Another estimating approach used that was noted (e.g., RECR-041, PW-020, RECR-043) involved obtaining input from general contractors for the work planned. Alternatives

to this specific quote approach could include obtaining multiple quotes to inform the estimate, which will help to mitigate any perception of bias that could arise.

- A practice that has recently been implemented at the City of St. Albert is the use of the "Cost Analysis Checklist." As we discuss in greater detail in our recommendations below, this checklist has great potential for improving certain City processes. City management indicated that both this checklist – and the related "Capital Project Cost Estimate Worksheet(s)" document that is included in the Project Charter itself – are under review and part of the City's continuous improvement efforts. Recommendations from this report will inform these ongoing improvements.
- In general, the way the "Capital Project Cost Estimate Worksheet(s)" have been used in the charters suggests these can be further enhanced through additional consistency in the application of various line items and how they are to be calculated or applied. Although the City's "Cost Analysis Checklist" describes each line item, these descriptions and directions will benefit from further dissemination across departments. These opportunities for improvement partly reflect the recent nature of the checklist itself, which post-dates the initial development of many of the charters reviewed.
  For example, the "Construction Management" line item in the worksheet was accounted for in a variety of ways. In some charters, this item was replaced with "Project Management"; however, in those cases, it was not clear whether this value was intended as an internal Project Administration resource or if the intent was to hire independent project managers to oversee the entire project. In other cases, additional line items were added to the worksheet to include "Project Staff" as well as a value for Construction Management. There did not appear to be a consistent application of costs for this line item. City management indicated that the original intent of this line item was to reflect whether the management work would be undertaken in-house or not. As the tool is developed further, these assumptions can be documented in order to reinforce consistency and transparency across estimates.

In general, increased detail and structure in the approach to documentation of the estimate will yield better results. A more detailed approach to such documentation, which includes detailed estimate assumptions and associated risk factors, will provide a full picture of what the estimate accounts for.

2.2.2 Operating Estimating

The operating impact of a capital project is a key element to consider when attempting to make a rational, informed decision about proceeding with a planned project. Although exceptions do exist in certain types of infrastructure, most capital projects involve an additional burden to the overall operating budget and proper consideration should therefore be given to the anticipated cost of new projects.

Our review of documentation included the City's "Capital Budget Operating Impacts Calculations Guidelines," which supports City personnel in developing operating estimates for new projects. These guidelines are helpful for providing an initial input; however, more definition is needed to ensure consistency especially during conceptual planning. Additional tools and methodologies can be identified in the guideline to better rationalize costs. Our observations can be summarized as follows:

- In general, the Operating Impacts Cost Estimates included in the Project Charters reviewed appeared to follow the City's "Capital Budget Operating Impacts Calculations Guidelines." In some of the charters, a 2% factor of the construction budget was allocated to develop a *macro* estimate, as instructed by the guidelines where specific detail is not available.
- Although the concept of a macro allowance is a rational approach for many projects, and, in general, we support the 2% recommended allowance as a general conservative rule of thumb, additional documentation within the charter would be helpful to understand how the 2% factor is applied.
- For costs related to trail and park maintenance, an estimate is developed at a fixed rate per kilometer or per hectare, respectively. These values have been calculated based on direct historical data obtained from the Public Works Long Term Development Plan.

Additional direction should be included within the guidelines in order to guide users to distinguish between actual construction costs and other elements, such as demolition or relocation costs, which will not directly impact a future operating budget. Additional commentary on the operating estimating practices and a recommendation for improving the guidelines is included in Recommendation #14 below.

3 Project Charters Review

3.1 SCOPE OF THE REVIEW

The independent peer review of cost estimates for the following Capital Project Charters is summarized in this section. The detailed review is included separately and in full in Appendix B, for ease of distribution as necessary. It should be noted that the review is not intended to be a definitive statement of project cost for each charter. Rather, it aims to support the recommendations made elsewhere in this report by providing a specific and detailed estimating process review and commentary.

The following charters were requested by the City of St. Albert for review:

Charter No.	Department	Project Charter Name
CULTR-005	Culture	Founders Walk Phase 3
CULTR-009	Culture	Heritage Park - French Canadian Farm
CULTR-010	Culture	Heritage Park - Landscaping and Accessibility
CULTR-011	Culture	Heritage Park - Interpretive Centre
DARP-005	Planning and Engineering	Millennium Park Phase 2

DARP-006	Planning and Engineering	Perron Street Pedestrian Improvements
PW-020	Public Works	Covered Sand Storage
RECR-010	Recreation and Parks	Lacombe Park Phase 2
RECR-041	Recreation and Parks	Erin Ridge North - School Playground
RECR-043	Recreation and Parks	Riel Park Phase 5
RECR-045	Recreation and Parks	Oakmont Trail Phase 2
RECR-049	Recreation and Parks	Neighborhood Park Construction
RECR-050	Recreation and Parks	Red Willow Park West
RECR-051	Recreation and Parks	Grey Nuns White Spruce Park
TRAN-007	Transportation	Transit North Park & Ride/Transit Centre

Our overall approach for the review had the following characteristics:

- All charters were reviewed in detail to understand the scope and intent of the project.
- The backup information related to the development of the charters was requested and, in most cases, was available. Instances where the support documentation was unavailable have been noted in the detailed review.
- The basis of each estimate was reviewed to ensure the intent of the estimate matched the general descriptions contained in the charters.
- Where applicable, the unit rates used in the base estimates were also reviewed and compared against historical data of similar works based on the descriptions provided in the estimate.
- No attempt was made to validate any measures of the specific works; however, spot checks of quantities were completed where the information was sufficient.
- In general, we relied upon the quantification as presented to complete the review and validation.

In summary, for each charter, we have provided a specific review of our observations and analysis of the basis of the estimate, including the content of the “Capital Project Cost Estimate Worksheet.” Where applicable, we have also developed a Recommended Charter Value (RCV) of the capital cost estimate based on our review and assumptions.

3.2 DETAILED METHODOLOGY

The review and validation process involved several key focuses, which are discussed in detail below. These include escalation, contingencies, construction vs. project management, commissioning and QA/QC costs, and operating costs.

3.2.1 Escalation

For project charters where the base cost was developed in previous years, we have used the following escalation rates based on the Hanscomb Escalation Watch developed from the Non-Residential Building Construction Price Indices (NRBCPI) data published by Statistics Canada (see Table 1).

Table 1. Escalation Rates

Year	Rate of Escalation
2010-11	5.8%
2011-12	4.1%
2012-13	3.0%
2013-14	1.1%
2014-15	1.5%
2015-16	(-1.4)%
Compounded Escalation	14.8%

All escalation is based on fourth quarter year-over-year values. Based on our understanding of the current market conditions, we believe that construction costs can be expected to rise by approximately 0.25% to 0.75% per annum throughout the remaining portion of 2016 and are forecasting approximately 1.5% escalation for 2016-2017.

For the purposes of our RCV, all base costs are developed in current 2016 dollars and escalated at 2% per year until 2016-2017. We have applied 3% thereafter. We have also applied this same escalation factor to design costs where applicable.

Alternatively, escalation rates that the City of St. Albert could also consider for implementation are those used by the City of Edmonton (see Table 2). While our recommendations have been made based on the above escalations, further discussion of the rationale for escalation would be worthwhile.

Table 2. City of Edmonton Escalation Rates

Year	Rate of Escalation
2010	2.09%
2011	4.08%
2012	3.85%
2013	0.94%
2014	-0.53%
2015	1.87%

2016	5.26

3.2.2 Contingencies

For each charter, we have attempted to evaluate the scope and nature of the project, and, based on the level of estimate detail provided, we have adjusted the Design Contingency Allowance accordingly.

As per Recommendation #15 described below, we have also added a Management Reserve Contingency to all of our RCVs. In general, we have allocated this allowance at 4% of the total of all costs developed in future dollars. This percentage is based upon experience gained on previous projects, which were in turn based upon historical data and anticipated risks. It is important to note that this contingency is still a requirement in the total of our recommended RCV, regardless of whether the recommendation is adopted. It has been identified separately in order to illustrate how it can be applied consistently in order to help make the estimate more transparent. If the City does not adopt the Management Reserve recommendation, we recommend that the value presented in our RCV should be retained in the estimate as part of a general contingency.

3.2.3 Construction/Project Management

Additional clarification of the Construction Management (CM) line item would provide greater consistency across charters. Based on the clarification we received during discussions with City management, we have used the term Project Management in the place of Construction Management in our RCV for clarity and have applied it as a percentage based on the construction cost.

3.2.4 Commissioning and QA/QC Costs

The City's "Cost Analysis Checklist" provides a brief description of when and how to apply the QA/QC costs, which could be implemented going forward as a means of establishing a more detailed estimate. As design and construction concepts move to higher levels of sustainable design, we feel that it is prudent even during the preliminary concept stage to include a value reflecting these costs. We have therefore applied the recommended 1% value to all RCV estimates.

3.2.5 Operating Costs

A general review was undertaken on the project charter Operating Impacts as well as the City's "Capital Budget Operating Impacts Calculations Guideline." Since many of the charters relied on the application of a macro 2% value of the construction cost or are based on what appears to be direct historical data for specific works, our review and commentary related to the Operating Impacts has been addressed primarily in the general discussion in Section 2.2.2 (Operating Estimating) as well as in Recommendation #14 below (see Section 5).

The project charter review for each of the required projects using the approach described above is given in Appendix B.

4 Comparison of Practices in Other Municipalities

The project also entailed a survey of other municipalities to better understand the context of the City of St. Albert's current estimating practices and to determine whether best or recommended practices currently implemented in other municipalities might be of relevance and benefit to the City of St. Albert.

Six municipalities were contacted for this part of the study. These included the City of Edmonton, the City of Lethbridge, Strathcona County, the City of Red Deer, the City of Calgary, and the City of Airdrie. A questionnaire was developed in conversation with St. Albert's project team. This survey investigated numerous aspects of the estimating process, including the makeup of the estimating units or personnel within the municipality, levels of accuracy encountered and expected, processes and tools used, organizational practices, the use of external experts for estimating, the municipality's approach to contingency amounts, and other issues. A detailed report of the findings is included in Appendix C.

At a high-level, the survey showed above all that the City of St. Albert's practices are not significantly different from other municipalities of comparable size. Indeed, not only were similar practices for estimating employed and similar challenges encountered across municipalities, but many municipalities expressed interest in implementing innovative estimating approaches already in place or under development at St. Albert (e.g., preliminary training component). The larger municipalities interviewed (City of Edmonton and City of Calgary) have been able to adopt different methodologies partly due to the nature and size of the projects undertaken; in some cases, these practices have been modified to form recommendations in this report. *Nevertheless, all municipalities faced challenges in their estimating practices and were looking for ways to improve.*

4.1 ESTIMATING PRACTICES

Estimating practices of municipalities are somewhat consistent across the Province. In larger municipalities such as Edmonton and Calgary, there is the ability to employ dedicated estimation staff; other municipalities rely upon project engineers, project managers, and various other staff members to carry out this responsibility. Likewise, many smaller municipalities do not have written estimation practices in place, while larger municipalities have well-articulated estimating practices and units dedicated to estimating. In this regard, St. Albert appears to be among the leaders investigating process improvement for municipalities of its size.

In general, most of the municipalities were satisfied with the level of accuracy obtained on highway project estimates and only somewhat satisfied with the level of accuracy obtained on building project estimates. This, again, appears to be in keeping with the experience of City of St. Albert personnel.

None of the municipalities use "class" or "level" to classify estimates, but estimating practices such as expert judgement, bottom-up estimating, analogous estimating, and parametric estimating are used frequently within municipalities. Typically, estimates are prepared in current

year dollars and then escalation/inflation is applied based on the budget cycle. A similar practice is in place in the City of St. Albert.

In all other municipalities, a budget office or finance division applies the escalation rates or inflation rate. Business units prepare the estimates in current year dollars.

For reviewing estimates, larger municipalities typically have adopted a formal review process, while smaller ones adopt informal peer review processes, not dissimilar to the process used by the City of St. Albert.

4.2 ESTIMATE TOOLS

The municipalities surveyed rarely used cost consultants for highways projects because most of the time design consultants were responsible for preparing these estimates.

All of the municipalities surveyed use historical data to compare and validate the costs in some horizontal construction projects. In the building sector, all smaller municipalities used design consultants for cost estimates; for some specialty projects, certain smaller municipalities have used dedicated cost consultants for estimating. To determine when to use independent cost consultants, the municipalities consider both the cost of the project and the type (new and unique) of the project. Depending on the project, smaller municipalities also at times rely upon data from a neighbouring larger municipality to validate the estimate for unique projects (such as a swimming pool). In all cases, these findings (especially for municipalities of comparable size) are very similar to the practices currently in place at the City of St. Albert.

Most municipalities do not include a Basis of Estimate document as part of the estimate. Nevertheless, most City staff members agree that such a document should be part of the estimate as a best practice and some of the municipalities are planning to mandate this practice in the near future.

Other comparable municipalities utilize checklists in a manner similar to City of St. Albert. These checklists are generally customized based on the type of the project (road projects, building project, etc.). Some of the municipalities have had issues with this approach because of how large these spreadsheets can be to manage (as an example, one municipality's Excel sheet consists of 1200 items).

In terms of the software tools used, smaller municipalities predominately use Excel spreadsheets for estimating, while larger ones typically rely upon custom or off-the-shelf software solutions.

4.3 ESTIMATE OUTCOMES

Most municipalities encounter variation between the estimate and the bid. This is sometimes attributed to prevailing economic conditions, though this is not the only contributing factor. A major challenge for municipalities can therefore be predicting the market condition. This challenge is in keeping with the issues that the City of St. Albert is also facing.

5 Summary of Findings

Based on the observations gathered through the review of the specified charters and of the current process, and drawing upon the findings of the best and recommended practice review and survey of municipalities, the project team has identified fifteen recommendations for improving the Capital Budgeting process at the City of St. Albert.

Notably, some of these recommendations build upon innovations and practices that are already being implemented at the City. This continuity was highlighted during the final workshop with the City, and we have attempted to represent it wherever possible in the findings below.

As indicated above, a detailed review of best and recommended practices for estimating was undertaken to inform the development of these recommendations. For the sake of space, the findings of this detailed review have been included separately in Appendix A.

The following recommendations have been organized in terms of three interrelated processes at the City of St. Albert: charter development, estimating, and budgeting. An accompanying Executive Report provides more specific guidelines on the prioritization of the above recommendations based on benefit and timing of implementation.

5.1 OBSERVATIONS AND RECOMMENDATIONS RELATING TO CHARTER DEVELOPMENT PROCESS

5.1.1 Focus Effort on Three-Year Planning Cycle

A challenge that all municipalities face is the difficulty of developing a project and estimate that is not expected to be initiated for several years. For the City of St. Albert, once a Project Charter has been approved, it is included as part of the 10-Year Capital Plan; however, issues can arise if a project has been included in the 10-Year Capital Plan for multiple years with the only revision to its scope or estimate being the application of an escalation rate. Personnel interviewed noted that typically projects will need to be fully revised, leading to uncertainty regarding the differences between the original estimate and the revised estimate.

A useful recent development within the City of St. Albert's planning approach pertains to its use of three-year planning cycles. These planning cycles comprise a "Concept Phase," "Design Phase," and "Construction Phase." City staff have also recommended and, in some cases, implemented, the addition of a fourth year to the beginning of this planning cycle. By adding a year at the beginning of a project primarily for strategic purposes, the aim is to provide more time for scope definition.

It is worth noting that the majority of the municipalities surveyed have a strategy stage as part of their standard project life cycle. Select municipalities are in the process of implementing a new methodology for the Council approval process. This methodology involves projects in the strategy stage going to Council for a design budget approval. Once a pre-determined percentage of the design is completed, the department will then return to Council with a construction budget. This approach is meant to help increase the degree of construction budget

accuracy, as well as providing Council with the ability to postpone projects or identify infeasible projects before construction commences.

This new approach resonates well with our recommendation, which is to focus development effort on projects planned to commence within the next three years. A likely effect of devoting extensive time to projects that are not due for initiation for many years is to create the necessity of rework. The more that the realization of the proposed scope is distant, the more uncertainties and variables will impact the estimate and, by extension, the degree of confidence it is possible to have. By separating the initial *strategic* scope definition effort from the detailed concept, design, and construction effort, the City can distribute its effort more effectively. Our recommendation that development effort on projects be focused specifically on those planned to commence within the next three years reinforces this strategy and provides additional benefit in terms of transparency.

Recommendation #1:
Focus development effort on projects planned to commence within the next three years.

As shown in Figure 3, there is a limited window within which estimates may be treated with confidence. Our proposed recommendation is that projects occurring within the next three years over the course of the rolling 10-Year Capital Plan would receive the predominant effort in terms of estimating and scoping. This effort may take the form of other recommendations included below (e.g., scoping exercises, planning exercises, etc.). By extension, it may be possible to explicitly constrain the amount of effort expended during the strategic phase of the project development (i.e., when a project is being developed for initial inclusion within the 10-Year Capital Plan).

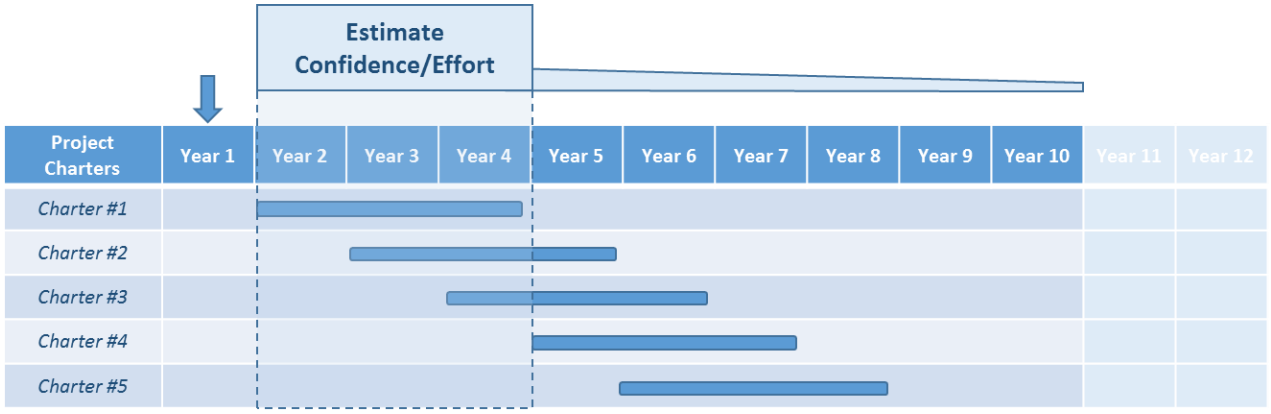


Figure 3. Estimate Confidence Window

By implementing this recommendation, it may also be possible to emphasize and clarify the necessary relationship between estimate confidence and the proximity of the project to its commencement. This emphasis would provide greater transparency to Council in terms of justifying the inevitable differences between the strategic phase scope and estimate and the concept phase scope and estimate.

5.1.2 Measure Project Maturity

A number of the challenges encountered in estimating can be traced back to the need for increased scope definition. This represents a serious challenge for any project team; sufficient information is needed to produce cost and schedule estimates with the desired degree of accuracy. This can be very much a "chicken and egg" problem. In the case of St. Albert's capital projects, the charter itself is typically required to obtain the budget to hire the designer. Without a design, however, scope cannot always be adequately defined, which in turn can lead to significant cost or schedule changes. A lack of scope definition has been identified by the Construction Industry Institute (CII) as one of the leading causes of project cost and schedule overruns and as something that can also result in long-term operational issues.[1]

The City of St. Albert's use of the recently developed "Cost Analysis Checklist" is a good start in addressing this issue by helping project charter developers to be aware of items that may need to be investigated or considered when developing the project. This effort could be further enhanced by ensuring that the checklist explicitly references the specific maturity level of the project.

Recommendation #2:
Adopt a structured scorecard approach for projects to enhance and measure project scope definition and assist in aligning the project team.

Our recommendation involves the implementation of a scorecard approach that is structured in a manner similar to the Project Definition Rating Index (PDRI).[2] This approach is distinct from the Cost Analysis Checklist insofar as it focuses upon scope definition primarily. It is a methodology developed by the Construction Industry Institute to measure the degree of scope definition, identify gaps, and take appropriate actions to reduce risk during front-end planning, providing a "balanced scorecard" approach to evaluating project maturity. With PDRI, the first step is to develop a detailed description of the project and product deliverables in a structured way that captures all project deliverables. Next, project deliverables and project work are subdivided into smaller, more manageable components, to be benchmarked against historical project performance data. As a project progresses, any gaps identified will continue to be addressed until a sufficient level of definition is achieved for the project to successfully proceed to detailed design and construction.

CII research has shown that the use of the PDRI in industrial construction can provide cost savings and schedule reductions. The reliability of project delivery has also been enhanced, as demonstrated through fewer project changes and increased predictability of operational performance. A successful PDRI customization and implementation has been performed by the City of Edmonton for its Drainage projects.

[1] Business Roundtable Construction Industry Cost Effectiveness (CICE) Project Report A-6. See also the Construction Industry Institute's "RS6-2 – Scope Definition and Control" (https://www.construction-institute.org/scriptcontent/more/6_2_more.cfm).

[2] Construction Industry Institute (CII). (2013). Project Definition Rating Index - Building Projects. CII.

The benefit of this approach is that it guides the development of a project and provides a central point for discussions about whether a project is ready to move forward. A sample of the PDRI scorecard has been included in Appendix D.

Based on discussions with City management, the area of project maturity assessment was noted as a gap that would be helpful to address. Personnel indicated that implementing a scorecard or similar approach would help with consistency and would build upon new reporting efforts already underway. They also indicated that the scorecard tool could be primarily used as an internal administrative document for the purposes of facilitating knowledge transfer and in developing official reports for Council.

5.1.3 Implement Scope Definition Exercises

As noted above, an inconsistent level of scope definition can correspond to an inconsistent degree of confidence in project estimates. In some cases, the limited scope definition available from earlier iterations of a project has made developing a reliable estimate challenging for City staff. Based on our interviews with staff, this limited scope definition could arise due to several different reasons. In some cases, projects may have been initiated based on a brief description in a planning document; at other times, the project and possibly a budget may have been initiated prior to current personnel coming on board. These scenarios can lead to uncertainty surrounding the nature of the scope envisioned for a project, particularly when concrete costs were already associated with the project.

During our meetings with personnel, it was noted that greater communication between departments would be helpful at an early stage as, first, it would give units that may need to be aware of a particular project later in its development the opportunity to provide input as soon as possible, and second, it would result in a more comprehensive scope definition by encouraging multiple sources with differing expertise to provide input.

Recommendation #3:
Implement a more formal scoping exercise at the initiation of the project, which includes a broader range of City personnel and results in a documented scope statement.

While some informal scoping exercises have been noted for certain projects, there is no formal exercise currently scheduled as part of the charter development process. The chief advantage of implementing such a formal exercise lies in the production of a documented scope statement, which can form the basis of several other documents. These include the Basis of Estimate (BOE) document, which is described in greater detail below, and the Project Charter itself. The document resulting from the formal scope exercise should also indicate which parties were involved in the development of the scope. These parties can then be accessed subsequently as the project moves through the remainder of its lifecycle.

By extension, implementing a formal scoping exercise as part of the development of all project charters will benefit the City of St. Albert by encouraging communication between disciplines within the City organization and by promoting transparency for the benefit of Council and overall knowledge transfer purposes.

5.1.4 Implement Planning Exercises

While preliminary planning work is often undertaken by the City of St. Albert in the form of a Master Plan or other similar document identifying the need for specific projects, this planning effort is at a much higher level than is necessary for the Project Charter itself. Notably, during our final workshop with City management, participants indicated that a certain number of the City's larger projects have recently implemented more formal planning exercises during the first year of the three-year planning cycle. The City could benefit by extending and formalizing this approach on additional projects.

Recommendation #4:
Allocate funding to implement planning exercises such value engineering, design reviews, constructability reviews, and stakeholder consultation on projects as applicable.

Based on recommendations from the Project Management Institute (PMI)[3] as well as our review of currently adopted practices by industry professionals and other municipalities, there are several key exercises that we believe would help improve planning and enhance the reliability of the cost and schedule estimates. For example, value engineering, when applied at the planning phase, can help to optimize design. Design review, when undertaken formally, can identify gaps in the design, avoiding costly rework later in the project. A high-level constructability review can also be conducted to ensure the applicability of developed design and safety during construction. Stakeholder consultation (both internal and external) is beneficial on a number of levels as it can help to define scope, create consensus on design, and avoid political risks later in a project by involving stakeholders early in the process. The AACE International[4] highly recommends the risk assessment and value engineering processes as part of its "Total Cost Management Framework" as their outputs provides a disciplined environment for proactive decision-making and scope alternatives with improved value, which must be decided upon by the strategic or project leadership. More information on helpful planning exercises is included in Appendix E.

These recommended techniques, which are current practices used by industry professionals and in municipalities such as the City of Edmonton, can help reduce risk and in turn clarify the uncertainties a project may face. Nevertheless, management should be strategic in determining the types of planning exercises that can best support a project at a given point in its development. For instance, constructability reviews will not be optimally effective until the design phase. By contrast, value engineering and stakeholder consultation may be useful earlier in the process as a means of understanding the functions and constraints of the project.

5.1.5 Implement Risk Analysis and Quantification

Risk analysis is a means of quantifying the uncertainty in the project, which directly reflects on the estimate accuracy. When risks are not quantified and included in estimates, there is the potential for significant impacts to the estimate. By extension, the use of a predetermined percentage for contingency can result in an estimate that does not take account of either scope

[3] Project Management Institute. (2013). *A Guide to the Project Management Body of Knowledge*. Pennsylvania, USA: PMI.

[4] AACE International. (2012). *Total Cost Management Framework: An Integrated Approach to Portfolio, Program, and Project Management*.

definition refinement or project maturity. Another disadvantage of using predetermined percentages, which was highlighted by AACE International[5], is that such a contingency approach cannot effectively address risks that are unique to a specific project, or risks that are common, but may have outsized impacts on a given project. Instead, each project contingency is treated the same.

Currently, risk analysis and quantification implemented by the City of St. Albert is limited in its scope. For contingency amounts, a static, predetermined percentage is typically used, and there is no requirement for a quantified and regularly updated project risk register to be included with the estimate. In a similar manner to St. Albert, all of the municipalities of comparable size that were interviewed indicated that they also use percentage contingencies without integrating a risk assessment exercise.

In general, risk management on projects is undertaken by relying upon expert judgement to determine the level of risk for a project and applying an appropriate contingency. The challenge of understanding the relationship of uncertainty to the project budget and schedule is an issue that common to all municipalities surveyed, including larger municipalities which also struggle with the management of unforeseen risks.

Recommendation #5:
Implement formal quantitative risk assessment of the project cost and schedule.

This recommendation, which is advocated by PMI[3] and AACE International[5], is used by other municipalities (including the City of Edmonton and the City of Calgary) and throughout the industry. It aims to capture the effect of uncertainties on project cost and schedule using a structured and documented approach. If implemented in a uniform and formal manner, it can reduce the risk of significant project estimate failures (i.e., when estimates are much too low or much too high). A structured risk analysis process is highly recommended to create a clear picture of how risks emerge and subsequently how they might impact the project; this in turn will encourage the efficient and effective mitigation of risks throughout the planning, design, construction, and operations phases of the project.

During the workshop with City management, several SLT (Senior Leadership Team) members indicated that this practice represented an important opportunity for improving the existing process that should be reviewed. The extent of risk assessment can be scaled based on the type of project. Ideally, the risk allowance determined through the risk analysis process would inform the determination of the design contingency allowance.

5.1.6 Use Consultants When Necessary

Many of the estimates reviewed in the charters appear to have been compiled by design consultants, while others appear to have been developed using internally by the City. Both approaches are acceptable and reasonable, but, as with any approach, have advantages and disadvantages. Design consultants are typically closely involved with the users and generally have a strong understanding of the concept scope, which helps them to ensure that all aspects

[5] AACE International. (2008). *Recommended Practice No. 40R-08, Contingency Estimating - General Principles*. Morgantown, WV: AACE International.

of the project have been accounted for in the estimate. At the same time, it can be challenging to confirm whether the estimates were prepared by the design team's in-house costing specialist or whether the design consultants were simply relying on their own historical data, which itself may or may not accurately reflect the current scope. In the case of the charters reviewed, no information was apparent on the design consultants' estimating methodology. The preparation of estimates by in-house City staff share many similar benefits and also challenges. City staff can naturally have a much clearer understanding of the needs of the stakeholders involved and a better sense of the internal dynamics of projects undertaken by the City; however, it can also be challenging to retain staff with specific cost expertise in leveraging historical cost data and other relevant cost data for usage on a project.

Retaining personnel with specialized costing and engineering expertise becomes increasingly significant as projects grow in size and complexity. Likewise, as the level of estimate detail increases, the cost and value to the owner of the cost estimating effort increases. The cost of preparing an AACE Class 2 or Class 1 estimate could approach 0.1 percent to 0.5 percent of project cost, representing a significant effort. The value of such detail, however, is likely recovered many times in the related value of engineering and design decisions made as a result of this detail. Increased detail results from increased effort, which does mean an increased cost for estimating; however, the overall project cost reductions that result from more expensive estimating practices can often justify the expense. The expected outcome of using external consultants more regularly for a municipality similar in size to St. Albert is an increased outlay in expense initially, which will ideally be recouped subsequently by cost savings realized later in the project.

Recommendation #6:
Utilize, as appropriate, the expertise of consultants for large and complex projects.

For projects above a certain threshold, the City should consult with independent expert consultants within their respective area of expertise when preparing and reviewing baseline estimates. This threshold will need to be established specifically by the City to reflect particular levels of project complexity, budget, or other factors. A potentially useful approach may be to apply Pareto analysis to identify the projects with the greatest impact on the City. Pareto analysis in this case would involve listing projects in descending order of scope size or budget size and then focusing attention upon the top 20%.

In the case of highly complex projects undertaken in St. Albert, consultants should also be involved to provide estimates for portions of the project relevant to their areas of expertise. Of the municipalities surveyed, decision-making regarding the use of cost consultants in particular was either based on specific criteria (e.g., the cost of the project, the nature of the project [e.g., if it is new or unique]) or to provide additional support to an existing estimate by providing a second opinion.

5.1.7 Implement a Robust Records Management System

The review of the Project Charters was facilitated whenever detailed background documentation was available. For certain charters, however, this level of documentation was difficult to obtain. In certain cases, only hard copies of documents existed. The difficulty in being able to access

historical documents such as master plans, functional plans, and other similar planning documents relates to the long development process of many of the projects reviewed. In some cases, projects currently being developed as charters were originally put forward as part of a larger planning study that may have taken place as many as ten to fifteen years' previously.

During the second workshop, participants noted that implementing a robust records management system would enable other recommendations (such as the Basis of Estimate document) to succeed and be effective.

Recommendation #7:
Implement a more robust records management system.

While no specific records management system is recommended here, this recommendation is included to emphasize the need for further study in this regard on the part of the City of St. Albert. The City can begin to determine what its specific needs are both in terms of records retention and records recovery. Among some municipalities interviewed, SharePoint was used (in certain cases) for workflow and document management purposes. While no particular software is recommended in this report, it is highly recommended to consider the International Organization Standardization (ISO)[6] concepts and principles from which approaches to the creation, capture and management of records can then be developed.

5.2 OBSERVATIONS AND RECOMMENDATIONS RELATING TO ESTIMATING PRACTICES

5.2.1 Implement Additional Training to Standardize Processes

As has been noted above, the City's ongoing efforts to improve processes are making headway towards stronger consistency across projects. By implementing the recommendations included in this report, we anticipate that the City will be able to augment these efforts.

A key recommendation that must accompany this expectation is that additional training be implemented.

Recommendation #8:
Implement additional training to standardize and enhance cost estimate knowledge.

The City of St. Albert is currently initiating a training program as part of its upcoming launch; however, it was noted during the final workshop that a formal training exercise would also be helpful. While other municipalities were found to have a checklist as part of their estimating process, no structured learning program appears to be in place elsewhere. St. Albert's implementation of a training component is an effective innovation. This recommendation aims to validate and promote the continuation of this approach.

[6] ISO 15489-1:2016, *Information and documentation – Record management – Part 1: Concepts and Principles* (available at: [http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=62542])

A further suggestion related to the need for training, which emerged during the final workshop, was to develop an estimating training manual. A training manual would help to reinforce knowledge transfer and further support the development of a consistent estimating process.

Another related suggestion, based on input from other municipalities, is to implement a formal "lesson learned" capturing system. Larger municipalities such as the City of Edmonton have stressed the benefit of such a tool. By capturing Lessons Learned at the end of a project, it is possible to implement specific recommendations on subsequent similar projects in the future. Best practices indicate that Lessons Learned sessions should be conducted during the project life cycle. Past lessons relevant to current projects should be reviewed by the project team.

5.2.2 Use Accurate Cost Estimate Information

The estimator applying historical data to a current project needs to clearly understand the scope of the historical data as well as where and how adjustments need to be made to apply it to a current design or concept. Most of the estimates reviewed were concept estimates with an expected degree of accuracy of ±50%. In many cases, the historical costs for construction used have subsequently been escalated at a rate of 8-10% per annum (this is the rate that was used in RECR-010, RECR-041, RECR-050, RECR-051). Additional documentation could help to ensure that the elements contained in these historical unit costs are applicable in today's market and directly comparable to the specific scope of the project.

The City has the opportunity to leverage the existing costing information it receives, primarily through projects actually tendered. This recommendation was echoed during our meetings with City management. Staff have indicated that many design-bid-build projects tendered by the City are unit-rate based and, as such, are immediately useful as historical data. In cases where the proposal offers a lump sum for the complete project, with no specific breakdown for items or work components, key cost information can still be obtained after the contractor is awarded the project and the WBS (Work Breakdown Structure) is developed as part of their monthly progress payments.

Recommendation #9:
Use standardized tools for documenting and applying historical cost information to enhance the quality of the estimates early in the project.

The City could benefit by developing and continuously updating standardized historical databases to track historical project and unit costs. This costs database could then provide the basis for checking the validity of estimates obtained from private consultants or be used in preparation of project charters. Tools such as RS Means[7] and other various construction data publications can also provide much needed historical data for estimators; however, similar to historical tender data, the unit costs need to be clearly delineated and adjustments will quite often be needed to allow the units to be applied to the current design. For projects above a certain threshold, expert consultants with specialized expertise in estimating can provide additional input and support in making these adjustments with accuracy.

[7] RSMeans (https://www.rsmeans.com/)

In general, all of the municipalities interviewed agreed upon the need for a historical data recording system. Most of the municipalities comparable in size to St. Albert used Excel to store data; by extension, they also faced challenges in retrieving the stored data.

One of the larger municipalities interviewed is implementing a common Work Breakdown Structure (WBS) approach across projects. This will enable them to record and store past project data in a consistent manner and subsequently compare projects to each other with greater accuracy and consistency. This technique, if implemented, could help with both the challenge of making use of historical data and, more generally, with the tracking of project maturity development.

During the workshop with City management, it was indicated that the City is exploring the possibility of developing a tool that would allow projects to be estimated in today's dollars and then show what the revised estimate would be for a given forecast year. This resonates well with our recommendation.

5.2.3 Make Expected Degree of Accuracy Transparent

The City Council Policy on Capital Project Management (C-P&E-02), revised in April 2016, identifies three degrees of accuracy, corresponding to three phases of capital cost estimation for projects (pg. 6). These degrees of accuracy are +/- 50% at Concept Phase, +/- 25% at Design Phase, and +/- 10% at Construction Phase. These degrees of accuracy are helpful for tracking the development of a project and are intended to reflect the inherent correspondence of estimate accuracy to project maturity.

These degrees of accuracy should be expressly highlighted in the Project Charters themselves in order to communicate the benefits of having degrees of accuracy to Council. Furthermore, while the three degrees identified in the City Council Policy are useful for planning purposes, they risk becoming primarily linked to the year in which a project is developed rather than the actual maturity of that project. For this reason, we recommend that a more detailed estimate classification system linked to project maturity be implemented by the City. We also recommend that the degree of accuracy to be expected at each milestone be clearly indicated in the charter documents.

Recommendation #10:
Adopt a City-wide estimate classification system and explicitly include degree of accuracy in charter documents.

Typically, each cost estimate for a specific project or feature is based on increasing levels of project refinement and more detailed levels of design data. Cost estimates, which are developed based on the best information available at the time, are expected to reflect reasonable and defensible expectations of costs for a specific level of estimate. As more refined cost estimates are developed, the confidence in and accuracy of the estimate is expected to be higher.

In both the public and private sectors, many levels or types of classifications of cost estimates exist, typically reflecting an agency's naming convention for each successive level of design. No matter the organization, the levels of cost estimating begin at the initial concept and master planning stages and continue through design at various milestones to ensure the design

evolution remains on budget. With each increasing level of design and cost estimate, the likelihood that the cost estimate will reflect the actual project costs increases. This leads to increased confidence in both the design and the estimated project cost.

The following matrix presents the level of project definition, typical end use, methodology, and expected degrees of accuracy for each specific estimate class in the AACE classifications of cost estimate[8] (see Table 3). We have drawn upon this matrix primarily in developing the overall recommended process proposed below. The City would benefit from the implementation of a similar classification system in addition to their existing degree of accuracy policy, ultimately providing a clearer understanding as to the definition of a project.

Table 3. AACE Accuracy Matrix for Estimating Classes

	Primary Characteristic			
ESTIMATE CLASS	**LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition	**END USE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges
Class 5	0% to 2%	Concept Screening	Capacity Factored, Parametric Models, Judgment or Analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget Authorization, or Control	Semi-Detailed Unit Costs with Assembly Level Line Items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 70%	Control or Bid/ Tender	Detailed Unit Cost with Forced Detailed Take-Off	L: -5% to -15% H: +5% to +20%
Class 1	50% to 100%	Check Estimate or Bid/Tender	Detailed Unit Cost with Detailed Take-Off	L: -3% to -10% H: +3% to +15%

5.2.4 Implement Design Contingency Allowance

Typically, the results of a formal risk analysis should form the basis for determining contingency. It should be noted that the use of cost risk analysis will not reduce the uncertainties associated with the project cost estimate or solve problems of cost variance due to insufficient

[8] AACE International. (2011). *Recommended Practice No. 17R-97: Cost Estimate Classification System.* Morgantown, WV: AACE International.

investigations or design data, but can provide the project team with a clear understanding of the current risks and how their impact on the project's budget may be mitigated.

The City of St. Albert's current practice already contains key components for implementing this recommendation. Charters already include unquantified risks in their descriptions. While the City's estimate approach currently uses a static, predetermined percentage for contingency, quantifying the risks and linking these with the contingency would permit the project team to adjust the amount of contingency allowance to reflect changing levels of uncertainty over the course of the project.

Recommendation #11:
Align design contingency allowance with identified and quantified risks.

Based on the best practices recommended by AACE International[5] and PMI[3], we recommend implementing a Design Contingency Allowance that will allow the amount of contingency allotted for the project to change to reflect the estimate accuracy as the project progresses. A Design Contingency Allowance can be thought of as covering identified risks. It represents an amount added to the Base Cost by the estimator to cover risk events that may potentially occur on the project, excluding changes in project scope. These risk events are identified early in the project and quantified in terms of their likelihood of occurrence and magnitude of impact if they do occur. This type of contingency, when properly managed, is vital in keeping estimate deviations to a minimum. The Design Contingency Allowance should include:

- Design evolution within scope of the original estimate.
- Unforeseen variations in market and environmental conditions.
- Risks identified in the Risk Management Plan (once a Project Management Plan [PMP] has been prepared).

Once a project is in the design phase, these risks and their contingency response plans should be identified in the Risk Management Plan.

5.2.5 Ensure Consistent and Comprehensive Estimate Documentation

Once the scope is well established, the estimates can be performed with a higher degree of confidence; however, to be useful they must be well-documented and traceable, or there is a risk of losing critical aspects of a project cost estimate that can contribute to the transparency of the basis of the estimate and estimating knowledge. The assumptions that accompany an estimate (e.g., design status, maturity, etc.) should be transparent and uniform across projects or else existing knowledge within departments may be difficult to access and use. Standardizing the estimate documentation process can therefore yield significant benefits.

During the workshop with City management, participants noted that the estimate documentation process at the City would benefit from an increased degree of comprehensiveness and consistency. This need is one shared by most other municipalities interviewed, as seen in the municipal comparison. The checklist that the City of St. Albert has implemented is an important step in delineating specific cost items required for an estimate. Our recommendation builds upon this by providing a template for documenting key estimate details and aligning this documentation process with cost estimating best practices.

Recommendation #12:
Implement a mandatory Basis of Estimate (BOE) document for all projects.

The Basis of Estimate (BOE) document is a succinct method of documenting the critical aspects of a project cost estimate for the purpose of mitigating project cost risk. It is also a well-known practice used in industry and is strongly recommended by the AACE International[9] estimating body. A BOE document clearly and concisely states the purpose of the estimate being prepared (i.e., cost study, project options, funding, etc.), the project scope, pricing basis, allowances, assumptions, exclusions, cost risks and opportunities, and any deviations from standard practices. It is also a documented record of pertinent conversations that have occurred and agreements that have been made between the estimator and other members of the project team. Appendix F provides a sample/template of a basis of estimate. Different departments may need to customize the checklists involved in the BOE development in accordance with their asset types to ensure consistency and completeness in carrying out the estimate task (e.g., different terminology). Nevertheless, to maintain consistency, these customizations should be as limited as possible.

The benefits of the recommended estimate classification system would also be enhanced in terms of transparency and clarity by the use of a BOE document. In a typical project, estimates are prepared at various design milestones. In the early stages of the project, a conceptual estimate will most likely be assembled, followed later by more detailed estimates as the project progresses through its lifecycle. A different level of detail will therefore be required for each of the accompanying BOE documents. This could be supported in the BOE through the adoption of a City-wide estimate classification system where the estimator is obligated to provide as much detail as necessary to support, justify, and confirm the information presented in the cost estimate.

This recommendation could also be implemented alongside the related recommendation described above regarding the implementation of a robust records management system. For the benefits of tracking the basis of estimate through a project's development to be fully realized, a system will be needed for quickly and efficiently locating versions of that document.

5.2.6 Review Estimates at Each Milestone

Similar to other comparable municipalities, the City of St. Albert does not have personnel on staff with formal estimating qualifications or specific estimating credentials (e.g., PQS or other quantity surveyor credentials). Estimates are internally reviewed by management prior to submission. Consultant estimates may be reviewed early in the process by engaging the consultant or another party.

While charter estimates are reviewed annually as part of the charter development and "refresher" process, reviews do not typically include a validation of the estimate. This estimate validation should occur regularly as the project matures.

[9] AACE International. (2014). *Recommended Practice No. 34R-05: Basis of Estimate*. Morgantown, WV: AACE International.

Recommendation #13:
Implement detailed review process for project estimates at each project milestone.

AACE International[10] highly recommends formal peer or external review for design estimates as this can help to bring consistency across all organization estimates. The level of review required is contingent upon the size or complexity of the project. Thus the review process could be achieved by requiring a detailed review by individuals who are familiar with the estimate development process and who have had no involvement in the development of the project estimate to date as either a peer review or an independent review with an estimating expert. Documenting the review process and clearly tracking the development of the estimate as the project matures provides greater transparency to Council and helps to support overall project understanding. As part of the review effort, the BOE document should also be revised.

5.2.7 Revise Operating Estimate Guidelines

As noted above, the "Capital Budget Operating Impacts Calculations Guidelines" document is a highly useful tool that should be maintained. The document could be further enhanced by providing additional guidance on what elements of the construction costs should be included when applying the recommended 2% factor to develop a macro estimate. Certain elements of the construction cost, such as a demolition or relocation costs, would not directly impact a future operating budget and so can be excluded.

Recommendation #14:
Revise operating estimate guidelines to provide clearer methodology and implement additional training to standardize and enhance cost estimate knowledge.

We recommend that the City of St. Albert build upon its existing guidelines for operating impact estimation in order to promote greater rigour in the application of the guidelines. For example, although the concept of a macro allowance is a rational approach for many projects, the guideline could provide more direction on what factors may or may not be captured in the 2% factor, as noted above. Likewise, it would be beneficial for the guideline to provide a more concise level of detail for various types of cost structures that are updated on an annual basis. For example, a neighborhood park may require a different level of cost per area as opposed to an open space park, and this should be more explicitly communicated in the guidelines.

Alongside this recommendation to revise the estimate guidelines, training opportunities should be provided for staff in order to standardize and enhance the practices. Details similar to those included above in Recommendation #8 are also applicable here.

[10] AACE International. (2009). *Recommended Practice No. 31R-03, Reviewing, Validating and Documenting the Estimate*. Morgantown, WV: AACE International.

5.3 OBSERVATIONS AND RECOMMENDATIONS RELATING TO THE BUDGETING PROCESS

5.3.1 Implement Management Reserve

The accuracy of estimates at different levels yields potential deviations from the budget simply by the nature of estimates. There is an expected degree of scope creep that occurs in most projects and situations in which unrealized risks occur are inevitable. The City of St. Albert currently has in place a Financial Reserve Policy (C-FS-01), with a reserve policy designated for the Capital Fund (Schedule C6). Based on best practices recommended by the AACE and implemented in the private sector, we recommend that a specific management reserve be explored further to determine whether the existing policy provides similar benefits.

Recommendation #15:
Establish a dynamic management reserve approach to reflect realization of unidentified risks or required scope changes at the Senior Leadership Team level.

The management reserve is an amount added to the Base Cost of a project to cover unidentified risk events that occur on the project, including minor changes in project scope. To benefit and control the management reserve properly, best practice dictates that it should not be controlled by the project manager; it should instead be managed by management personnel from outside the project team. Whenever any unidentified risk occurs, the project manager would be required to get approval from management to use the management reserve. For St. Albert, the Senior Leadership Team (SLT) may be an appropriate group for managing this contingency reserve. AACE International[9] recommends documenting the use of the management reserve and the approval process as part of the BOE document. A management reserve will typically account for:

- Planning and estimating errors,
- Minor scope changes, and
- Other program- or organization-level risks that were not explicitly identified in the contingency reserve.

Among the key advantages of implementing a management reserve is the constrained flexibility it provides for facilitating specific, well-documented decision-making. Versions of the management reserve contingency approach are in place or being explored at some of the municipalities surveyed. Another advantage (illustrated in Figure 4) is that this allows for the contingency of a project to be delineated more clearly, which can provide greater transparency to Council.

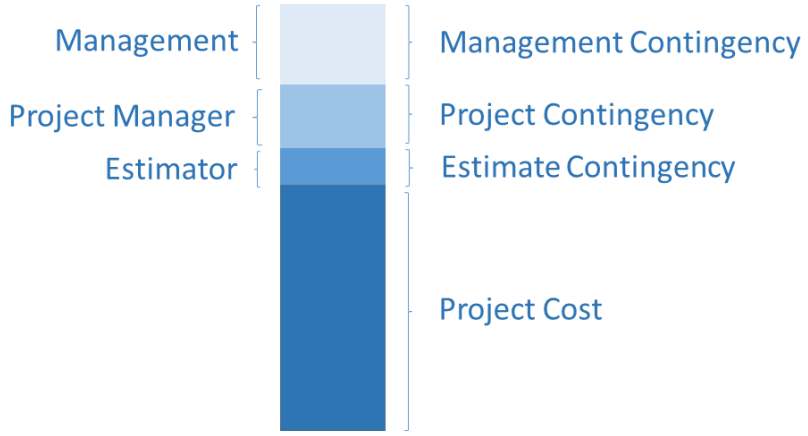


Figure 4. Types of Project Contingencies

In some surveyed municipalities comparable to the City of St. Albert, the City Manager has the ability to transfer funds from one project to another up to a certain limit (e.g., the limit in one municipality is $50,000). While not identical with the dynamic management reserve approach, this option similarly aims to provide greater flexibility to account for the inevitable uncertainties that accompany cost estimating.

During our workshop with City management, it was noted that an alternative to this recommendation, which is already being done by the City in certain cases, is to package projects into composite projects. This may allow for some sharing of contingency across sub-projects, which would give greater flexibility to the Project Manager or Leadership Team in cases where unidentified risks or scope changes occur.

5.4 PROPOSED INTEGRATED PROCESS

Based on the findings of our review of the current process and the recommendations developed above, we have assembled a proposed integrated process in order to demonstrate how these recommendations might be implemented over the course of a project.

Figure 5 shows the recommended cost estimate attributes and uses by project phase, including the expected approach and level of detail, the level of uncertainty at various times in the project delivery cycle, and the decision-making processes where cost estimates are used, including stage gates; rates and budgeting; and risk assessment and value engineering, which may also include planning exercises more generally.

As mentioned above, the Basis of Estimate (BOE) document summarizes the information, assumptions, and methodology used to develop a project cost estimate. Each time an estimate is updated, changes should be explained in the BOE. At the end of the concept phase, a BOE should be completed, noting any differences between the alternatives that are being considered. If the options are substantially different, then a separate Basis of Estimate for each alternative should be completed. Before Stage Gate 2 some BOE information may not be available, but after Stage Gate 2 all the BOE sections should be completed.

The construction bid amount should also be estimated using specific recommended methods according to each project phase. According to the degree of project maturity, there will be different estimating practices that are possible and that will provide different levels of estimate confidence.

Soft costs should also be estimated prior to Stage Gate 2 approval using actual soft cost percentages by project phase from recently completed projects. After Stage Gate 2 approval, project teams will estimate soft costs through the development of a work breakdown structure and Project Management Plan (PMP).

Before Stage Gate 2 approval, a contingency allowance should be established by adding an appropriate percentage of the Base Cost. Unusually complex or simple projects may use higher or lower contingencies, respectively. After projects pass Stage Gate 2, however, a risk register and risk management plan should be developed, which will form the basis of the contingency allowance. If the risks identified could require a response, these will calculate the contingency amount in reserve. The Management Reserve should be established by adding a percentage of the Base Cost.

The integrated process represents an ideal approach to implementing the above recommendations (and other Best Practices uncovered during our review); however, the challenges involved in implementing substantial process review may require a prioritized approach on the part of the City of St. Albert.

Recommended Capital Projects Estimate Process

PROJECT PHASE	Concept		Design				Construction
Project Maturity	1%	2%→15%*	30%	60%	90%	Final/Bid	Construction
STAGE GATE	1. Project Brief Approval	2. Funding Approval				3. Construction Cost & Contract Approval	4. Project Close Out Approval
USAGE OF ESTIMATE	Comprehensive Planning, Project Identification, Financial Planning	Feasibility Analysis	Design Development	Project Management & Control	Project Management & Control Or Bid Tender	Ensure Funding	Project Management & Control
ESTIMATE ACCURACY - AACE INTERNATIONAL	**-30% → +50%**	**-20% → +30%**	**-15% → +20%**	**-10% → +15%**	**-5% → +10%**	**-5% → +10%**	**Actual**
SCOPE DEFINITION	General	Assumed	Preliminary	Defined	Defined	Defined	Monitored
PLAN & SCHEDULE	None	General	Preliminary	Preliminary/Defined*	Defined	Defined	Monitored
RISK ANALYSIS / VALUE ENGINEERING		Preliminary Risk Assessment & Value Engineering	Risk Analysis, Value Engineering, Design Options & Constructability			Risk Register & RMP	
AACE INTERNATIONAL ESTIMATE CLASS	Class 5	Class 4	Class 3	Class 2		Class 1	
INPUTS	*Master Plan, Previous funding amount, historical Project Information*	*Master Plan, Project brief, Project Location, RMR Capital Plan, Growth Capital Plan*	*Project Charter, Preliminary Schedule, Concept (preliminary Design), BOE*	*Project Charter, Project Schedule, Design Drawings, BOE*	*Project Charter, Project Schedule, Design Drawings, BOE*	*Project Charter, Tender Documents, Design Drawings, Project Schedule BOE*	*Project Charter, Project Schedule, Design Drawings, Project Contract*
TASKS	Project outline Preliminary cost estimate Strategic Design*	Project Staging Concept (Schematic) Design Development Determine Estimating Approach Estimate Development Conduct Sensitivity/ Risk Analysis Basis of Estimate Draft Preliminary Schedule Development Conduct peer Review Charter Development Store Estimate data in database Finance & Engineering Review SLT & Council Review	Risk Analysis & Value Engineering Design Detailing Estimate Update Scope Adjustment Schedule Detailing BOE Update Charter Update	Estimate Update Scope Adjustment Schedule Detailing BOE Update Charter Update	Estimate Update Scope Adjustment Schedule Detailing BOE Update Charter Update	Estimate Review/Approval Schedule Review/Approval BOE Update Charter Update Tendering	Schedule Update BOE Update Charter Update
OUTPUTS	*SLT Approval*	*Council Approval*				*Council Approval*	*Project Closure*
BASIS OF ESTIMATE (BOE) DOCUMENT	On Problem Statement/Project Objectives, Project Schedule. Construction Costs Based on Historical Unit Costs, Costs of Similar Completed Projects, and/or Expert Judgement. Soft Costs Based on Recent Soft Costs.		Project Scope, Schedule; CCBS for construction cost and WBS for soft cost; industry data and historical costs.	Project Scope, Schedule. Preferred Design Solution. Construction Costs based on CCBS and Soft Costs based on WBS			Actual and Anticipated Cost
CONSTRUCTION COST	Historical Unit Costs, Costs of Similar Completed Projects, and/or Expert Judgement		Line Item Costs for Major Items and Equipment	Line Item Costs for Major Items and Equipment; Semi-detailed Line Item Unit Costs for Remainder	Line Item Costs for Major Items and Equipment; Increased Detailing of Remainder	Detailed Take Off, Unit Costs, Apparent Low or best Value Bidder	Including Change Orders
ALLOWANCE FOR INDETERMINATES	Included in Base Cost		15% to 25% of Bid Cost	5% to 15% of Bid Cost	0% to 5% of Bid Cost	0% of Bid Cost	N/A
SOFT COST	Based on similar or completed project Soft Costs	By Phase or Based on similar or completed project Soft Costs	Based on PMP				
CONTINGENCY	25% to 40% of Base Cost	15% to 25% of Base cost	Based on PMP Risk Register / Historical Averages				
MANAGEMENT RESERVE	10% to 25% of Base Cost	10% to 20% of Base Cost	5% → 15% of Base Cost	5% → 10% of Base Cost	0% → 5% of Base Cost	0% → 5% of Base Cost	0% → 5% of Base Cost

LEGEND **BOE** Basis of Estimate **RMP** Risk Management Plan **PMP** Project Management Plan **WBS** Work Breakdown Structure **CCBS** Construction Cost Breakdown Structure → Increase as project progress
* Based on Project Type, Size & Complexity **General** High Level Scope Identified **Assumed** Basic understanding of Scope **Preliminary** Major Items defined **Defined** No further work required

Figure 5. Proposed Integrated Process

5.5 IMPLEMENTING THE RECOMMENDED PROCESS ENHANCEMENTS

As noted, while the benefits are expected to be significant, adoption and implementation of these recommendations could present certain challenges. Some key areas in which additional effort may be required include:

- Change management. Some of these changes are significant and affect numerous personnel. The use of change management best practices would be required for recommendations to be successfully implemented. These include the provision of training opportunities, facilitated engagement, and receiving additional input from other parties.
- Policy revision. Some of the recommendations may not align with current organizational culture or formal City policy, so will require respectful consultation and potentially additional cost-benefit analysis to determine the value of implementing versus that of maintaining current practices.
- Workload. City personnel may not have the time to undertake the tasks necessary for implementation; for example, the development of a cost estimating data bank would require relatively significant setup work.
- Timeline constraints with the current process. An example in which this challenge may be encountered is with the recommendation to implement planning exercises such as Value Engineering and constructability review. The current timeline between approving the initial project brief in December and developing the Project Charter itself may be too aggressive to allow for this recommendation (RMR: Jan 30; Growth: Mar 15).

6 Appendices

Appendix A – Review of Best and Recommended Practices

Appendix B – Review of Designated Project Charters

Appendix C – Municipality Comparison of Estimating Practices Report

Appendix D – Sample PDRI Scorecard

Appendix E – Planning Exercise Descriptions

Appendix F – Sample Basis of Estimate (BOE) Document

Appendix G – Schedule of Industry Assumptions/Metrics

Appendix A

Review of Best and Recommended Practices

The following descriptions draw upon or represent selections from several resources, including those of AACE International and Project Management Institute (PMI). Sources have been indicated wherever possible for ease of retrieval.

1 Cost Estimating Process

The estimating process presented in Figure 1, and described below, illustrates the dominant approach used by practitioners to develop project cost estimates. This general approach has been widely adopted by many local and national municipalities, including the City of Edmonton, City of Calgary, Washington State Department of Transportation (WSDOT), and the Seattle Public Utility. It is applied to all phases of project delivery, beginning with the initial planning phase estimate up to the construction and close-out phases. Each phase of an estimate may require different estimating inputs, methods, techniques, and tools.

The cost estimating process is a multi-step process. A complete understanding of any available project information, including the project location and site characteristics, project schedule, project scope, and any assumptions being made, is an important starting point. These form the backbone of a Basis of Estimate (BOE), a best practice recommended by the AACE International.[1] The BOE offers traceability to the project by building a consistent documentation, capable of tracking changes over time.

The BOE informs the development of a baseline estimate, informed by historical data and the input of subject-matter experts. The baseline estimate should be in current year dollars. Once the baseline estimate is in place, it should be reviewed regularly to determine whether several key elements are accurate and correct: project assumptions; scope of work; the calculation of schedule, cost, and scope items; and reasonable usage of historical data.

Risk assessment focuses on in the uncertainty faced by the project and evaluates the likelihood of risks being realized and the magnitude of impact they could have to the project's cost, schedule, and goals if they occur. Risk assessment can be undertaken internally or via external experts. It is a best practice recommended by numerous bodies, including the AACE International recommended practice for contingency estimating[2] and PMI practice standard for project risk management[3]. Appendix E (Planning Exercises) of this report also includes a description of a structured risk analysis methodology.

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[1] AACE International, *Recommended Practice No. 34R-05: Basis of Estimate*, 2014.
[2] AACE International, *Recommended Practice No. 40R-08, Contingency Estimating - General Principles*, 2008
[3] Project Management Institute. (2009). *Practice Standard for Project Risk Management*. PMI.

Once the estimate has been developed, an approach for communicating it to all project stakeholders should be followed, which identifies what recipients should receive what level of information and when.

Before they are presented to management staff, estimates should be reviewed and revised to account for any further costs that have emerged as a result of changes to project requirements. Revision also may be required before management is able to endorse and estimate, which could also involve adjustments to cost baselines.

Additional information on the cost estimating process is available through the AACE International as well as in the Washington State Department of Transportation's helpful *Cost Estimating Manual for Projects* (2015), which can be accessed online: http://www.wsdot.wa.gov/publications/manuals/fulltext/M3034/EstimatingGuidelines.pdf

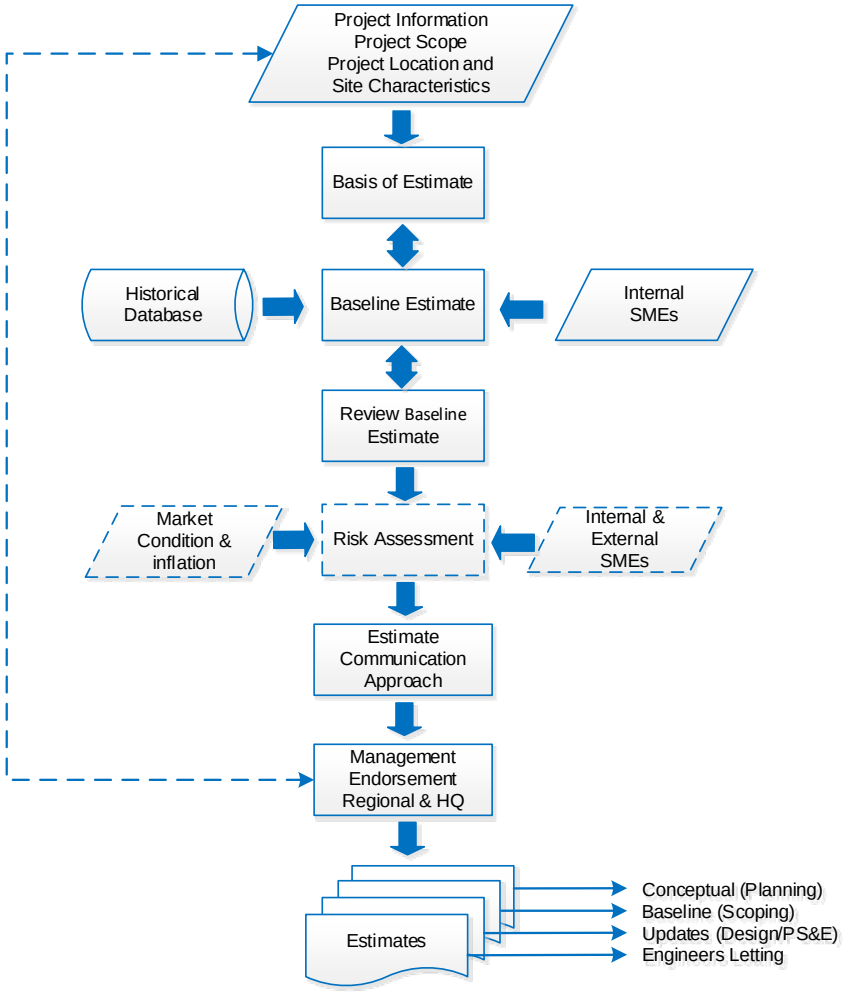

Figure 1. Cost Estimating Process (WSDOT Cost Estimate Manual)[4]

[4] Washington State Department of Transportation. (2015). *Cost Estimating Manual for Projects*.

2 Cost Estimate Classification System - AACE International – 56R-08

The AACE International[5] Recommended Practice No. 56R-08 ("Cost Estimate Classification System – As Applied for the Building and General Construction Industries") provides a detailed system for categorizing types of cost estimates. The most significant features identified include scope definition, how the estimate is used, the methodology employed, and the expected degree of accuracy.

The AACE indicates: "While the maturity level of project definition is a continuous spectrum, it was determined from benchmarking industry practices that three to five discrete categories are commonly used" (2).[6] In the matrix developed by the AACE (see Table 1), five categories have been defined, with the maturity of the project's definition as the "primary" determining characteristic of Class. The maturity definition ranges from Class 5, which is the least mature, to Class 1, where the project definition is most mature.

Table 1: Generic Cost Estimate Classification Matrix – adopted from AACE International[5]

	Primary Characteristic	***Secondary Characteristic***		
Estimate Class	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACURRACY RANGE** Typical variation in low and high ranges[a]
Class 5	0% to 2%	Functional area, or concept screening	SF or m^2 factoring, parametric models, judgment, or analogy	L: -20% to -30% H: +30% to +50%
Class 4	1% to 15%	or Schematic design or concept study	Parametric models, assembly driven models	L: -10% to -20% H: +20% to +30%
Class 3	10% to 40%	Design development, Budget authorization, feasibility	Semi-detailed unit costs with assembly level line items	L: -5% to -15% H: +10% to +20%
Class 2	30% to 75%	Control or bid/tender, semi-detailed	Detailed unit cost with forced detailed take-off	L: -5% to -10% H: +5% to +15%
Class 1	65% to 100%	Check Estimate or Bid/Tender, change order	Detailed unit cost with detailed take-off	L: -3% to -5% H: +3% to +10%

Notes:
[a] The state of construction complexity and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual cost from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

[5] AACE International, *Recommended Practice no. 56R-08: Cost Estimate Classification System*, 2012.
[6] AACE International, *Recommended Practice no. 17R-97: Cost Estimate Classification System*, 2011.

3 Cost Estimate Methodologies

There are different estimating methodologies that could be used at various stages of project development to aid the estimator in preparing cost estimates, including: (1) parametric, (2) historical bid-based, (3) cost-based, and (4) risk-based. The following definitions are drawn from the Washington State Department of Transportation's *Cost Estimating Manual for Projects*:[7]

3.1 PARAMETRIC METHODS

These are applied to projects at the early phases of a project. They use historical data, such as similar projects and historical percentages data, to define the cost of a typical project. They are easy to understand and implement; an example of its output is cost per square foot.

3.2 HISTORICAL BID-BASED METHODS

In this approach, data from prior projects, subject to adjustments to reflect current prices and project-specific conditions, are used to determine the unit cost prices. These are commonly used at late stages of a project, particularly, when bid items become quantifiable from design to develop construction cost estimates.

3.3 COST-BASED ESTIMATE METHODS

These methods focus on items that encompass the major dollar value of the project and they are based on estimating the contractor's direct cost plus the estimated overhead and profit. WSDOT recommend using these methods in situations where there are no historical unit prices available, or where the available historical bid-based information is not appropriate for the given project.

3.4 RISK-BASED ESTIMATE METHODS

These methods use the probabilistic relationships between cost, durations, and risks related to the project. This approach may incorporate all of the former techniques as well as expert judgement for given types of work, to develop the base cost. Monte Carlo simulation is used to apply defined risks to the base cost to provide a probable range for project cost and schedule.

4 Classes of Contingency Methods and General Principle Considerations – AACE International – 40R-08

[7] Washington State Department of Transportation. (2015). *Cost Estimating Manual for Projects*.

AACE International[8] identifies four classes of methods used to estimate risk cost/time in terms of contingency, including some that draw upon the methods described in the previous section:

4.1 EXPERT JUDGMENT

This method relies on the expert experience and competency in risk management and analysis, which makes it subject to self-inflicted risk when there is inconsistency or bias in the judgment. To minimize these risks, the AACE International[8] recommended obtaining the consensus of multiple experts that are not present within the project team, provided there is varied, independent opinion.

4.2 PREDETERMINED GUIDELINES

This method employs a single contingency or float value (e.g., percentage of base cost) for use on all estimates of a certain type. The simplicity of this method makes it understandable and, as advantage, it ensures consistency in estimates. Because the method is "simple," it can sometimes be used by personnel with insufficient experience; therefore, the guidelines must be clearly described and documented and supported by training.

4.3 SIMULATION ANALYSIS

This method combines expert judgment with an analytical model to provide probabilistic output. The utilization of experts' experience and inputs makes it well suited for project-specific risks; however, the complexity of this method requires expertise in application, and the outcomes are not highly consistent.

The most common methods in use are range estimating and expected value, both of which use Monte Carlo or similar simulation routines.

4.4 PARAMETRIC MODELING

A parametric model is defined by the AACE as an "empirically-based algorithm, usually derived through regression analysis, with varying degrees of judgment used" (4).[9] Similar to the predetermined method, the simplicity of using this method and its empirical nature makes it understandable and consistent.

However, the challenge of developing the parametric model is its complexity, which can require statistical skills and historical data with a range of risks and outcomes. The method also falls short in effectively addressing risks that are unique to a specific project, or risks that are common, but may have unusual impacts on a given project.

[8] AACE International, *Recommended Practice No. 40R-08, Contingency Estimating - General Principles*, 2008.
[9] AACE International, *Recommended Practice No. 40R-08, Contingency Estimating - General Principles*, 2008.

4.5 HYBRID METHODS

To take full advantage of the classes of methods described above and avoid their relative disadvantages, two or more methods could be combined to estimate risk cost/time. The most common combination is to use expert judgment with any other method.

Table 2 below provides an overview of the primary classes of contingency estimating methods recommended by the AACE.

Table 2. Classes of Contingency Methods and General Principle Considerations (AACE International[10])

	Classes of Contingency Estimating Methods			
First Principles	**Expert Judgment**	**Predetermined Guidelines**	**Simulation Analysis***	**Parametric Modeling**
Meets client objectives, expectations and requirements	Whether a given method or combination of methods best meets the client's objectives, expectation or requirements must be determined prior each application			
Part of a risk and decision management process	Any method can potentially be incorporated in a process.			
Fit-for-use	Any method can potentially be made to address a variety of applications, but typically each method has strengths and weakness. Hybrid approaches can take advantage of the strengths of several methods			
Starts with identifying risk drivers	Any method can potentially be made to start with identifying risk drivers.			
Links risk drivers and cost/schedule outcomes	Requires that expert(s) make and communicate the linkages	Linkages can be directly incorporated in the guidelines	Linkages are directly used in the expected value method	Linkage is inherent to this method
Avoids iatrogenic (self-inflicted) risks	Bias must be tempered, often through consensus	Care must be taken with risks not considered in the guidelines	Complexity of the method increases the need for disciplined approach	Care must be taken with risks not considered in the model
Employs empiricism	Generally, requires the use of lessons learned, and/or validation or benchmarking using historical information (not an inherent feature of the method)			Explicitly addressed if regression based

[10] AACE International, *Recommended Practice No. 40R-08, Contingency Estimating - General Principles*, 2008.

	Classes of Contingency Estimating Methods			
First Principles	**Expert Judgment**	**Predetermined Guidelines**	**Simulation Analysis***	**Parametric Modeling**
Employs experience /competency	Expertise explicitly required	Expertise employed in development	Expertise employed in analysis	Expertise employed in development
Provides probabilistic estimating results	Can provide subjective ranges	Can provide predetermined ranges	Direct output of most simulations	Can be a direct output of algorithm

5 High Level Outline of Skills and Knowledge of Cost Estimating - AACE International – 46R-11

The AACE provides recommendations regarding the skills and competencies project cost estimators should have in order to understand the work being planned and estimate effectively.

The figure below illustrates the recommended hierarchical structure of the skills and knowledge competency model for a cost estimator by AACE International[11].

[11] AACE International, *Recommended Practice No. 46R-11, Required Skills and Knowledge of Project Cost Estimating*, 2013.

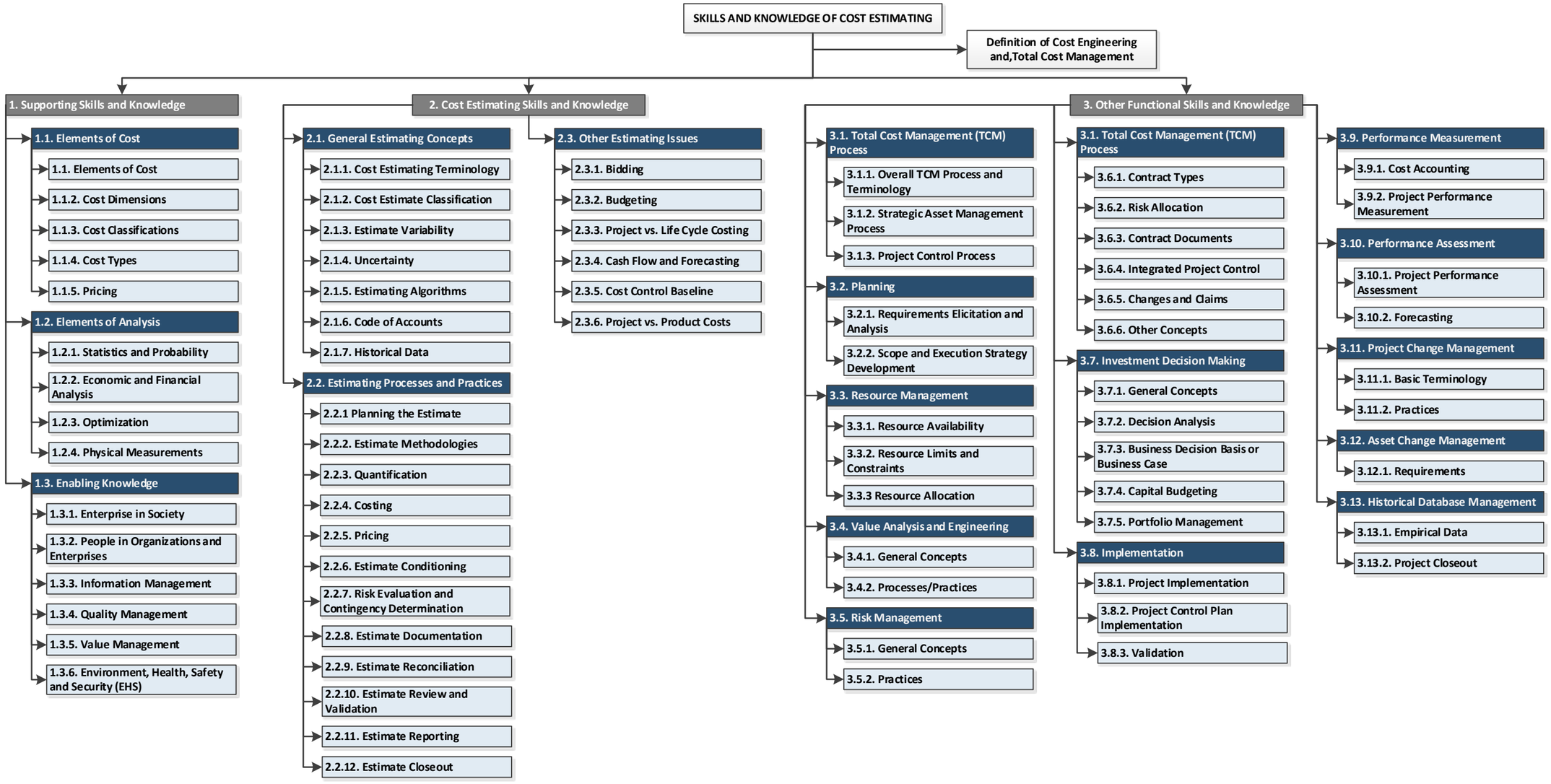

Figure 2: 5 High Level Outline of Skills and Knowledge of Cost Estimating - taken from AACE International[11]

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Appendix B

Project Charter Review

1 Overall Approach

The independent peer review of cost estimates for the following Capital Project Charters is summarized in this section. It should be noted that the review is not intended to be a definitive statement of project cost for each charter. Rather, it aims to support the recommendations made elsewhere in this report by providing a specific and detailed estimating process review and commentary.

The following charters were requested by the City of St. Albert for review:

Charter No.	Department	Project Charter Name
CULTR-005	Culture	Founders Walk Phase 3
CULTR-009	Culture	Heritage Park - French Canadian Farm
CULTR-010	Culture	Heritage Park - Landscaping and Accessibility
CULTR-011	Culture	Heritage Park - Interpretive Centre
DARP-005	Planning and Engineering	Millennium Park Phase 2
DARP-006	Planning and Engineering	Perron Street Pedestrian Improvements
PW-020	Public Works	Covered Sand Storage
RECR-010	Recreation and Parks	Lacombe Park Phase 2
RECR-041	Recreation and Parks	Erin Ridge North - School Playground
RECR-043	Recreation and Parks	Riel Park Phase 5
RECR-045	Recreation and Parks	Oakmont Trail Phase 2
RECR-049	Recreation and Parks	Neighborhood Park Construction
RECR-050	Recreation and Parks	Red Willow Park West
RECR-051	Recreation and Parks	Grey Nuns White Spruce Park
TRAN-007	Transportation	Transit North Park & Ride/Transit Centre

Our overall approach for the review had the following characteristics:

- All charters were reviewed in detail to understand the scope and intent of the project.
- The backup information related to the development of the charters was requested and, in most cases, was delivered. Instances where the support documentation was unavailable have been noted in the detailed review.
- The basis of each estimate was reviewed to ensure the intent of the estimate matched the general descriptions contained in the charters.
- Where applicable, the unit rates used in the base estimates were also reviewed and compared against historical data of similar works based on the descriptions provided in the estimate.
- No attempt was made to validate any measures of the specific works; however, spot checks of quantities were completed where the information was sufficient.
- In general, we relied upon the quantification as presented to complete the review and validation.

In summary, for each charter, we have provided a specific review of our observations and analysis of the basis of the estimate, including the content of the "Capital Project Cost Estimate Worksheet." Where applicable, we have also developed a Recommended Charter Value (RCV) of the capital cost estimate based on our review and assumptions.

2 Detailed Methodology

The review and validation process involved several key focuses, which are discussed in detail below. These include escalation, contingencies, construction vs. project management, commissioning and QA/QC costs, and operating costs.

2.1 ESCALATION

For project charters where the base cost was developed in previous years, we have used the following escalation rates based on the Hanscomb Escalation Watch developed from the Non-residential Building Construction Price Indices (NRBCPI) data published by Statistics Canada (see Table 1).

Table 1. Escalation Rates

Year	Rate of Escalation
2010-11	5.8%
2011-12	4.1%
2012-13	3.0%
2013-14	1.1%
2014-15	1.5%
2015-16	(-1.4)%

Compounded Escalation	14.8%

All escalation is based on fourth quarter year over year values. Based on our understanding of the current market conditions, we believe that construction costs can be expected to rise by approximately 0.25% to 0.75% per annum throughout the remaining portion of 2016 and are forecasting approximately 1.5% escalation for 2016-2017.

For the purposes of our RCV, all base costs are developed in current 2016 dollars and escalated at 2% per year until 2016-2017. We have applied 3% thereafter. We have also applied this same escalation factor to design costs where applicable.

2.2 CONTINGENCIES

For each charter, we have attempted to evaluate the scope and nature of the project, and, based on the level of estimate detail provided, we have adjusted the Design Contingency Allowance accordingly.

As per Recommendation #15 described below, we have also added a Management Reserve Contingency to all of our RCVs. In general, we have allocated this allowance at 4% of the total of all costs developed in future dollars. This percentage is based upon experience on previous projects, which were in turn based upon historical data and anticipated risks. It is important to note that this contingency is still a requirement in the total of our recommended RCV, regardless of whether the recommendation is adopted. It has been identified separately in order to illustrate how it can be applied consistently in order to help make the estimate more transparent. If the City does not adopt the Management Reserve recommendation, the value presented in our RCV should be retained in the estimate as part of a general contingency.

2.3 CONSTRUCTION/PROJECT MANAGEMENT

As noted elsewhere in this report, the interpretation of the Construction Management (CM) line item on many of the charters at times appears inconsistent. Since CM is typically used as a method of construction procurement, we have used the term Project Management in our RCV for clarity and have applied it as a percentage based on the construction cost.

2.4 COMMISSIONING AND QA/QC COSTS

The City's "Cost Analysis Checklist" provides a brief description of when and how to apply the costs, which could be implemented going forward as a means of establishing a more detailed estimate. As design and construction concepts move to higher levels of sustainable design, we feel that it is prudent even during the preliminary concept stage to include a value reflecting these costs. We have therefore applied the recommended 1% value to all RCV estimates.

2.5 OPERATING COSTS

A general review was undertaken on the project charter Operating Impacts as well as the City's "Capital Budget Operating Impacts Calculations Guideline." Since many of the charters relied on

the application of a macro 2% value of the construction cost or are based on what appears to be direct historical data for specific works, our review and commentary related to the Operating Impacts has been addressed primarily in the general discussion in the main body of the report (see Section 2.2.2 and also Section 5 [Recommendation #14]).

3 Summary of Review

On the following page, we have included a summary of all reviews, which shows the initial value breakdown from the original project charter and then the Recommended Charter Value resulting from our review. This summary is followed by the detailed charter review and commentary.

City of St.Albert
Capital Project Charters
Budget 2017

Estimates Reviews
Report Date : August 2016

Charter No.	Project Charter Name	Project Start Years		Land Costs	Planning & Design	Staff	Site Servicing	Construction	Landcaping	Const. Mgm't	Public Art	Commisioning QA/QC	Contingency		Escalation	Totals	VARIANCE	
		Planning/ Design	Constuction										Design Allowance	Mgm't Reserve			$	%
CULTR-005	Founders Walk Phase 3	2017	2017					$2,300,000		$50,000	$22,250		$460,000			$2,832,250		
	Charter Review Values				$46,000			$2,300,000		$46,000	$23,000	$23,000	$230,000	$108,900	$53,400	$2,830,300	-$1,950	-0.07%
CULTR-009	Heritage Park - French Canadian Farm	2017	2017					$1,795,400		$50,000	$17,954		$359,000			$2,222,354		
	Charter Review Values				$120,500			$1,506,200		$45,200	$15,100	$15,100	$301,200	$81,700	$40,100	$2,125,100	-$97,254	-4.38%
CULTR-010	Heritage Park - Landscaping and Accessibility	2017	2018		$567,748			$4,731,234		$50,000	$47,320		$946,246			$6,342,548		
	Charter Review Values				$441,600			$3,839,800		$115,200	$38,400	$38,400	$768,000	$219,700	$251,700	$5,712,800	-$629,748	-9.93%
CULTR-011	Heritage Park - Interpretive Centre	2018	2019		$531,900			$4,432,323		$100,000	$44,323		$664,854			$5,773,400		
	Charter Review Values				$389,800			$3,389,600		$101,700	$33,900	$33,900	$677,900	$194,000	$222,200	$5,043,000	-$730,400	-12.65%
DARP-005	Millenium Park Phase 2	2017	2018		$690,000	$126,000		$5,428,020		$100,000	$54,280					$6,398,300		
	Charter Review Values																	
DARP-006	Perron Street Pedestrian Improvements	2017	2018		$514,100	$232,500		$4,700,000		$100,000	$47,000					$5,593,600		
	Charter Review Values				$540,500			$3,760,000		$139,800	$37,600	$37,600	$806,100	$197,500	$250,200	$5,769,300	$175,700	3.14%
PW-020	Covered Sand Storage	2017	2017		$80,000		$5,000	$2,106,423		$50,000	$21,114		$422,285			$2,684,822		
	Charter Review Values				$71,200		$5,000	$1,780,800		$53,600	$17,900	$13,400	$178,600	$86,500	$42,400	$2,249,400	-$435,422	-16.22%
RECR-010	Lacombe Park Phase 2	2017	2018		$153,000			$1,809,100		$175,000	$18,100		$416,240			$2,571,440		
	Charter Review Values				$150,000			$1,471,400		$147,200	$14,700	$14,700	$253,700	$87,800	$143,500	$2,283,000	-$288,440	-11.22%
RECR-041	Erin Ridge North - School Playground	2017	2017					$175,000	$6,125,000	$25,000	$63,050					$6,388,050		
	Charter Review Values															$0		
RECR-043	Reil Park Phase 5	2016	2017		$136,250				$1,714,244		$17,142		$370,098			$2,237,734		
	Charter Review Values				$127,400				$1,593,100	$47,800	$15,900	$15,900	$159,300	$79,900	$39,200	$2,078,500	-$159,234	-7.12%
RECR-045	Oakmont Trail Phase 2	2018	2019		$200,000				$1,300,000	$25,000	$13,000					$1,538,000		
	Charter Review Values				$170,000				$1,099,650	$66,000	$11,000	$11,000	$110,000	$63,100	$115,200	$1,645,950	$107,950	7.02%
RECR-049	Neighborhood Park Construction		2019						$25,416,502		$254,259					$25,670,761		
	Charter Review Values																	
RECR-050	Red Willow Park West	2018	2019		$300,000				$3,162,420		$31,624		$1,166,847			$4,660,891		
	Charter Review Values				$300,000				$2,422,250	$72,700	$24,200	$24,200	$635,600	$149,800	$275,400	$3,904,150	-$756,741	-16.24%
RECR-051	Grey Nuns White Spruce Park	2018	2019		$153,000				$1,410,000	$100,000	$14,100		$381,400			$2,058,500		
	Charter Review Values				$138,400				$1,257,823	$37,700	$12,600	$12,600	$202,500	$71,500	$131,700	$1,864,823	-$193,677	-9.41%
TRAN-007	Transit North Park & Ride/Transit Centre	2020	2020	$3,500,000	$1,515,000			$13,350,000		$150,000	$135,000					$18,650,000		
	Charter Review Values																	

Charter Number	CULTR-005
Charter Name	Founders Walk Phase 3
Department	Culture
Year	2017
Estimated Capital Cost	$2,832,250

Estimate Basis	
	Due to the long development period of this project, the original estimate calculations that were used to develop the current estimate were unavailable. Costs appear to have been escalated from the original 2009 estimate. As a result, our evaluation is limited to the information presented in the Capital Project Charter.

Observations	
	The primary basis of the estimate is developed on the assumption of the requirement of ten (10) interpretative nodes at an average cost of $222,500 plus an additional $75,000 for research and writing. In addition to providing interpretive signage to tell the stories of the community, the project charter also indicated that this cost should include the provision of benches, park furniture, and the like. In general, we believe that the allocation of an average cost per node based on historical costs is a rational approach to developing a baseline budget at this level of concept.

Analysis & Summary	
	We would recommend that this charter be carried forward as such and that the design consultants be made aware of the implications and importance of designing the nodes and related infrastructure to the budget allocated. This recommendation is based partly on the absence of more specific details on the interpretive node. As indicated in our interviews, this charter in its more recent iteration was developed based on a previous budget allocation as opposed to a detailed concept estimate. It may not be prudent to expect the budget to carry the expected degree of accuracy that is outlined in the City of St. Albert's Capital Project Management document C-P&E-02 (+/-50%). In this case, the client and consultants should ensure that the design follows the budget and not vice-versa. For future similar projects, it may be useful to the City to allocate funds to develop independent costs earlier in the process rather than waiting for completion of the detailed design.

Recommended Charter Value			**2017**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$2,300,000	2.0%	$46,000
Site Servicing		Allow	$0
Structure/Building Construction			$2,300,000
Landscaping		n/a	$0
Project Management	$2,300,000	2.0%	$46,000
Public Art/Banding	$2,300,000	1.0%	$23,000
Commissioning and QA/QC	$2,300,000	1.00%	$23,000
Design Contingency Allowance	$2,300,000	10%	$230,000
	Sub-Total - 2016 dollars		**$2,668,000**
Escalation to 2017	$2,668,000	2.0%	$53,400
Management Reserve	$2,721,400	4.0%	$108,900
TOTAL RECOMMENDED CHARTER - 2017			**$2,830,300**

Charter Number	CULTR-009
Charter Name	Heritage Park - French Canadian Farm
Department	Culture
Year	2017
Estimated Capital Cost	$2,222,354

Estimate Basis	
	Information was originally developed in the "Master Plan for the St. Albert Heritage Sites" (dated August 30, 2004), and subsequently updated in the "St. Albert Heritage Site Functional Plan" (dated January 2010).

Observations	
	As noted, the design and cost information was initially developed in 2004 and then subsequently updated in 2009 dollars. The latter plan staged the overall project across five phases. The focus of this Charter is primarily the scope outlined for Phase 4. Due to issues with the original design, the estimate in the charter has been modified to account for more recent information. Some items of work were therefore omitted or previously completed and other items, originally from Phase 2, have been carried forward. The values from the 2010 report were then escalated to current dollars.
	All costs included in the 2010 report have a 25% factor applied, which appears to include a fee allowance for "detailed design and construction allowance." For the purposes of our evaluation, we have assumed that this allowance equates to 10% of the 25% factor and have deducted this amount to determine base costs. Detailed design and administration is then applied using the recommended calculations noted below.

Analysis & Summary	
	Based on our understanding of the charter and the functional plan, the base scope values extracted from the 2010 report equate to $1,277,500 in 2010 dollars. Upon review of many of the scope items and descriptions, in general, the allocations of costs appeared to be fair and rational for the scope described. In the below noted recommendation, we have used this base value escalated per the compounded rate identified in our front-end methodology. We have also added detailed planning and design costs to the recommendation.

Recommended Charter Value			**2017**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$1,506,200	8.0%	$120,500
Site Servicing		n/a	$0
Structure/Building Construction			$1,506,200
Landscaping		n/a	$0
Project Management	$1,506,200	3.0%	$45,200
Public Art/Banding	$1,506,200	1.0%	$15,100
Commissioning and QA/QC	$1,506,200	1.0%	$15,100
Design Contingency Allowance	$1,506,200	20%	$301,200
	Sub-Total - 2016 dollars		**$2,003,300**
Escalation to 2017	$2,003,300	2.0%	$40,100
Management Reserve	$2,043,400	4.0%	$81,700
TOTAL RECOMMENDED CHARTER - 2017			**$2,125,100**

Charter Number	CULTR-010
Charter Name	Heritage Park - Landscaping and Accessibility
Department	Culture
Year	2017-18
Estimated Capital Cost	$6,342,548

Estimate Basis
Information was originally developed in the "Master Plan for the St. Albert Heritage Sites" (dated August 30, 2004), and subsequently updated in the "St. Albert Heritage Site Functional Plan" (dated January 2010).

Observations
As noted, the design and cost information was initially developed in 2004 and then subsequently updated in 2009 dollars. The latter plan staged the overall project across five phases. The focus of this Charter is primarily the scope outlined for Phase 4. Due to issues with the original design, the estimate in the charter has been modified to account for more recent information. Some items of work were therefore omitted or previously completed and other items, originally from Phase 2, have been carried forward. The values from the 2010 report were then escalated to current dollars. All costs included in the 2010 report have a 25% factor applied, which appears to include a fee allowance for "detailed design and construction allowance." For the purposes of our evaluation, we have assumed that this allowance equates to 10% of the 25% factor and have deducted this amount to determine base costs. Detailed design and administration is then applied using the recommended calculations noted below.

Analysis & Summary
Based on our understanding of the charter and the functional plan, the base scope values (excluding design fees [-10%]) extracted from the 2010 report equate to $3,256,800 in 2010 dollars. Upon review of many of the scope items and descriptions, in general, the allocations of costs appeared to be fair and rational for the scope described. In the below-noted recommendation, we have used this base value escalated per the compounded rate identified in our front-end methodology. We have also added detailed planning and design costs to the recommendation.

Recommended Charter Value			**2017**
Detailed Planning and Design	$3,839,800	11.5%	$441,600
	Sub-Total - 2016 dollars		**$441,600**
Escalation to 2017	$441,600	2%	$8,800
Management Reserve	$450,400	4%	$18,000
TOTAL RECOMMENDED CHARTER - 2017			**$468,400**

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Recommended Charter Value			2018
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$3,839,800	11.5%	$0
Site Servicing		n/a	$0
Structure/Building Construction			$3,839,800
Landscaping		n/a	$0
Project Management	$3,839,800	3.0%	$115,200
Public Art/Banding	$3,839,800	1.0%	$38,400
Commissioning and QA/QC	$3,839,800	1.0%	$38,400
Design Contingency Allowance	$3,839,800	20%	$768,000
	Sub-Total - 2016 dollars		**$4,799,800**
Escalation to 2017	$4,799,800	2.0%	$96,000
Escalation to 2018	$4,895,800	3.0%	$146,900
Management Reserve	$5,042,700	4.0%	$201,700
TOTAL RECOMMENDED CHARTER - 2018			**$5,244,400**

Charter Number	CULTR-011
Charter Name	Heritage Park - Interpretive Centre
Department	Culture
Year	2017
Estimated Capital Cost	$5,773,400

Estimate Basis	
	Information was originally developed in the "Master Plan for the St. Albert Heritage Sites" (dated August 30, 2004), and subsequently updated in the "St. Albert Heritage Site Functional Plan" (dated January 2010).

Observations	
	The 2010 plan staged the overall project across five phases. In discussion with representatives from Culture, it was determined that this Charter primarily addresses the scope outlined for Phase 5. The values from the 2010 report were subsequently escalated forward. All costs included in the 2010 report have a 25% factor applied which appears to include a fee allowance for "detailed design and construction allowance". For the purposes of our evaluation, we have assumed that this allowance equates to 10% of the 25% factor and have deducted this amount to determine base costs. Detailed design and administration is then applied using the recommended calculations noted below.

Analysis & Summary	
	Based on our understanding of the charter and the functional plan, the base scope values (excluding design fees [-10%]) extracted from the 2010 report equate to $2,875,000 in 2010 dollars. Upon review of many of the scope items and descriptions, in general, the allocations of costs appear to be fair and rational for the scope described. In the below-noted recommendation, we have used this base value escalated per the rates identified in our methodology. We have also added detailed planning and design costs to the recommendation.

Recommended Charter Value			**2017**
Detailed Planning and Design	$3,389,600	11.5%	$389,800
	Sub-Total - 2016 dollars		**$389,800**
Escalation to 2017	$389,800	2%	$7,800
Management Reserve	$397,600	4%	$15,900
TOTAL RECOMMENDED CHARTER - 2017			**$413,500**

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Recommended Charter Value			2018
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$3,389,600	11.5%	$0
Site Servicing		n/a	$0
Structure/Building Construction			$3,389,600
Landscaping		n/a	$0
Project Management	$3,389,600	3.0%	$101,700
Public Art/Banding	$3,389,600	1.0%	$33,900
Commissioning and QA/QC	$3,389,600	1.0%	$33,900
Design Contingency Allowance	$3,389,600	20%	$677,900
	Sub-Total - 2016 dollars		**$4,237,000**
Escalation to 2017	$4,237,000	2.0%	$84,700
Escalation to 2018	$4,321,700	3.0%	$129,700
Management Reserve	$4,451,400	4.0%	$178,100
TOTAL RECOMMENDED CHARTER - 2018			**$4,629,500**

Charter Number	DARP-005
Charter Name	Millenium Park Phase 2
Department	Planning & Engineering
Year	2017-18
Estimated Capital Cost	$6,398,300

Estimate Basis
The relevant documents available for review included "City Council Meeting Minutes" (dated May 24, 2011), and the "Downtown Area Redevelopment Plan Implementation Strategy" (dated May 2011). No formal basis of estimate was available.

Observations
While no formal basis of estimate is available, Appendix 1 of the "Downtown Area Redevelopment Plan Implementation Strategy" includes preliminary budget numbers for the various DARP projects. Listed under the Millennium Park projects are costs related to 3 Phases: Phase 1 - Engineering & Design All Phases - $1,253,000 Phase 2 - Millennium Park - $2,108,000 Phase 3 - Millennium Park - $1,453,000 The values listed in the Charter indicate $690,000 for design and $5,428,020 for construction.

Analysis & Summary
Based on the uncertainty regarding the relationship between the above-noted values and Millennium Park Phase 2 (the subject of this charter), we are not able to provide additional analysis in order to correlate the values contained in the 2011 Implementation Strategy with the values provided in the charter. Further basis of estimate would be necessary to clarify these values.

Recommended Charter Value	**TBC**

Charter Number	DARP-006
Charter Name	Perron Street Pedestrian Improvements
Department	Planning & Engineering
Year	2017-19
Estimated Capital Cost	$5,593,600

Estimate Basis
The relevant documents available for review included "City Council Meeting Minutes" (dated May 24, 2011), and the "Downtown Area Redevelopment Plan Implementation Strategy" (dated May 2011). No formal basis of estimate was available.

Observations
While no formal basis of estimate is available, Appendix 1 of the "Downtown Area Redevelopment Plan Implementation Strategy" includes preliminary budget numbers for various DARP projects. Listed under the Perron Street roadway project is an all-inclusive (design/engineering/construction) value of $5,000,000 in 2011 dollars. Assuming that there has been no change in scope and that no work has been completed since the 2011 report, the current value appears to include appropriate escalation. In addition, the "Capital Project Cost Estimate" worksheet does not apply a value against the contingency so we have assumed that the base costs presented include an overall contingency.

Analysis & Summary
Although we cannot comment on the specifics of the estimate, in general, based on our understanding of the planned scope of the project, the value carried as noted appears fair and rational for a Class 5 budget estimate. For the purpose of our calculations, we have reduced the base construction value under the assumption that it had carried both escalation and contingency. We would recommend that, as design evolves to preliminary design, updated cost estimates should be developed to ensure the scope can indeed meet the anticipated budget.

Recommended Charter Value			**2017**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$4,700,000	11.5%	$540,500
Site Servicing		n/a	$0
Structure/Building Construction			$0
Landscaping		n/a	$0
Project Management	$540,500	5.0%	$27,000
Public Art/Banding	$0	1.0%	$0
Commissioning and QA/QC	$0	0.00%	$0
Design Contingency Allowance	$540,500	10%	$54,100
	Sub-Total - 2016 dollars		**$621,600**
Escalation to 2017	$621,600	2%	$12,400
Management Reserve	$0	4%	$0
TOTAL RECOMMENDED CHARTER - 2017			**$634,000**

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Recommended Charter Value			2018
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$3,760,000	11.5%	$0
Site Servicing		n/a	$0
Structure/Building Construction			$3,760,000
Landscaping		n/a	$0
Project Management	$3,760,000	3.0%	$112,800
Public Art/Banding	$3,760,000	1.0%	$37,600
Commissioning and QA/QC	$3,760,000	1.0%	$37,600
Design Contingency Allowance	$3,760,000	20%	$752,000
	Sub-Total - 2016 dollars		**$4,700,000**
Escalation to 2017	$4,700,000	2.0%	$94,000
Escalation to 2018	$4,794,000	3.0%	$143,800
Management Reserve	$4,937,800	4.0%	$197,500
TOTAL RECOMMENDED CHARTER - 2018			**$5,135,300**

TOTAL RECOMMENDED CHARTER	**$5,769,300**

Charter Number	PW-020
Charter Name	Covered Sand Storage
Department	Public Works
Year	2017
Estimated Capital Cost	$2,684,822

Estimate Basis
The basis of the estimate appears to be a contractor's quote dated March 21, 2016, based on a detailed concept design.

Observations
Based on a review of the contractor's quote of $1,780,848, this equates to approximately $958/m2 of Gross Floor Area and appears to include all items as required, including general site requirements, permits and fees, and complete construction. Based on the design and material information provided, we believe that this value represents fair market value.

Analysis & Summary
As noted, with only minor exceptions, the contractor's quote appears to be all-inclusive; however, the value carried on the Capital Project Cost Estimate sheet (line item 5) is $2,106,423, which represents a variance of $325,575 or approximately 18%. The charter and additional information does not appear to contain justification for including this additional money, particularly as the design and site servicing is costed separately on the Capital Project Cost Estimate worksheet. In addition, based on the nature of this project and the level of design information that has been developed to date, we feel that this estimate does not necessarily require a 20% contingency. We would recommend that this be applied at 10% of the construction estimate.

Recommended Charter Value			**2017**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$1,780,800	4.0%	$71,200
Site Servicing		Allow	$5,000
Structure/Building Construction			$1,780,800
Landscaping		n/a	$0
Project Management	$1,785,800	3.0%	$53,600
Public Art/Banding	$1,785,800	1.0%	$17,900
Commissioning and QA/QC	$1,785,800	0.75%	$13,400
Design Contingency Allowance	$1,785,800	10%	$178,600
	Sub-Total - 2016 dollars		**$2,120,500**
Escalation to 2017	$2,120,500	2.0%	$42,400
Management Reserve	$2,162,900	4.0%	$86,500
TOTAL RECOMMENDED CHARTER			**$2,249,400**

Charter Number	RECR-010
Charter Name	Lacombe Park Construction Phase 2
Department	Recreation and Parks
Year	2017-19
Estimated Capital Cost	$2,571,440

Estimate Basis	
	The basis of the estimate includes detailed estimates (dated March 10, 2016) that appear updated from the Lacombe Park (West) Park Master Plan (dated April 2015). Components of each year's scope is calculated separately. In general, the scope appears similar in the 2016 estimate to that of the 2015 Master Plan with some minor scope and cost variations. We have evaluated the scope of the 2016 update.

Observations	
	Estimate 2017 - The 2017 estimate of $183,000 is primarily for design services. The base cost is allocated at $150,000, plus a 20% contingency of $30,000 and 10% escalation on the contingency for an additional $3,000. **Estimate 2018 -** The 2018 estimate is primarily for Phase 2A - Linear Natural Area and is allocated at $654,940. This is the value on the Capital Project Cost Estimate, yet the detailed value on the back-up provided is $656,206. **Estimate 2019 -** The 2019 estimate is primarily for Phase 2B Storm Water management facility and is allocated at $1,733,500. This is the value on the Capital Project Cost Estimate yet the value on the back-up provided is $1,720,480.

Analysis & Summary	
	As noted, the values that appear in the 2018 and 2019 backup documentation do not match the values presented in the Charter. Further clarification should be obtained for these variances. **Estimate 2017** - Based on the current market conditions for design services, we feel that the $150K amount allocated is rational, and we do not feel that this estimate requires either a 20% contingency or the escalation on the contingency at the rate applied. **Estimate 2018 -** In general, the trade unit costs applied to the quantities provided at this level of estimate appear fair and rational for a base cost of $369,630. Included is a line item for "mobilization and demobilization" at 10%. We have assumed this to be include all general site requirements and general contractor fees, for a total base cost of $406,600. Based on the nature of the scope of the project and the level of detail and specific measures included in the estimate, we have assumed a Class 3 estimate, to which we have reduced the Design Contingency Allowance to 10%. (...cont'd)

Estimate 2019 - In general, the trade unit costs applied to the quantities provided at this level of estimate appear to be fair and rational, for a total base cost of $1,064,827. Included in this estimate is $465,000 for an all-inclusive "Interpretive Boardwalk" allocated at $1,500/m2. This item appears to be a major variance to the 2014 Master Plan and, based on the subjective nature of this component's description, we have assumed the baseline to be a Class 4 estimate to which we have applied the Design Contingency Allowance to 20%.

Recommended Charter Value			**2017**
Detailed Planning and Design	$406,600	11.5%	$150,000
	Sub-Total - 2016 dollars		**$150,000**
Escalation to 2017	$150,000	2%	$3,000
Management Reserve	$153,000	4%	$6,100
TOTAL RECOMMENDED CHARTER - 2017			**$159,100**

Recommended Charter Value			**2018**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$406,600	11.5%	$0
Site Servicing		n/a	$0
Structure/Building Construction			$406,600
Landscaping		n/a	$0
Project Management	$406,600	10.0%	$40,700
Public Art/Banding	$406,600	1.0%	$4,100
Commissioning and QA/QC	$406,600	1.0%	$4,100
Design Contingency Allowance	$406,600	10%	$40,700
	Sub-Total - 2016 dollars		**$496,200**
Escalation to 2017	$496,200	2.0%	$9,900
Escalation to 2018	$506,100	3.0%	$15,200
Management Reserve	$521,300	4.0%	$20,900
TOTAL RECOMMENDED CHARTER - 2018			**$542,200**

Recommended Charter Value			**2019**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$1,064,800	11.5%	$0
Site Servicing		n/a	$0
Structure/Building Construction			$1,064,800
Landscaping		n/a	$0
Project Management	$1,064,800	10.0%	$106,500
Public Art/Banding	$1,064,800	1.0%	$10,600
Commissioning and QA/QC	$1,064,800	1.0%	$10,600
Design Contingency Allowance	$1,064,800	20%	$213,000
	Sub-Total - 2016 dollars		**$1,405,500**
Escalation to 2017	$1,405,500	2.0%	$28,100
Escalation to 2018	$1,433,600	3.0%	$43,000
Escalation to 2019	$1,476,600	3.0%	$44,300
Management Reserve	$1,520,900	4.0%	$60,800
TOTAL RECOMMENDED CHARTER - 2019			**$1,581,700**

TOTAL RECOMMENDED CHARTER	**$2,283,000**

Charter Number		RECR-041
Charter Name		Erin Ridge North - School Playground and Phase 1/2
Department		Recreation and Parks
Year		2017-21
Estimated Capital Cost		$6,388,050

Estimate Basis		
		The basis of the estimate is outlined in a previous version of the Charter. It appears that the estimates were developed by applying an all-inclusive cost per square meter of $43/m2 of park space allocated to an area of park space planned in the Charter. It indicates that the unit cost was derived from "cost estimates" received in 2012 and was subsequently escalated at a rate of 10% per annum. It also indicates that the School and Community Playgrounds cost is based on 2013 tender prices received; however, further breakdown of these costs or additional information would be required to permit a detailed review.
		Although this is indeed a concept estimate with an expected degree of accuracy of +/- 50%, the variance could be significant in terms of being able to complete the planned program, based on the absence of specific back-up to validate the calculations and assumptions. Due to the fact that the majority of this Charter's estimate appears to have been developed based on an all-inclusive unit cost estimated four years ago, we would recommend that further information regarding both the planned scope of the parks and the elements contained in the 2012 historical unit costs be reviewed to determine if the unit remains applicable in today's market. The utilization of tender prices from 2013 should also be reviewed for scope to ensure the general intent meets the goals of the Charter.
Observations		

Analysis & Summary		
		The estimate appears to have been developed in conformity with the City of St. Albert's current policy for concept phase estimates, as it relies upon a parametric estimate. While the source for the cost per square meter provided was not provided to the city and therefore could not be validated, the process for developing the estimate appears to follow city policy.

Recommended Charter Value		
		Further back-up regarding base unit prices, applied areas, and assumptions is required to permit a detailed review.

Charter Number	RECR-043
Charter Name	Riel Park Phase 5
Department	Recreation and Parks
Year	2017
Estimated Capital Cost	$2,237,734

Estimate Basis
The basis of the estimate appears to be an undated independent engineer's estimate, which has been escalated by a total of approximately 9%. Although the estimate is not dated, it is our understanding that it was completed in 2015.

Observations
The estimate developed appears to be based on specific quantities and scope of work with a construction total of $1,422,700. Based on the units provided, in general, this estimate appears fair and rational. To this value, a total of $150,000 was included for General Requirements, equating to 10.5% of the construction cost, which would be in the range for this nature of work, for a base cost of $1,572,700 in 2015 dollars.

Analysis & Summary
As noted, in general, the baseline engineer's estimate appears fair and rational. Based on our current market conditions, we do feel that the application of 9% to the engineer's estimate is required as many of the unit prices appear to reflect current market pricing. Based on the nature of the scope of the project, as well as the level of detail and specific measures included in the estimate, we have assumed a Class 3 estimate, to which we have reduced the Design Contingency Allowance to 10%.

Recommended Charter Value			**2017**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$1,593,100	8.0%	$127,400
Site Servicing		n/a	$0
Structure/Building Construction			
Landscaping		n/a	$1,593,100
Project Management	$1,593,100	3.0%	$47,800
Public Art/Banding	$1,593,100	1.0%	$15,900
Commissioning and QA/QC	$1,593,100	1.0%	$15,900
Design Contingency Allowance	$1,593,100	10%	$159,300
	Sub-Total - 2016 dollars		**$1,959,400**
Escalation to 2017	$1,959,400	2.0%	$39,200
Management Reserve	$1,998,600	4.0%	$79,900
TOTAL RECOMMENDED CHARTER - 2017			**$2,078,500**

Charter Number	RECR-045
Charter Name	Oakmont Trail Phase 2
Department	Recreation and Parks
Year	2018-2019
Estimated Capital Cost	$1,538,000

Estimate Basis
The basis of the estimate is a detailed estimate dated July 5, 2016.

Observations
The application of values from the back-up estimate to the Charter's Capital Project Cost Estimate includes some inconsistencies. Contingencies are not indicated on the charter and appear to be included in the landscaping cost. Additionally, the application of the Construction Management line item appears to be blended into the 2018 values for public consultation and detailed design. Further clarification is recommended. **Estimate 2018 -** The 2018 estimate is primarily for design services carried at $200,000 and public consultation at $25,000. The value indicated in the back-up estimate detail for design is $145,000 and, based on the below-noted construction value, we feel that this number is fair and rational for the design. **Estimate 2019 -** The 2019 estimate is primarily for the construction works and is estimated at a current base value of $1,209,835. The total value on the back-up estimate, including contingency and escalation is $1,652,032; however, the value reported on the Charter's Capital Project Cost Estimate is $1,313,000.

Analysis & Summary
Estimate 2018 - In general, the allocation of $170,000 for design and public consultation in the detailed estimate appears fair and rational. Based on the current market conditions for this nature of work, we do not feel that an 8% per annum allowance for inflation is required. (....cont'd)

Estimate 2019 - In general, the unit costs applied to the quantities provided at this level of estimate appear fair and rational. However, we cannot explain the variance from the estimated value noted above to the value presented on the Charter. Since the back-up estimate is relatively current, for this evaluation we have applied the base construction cost of $1,099,850 to our recommendation noted below. As noted, however, we would recommend that further clarification and evaluation of this estimate and charter be completed prior to approval.

Recommended Charter Value			**2018**
Concept Planning/Public Consultation			$25,000
Detailed Planning and Design			$145,000
	Sub-Total - 2016 dollars		**$170,000**
Escalation to 2017	$170,000	2%	$3,400
Escalation to 2018	$173,400	3%	$5,200
Management Reserve	$173,400	4%	$6,900
TOTAL RECOMMENDED CHARTER - 2018			**$185,500**

Recommended Charter Value			**2019**
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$1,099,650	11.5%	$0
Site Servicing		n/a	$0
Structure/Building Construction			$1,099,650
Landscaping		n/a	$0
Project Management	$1,099,650	6.0%	$66,000
Public Art/Banding	$1,099,650	1.0%	$11,000
Commissioning and QA/QC	$1,099,650	1.0%	$11,000
Design Contingency Allowance	$1,099,650	10%	$110,000
	Sub-Total - 2016 dollars		**$1,297,650**
Escalation to 2017	$1,297,650	2.0%	$26,000
Escalation to 2018	$1,323,650	3.0%	$39,700
Escalation to 2019	$1,363,350	3.0%	$40,900
Management Reserve	$1,404,250	4.0%	$56,200
TOTAL RECOMMENDED CHARTER - 2019			**$1,460,450**

TOTAL RECOMMENDED CHARTER	**$1,645,950**

Charter Number		RECR-049
Charter Name		Neighborhood Park Construction
Department		Recreation and Parks
Year		2013-2023
Estimated Capital Cost		$25,670,761

Estimate Basis		
		No basis of the estimates included in the charter is available. Based on further discussion with City personnel, there was some indication that the estimate was developed using a cost per square meters of $43 per square meter. This amount was based upon cost estimates received from Consultants and in RFPs. City personnel indicated that this is a high-level number that will be refined once Park concept plans are developed and costing is completed.

Observations		
		The total Charter is broken down as follows; - 2019 - $4,544,600 - 2020 - $4,443,700 - 2021 - $10,724,061 - 2022 - $4,191,100 - 2023 - $1,767,300 Included in each year is a 1% allowance for Public Art. No other breakdowns are provided.

Analysis & Summary		
		The estimate appears to have been developed in conformity with the City of St. Albert's current policy for concept phase estimates, as it relies partly upon a parametric estimate. While the source for the cost per square meter provided was not provided to the city and therefore could not be validated, the process for developing the estimate appears to follow city policy.

Recommended Charter Value		
		Further back-up of base unit prices, applied areas, and estimate assumptions are required before the charter value can be validated.

Charter Number	RECR-050
Charter Name	Red Willow Park West
Department	Recreation and Parks
Year	2018-2019
Estimated Capital Cost	$4,660,891

Estimate Basis
The basis of the estimate is a detailed estimate (dated March 18, 2016) that appears to have originated in the Red Willow Park - Meadowview Concept Plan (dated June 3, 2003).

Observations
Estimate 2018 - The 2018 estimate is primarily for design services estimated in 2016 dollars at $250,000. This value is escalated at approximately 9% per year. Added to the escalated design value is a 20% contingency of $60,000, for a total of $360,000. The contingency applied also includes "Soft Costs," but no specific definition of these has been added. **Estimate 2019 -** The 2019 estimate is primarily for the construction works and is estimated at a 2016 value of $2,422,250. This has also been escalated by approximately 9% per year for a total construction value of $3,162,420. Added to this value is a 35% contingency of $1,106,847 that also includes "Soft Costs," but no specific definition of these has been provided.

Analysis & Summary
Estimate 2018 - Based our understanding of the scope, this value appears on the high-end of what we would anticipate and, as a result, we have reduced the Design Contingency Allowance to 10%. Clarification of the intent of the Soft Costs included is recommended.
Estimate 2019 - Based our understanding of the scope, in general, the unit prices appear fair and rational for the descriptions provided. Based on the level of information, we had assumed a Class 4 level of estimate and, based on the nature of scope, we have reduced the Design Contingency Allowance to 25%. Clarification of the intent of the Soft Costs included is recommended.

Recommended Charter Value			**2018**
Detailed Planning and Design			$300,000
Design Contingency Allowance	$300,000	10.0%	$30,000
	Sub-Total - 2016 dollars		**$330,000**
Escalation to 2017	$330,000	2%	$6,600
Escalation to 2018	$336,600	3%	$10,100
Management Reserve	$336,600	4%	$13,500
TOTAL RECOMMENDED CHARTER - 2018			**$360,200**

Recommended Charter Value			2019
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$2,422,250		$0
Site Servicing		n/a	$0
Structure/Building Construction			$2,422,250
Landscaping		n/a	$0
Project Management	$2,422,250	3.0%	$72,700
Public Art/Banding	$2,422,250	1.0%	$24,200
Commissioning and QA/QC	$2,422,250	1.0%	$24,200
Design Contingency Allowance	$2,422,250	25%	$605,600
	Sub-Total - 2016 dollars		**$3,148,950**
Escalation to 2017	$3,148,950	2.0%	$63,000
Escalation to 2018	$3,211,950	3.0%	$96,400
Escalation to 2019	$3,308,350	3.0%	$99,300
Management Reserve	$3,407,650	4.0%	$136,300
TOTAL RECOMMENDED CHARTER - 2019			**$3,543,950**

TOTAL RECOMMENDED CHARTER	**$3,904,150**

Charter Number	RECR-051
Charter Name	Grey Nuns White Spruce Park
Department	Recreation and Parks
Year	2018-2019
Estimated Capital Cost	$2,058,500

Estimate Basis
The basis of the estimate is a detailed estimate dated March 11, 2016.

Observations
Estimate 2018 - The 2018 estimate is primarily for design services estimated at $153,000. Added to the design value is a contingency of $30,000. No escalation appears to have been added.
Estimate 2019 - The 2019 estimate is primarily for the construction works and is estimated at a current value of $1,410,000 without contingencies. Added to this value is Construction Management ($100,000), Public Art ($14,100) and a contingency of $351,400.

Analysis & Summary
Estimate 2018 - Based our understanding of the scope, this value appears on the high end of what we would anticipate. We have allowed 11% of the base construction cost, and we have reduced the Design Contingency Allowance to 10%.
Estimate 2019 - Based our understanding of the scope, in general, the unit prices appear fair and rational for the descriptions provided. Based on the level of information, we had assumed a Class 4 level of estimate and, based on the nature of scope, we have reduced the Design Contingency Allowance to 15%.

Recommended Charter Value			**2018**
Detailed Planning and Design	$1,257,823	11%	$138,400
Design Contingency Allowance	$138,400	10.0%	$13,800
	Sub-Total - 2016 dollars		**$152,200**
Escalation to 2017	$152,200	2%	$3,000
Escalation to 2018	$155,200	3%	$4,700
Management Reserve	$155,200	4%	$6,200
TOTAL RECOMMENDED CHARTER - 2018			**$166,100**

Recommended Charter Value			2019
Land Determined Costs		n/a	$0
Concept Planning		n/a	$0
Detailed Planning and Design	$1,257,823		$0
Site Servicing		n/a	$0
Structure/Building Construction			$1,257,823
Landscaping		n/a	$0
Project Management	$1,257,823	3.0%	$37,700
Public Art/Banding	$1,257,823	1.0%	$12,600
Commissioning and QA/QC	$1,257,823	1.0%	$12,600
Design Contingency Allowance	$1,257,823	15%	$188,700
	Sub-Total - 2016 dollars		**$1,509,423**
Escalation to 2017	$1,509,423	2.0%	$30,200
Escalation to 2018	$1,539,623	3.0%	$46,200
Escalation to 2019	$1,585,823	3.0%	$47,600
Management Reserve	$1,633,423	4.0%	$65,300
TOTAL RECOMMENDED CHARTER - 2019			**$1,698,723**

TOTAL RECOMMENDED CHARTER	**$1,864,823**

Charter Number		TRAN-007
Charter Name		Transit North Park and Ride / Transit Centre
Department		Transportation
Year		2019
Estimated Capital Cost		$18,650,000

Estimate Basis		
		No detailed basis of the estimate included in the charter is available. Our review of the "Capital Region Board Expression of Interest for the Green*TRIP* Program" document (dated August 10, 2010) suggested that the initial cost estimates were based upon similar projects in Edmonton (see page 4 of the above document). Notably, however, the numbers appearing in the 2010 document varied significantly from those appearing in the Project Charter reviewed, with the former listed as $6,200,000. This variance requires additional information.

Observations		

Analysis & Summary		
		The estimate appears to have been developed in conformity with the City of St. Albert's current policy for concept phase estimates, as it relies partly upon an analogous estimate to similar City of Edmonton projects. While the precise project source was not provided in the material and therefore could not be validated, the process for developing the estimate appears to follow city policy.

Recommended Charter Value		
		Further back-up of base unit prices, applied areas, and estimate assumptions are required before the charter value can be validated.

Appendix C

Summary of Cost Estimating Practices within Alberta Municipalities

The findings below predominantly represent the views of municipality staff involved in building projects and transportation projects. This summary consists of findings from six municipalities, of which four participated in detailed, in-person interviews (City of Edmonton, City of Lethbridge, Strathcona County and City of Red Deer) and two (City of Calgary and City of Airdrie) partook in brief telephone interviews.

At a high-level, municipalities that were of comparable size to the City of St. Albert (including the City of Lethbridge, Strathcona County, City of Red Deer, and City of Airdrie) were found to be relatively similar to each other in terms of their cost-estimating practices, while larger municipalities (including the City of Edmonton and City of Calgary) adopted different methodologies due to the sheer nature and size of the projects undertaken.

Key components of the conducted interviews are summarized below.

1 General Overview

Municipalities such as Edmonton and Calgary employ dedicated estimation staff, while in other municipalities this responsibility is typically carried out by a project engineer, project manager or various other staff members.

In terms of policy and formal procedures, only of the comparable municipalities to the City of St. Albert has adopted written estimating policies; others do not appear to have written policies in place. Municipalities such as Edmonton and Calgary have written estimating practices and self-performing business units within these municipalities, which in turn have well-articulated estimating practices (at a level comparable to general contractors).

2 Variation in Estimates, Bid, and Final Cost

All of the municipalities interviewed experience variation between the estimate and the bid provided by the contractors. All also indicated that the cause for these variations is a result of market conditions. Recently, some municipalities have received bids within a 5% - 30% margin due to the current economic condition in Alberta. Usually, the variations are around 5-10% or more. Another reason for variation was due to contractors utilizing different construction methods instead of the methods assumed by the municipality.

All the municipalities also experience variation between contractor bid verses final cost. Major causes for these variations are scope changes or approved change orders. Some of the municipalities/units experience visits from the City Auditor's office when these variations are too high. Improper scope definition and irregularities in estimation contribute to this situation occurring.

3 Accuracy Level and Satisfaction by City Council

Most of the municipalities are satisfied with the level of accuracy in highway project estimates and somewhat satisfied with building project estimates. Elected officials and council members are somewhat satisfied with the level of accuracy provided by the estimates. As an example, when municipal staff identifies a unit cost of $200 – $300 CAD per square foot during the strategic stage of the estimate, consultants rarely exceed that amount. In renovation projects, some municipalities encounter issues in terms of level of accuracy and reliability. All the participants agreed that City councils need to be educated on these estimates and the level of accuracy; likewise, the basis for the estimates needs to be communicated. That transparency will help to increase City Council confidence and also provide an opportunity for City management to provide useful rationale to Council when projects under- or over-perform that estimate.

One of the comparable municipalities to St. Albert is in the process of introducing a Capital Projects division to improve the quality assurance process of the estimates. This unit will review the estimates before submitting to City Council. The approval process will also be broken down into two parts: projects in the strategic stage will go to council for design budget approval, while projects that satisfy the criteria corresponding to the concept stage (similar to a gated process) would go separately for construction budget approval. This allows Council to have control over projects. It is similar to the AFE (Approval for Expenditure) procedure used in the oil and gas industry.

4 Technology Usage in Estimation and Project Management

Larger municipalities such as Edmonton and Calgary use specialized software for cost estimation; other municipalities comparable to the City of St. Albert typically use Excel spreadsheets for estimating. Those municipalities use internally developed checklists (similar to St. Albert) to ensure that all necessary elements are incorporated in the estimate. One of the comparable municipalities is in discussion with Oracle Corporation to acquire a customized version of *Hyperion Planning* for budgeting, estimating, and planning purposes.

The most commonly used project management software among municipalities is MS Project for scheduling purposes. Other than that, some municipalities utilize SharePoint for workflows and document management purposes. Larger municipalities such as the City of Edmonton is developing a PMIS (project management information system) for project management.

5 Estimating Practice

All of the municipalities surveyed use classification systems to differentiate estimates. This is solely dependent upon the stage or life cycle of the project (strategic to award). Different levels of accuracy and contingency levels are used for different types of projects. One example is given below:

Project Phases	Project Type				
	Roadways	Drainage	Landscaping	New Buildings	Building Renovations
Strategic	±50%	-75% to 100%	±40%	N/A	N/A
Concept	±40%	±40%	±30%	-30% to +50%	-50% to +50%
Preliminary Design	±30%	±30%	±20%	-15% to +30%	-20% to +35%
Detail Design	±20%	±20%	±15%	-15% to +20%	-15% to +20%
Award	±10%	±10%	±10%	±10%	±10%

Estimating methods given below are used by municipalities in varying degrees

I. Expert Judgment
II. Analogous Estimating
III. Parametric Estimating
IV. Bottom-Up Estimating
V. Three-Point Estimating

These methods have different uses in different stages. As an example, in the strategic stage, most of the municipalities interviewed use expert judgement for estimating.

All municipalities use current year dollars for estimating and adjust for escalation and inflation in the budget by finance division.

For all municipalities, estimates are prepared in a consistent manner within a unit, while between units there are some differences. These differences are due to the nature of the work and differences in the unit leadership. Larger municipalities utilize the ISO 9001 quality management and quality assurance process to ensure consistent estimates within units and between units.

All of the municipalities have a written process on how to update estimates. They follow different processes depending on whether the estimate is developed by the consultants or within the municipality. All scope changes and change orders are part of this process. Depending on the dollar value, the department or unit might have to go back to Council for approval. When consultants manage the projects, they periodically update the municipality on the status of the project or cost.

Key Pros and Cons of the current estimating practices within the municipalities interviewed are given below:

Pros	Cons
Larger municipalities have their own estimate departments and as a result can easily change or update estimates.	Most of the municipalities have historical data. Unfortunately, these data points are often not stored properly, so there are difficulties in retrieving data.
In-house expertise can be better compared to outside consultants due to subject matter knowledge, depending on project type.	Unavailability of a lessons learned reporting system to create and disseminate the leant lessons.
Formal risk management and risk quantification system for larger projects.	Lack of guidelines to determine contingencies and sensitivity analysis to validate these contingencies (better contingency ranges for different project types).
Some smaller projects prepopulated excel sheets.	Absence of a tracking system to perpetual cost vs construction cost.
Quick turnaround time.	Some of the written processes are too cumbersome for small projects.

All of the municipalities agree that there is room to improve the processes currently utilized and most of the municipalities are working on different initiatives to improve current practices. As an example, some larger municipalities are in the process of introducing a common WBS structure for each project type, which will enable them to compare “apples to apples.” Some also mentioned that a robust lessons learned system should be introduced for continuous improvement within and between municipalities.

All the municipalities follow at least a simple internal peer review process for quality control. In some of the municipalities, larger projects utilize quality assurance through review by a construction manager or project manager before construction commences. Some comparable municipalities to the City of St. Albert lack this quality assurance process, while some are in the process of introducing this to their current practice.

All of the municipalities agree that estimation basis should be part of the estimate and that all of the project team members should know the basis of the estimate. Some of the municipalities are planning to implement a best practice to incorporate estimation basis as part of the estimate.

All of the municipalities use the following data sources for estimates

I. Outline agreements
II. Historical data
III. RS means
IV. Data from larger municipalities in the area

V. Historical data from Alberta Transportation

Most municipalities use SAP or JDE packages to track project cost. Still, this is a work-in-progress for most of the municipalities. All the municipalities have a written change management process.

All the municipalities present estimates as single values with a pre-determined level of accuracy rather than range estimates.

6 Independent Cost Consultants

All the municipalities review the estimates prepared by design consultants. In some instances, they utilize specialized cost consultants for the projects. Most of the municipalities do not rely upon cost consultants as they do not believe they will improve accuracy estimates. Municipalities mainly use cost consultants for large projects and unique projects. All the municipalities use consultants predominantly for building projects and rarely for road projects. The decision to hire consultants are based on following criterions;

- Cost of the project
- Complexity
- Lack of familiarity with the project (new and unique)
- Political (if a second opinion will help to make the case for the project)

7 Scope Definition and Contract Management

Scope definition occurs mainly in the strategy level and is updated throughout the project life cycle. None of the municipalities have a gated process, but have identified deliverables in each stage of the project. Certain check points are in place between project stages and need approval to move from one to another; however, a formal gate review process is not part of the execution.

Municipalities use most of the contract types given below

I. Lump Sum
II. Unit Rate
III. Integrated Project Delivery (IPD)/Alliance
IV. Guaranteed Maximum Price

Road projects use unit rate contracts most of the time, while building projects use lump sum contracts. Some of municipalities have utilized IPD-type contracts in some complex projects to minimize the risk while maximizing the benefits for project and stakeholders. Some of the comparable municipalities had success with a mixed contract approach that involves “cost plus contract with guaranteed maximum price clauses.” This is mainly used with design work.

8 Project Life Cycle

Project Development Stage	Prepared by (Role)	Typical Contingency %	Frequency of Updates
Preliminary Planning	Municipality	50% - 70%	Depends on project
Concept	Municipality or Design Consultant. If prepared by consultants, city reviews.	45% – 50%	Depends on project
Preliminary Design	Municipality or Design Consultant. If prepared by consultants, city reviews.		Depends on project
Detailed Design	Municipality or Design Consultant. If prepared by consultants, city reviews.		Depends on project
Construction	Municipality or Design Consultant. If prepared by consultants, city reviews.	10%	Depends on project

9 Risk and Contingency

Most of the municipalities use some kind of risk management process to determine contingency amounts or use expert judgment of the project team to determine the contingency amounts. All the municipalities have room for improvement in this area specifically to determine the unknown-unknown portion of the risks. All of the comparable municipalities to the City of St. Albert acknowledged room for improvement in risk management, as all of them use percentages of cost rather than a risk-driven approach for contingency. Some of the municipalities use expert judgment as means to determine contingency for projects.

10 Procurement

All of the municipalities have a centralized procurement group with the capability to single-source with some limitation (e.g., up to $10,000 CAD for professional services and up to $200,000 CAD for construction).

Appendix D

Project Definition Rating Index (PDRI)

The Project Definition Rating Index (PDRI) is a powerful and simple tool that offers a method to measure project scope definition for completeness. The PDRI offers a comprehensive checklist of scope definition elements in an easy-to use score sheet format. Each element is weighted based on its relative importance to the other elements. Since the PDRI score relates to risk, those areas that need further work can easily be isolated. The PDRI identifies and precisely describes each critical element in a scope definition package and allows a project team to quickly predict factors impacting project risk. It is intended to evaluate the completeness of scope definition at any point prior to the time a project is considered for development of construction documents and construction.

The PDRI consists of three main sections, each of which are broken down into a series of categories which, in turn, are further broken down into elements. A sample of a complete list of the PDRI's three sections, categories, and elements, which was initially customized by the City of Edmonton for its Drainage Projects is given following an initial discussion.

In order to provide the most value to the City of St. Albert, a team of City project professionals should be formed to customize the PDRI to the City's projects. Each of the PDRI elements should be reviewed for applicability to the corresponding projects and their descriptions should include the City-specific terminology and administrative requirements.

1 Benefits of PDRI

A significant feature of the PDRI is that it can be utilized to fit the needs of almost any individual project, small or large. Elements that are not applicable to a specific project can be zeroed out, thus eliminating them from the final scoring calculation. It is a "best practice" tool (advocated by the Construction Industry Institute [CII]) that can provide numerous benefits to municipalities, including:

- A checklist that a project team can use for determining the necessary steps to follow in defining the project scope
- A listing of standardized scope definition terminology throughout the City
- An industry standard for rating the completeness of the project scope definition package to facilitate risk assessment and prediction of escalation, potential for disputes, etc.
- A means to monitor progress at various stages during the front-end planning effort
- A tool that aids in communication and promotes alignment between the City and its contractors by highlighting poorly defined areas in a scope definition package
- A means for project team participants to reconcile differences using a common basis for project evaluation

- A benchmarking tool for the City to use in evaluating completion of scope definition versus the performance of past projects

2 Scoring a Project

Individuals involved in the front-end planning effort should use a Project Score Sheet similar to the one shown in this Appendix when scoring a project. Note that two score sheets should be available: the first is simply an unweighted checklist and the second contains the weighted values and allows a front-end planning team to quantify the level of scope definition at any stage of the project on a point scale. The unweighted sheets should be used in the team scoring process to prevent bias in choosing the level of definition and "targeting" a specific score. The team leader or facilitator can easily score the project as the weighting session is being held.

PDRI templates are usually organized in three sections for systematic assessment of the:

- Basis of project decision – the business objectives and drivers
- Basis of design – processes and technical information required
- Execution approach – for executing the project construction and closeout

Each section is broken down into categories and elements. The element is the lowest level of the index where the assessment of scope definition is conducted. Elements should be rated numerically from 0 to 5. The scores range from 0 - not applicable, 1 - complete definition to 5 - incomplete or poor definition as indicated in the legend at the bottom of the score sheet. The elements that are as well defined as possible should receive a perfect definition level of "one." Elements that are not completely defined should receive a "two," "three," "four," or "five," depending on their levels of definition as determined by the team. Those elements deemed not applicable for the project under consideration should receive a "zero," thus not affecting the final score. The definition levels are defined as follows:

Definition Levels
0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

All elements have five pre-assigned scores, one for each of the five possible levels of definition. Only one definition level should be chosen (0, 1, 2, 3, 4, or 5) for that element based on the perception of how well it has been addressed. Once the appropriate definition level for the element have been chosen, the value of the score that corresponds to the level of definition

chosen should be written in the “Score” column. This should be done to all elements in the Project Score Sheet. Each of the element scores within a category should be added to produce a total score for that category. The scores for each of the categories within a section should then be added to arrive at a section score. Finally, the three section scores should be added to achieve a total PDRI score. Importantly, the City should identify a PDRI benchmark score to measure against. For example, the CII PDRI for building projects indicates a PDRI score of 200 or less has been shown to greatly increase the probability of a successful project. The determination of this PDRI benchmark score will typically require an initial setup meeting between the front-end planning team and other key project team members.

Project: _____ **Date:** _____

Project Manager: _____

Facilitator: _____

Status of Project: _____

Overall	Score	Max Score
Section I - Basis Of Project Decision	-	-
Section II - Basis Of Design	-	-
Section III - Execution Approach	-	-
TOTAL	**-**	**-**
PDRI TOTAL MAXIMUM SCORE	**N/A**	

Top ten - Business	Score	Max Score
1. B3. Project Execution Strategy	-	-
2. B5. Capacities to commence/continue project	-	-
unit, automated total station surveying, Simulation		
3. Models)	-	-
4. alignment	-	-
5. D3. Site Characteristics Available vs. Required	-	-
6. B2. SSSF Funding Strategy	-	-
7. D1. Project Objectives Statement	-	-
8. B3. Project Execution Strategy	-	-
9. D2. Project Design Criteria	-	-
10. A1. Reliability of subcontractors and consultants	-	-
TOTAL	**-**	**-**
PDRI BUSINESS SCORE	**N/A**	

Top ten - Technical	Score	Max Score
1. G1. Mobilization plan	-	-
2. F1. Site Location	-	-
3. G3. Laydown drawings	-	-
4. G2. Procurement plan	-	-
5. F3. Environmental Assessment (ECO plan, ESC)	-	-
6. F5. Utility Sources with Supply Conditions	-	-
7. G9. Mechanical Equipment List	-	-
8. G6. TBM Specifications for eg. teeth, foam unit, doors	-	-
9. G8. Geotechnical information	-	-
10. H1. Equipment Status	-	-
TOTAL	**-**	**-**
PDRI TECHNICAL SCORE	**N/A**	

Project: _____ **Date:** _____

SECTION I - BASIS OF PROJECT DECISION

CATEGORY / Element	Definition Level 0	1	2	3	4	5	Score	Comments
A. MANUFACTURING OBJECTIVES CRITERIA							0	
A1. Reliability of subcontractors and consultants								
A2. Maintenance availability								
A3. Operating Philosophy								
B. BUSINESS OBJECTIVES							0	
B1. Knowledge and partnering with construction planning branch.								
B2. SSSF Funding Strategy								
B3. Project Execution Strategy								
B4. Affordability/Feasibility of Budget								
B5. Capacities to commence/continue project								
B6. Future Expansion Considerations (Stubs)								
B7. Expected Project Life Cycle								
B8. Social Issues and stake holder involvment								
C. BASIC DATA RESEARCH & DEVELOPMENT							0	
C1. Technology available and encorporated (foaming unit, automated total station surveying, Simulation Models)								
C2. Legal entitlement check for the proposed alignment								
D. PROJECT SCOPE							0	
D1. Project Objectives Statement								
D2. Project Design Criteria								
D3. Site Characteristics Available vs. Required								
D4. installing and removal Requirements for TBM								
D5. Lead/Discipline Scope of Work								
D6. Project Schedule detail								
E. VALUE ENGINEERING							0	
E1. scenarion based simulation completed and most preferred scenario								
E2. Design & Material Alternatives Considered/Rejected								
E3. Design for Constructability Analysis								
							Total score	0

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

Project: _____ **Date:** _____

SECTION II - BASIS OF DESIGN

CATEGORY / Element	Definition Level 0	1	2	3	4	5	Score	Comments
F. SITE INFORMATION							0	
F1. Site Location								
F2. Surveys & Soil Tests								
F3. Environmental Assessment (ECO plan, ESC)								
F4. Permit Requirements (first call, OSCAM)								
F5. Utility Sources with Supply Conditions								
F6. Fire Protection & Safety Considerations								
G. CMP Plan							0	
G1. Mobilization plan								
G2. Procurement plan								
G3. Laydown drawings								
G4. Safety Management plan								
G5. Utility plan								
G6. TBM Specifications for eg. teeth, foam unit, doors.								
G7. Tunnel Requirements (segments, track)								
G8. Geotechnical information								
G9. Mechanical Equipment List								
G10. Staging Requirements								
G11. Connection knowledge and Asbuilts								
G12. Specialty equipment requirements (segments etc.)								
G13. Commissioning knowledge								
H. EQUIPMENT SCOPE							0	
H1. Equipment Status								
H2. Equipment Location Drawings received/planned to								
H3. Equipment Utility Requirements								
I. CIVIL, STRUCTURAL, & ARCHITECTURAL							0	
I1. Civil/Structural Requirements for Entire Project								
I2. Architectural Requirements Civil works contractors (pump house and/or transformer civil works design)								
J. INFRASTRUCTURE							0	
J1. Existing infrastructure Requirements (existing pumphouse)								
J2. Loading/Unload./Storage space Req'mts								
J3. Transportation Requirements and plan (TBM, Drill Rig)								
K. INSTRUMENT & ELECTRICAL							0	
K1. Temp / Preminant transformers availability from EPCOR								
K2. Mole Cable and structure storage								
K3. Phone line from Telus planned to be installed to transformers								
K4. Power Sources Identified								
K5. Transformer and Gantry plan (when and where to locate transformers)								
K6. Instrument & Electrical Specifications (500KV transformer)								

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

Project: _____ **Date:** _____

SECTION III - EXECUTION APPROACH

CATEGORY / Element	Definition Level 0	1	2	3	4	5	Score	Comments
L. PROCUREMENT STRATEGY							0	
L1. Identify Long Lead/Critical Equipment & Materials								
L2. Procurement Procedures Plan/tender documents								
L3. Procurement Responsibility assigned								
M. DELIVERABLES							0	
M1. Overall Tunnel Construction Requirements Materials and								
M2. Deliverables Defined (Tunnel Objectives through simulation								
M3. Distribution/monitoring of Flow durring construction for saftey, and also after construction structures.								
N. PROJECT CONTROL							0	
N1. Project Manager Requirements defined and communicated								
N2. Project Accounting/ cashflow/ workpackage cost Requirements defined through Simulation models								
N3. Risk Analysis completed and Risk Management Plan in place								
P. PROJECT EXECUTION PLAN							0	
P1. Has The Owner Approved the Construction Requirements								
P2. Engineering/Construction Plan & Approach								
P3. Shut Down/Turn-Around plan in place durring christmas and extended holidays								
P4. Commissioning and maintenance requirements								
P5. Mobilization requirments met and communicated to								
P6. Training Requirements (crews, TBM operator)								

Definition Levels

0 = Not Applicable
1 = Complete Definition
2 = Minor Deficiencies
3 = Some Deficiencies
4 = Major Deficiencies
5 = Incomplete or Poor Definition

Appendix E

Planning Exercise Descriptions

1 Value Engineering

Value Engineering typically follows the process and standards published by the Society of American Value Engineers (SAVE) International, and is guided by a certified value facilitator (e.g., a Value Methodology Associate [VMA], Associate Value Specialist [AVS], or Certified Value Specialist [CVS] or equivalent). Value engineering has been used since 1947 to improve the function and optimize the cost of an incredible range of designs, from small appliances to major construction projects. The method works by engaging a multidisciplinary team to break down the study item into its key functions, generate creative ideas for meeting those functions, and evaluate those ideas through the lens of value: the ratio of function to cost. Value Engineering is used all over the world by thousands of practitioners.

Value Engineering can be performed at several different levels, depending on the project complexity and the needs of the client. Value Engineering is also used very effectively as a decision support methodology for situations where one solution is sought, rather than multiple suggestions. The same structured process is used in all cases.

The Value Engineering process consists of three stages (pre-workshop, workshop and post-workshop), and the workshop is comprised of six phases, shown in Figure 1.

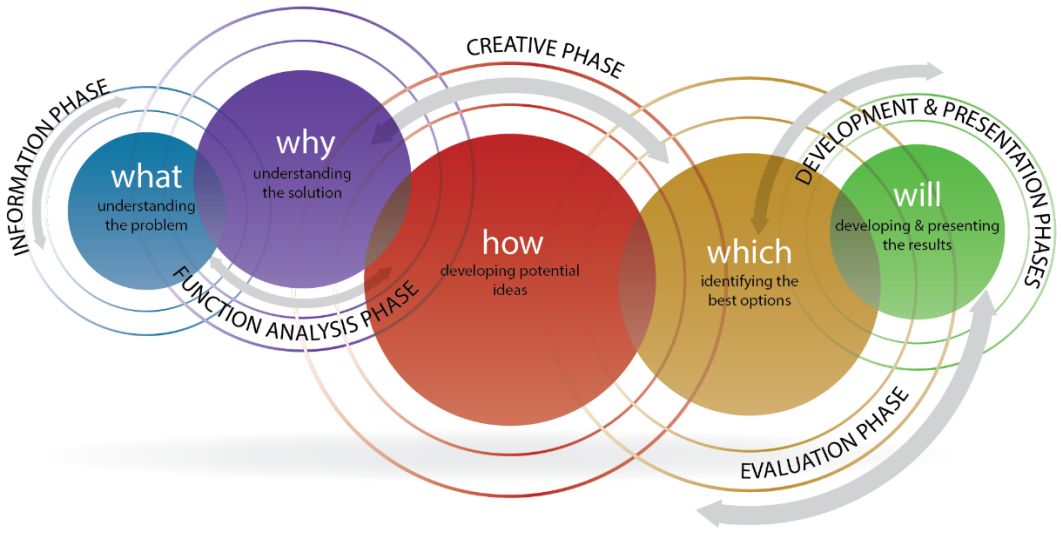

Figure 1. Steps in the Value Analysis Process (Image: SMA Consulting Ltd.)

1.1 STAGE I: PRE-WORKSHOP/STUDY STAGE

The key purpose of this stage is to plan and organize the Value Study. Common activities include:

- Obtain senior management support for the job plan, responsibilities, and roles.
- Develop the scope and objective for the Value Study
- Obtain and review project data and key documentation
- Identify and prioritize strategic issues of concern
- Develop the study schedule and determine team members
- Review project cost/develop information model
- Agree on workshop logistics, agenda, objective, timing, location, etc.

1.2 STAGE II: WORKSHOP/STUDY STAGE

A Value Engineering Workshop includes the six phases shown above in Figure 1. Once the Pre-Workshop Stage is complete, the Workshop Stage can begin.

1.2.1 Phase I: Information Phase

The purpose of the Information Phase is to understand the current state of the project and any constraints that have influenced project decisions. Common activities include:

- Obtain project data, information, and key documents
- Identify and prioritize strategic issues of concern
- Project team presents the original/current design concepts
- Perform competitive benchmarking analysis (such as Benchmarking, Pareto Analysis)
- Visit site or facility
- Determine study logistics
- Distribute project information
- Define performance attributes
- Develop understanding for:
    - Project scope
    - Schedule
    - Budget
    - Risk
    - Costs
    - Issues
    - Non-monetary performance
    - Confirm most current project concept
    - Identify high-level project functions
    - Confirm success parameters

The typical outcome of this phase is to bring the team to a common, basic level of understanding of the project.

1.2.2 Phase II: Function Analysis

The purpose of function analysis is to understand the project from a functional perspective: 'what must the project *do* to be successful?'. The key goal is to determine the functions and how are they related. Common activities in this phase include:

- Random function generation
- Classify project functions
- Develop function models
- Dimension the model of the cost drivers
- Estimate worth of functions (value index=function cost/function worth)

This phase focusses the team on validating that the project satisfies the needs and objectives of the customer, and it provides a more comprehensive understanding of the project by focusing on what it must do, rather than what it is. It also serves to identify value mismatched functions, and opportunities for improvement.

1.2.3 Phase III: Creativity Phase

The purpose of the Creativity Phase is to generate a large quantity of ideas for alternative ways for the project to perform the functions which have been identified. Common activities include:

- Conduct creative warm-up exercise
- Establish rules that protect creativity
- Employ group idea stimulation techniques
- Generate alternative ideas that may improve value
- Produce solution quantity not quality
- Brainstorming is: team effort, force ideas, everything goes, jump on the bandwagon

The typical outcome of the Creative Phase is a wide variety of ideas that provide possible alternatives for performing the functions of the project and improving its value.

1.2.4 Phase IV: Evaluation Phase

The purpose of the Evaluation Phase is to evaluate the ideas which have been produced, reducing the quantity of ideas to a short list with the greatest potential to improve the project. In the case of a Decision Support Value Engineering Workshop, only one option will be carried forward. The key question being asked in this phase is: of all these ideas, which are worth spending quality time to further develop? Common activities include:

- Clarify and categorize each idea to develop shared understanding
- Discuss how the ideas affect project cost and performance parameters
- Select and prioritize ideas for further development
- Explain how ideas are to be written as a standalone risk-reward investment proposal
- Perform differential risk analysis
- Determine criteria and weight criteria using pair-wise comparison and the Analytic Hierarchy Process (AHP)
- Score options using weighted criteria

The typical outcome from the Evaluation Phase is the selection of one or more concepts that

warrant quality time to develop into value-based solutions that can be implemented into a project or a project feature.

1.2.5 Phase V: Development Phase

During the Development Phase, the study participants further analyze and develop the short list of ideas, developing those with merits into value alternatives. The key purpose of this phase is to clearly describe each selected idea, develop a rationale for making each change, and identify ideas which are mutually exclusive. Common activities include:

- Compare the study conclusion to the measure of success defined during the information phase
- Prepare a written value alternative for each idea selected for further development
- Assess and allocate risk judgment and cost where appropriate
- Conduct cost/benefit analysis
- Generate sketches and information needed to convey the concept
- Confirm that the alternative should be further developed
- Finish initial alternative development
- Develop action plan

Ultimately, the value study team creates alternatives and low-medium-high risk scenarios, and offers these alternatives to senior management as holistic options that address the pre-workshop objectives.

1.2.6 Phase VI: Presentation Phase

During the Presentation Phase, the value study team present their value alternatives to the management team and other project stakeholders. An idea which has value may conflict with strategic plans; it is vital that senior management understand the ideas being presented. Activities include:

- Prepare presentation and supporting documents
- Compare the study conclusion to the success requirements
- Offer management “risk-reward” innovation scenarios to select value alternatives
- Exchange information
- Ensure management has full and objective information upon which they can make decisions
- Outline an anticipated implementation plan
- Prepare formal report

The final outcome of this phase is the formal report, but if possible it is best to have the value study team present their findings in person to allow for questions.

1.3 STAGE III: POST-WORKSHOP/STUDY STAGE: IMPLEMENTATION AND FOLLOW-UP

The post-workshop implementation stage is the most important of all of the preceding phases, as an idea which is never implemented means a benefit which will never be realized. The

project team must develop a plan for how to implement and track the ideas developed during the study. Activities of this phase include:

- Review preliminary report
- Conduct implementation meeting
- Establish action plan
- Set time frame
- Track value achievement resulting from implemented alternatives

Ultimately, the stakeholders will determine what will be changed in the project as a result of the value study.

2 Risk Assessment and Management

There are numerous approaches used for Risk Assessment and Management. An approach that SMA has developed over the past 20 years and in collaboration with the University of Alberta is the “Structured Risk Analysis Process.” This approach makes use of a rigorous technique to understanding the projects context and then filtering this context down to the key risks and risk drivers on the project. This creates a clear picture of how risks arise and subsequently how they could impact the project, thereby allowing for efficient and effective mitigation of risks through the planning, design, construction, and operations phases of the project. The context based approach combined with our risk quantification techniques honed over the last 20 years and use of Monte Carlo Simulation create an accurate picture of risk exposure on the project and a clear path to reducing it. The analysis is carried out in multi-disciplinary brainstorming sessions guided by our expert facilitators and our structured approaches. Banks of risk factors from past projects and our research capabilities are used to augment these sessions. The process involves 4 primary steps: risk identification, risk quantification, risk mitigation and allocation, and risk monitoring and control (see Figure 2).

Figure 2. Risk Management Steps (Image: SMA Consulting Ltd.)

2.1 RISK IDENTIFICATION

The identification process starts with a comprehensive register of construction project Risk Issues, general risks that could be realized but are not specific enough to quantify or mitigate (e.g. “Traffic Issues”). Each Risk Issue will contain numerous specific Risk Events that will be quantified and tracked separately. The Issues register is narrowed down to only include the issues relevant to the project, giving the team a starting point for detailed risk identification.

Understanding the project’s context is essential to rigorous risk identification. A contextualizing approach can be used that develops a comprehensive view of the project by determining its Physical, Process, Participant, and Environmental contexts. The Physical Context encompasses the project deliverables, what is being built, and where it is being built. The Process Context is the schedule or sequence of events and activities required to complete the project. The Participant Context identifies all the stakeholders/parties involved or impacted by the project. Finally, the Environmental Context refers to the natural and man-made environments that the project is situated in.

Each context category is populated with all information relevant to the project, and we use this information to answer a series of pre-established questions to determine risk-related attributes of each context item. These questions help to identify the areas of the project that may be of concern regarding Risk Events, and may themselves become risk drivers (a risk driver is a potential root cause of a risk). By following this structured process of understanding the project, we gain a clear and robust understanding of the potential areas of risk. This not only allows a thorough identification of risk factors relevant to the project, but provides immediate feedback on their root causes, thereby informing the quantification and mitigation processes that will follow.

The risk identification process is initiated by the risk analysts, and information is populated through review of project documents, review of our library of past project risks and lessons learned, and interviews with subject matter experts and project team members.

Once the context is clearly outlined and understood, an iterative linking process is conducted by running through the register of Risk Issues one by one, and linking these to the related context items and attributes. If the context attributes expose an area of potential risk, a Risk Event is created within that Risk Issue category. In developing these risk events, the aim should be for clear, concise, unique, and quantifiable descriptions.

Once a preliminary risk register is developed, a risk analysis workshop is held with the project team to review and refine the register. The end result is a list of Risk Events organized according to high level Risk Issues and associated with all potential causes and area of impact.

2.2 RISK QUANTIFICATION

Once an understanding of the Risk Events is gained, the risks are quantified in terms of their probability of occurrence, impact to the project and stakeholders, and severity or level of importance of the risk. This can be determined holistically (the risk’s impact on the project as a

whole), or, if the risk is associated with specific work packages, the probability and impact can be determined for each work package.

2.2.1 Probability

Probability is a key facet in determining the importance of risk, but defining it is one of the most difficult tasks. Often there are differing views on probability, for instance what a probability descriptor such as “Unlikely” means in percentage terms (10%? 25%?). To overcome this, SMA’s probability table (shown below) was built off of University of Alberta research and an industry-wide survey to determine what each probability descriptor represents. Further, a distribution is used to represent the probability range instead of a single value. Flexibility is allowed, and the probability of any risk event can be modified to reflect a more customized range if required.

Likelihood	Description	Most Likely	Minimum	Maximum
Very Likely	Almost certain that it will happen, and with very frequent occurrence	90%	70%	100%
Likely	Has a good chance of happening, but certainly not a given	70%	50%	90%
Somewhat Likely	Some doubt if it will materialize, but still a reasonable chance it could occur	55%	35%	75%
Unlikely	Small likelihood, but could still happen	30%	0%	60%
Extremely Unlikely	Just possible, but would be very surprising	10%	0%	25%

2.2.2 Impact

Impact is similarly determined using a pre-defined table with descriptors and associated impact values. The key is that impacts can be of several different types: cost, schedule, goals, safety, etc. and quantification must be able to accommodate each type. SMA uses a pre-determine list for descriptors, but the impacts are customized to the type and scale of the project. A sample cost impact table is shown below.

Impact	Description	Minimum	Maximum
Disastrous	The impact is totally unacceptable to the organization – value established by owner.	50%	100%
Severe	Serious threat to the project success, threat to organization or public.	15%	50%
Substantial	Considerably affects cost, schedule or other criteria	5%	15%
Moderate	Moderately affects cost, schedule or other criteria	2%	5%
Marginal	Small effect on cost, schedule or other criteria	0.1%	2%
Negligible	Trivial effect on cost, schedule or other criteria	0%	0.1%

2.2.3 Severity

Severity determines the level of imporance that each risk has on the project, and it is a starting point for determining risk treatment. The severity of a Risk Event is determined by multiplying the probability by the impact. These results can be communicated in several different ways including SMA’s severity score, cost risk allowance, and schedule risk allowance. The

placement of severity is dependent on the owners risk appetite and will be customized to the project.

Total Severity Value	Category	Response
Over 10,000	Intolerable	Risk has potential to jeopardize success of project. Must reduce, eliminate or transfer risk. High-priority item for mitigation whether in planning, design, construction or operations. May consider not proceeding until risk can be reduced.
5,001-10,000	Critical	Expected impact to the project is high in its current state. This risk is highly recommended to be reduced, eliminated or transferred before proceeding with procurement and/or construction of the project.
1,001-5,000	Serious	Expected impact is significant enough to warrant further investigation and mitigation. It is probably cost effective to reduce risk through planning and design activities. If not, eliminate or transfer this risk.
201-1,000	Important	Mitigate through planning and design, consider eliminating or transferring. If accept, then manage proactively.
26-200	Acceptable	Accept and manage.
0-25	Negligible	Insignificant. Not required to be on the risk register.

2.2.4 Simulation

Although the risk quantification can be used as static values, the true extent of risk exposure on the project and the level of severity of each risk is best quantified through simulation. Since our inputs are in the form of distributions, we have the capability of conducting Monte Carlo simulation, and we generally recommend this analysis be undertaken on the costs and schedule impacts.

2.3 RISK MITIGATION AND ALLOCATION

Once the identification and quantification have been completed, a risk mitigation strategy is developed for the project. This is described below:

1. Decide on the actions to be taken in response to key risks. Actions can include:
    a. Reduce uncertainty by obtaining more information. (This generally leads to a re-evaluation of the likelihood and sometimes the magnitude.)
    b. Eliminate or avoid the risk factor through means such as partial or complete modifications to the proposed ideas, a different strategy or method, etc.
    c. Transfer the risk element to other parties.

d. Insure against the occurrence of the factor if and when possible.

2. Plan mitigation actions for risks.

The key to developing effective risk mitigation actions is to pinpoint the root causes of risk events and determine which actions reduce those causes and prevent the subsequent risks from materializing. A root cause analysis can be undertaken on the risk causes that were identified during the risk identification phase. They are sequentially ordered and prioritized in terms of which risks they are linked to, how many risks they are linked to, and the relationships between causes. Once this is understood, mitigation actions are developed and assigned timelines and responsible parties during the risk monitoring and controls stage.

Risk allocation is a primary component of risk mitigation. Proper allocation of risk between the parties involved in a project will yield the lowest risk exposure and consequently the lowest cost on a project. Optimal risk allocation is achieved if the party most able to control a risk is responsible for it.

2.4 RISK MONITORING AND CONTROL

Understanding the risks is only useful if it results in a plan to manage them: this stage converts the risk register developed in the previous stages into a risk management plan. This process formalizes the risk responses by defining specific tasks to be undertaken which will mitigate the risk, setting the timelines of these tasks, assigning the responsibilities for each risk, and establishing a framework that ensures that risk factors are followed up with on a regular basis until the project is complete. This is summarized as follows:

1. Develop a risk control plan. This should be composed of a set of tasks for each risk factor with responsibility and delivery date assigned (relative to a given project).
2. Require that the risk control plan be properly maintained.
3. Report changes and repeat risk identification and quantification if conditions change.

3 Constructability Review

Constructability Review is a best practice approach recommended by the Construction Industry Institute. It focuses upon “the optimum use of construction knowledge and experience in planning, design, procurement, and field operations to achieve overall project objectives.” One approach to Constructability Review involves providing an in-depth analysis of the design from the contractors’ perspective, utilizing a multidisciplinary team approach, assisted by structured guidelines and identification of key issues which need to be addressed.

The constructability review will typically include reviewing the current design and defining project components, construction methods, site layout and access, and construction sequencing and scheduling. In addition, any new construction options that may present themselves will be

recorded and analyzed as necessary. It is also possible to incorporate an operability review by modeling project components within simulation models developed using state-of-the-art modeling environments. Sensitivity analysis of the project components is carried out, allowing us to point out operability issues.

Workshop facilitation is carried out starting with an overview of the project's current status and design. This is followed by a review of the construction methods, sequencing, and schedule to be used for the proposed options. During this review, additional design and construction options are presented and briefly analyzed in order to make the proper decisions.

The following steps are typically taken in completing the constructability review for a project:

- **Step 1:** The team develops an understanding of the project, its constraints, design, and underlying assumptions.
- **Step 2:** The team becomes familiar with the plans, learning what features are existing and proposed.
- **Step 3:** The team identifies potential conflicts and evaluates the proposed design in detail.
- **Step 4:** The team starts developing concepts "as a contractor would build the project" under the given constraints. This allows us to develop alternatives for the design and/or to recommend enhancements where applicable.
- **Step 5:** The staging plan and schedule are put together based on various assumptions regarding achievable productivities and methods of construction.

The participants also discuss general constructability issues such as the site layout, coordination with other projects in the area and other departments in the municipality, and so forth.

4 Stakeholder Engagement

4.1 STAKEHOLDER IDENTIFICATION

Stakeholder identification is a vital aspect of any workshop and is especially important as part of public involvement and engagement. Stakeholders can be defined as those who have an interest in or may be impacted by the outcome of a project. While an internal stakeholder group will be composed of representatives from the specific City of St. Albert department responsible for the project as well as any other relevant municipal departments, other groups will be determined using Best Practices for stakeholder involvement, developed by the International Association for Public Participation (IAP2).

These practices include:

- Identifying groups and individuals with interest in the project outcome or who will be impacted by it

- Identifying key members or organizations in the community and further developing a potential stakeholders list through discussion with them
- Proactively identifying groups that may be difficult to reach or not typically considered as part of the public

Stakeholders should be kept informed throughout all stages of the project and should be communicated with on an ongoing basis to resolve access issues and respond to concerns and general questions and inquiries. To ensure that this requirement is met, stakeholder identification should be accompanied by a communications plan to further enhance the Public Involvement Plan, which will form the base document for the engagement exercise.

The communications plan includes strategies for reaching each of the identified stakeholder groups. As with the public involvement process, form will follow function in communications, meaning that the needs and values of the stakeholder group members will dictate the best form for communicating with them. To begin to understand these values and needs, a high-level correlation matrix of stakeholders with project issues should be developed. This matrix will provide additional information regarding each stakeholder group (including key contacts) as well as evaluating each stakeholder's level of concern regarding the issue and the level of impact the issue might have upon stakeholders in general.

Communications strategies can be implemented through several methods, including (but not limited to):

- Print media
- Websites and social media
- Broadcast media
- Coordination with existing City communications approaches and mechanisms
- Coordination with translators and other interpretive services where required to accommodate diverse stakeholder groups throughout the process

4.2 PUBLIC INVOLVEMENT

There are numerous approaches to public consultation and involvement. The international body for public participation is the International Association for Public Participation (IAP2). One approach to public consultation and involvement involves three phases: (1) Planning Phase, (2) Design Phase and (3) Delivery Phase.

The Planning and Design Phases focus on planning and refining the approach to use for the public consultation effort, including the identification of needs and resources and the study of the parameters that would define the public consultation process. As early as possible in the Public Involvement process, the municipality should be contacted to determine at what level the public involvement will be held. To involve the public transparently means being clear from the beginning about what contributions are being asked for from the public. This could be anything from an invitation to hear information provided by City representatives, to various degrees of consultation involving the invitation to provide feedback, to involvement in the decision-making process.

This factor and the other demands of the individual project, combined with the particular needs of the stakeholders identified during that stage of the planning phase, will directly feed into the Public Involvement Plan development and design phase in general. The Design Phase therefore includes the definition of the process to be carried out, making sure that it complies with any municipal requirements. Appropriate techniques for understanding the public's interaction with the project will be determined only after the planning decision-making has been completed.

The Delivery Phase consists of carrying out the facilitation, reporting, and providing follow-up as planned.

4.2.1 Techniques

As noted, depending on the requirements of each project, the public consultation effort can include a range of traditional and dynamic tools and techniques for encouraging, gathering, and documenting public feedback.

These techniques include the following:

- Public presentations and open houses.
- Opinion surveys (web-based, paper based) based on sound statistical design of experiments.
- Facilitation of large events during the public consultation process using a partnering approach to projects.

Appendix F

Basis of Estimate[1]

The Basis of Estimate (BOE) is a document that details the assumptions and background for the elements of a project cost estimate (e.g., cost and labor estimates, material availability, any assumptions or deviations, any studies or analysis used as a reference and any other details that have impacted the cost estimates). Numerous major academic and industry bodies, including the Project Management Institution (PMI)[2] and AACE International have underscored the importance of maintaining detailed documentation as part of an organization's estimating development process. The following sections describes the suggested topics and contents included in a typical BOE, according to the AACE International's *Recommended Practice No. 34R-05*.

1. Purpose

This initial section it to provide a description of the total project, identifying the type of project as well as the capacity of the process units, the location of the facility, and the overall timing of the project.

2. Project Scope Description

This section should provide a semi-detailed description of the scope of work for each major segment of the project. The AACE International recommends organizing this section in accordance with the project's work breakdown structure as well as indicating the primary trades that will be involved with the project.

3. Methodology

This section describes the primary estimating methodology used to prepare the cost estimate. This should include documentation of the use of cost resources, historical data and project benchmarking. Documenting the level of effort or man-hours used in preparation of the estimate is also recommended.

4. Estimate Classification

In accordance with the estimate classification system adopted by the organization, this section identifies the estimate classification that is corresponding to the BOE under development, along with reasons or justification used in the selection of the estimate classification.

5. Design Basis

In this section, the estimator will identify the types and status of engineering and design deliverables that were provided to prepare the estimate including any design basis assumptions. A listing of all engineering drawings (including revision number and date), as well as other design information should be referenced and attached to the estimate basis.

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[1] This section relies upon the Basis of Estimate contents recommended by the AACE International (2014), *Recommended Practice No. 34R-05* and draws upon the definitions included therein.

[2] Project Management Institute. (2013). *A Guide to the Project Management Body of Knowledge.*

6. Planning Basis

In this section, the estimator should document the project management, engineering, design, procurement, fabrication, and construction approaches to the project. The estimator should also identify the overall project schedule and key milestones, the contracting and resource strategies, as well as any assumptions that were made with regard to the workweek schedule, planned use of overtime, constructability, modularization and use of specialized construction equipment.

7. Cost Basis

In this section, the estimator should describe the methods and sources used for determining all material, labor and subcontract pricing. Identify the following:

- Pricing sources for all major equipment (vendor quotes, historical data, etc.).
- Bulk material and commodity pricing sources, including any discount strategies.
- The pricing source for all labor hours, and all labor productivity adjustments. Provide appropriate detail if productivities vary by trade and/or location within the project (plant, etc.).
- All wage rates used (including crew/craft rates, craft mix, etc.). Identify all items included in all-in rates (if used).
- Pricing source and methodology for construction indirects.
- Pricing source for all start-up costs.
- Pricing source and methodology for all home office costs (project management, engineering, design, etc.). Document the basis for any contractor fee costs.
- Pricing source and methodology for costs such as freight, taxes, duties, etc.
- Pricing source for any owner's costs included in the estimate.
- Currency exchange rates if applicable, as well as the stability and/or volatility of rates.
- Escalation indices used, and the method of calculation (including duration).
- Contingency development and basis.
- Location factors used and the basis for these factors.
- Influence of local market conditions.
- Capital costs vs. expense costs, or other categorization as necessary.
- Any other pricing factors or external influences that may have a significant impact on project cost should be identified.

8. Allowances

The level and types of allowances used in the estimate should be described in this section along with a description of the basis for the common estimating allowances such as design allowances for engineered equipment, working height allowances, etc. Also, the estimator should describe any other costs that have not been detailed in the body of the estimate, such as lump-sum allowances for specific areas of scope.

9. Assumptions

In this section, all assumptions, regardless of their impact, which have been made by the estimator, but not documented elsewhere in the estimate basis, should be described.

10. Exclusions

This section should document all potential items of cost which a reviewer might associate with the project, but for which no costs have been included in the estimate. Examples of potential

items are removal of hazardous wastes, acquisition of land, taxes, financing costs, licensing costs, etc.

11. Exceptions

In this section the estimator should identify and document any significant deviations from the project and/or engineering deliverables normally required for the applicable class of estimate. A good practice is to provide a checklist that corresponds to the organization's estimating practice as an attachment to the BOE that will document any exceptions that are identified.

12. Risks and Opportunities

In this section, the estimator should identify any areas of the estimate containing significant risk or opportunity. If applicable, the estimator should also describe any formal risk analysis study that has been prepared; in particular, identifying those cost elements that have been identified with high or very high risk or opportunity values. It is a good practice to attach the risk analysis report (or summary) to the BOE.

13. Containments

In this section, the estimator should describe the cost elements in the estimate that are related to measures included to prevent and/or mitigate the identified risks.

14. Contingencies

This section should identify the amount of contingency included in the estimate to cover the uncertainty and variability associated with a cost estimate, and unforeseeable elements of cost within the defined project scope. The methods used to determine the contingency amount should also be identified.

15. Management Reserve

This section should identify the amount of cost, typically, referred to as management reserve, to cover the costs for items that may be required but have not yet been specifically identified as being included in the current project scope. Also, the intended purpose and use of management reserve should be clearly identified along with the approval process, management and tracking of the management reserve.

16. Reconciliation

This section should provide an overview of the major differences between the current estimate and the last estimate prepared for this project. This includes identifying the cost impacts due to scope changes, pricing updates, labor productivity adjustments, estimate refinement, etc.

17. Benchmarking

This section should document any comparisons of overall estimate metrics, ratios, and factors with similar projects, historical data, and industry data.

18. Estimate Quality Assurance

This section should identify all estimate reviews that have taken place to date, and any additional reviews that are proposed to take place. All review comments or analysis should be included as an attachment to the BOE. In case of an external review this section should include who executed the review, when it was conducted, and what references were used.

19. Estimating Team

In this section, the estimator should identify all members of the estimating team as well as their roles and responsibilities.

PROJECT

Responsible Person:	Name/Title/Tel Number
Estimator:	Name and Contact Info
Estimator's Department:	Name
Project Location:	Location
Date of Report:	Month and Year
Start of Construction:	Month and Year
Estimating Processing Software:	Excel or ?
Work Breakdown Structure (WBS):	Very Basic (describe)
Project No:	#####
Project Type:	Specify Project Type
Database for cost estimate:	Sources

PURPOSE

Describe the project, its purpose, timing and location.

SCOPE

Mission/Design:	Improve safety and congestion at ###/##
Estimate Type:	Parametric, Deterministic or Stochastic
Project Type (Greenfield vs. Upgrade):	Upgrade existing facility
New structures required:	Yes
Existing Structures which need to be modified:	Assumed structure is replaced
Demolition:	Bridge and buildings
Hazardous Materials:	Anticipated
Archeological Impacts:	Not anticipated, based on database research
Native American (Tribal) Issues:	Not anticipated, based on contacts made to date

Describe in paragraph form the basic scope of the project.

METHODOLGY

Describe the primary estimating methodology use for the cost estimate. Several different methodologies may be used in one estimate. Also list the schedule or timeline for the estimating process.

ESTIMATE CLASSIFICATION

Identify the estimate class that correspond with update of the estimate. Also, provide the reasons and justification used in the section of the estimate classification.

DESIGN BASIS

Describe the types and status of engineering and design deliverables used to prepare the estimate, including any design assumptions.

PLANNING BASIS

Describe the project management, engineering, design, and construction approached used to prepare the estimate. This should include proposed or assumed working schedule, construction sequence, etc. List overall project milestones and project schedule.

CAPITAL COST BASIS

Describe methods and sources for determining listed item pricing. Provide detailed backup of the date in the attachments.

OPERATIONS COST BASIS

Describe methods and sources for determining listed item pricing. Provide detailed backup of the date in the attachments.

ALLOWANCES

Describe allowances in the cost estimate. Include their purpose and how the allowance amount was determined.

ASSUMPTIONS

Discuss all assumptions not covered in other areas of the Basis of Estimate. Samples are listed in blue.

- Construction funding all at once
- Will need to replace bridge ###/Bridge No.
- Stormwater retrofit of #######
- Environmental regulations don't change
- Today's dollars, unknown future inflation rate
- Mid point of construction could change.
- Undeveloped properties remain undeveloped. At this time there are no known proposed developments on the properties, although some of the properties are for sale.
- There are good soils.
- Captured major bid items
- Right of Way is not needed to relocate the gas line.
- The project is in the process of selecting a preferred alternative for analysis in an EA. At this time there are two alternative, a preferred alternative should be selected by MONTH AND YEAR. The estimate is based on alternative #### with the thought that it may be the more expensive of the two options.

EXCLUSIONS

List those items NOT INCLUDED in the cost estimate. Include those things that an outside person might think are included but are not.

EXCETPTIONS

Describe any item that does not follow City St. Albert standards for cost estimating.

RISKS AND OPPPORTUNITIES

Describe all threats and opportunities that surface during the preparation of the cost estimate. This can become the basis for a risk management plan.

CONTINGENCIES

Identify the amount of contingency included in the estimate, the methodology used to determine the contingency amount and the associated confidence level, if risk techniques were used.

MANAGEMENT RESERVE

Identify the amount of management reserve included in the estimate, the intended purpose and use and the approval process.

ESTIMATE QUALITY ASSURANCE

Describe the quality assurance plan for the estimate. What reviews or benchmarking has been done on this estimate?

RECONCILIATION

How were review comments incorporated into the estimate? How does this estimate compare to the previous one preformed for this project? What are the differences and how are they explained?

ESTIMATING TEAM

List all parties involved in preparing the estimate. Phone and email records should be kept of all the people that had input into the estimate.

Lead:	Name and Contact Info
Quantity Survey:	Name and Contact Info
Unit Cost Development:	Capital Projects
Summarization and Presentation:	Name and Contact Info
Estimate Review & QA/QC:	Name and Contact Info

#	Question	Include?			Comments
1	Has a preferred alternative been selected?	Yes	No	N/A	
2	Have any environmental mitigation measures been defined and included in the estimate?	Yes	No	N/A	
3	Has an alignment been established?	Yes	No	N/A	
4	Has a typical section been established?	Yes	No	N/A	
5	Have the geotechnical site conditions been researched?	Yes	No	N/A	
6	Have potential geotechnical cost issues been factored into the estimate?	Yes	No	N/A	
7	Has a drainage report and concept plan been prepared?	Yes	No	N/A	
8	Has a pavement life cycle cost analysis been performed?	Yes	No	N/A	
9	Have any investigations been done in regards to potential major utility impacts?	Yes	No	N/A	
10	Has a conceptual landscaping and aesthetics plan been developed?	Yes	No	N/A	
11	Are there any design deviations that are or expected to be of concern?	Yes	No	N/A	
12	Were other projects used as metrics of comparison for the estimate? If so, please list projects.	Yes	No	N/A	
13	Has funding been identified for: Design/PS&E?	Yes	No	N/A	
14	Has funding been identified for: Construction?	Yes	No	N/A	
15		Yes	No	N/A	

This check list should be customized for each department in accordance with their projects nature to ensure consistency and completeness in carrying out the estimate task.

Appendix G

Schedule of Industry Assumptions/Metrics

Included below is a discussion of the key industry assumptions and metrics used in the compilation of the charter review for use by the City on future project estimating. To further support future estimating, we have also included a list of industry standard databooks and guides, which we recommend as supplements to the City's internal estimating efforts. Please note, as indicated in the main body of the report, that the best metrics will be drawn from the City's own historical data as this will account for local, specific characteristics in ways that generic data cannot (even with factors for location and other specifics applied). Furthermore, the use of these databooks should be undertaken with the support of experts capable of manipulating the data appropriately.

1 Assumptions/Metrics Used in Charter Review

1.1 CONTINGENCIES

Design Contingency Allowance

Estimate contingency is defined as a special monetary provision in the project estimate to cover uncertainties or unforeseeable elements of cost in the estimate associated with the normal design evolution and execution of a project. Estimate contingencies are generally calculated using a risk model with input from a knowledgeable team of cost experts. In lieu of a formal risk assessment, a Design Contingency Allowance is typically assigned by an experienced estimator taking into consideration the complexity of the project and the current level of design. Since the application of contingencies rely heavily on the experience of the estimator preparing the estimate, there are no formal industry standards that define the percentage of Contingency at a specific design stage. Typically, the following percentages for Design Contingency Allowance are considered acceptable applied to the construction component of an estimate;

Class D / Class 5 Estimate	15-20%
Class C / Class 4 Estimate	10-15%
Class B / Class 3/2 Estimate	5-10%
Class A / Class 1 Estimate	0-5%

In the case of the specific charter reviews, we have relied on Hanscomb's experience and judgement related to the specific information contained in the various Charters and estimate back-up to apply an appropriate Design Contingency Allowance to each charter.

Management Reserve

Management Reserve is a further contingency typically included in a total project estimate based on the client's management team's perception of the overall likelihood of the project cost and associated risks. Unlike the Design Contingency Allowance, which is typically specific to the construction cost, the Management Reserve applies a contingency to the overall total project cost.

The range for Management Reserve can be as low as 1%-2% and as high as 10-15% depending on a number of factors related to the project. Once again, we have relied upon Hanscomb's experience to provide a recommended Management Reserve of 4% of the total cost developed for the majority of the charters reviewed. The Management Reserve is under the control of City management rather than the specific project manager and any reliance upon the reserve must have the approval of management.

1.2 ESCALATION

Escalation is a provision in actual or estimated costs for an increase in the costs of equipment, material, and labour from a set point in time and is due to a continuing price change over time until the completion of the project. Escalation does not cover hyper-escalation – that is, escalation which is outside what is expected from published indices. Hyper-escalation should be covered by contingency and allocated based on the perceived risk. As noted elsewhere, the historical escalation is generally readily accessible from various sources. We have utilized Hanscomb's quarterly "Escalation Watch" newsletter that is developed from information published by StatsCan for escalating project costs developed in years past.

To forecast future escalation, estimators and cost consultants utilize their historical escalation data, combined with current project data and trade market sources to determine potential trends in the industry. Typically, future escalation is trended for 2-3 years at a maximum and then carried forward a set rate usually 1% to 2% over the last trended value.

While our project charter review relied upon the escalation rates derived from Statistics Canada, another useful resource that may be of interest to the City of St. Albert due to their proximity is the City of Edmonton's inflation rate (see Table 1).

Table 1. City of Edmonton Escalation Rates

Year	Rate of Escalation
2010	2.09%
2011	4.08%
2012	3.85%
2013	0.94%
2014	-0.53%

2015	1.87%
2016	5.26

1.3 ACCURACY RANGE

In the report we have made recommendations regarding the expected accuracy range at each estimate class. These recommendations are based upon the AACE Accuracy Matrix for Estimating Classes.

To provide the City of St. Albert with a basis for developing more detailed accuracy ranges based on type of project, we are also including the following table (see Table), which we developed initially based on work with the City of Edmonton. These ranges are subject to further review and study, but may be useful as a template for the City of St. Albert to develop a City-specific breakdown.

Table 2. Expected Accuracy Ranges for Various Project Phases (City of Edmonton)

Project Type	Phase	Suggested Range
Local Sewer Rehab	Concept	-30%;50%
	Prelim	-15%;30%
	Detailed	-5%;+15%
	Award	±0.10
Pump Station Upgrades	Concept	-30%;50%
	Prelim	-15%;30%
	Detailed	-5%;+15%
	Award	±0.10
Drainage – Single Projects	Concept	±0.3
	Prelim	±0.2
	Detailed	±0.1
	Award	±0.1
Building Engineering	Concept	-30%;50%
	Prelim	-15%;30%
	Detailed	±0.15

	Award	±0.10
Roads – Single Projects	Concept	±0.3
	Prelim	±0.25
	Detailed	±0.1
	Award	±0.1
Roads – Arterial	Concept	-30%;50%
	Prelim	-15%;30%
	Detailed	±0.15
	Award	±0.1

2 Recommendations for Cost Data

Although there are numerous cost data publications related to cost estimating, as noted elsewhere, we would recommend that the City develop their own comprehensive data based on their internally gathered historical tender and project cost information. Unfortunately, the development of a useable database of various construction costs can quite often require extensive effort to prepare; the use of industry publications is therefore not unusual.

A very good example of the type of client data information available is found in Alberta Transportation's Unit Price Averages Report.[1] This document could be used as a template for developing similar costs from St. Albert's own historical tender and project records to be used by the City's estimators.

In terms of specific cost estimating data reference publications, the industry leader is RS Means (https://www.rsmeans.com/). RS Means publishes over 50 different construction reference books and manuals, many of which are dedicated to various estimating approaches. Although many of their publications deal with specific components and trade-specific labour and material values for a wide myriad of construction items, at the Charter Development level, the following RS Means publications would be considered the most applicable for the City's chief estimators to utilize as a source of cost information:

- **RS Means – Site Work & Landscape Cost Data:** This manual provides cost data for earthwork, sewerage, piped utilities, drainage, paving, street repairs, landscaping, etc., including location factor adjustments for various major centres in Canada, including Edmonton and Calgary.
- **RS Means – Heavy Construction Cost Data:** This manual provides cost data for large civil projects including highways, bridges, utilities, etc., including location factor adjustments for various major centres in Canada, including Edmonton and Calgary.

[1] http://www.transportation.alberta.ca/Content/docType257/Production/UnitPriceList.pdf

- **RS Means – Facility Construction Cost Data:** This manual is devoted specifically to the needs of professionals responsible for the maintenance, construction and renovation of commercial, industrial, municipal and institutional properties. This reference provides immediate access to every imaginable cost associated with facilities construction and renovation, plus many common maintenance items with more than 48,000 unit price line items and thousands of assemblies, including location factor adjustments for various major centres in Canada, including Edmonton and Calgary.
- **RS Means – Facility Maintenance Cost Data:** This manual addresses the cost of all aspects of maintaining a facility: maintenance and repair, preventive maintenance, general maintenance and complete details about the cost and repair frequencies of thousands of work items. This book provides comprehensive coverage of all aspects of buildings and grounds, from preventive maintenance schedules on large boilers, to replacing fire hydrants, to resurfacing parking lots including location factor adjustments for various major centres in Canada, including Edmonton and Calgary.